# Course: Integrated Science 3- 2002440

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## BASIC INFORMATION

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| **Course Number:** | 2002440 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated Science 3, INTEG SCI 3, Integrated |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Integrated Sciences |
| **Course Title:** | Integrated Science 3 |
| **Course Abbreviated Title:** | INTEG SCI 3 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices** Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence).<br><br>**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations. |

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| | • Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (89)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 |

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| | texts and topics. |
| LAFS.1112.RST.2.5: | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| LAFS.1112.RST.2.6: | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| LAFS.1112.RST.3.7: | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| LAFS.1112.RST.3.8: | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| LAFS.1112.RST.3.9: | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| LAFS.1112.RST.4.10: | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| LAFS.1112.WHST.3.8: | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| LAFS.1112.WHST.3.9: | Draw evidence from informational texts to support analysis, reflection, and research. |
| LAFS.1112.WHST.4.10: | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| LAFS.1112.SL.1.1: | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with |

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| | diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to |

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| | enhance understanding of findings, reasoning, and evidence and to add interest. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a |

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| | discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation |

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| | provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. |

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| | Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value** |

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| | functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. |

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| | Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **SC.912.E.5.9:** | Analyze the broad effects of space exploration on the economy and culture of Florida.<br>Remarks/Examples |
| | Recognize the economic, technical and social benefits of spinoff technology developed through the space program. |
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| **SC.912.E.6.4:** | Analyze how specific geologic processes and features are expressed in Florida and elsewhere.<br>Remarks/Examples |
| | Describe the effect of ocean and Gulf water currents, gravel mining, beach erosion, dune development, aquifers and ground water, salt water intrusion, springs, and sink holes on the formation of the Florida peninsula. Explain the effects of latitude, elevation, topography (land surface type), proximity to large bodies of water, and temperature of ocean currents, on climate in Florida. |
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| **SC.912.E.7.6:** | Relate the formation of severe weather to the various physical factors.<br>Remarks/Examples |
| | Identify the causes of severe weather. Compare and contrast physical factors that affect the formation of severe weather events (e.g. hurricanes, tornados, flash floods, thunderstorms, and drought). |
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| **SC.912.E.7.8:** | Explain how various atmospheric, oceanic, and hydrologic conditions in Florida have influenced and can influence human behavior, both individually and collectively.<br>Remarks/Examples |
| | Describe and discuss the conditions that bring about floods, |

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| | droughts, wildfires, thunderstorms, hurricanes, rip currents, and tsunamis and how these conditions can influence human behavior (e.g. energy alternatives, conservation, migration, storm preparedness). |
| **SC.912.E.7.9:** | Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.<br>Remarks/Examples |
| | Explain how the oceans act as sources/sinks of heat energy, store carbon dioxide mostly as dissolved HCO3– and CaCO3 as precipitate or biogenic carbonate deposits, which have an impact on climate change. |
| **SC.912.L.15.1:** | Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.<br>Remarks/Examples |
| | Annually Assessed on Biology EOC. Also assesses SC.912.L.15.10; SC.912.N.1.3; SC.912.N.1.4; SC.912.N.1.6; SC.912.N.2.1; SC.912.N.3.1; and SC.912.N.3.4. |
| **SC.912.L.15.10:** | Identify basic trends in hominid evolution from early ancestors six million years ago to modern humans, including brain size, jaw size, language, and manufacture of tools. |
| **SC.912.L.15.13:** | Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. Also assesses SC.912.L.15.14, SC.912.L.15.15, and SC.912.N.1.3. |
| **SC.912.L.15.14:** | Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow. |
| **SC.912.L.15.15:** | Describe how mutation and genetic recombination increase |

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| | genetic variation. |
| SC.912.L.15.6: | Discuss distinguishing characteristics of the domains and kingdoms of living organisms.<br>Remarks/Examples<br>Annually Assessed on Biology EOC. Also assesses SC.912.L.15.4; SC.912.L.15.5; SC.912.N.1.3; and SC.912.N.1.6. |
| SC.912.L.16.10: | Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| SC.912.L.16.13: | Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| SC.912.L.16.4: | Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring. |
| SC.912.L.16.8: | Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.<br>Remarks/Examples<br>Integrate HE.912.C.1.7. Analyze how heredity and family history can impact personal health. |
| SC.912.L.17.11: | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| SC.912.L.17.13: | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| SC.912.L.17.20: | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br>Remarks/Examples |

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| | Annually assessed on Biology EOC. Also assesses SC.912.L.17.11, SC.912.L.17.13, SC.912.N.1.3. |
| SC.912.L.17.5: | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.L.17.2; SC.912.L.17.4; SC.912.L.17.8; SC.912.N.1.4. |
| SC.912.L.17.6: | Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism. |
| SC.912.L.17.8: | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species. |
| SC.912.L.18.10: | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell. |
| SC.912.L.18.11: | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity. |
| SC.912.L.18.12: | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples<br>Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and |

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| | persevere in solving them. |
| SC.912.N.1.7: | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| SC.912.N.2.1: | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
| SC.912.N.2.2: | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and |

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| | open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.1.1: | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, |

technique, maintenance, and storage).

7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

Remarks/Examples

Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

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| | LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples<br>Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions. |

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| | Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| | |
| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
| | |
| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
| | |
| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| | |
| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| | |
| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues. |

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| | Remarks/Examples |
| | Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
| | |
| **SC.912.P.10.16:** | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br>Remarks/Examples |
| | Explain that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize the Lorentz force is the force on a point charge due to electromagnetic fields and occurs in many devices, including mass spectrometers. |
| | |
| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source |

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| | or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
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| SC.912.P.10.22: | Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.<br>Remarks/Examples |
| | Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size. |
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| SC.912.P.10.3: | Compare and contrast work and power qualitatively and quantitatively. |
| SC.912.P.10.6: | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
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| SC.912.P.10.9: | Describe the quantization of energy at the atomic level.<br>Remarks/Examples |
| | Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship $E = hv$). |
| | |
| SC.912.P.12.10: | Interpret the behavior of ideal gases in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and number of particles in a gas sample (Avogadro's hypothesis). |

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| **SC.912.P.12.11:** | Describe phase transitions in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Explain, at the molecular level, the behavior of matter as it undergoes phase transitions. |
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| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br>Remarks/Examples |
| | Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
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| **SC.912.P.12.13:** | Explain the concept of dynamic equilibrium in terms of reversible processes occurring at the same rates.<br>Remarks/Examples |
| | Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing). Explain that equilibrium is established when forward and reverse-reaction rates are equal. |
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| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples |
| | (e.g. elastic and completely inelastic collisions). |
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| **SC.912.P.12.6:** | Qualitatively apply the concept of angular momentum.<br>Remarks/Examples |
| | Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]). |
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| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they |

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| | or the light source are moving.<br>Remarks/Examples |
| | Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
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| SC.912.P.12.9: | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples |
| | The energy $E$ and the momentum $p$ depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
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| SC.912.P.8.10: | Describe oxidation-reduction reactions in living and non-living systems.<br>Remarks/Examples |
| | Identify the substance(s) losing and gaining electrons in oxidation-reduction reactions. Discuss voltaic cells, various types of batteries, electrolysis of water, smelting and purification of metals, electrolysis of brine versus molten NaCl, neutralization reactions, electrolytic cells, and living systems (photosynthesis and cellular respiration). |
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## RELATED GLOSSARY TERM DEFINITIONS (80)

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| **Abiotic:** | An environmental factor not associated with or derived from living organisms. |
| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |
| **Adenosine triphosphate (ATP):** | An organic compound that is composed of adenosine and three phosphate groups. It serves as a source of energy for many metabolic processes. ATP releases energy when it is broken down into ADP and phosphate by hydrolysis during cell metabolism. |
| **Anatomy:** | The scientific study of the shape and structure of organisms and |

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| | their parts. |
| **Angular momentum:** | A vector quantity that is a measure of the rotational momentum of a rotating body or system, that is equal in classical physics to the product of the angular velocity of the body or system and its moment of inertia with respect to the rotation axis, and that is directed along the rotation axis. |
| **Axis:** | The imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph. |
| **Biotechnology:** | The manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals). |
| **Biotic:** | Factors in an environment relating to, caused by, or produced by living organisms. |
| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Dissolve:** | To cause to pass into solution. |
| **DNA:** | Deoxyribonucleic acid; a nucleic acid that is genetic material; present in all organisms. |
| **Dune:** | A hill or ridge of sand piled up by the wind. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electromagnetic** | The entire range of electromagnetic radiation. At one end of the |

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| **spectrum:** | spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Embryology:** | The branch of biology that deals with the formation, early growth, and development of living organisms. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |
| **Erosion:** | The wearing away of Earth's surface by the breakdown and transportation of rock and soil. |
| **Evolution :** | A theory that the various types of species arise from pre-existing species and that distinguishable characteristics are due to modifications through successive generations. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fertilization:** | The process by which the female reproductive cell (egg) is united with the male reproductive cell (sperm). |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |

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| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |
| **Gamete:** | A reproductive cell having the haploid number of chromosomes, especially a mature sperm or egg capable of fusing with a gamete of the opposite sex to produce the fertilized egg. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Genetic:** | Affecting or determined by genes. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Heredity:** | The passage of biological traits or characteristics from parents to offspring through the inheritance of genes. |
| **Hominid:** | A group of primates of the family Hominidae, which includes modern humans. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Latitude:** | A measure of relative position north or south on the Earth's surface, measured in degrees from the equator, which has a latitude of 0°, with the poles having a latitude of 90° north and south. |

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| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Magnet:** | An object that produces a magnetic field and that has the property, either natural or induced, of attracting iron or steel. |
| **Magnetic:** | Having the property of attracting iron and certain other materials by virtue of a field of force. |
| **Magnetic field:** | The region where magnetic force exists around magnets or electric currents. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Metal:** | Any of a category of electropositive elements that usually have a shiny surface, are generally good conductors of heat and electricity, and can be melted or fused, hammered into thin sheets, or drawn into wires. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Mutation:** | A change in genetic sequence. |
| **Natural selection:** | The theory stating every organism displays slight variations from related organisms, and these variations make an organism more or less suited for survival and reproduction in specific habitats. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of |

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| | energy or mass or by being broken apart. |
| **Observation :** | What one has observed using senses or instruments. |
| **Offspring:** | The progeny or descendants of an animal or plant considered as a group. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Physiology:** | The scientific study of an organism's vital functions, including growth, development, reproduction, the absorption and processing of nutrients, the synthesis and distribution of proteins and other organic molecules, and the functioning of different tissues, organs, and other anatomic structures. |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Reproductive system:** | The system of organs involved with animal reproduction, especially sexual reproduction. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |

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| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Volume:** | A measure of the amount of space an object takes up; also the loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Integrated Science 3 for Credit Recovery- 2002445

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4394

## BASIC INFORMATION

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| **Course Number:** | 2002445 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated, Integrated Science 3 for Credit Recovery, Integrated Science, Credit Recovery, INTEG SCI 3 CR, Core |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Integrated Sciences |
| **Course Title:** | Integrated Science 3 for Credit Recovery |
| **Course Abbreviated Title:** | INTEG SCI 3 CR |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Credit Recovery (R) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, |

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| | research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>Credit Recovery courses are credit bearing courses with specific content requirements defined by Florida's Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery courses are exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.<br><br>**Instructional Practices** Teaching from a range of complex text is optimized when teachers in all subject areas implement the |

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| | following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (89)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical |

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| | tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile |

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| | range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the |

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| | task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from |

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| | alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and |

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| | techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples<br>**Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications** |

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| | i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in** |

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| | simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |

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| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **SC.912.E.5.9:** | Analyze the broad effects of space exploration on the economy and culture of Florida.<br>Remarks/Examples<br>Recognize the economic, technical and social benefits of spinoff technology developed through the space program. |
| **SC.912.E.6.4:** | Analyze how specific geologic processes and features are expressed in Florida and elsewhere.<br>Remarks/Examples<br>Describe the effect of ocean and Gulf water currents, gravel mining, beach erosion, dune development, aquifers and ground water, salt water intrusion, springs, and sink holes on the formation of the Florida peninsula. Explain the effects of latitude, elevation, topography (land surface type), proximity to large bodies of water, and temperature of ocean currents, on climate in Florida. |
| **SC.912.E.7.6:** | Relate the formation of severe weather to the various physical factors.<br>Remarks/Examples<br>Identify the causes of severe weather. Compare and contrast physical factors that affect the formation of severe weather events (e.g. hurricanes, tornados, flash floods, thunderstorms, and drought). |

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| SC.912.E.7.8: | Explain how various atmospheric, oceanic, and hydrologic conditions in Florida have influenced and can influence human behavior, both individually and collectively.<br>Remarks/Examples<br>Describe and discuss the conditions that bring about floods, droughts, wildfires, thunderstorms, hurricanes, rip currents, and tsunamis and how these conditions can influence human behavior (e.g. energy alternatives, conservation, migration, storm preparedness). |
| SC.912.E.7.9: | Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.<br>Remarks/Examples<br>Explain how the oceans act as sources/sinks of heat energy, store carbon dioxide mostly as dissolved HCO3– and CaCO3 as precipitate or biogenic carbonate deposits, which have an impact on climate change. |
| SC.912.L.15.1: | Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.<br>Remarks/Examples<br>Annually Assessed on Biology EOC. Also assesses SC.912.L.15.10; SC.912.N.1.3; SC.912.N.1.4; SC.912.N.1.6; SC.912.N.2.1; SC.912.N.3.1; and SC.912.N.3.4. |
| SC.912.L.15.10: | Identify basic trends in hominid evolution from early ancestors six million years ago to modern humans, including brain size, jaw size, language, and manufacture of tools. |
| SC.912.L.15.13: | Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.L.15.14, |

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| | SC.912.L.15.15, and SC.912.N.1.3. |
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| SC.912.L.15.14: | Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow. |
| SC.912.L.15.15: | Describe how mutation and genetic recombination increase genetic variation. |
| SC.912.L.15.6: | Discuss distinguishing characteristics of the domains and kingdoms of living organisms.<br>Remarks/Examples |
| | Annually Assessed on Biology EOC. Also assesses SC.912.L.15.4; SC.912.L.15.5; SC.912.N.1.3; and SC.912.N.1.6. |
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| SC.912.L.16.10: | Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. |
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| SC.912.L.16.13: | Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. |
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| SC.912.L.16.4: | Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring. |
| SC.912.L.16.8: | Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.<br>Remarks/Examples |
| | Integrate HE.912.C.1.7. Analyze how heredity and family history can impact personal health. |
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| SC.912.L.17.11: | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |

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| SC.912.L.17.13: | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| SC.912.L.17.20: | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.L.17.11, SC.912.L.17.13, SC.912.N.1.3. |
| SC.912.L.17.5: | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.L.17.2; SC.912.L.17.4; SC.912.L.17.8; SC.912.N.1.4. |
| SC.912.L.17.6: | Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism. |
| SC.912.L.17.8: | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species. |
| SC.912.L.18.10: | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell. |
| SC.912.L.18.11: | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity. |
| SC.912.L.18.12: | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied. |

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| | Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification). |

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| | Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other** |

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| | **systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br>For Students in Grades 9-10<br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>For Students in Grades 11-12<br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the |

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| | author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br><br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of |

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| | alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence. |

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| | Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason |

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| | abstractly and quantitatively. |
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| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.<br>Remarks/Examples |
| | Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
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| **SC.912.P.10.16:** | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br>Remarks/Examples |
| | Explain that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize the Lorentz force is the force on a point charge due to electromagnetic fields and occurs in many devices, including mass spectrometers. |
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| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how |

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| | conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
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| **SC.912.P.10.22:** | Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.<br>Remarks/Examples |
| | Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size. |
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| **SC.912.P.10.3:** | Compare and contrast work and power qualitatively and quantitatively. |
| **SC.912.P.10.6:** | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
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| **SC.912.P.10.9:** | Describe the quantization of energy at the atomic level.<br>Remarks/Examples |
| | Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship $E = hv$). |
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| **SC.912.P.12.10:** | Interpret the behavior of ideal gases in terms of kinetic molecular theory.<br>Remarks/Examples |

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| | Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and number of particles in a gas sample (Avogadro's hypothesis). |
| **SC.912.P.12.11:** | Describe phase transitions in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Explain, at the molecular level, the behavior of matter as it undergoes phase transitions. |
| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br>Remarks/Examples |
| | Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
| **SC.912.P.12.13:** | Explain the concept of dynamic equilibrium in terms of reversible processes occurring at the same rates.<br>Remarks/Examples |
| | Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing). Explain that equilibrium is established when forward and reverse-reaction rates are equal. |
| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples |
| | (e.g. elastic and completely inelastic collisions). |
| **SC.912.P.12.6:** | Qualitatively apply the concept of angular momentum.<br>Remarks/Examples |
| | Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a |

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| | change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]). |
| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br>Remarks/Examples<br>Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
| **SC.912.P.12.9:** | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples<br>The energy *E* and the momentum *p* depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
| **SC.912.P.8.10:** | Describe oxidation-reduction reactions in living and non-living systems.<br>Remarks/Examples<br>Identify the substance(s) losing and gaining electrons in oxidation-reduction reactions. Discuss voltaic cells, various types of batteries, electrolysis of water, smelting and purification of metals, electrolysis of brine versus molten NaCl, neutralization reactions, electrolytic cells, and living systems (photosynthesis and cellular respiration). |

## RELATED GLOSSARY TERM DEFINITIONS (80)

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| **Abiotic:** | An environmental factor not associated with or derived from living organisms. |
| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |

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| **Adenosine triphosphate (ATP):** | An organic compound that is composed of adenosine and three phosphate groups. It serves as a source of energy for many metabolic processes. ATP releases energy when it is broken down into ADP and phosphate by hydrolysis during cell metabolism. |
| **Anatomy:** | The scientific study of the shape and structure of organisms and their parts. |
| **Angular momentum:** | A vector quantity that is a measure of the rotational momentum of a rotating body or system, that is equal in classical physics to the product of the angular velocity of the body or system and its moment of inertia with respect to the rotation axis, and that is directed along the rotation axis. |
| **Axis:** | The imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph. |
| **Biotechnology:** | The manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals). |
| **Biotic:** | Factors in an environment relating to, caused by, or produced by living organisms. |
| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Dissolve:** | To cause to pass into solution. |
| **DNA:** | Deoxyribonucleic acid; a nucleic acid that is genetic material; present in all organisms. |

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| **Dune:** | A hill or ridge of sand piled up by the wind. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Embryology:** | The branch of biology that deals with the formation, early growth, and development of living organisms. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |
| **Erosion:** | The wearing away of Earth's surface by the breakdown and transportation of rock and soil. |
| **Evolution :** | A theory that the various types of species arise from pre-existing species and that distinguishable characteristics are due to modifications through successive generations. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fertilization:** | The process by which the female reproductive cell (egg) is united with the male reproductive cell (sperm). |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |

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| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |
| **Gamete:** | A reproductive cell having the haploid number of chromosomes, especially a mature sperm or egg capable of fusing with a gamete of the opposite sex to produce the fertilized egg. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Genetic:** | Affecting or determined by genes. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Heredity:** | The passage of biological traits or characteristics from parents to offspring through the inheritance of genes. |
| **Hominid:** | A group of primates of the family Hominidae, which includes modern humans. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |

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| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Latitude:** | A measure of relative position north or south on the Earth's surface, measured in degrees from the equator, which has a latitude of 0°, with the poles having a latitude of 90° north and south. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Magnet:** | An object that produces a magnetic field and that has the property, either natural or induced, of attracting iron or steel. |
| **Magnetic:** | Having the property of attracting iron and certain other materials by virtue of a field of force. |
| **Magnetic field:** | The region where magnetic force exists around magnets or electric currents. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Metal:** | Any of a category of electropositive elements that usually have a shiny surface, are generally good conductors of heat and electricity, and can be melted or fused, hammered into thin sheets, or drawn into wires. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Mutation:** | A change in genetic sequence. |
| **Natural selection:** | The theory stating every organism displays slight variations from |

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| | related organisms, and these variations make an organism more or less suited for survival and reproduction in specific habitats. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Observation :** | What one has observed using senses or instruments. |
| **Offspring:** | The progeny or descendants of an animal or plant considered as a group. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Physiology:** | The scientific study of an organism's vital functions, including growth, development, reproduction, the absorption and processing of nutrients, the synthesis and distribution of proteins and other organic molecules, and the functioning of different tissues, organs, and other anatomic structures. |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Reproductive system:** | The system of organs involved with animal reproduction, especially sexual reproduction. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |

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| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Volume:** | A measure of the amount of space an object takes up; also the loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Integrated Science 3 Honors-2002450

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4932

## BASIC INFORMATION

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| **Course Number:** | 2002450 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated Science 3 Honors, INTEG SCI 3 HON, Honors |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Integrated Sciences |
| **Course Title:** | Integrated Science 3 Honors |
| **Course Abbreviated Title:** | INTEG SCI 3 HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **General Notes:** | While the content focus of this course is consistent with the |

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| | Integrated Science 3 course, students will explore these concepts in greater depth. In general, the academic pace and rigor will be greatly increased for honors level course work.<br><br>Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices**<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities |

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| | (claims and evidence).<br><br>**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations.<br>• Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (104)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize |

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| | complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |

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| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |

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| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-VM.1.3:** | Solve problems involving velocity and other quantities that can be represented by vectors. |
| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a |

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| | discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation |

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| | provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. |

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| | Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value** |

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| | functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate |

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| | to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess |

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| | how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.E.5.8:** | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.<br>Remarks/Examples |
| | Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
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| **SC.912.E.5.9:** | Analyze the broad effects of space exploration on the economy and culture of Florida.<br>Remarks/Examples |
| | Recognize the economic, technical and social benefits of spinoff technology developed through the space program. |
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| **SC.912.E.6.4:** | Analyze how specific geologic processes and features are expressed in Florida and elsewhere.<br>Remarks/Examples |
| | Describe the effect of ocean and Gulf water currents, gravel mining, beach erosion, dune development, aquifers and ground water, salt water intrusion, springs, and sink holes on the formation of the Florida peninsula. Explain the effects of latitude, elevation, topography (land surface type), proximity to |

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| | large bodies of water, and temperature of ocean currents, on climate in Florida. |
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| **SC.912.E.7.1:** | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.<br>Remarks/Examples |
| | Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun. |
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| **SC.912.E.7.5:** | Predict future weather conditions based on present observations and conceptual models and recognize limitations and uncertainties of such predictions.<br>Remarks/Examples |
| | Use models, weather maps and other tools to predict weather conditions and differentiate between accuracy of short-range and long-range weather forecasts. |
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| **SC.912.E.7.6:** | Relate the formation of severe weather to the various physical factors.<br>Remarks/Examples |
| | Identify the causes of severe weather. Compare and contrast physical factors that affect the formation of severe weather events (e.g. hurricanes, tornados, flash floods, thunderstorms, and drought). |
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| **SC.912.E.7.8:** | Explain how various atmospheric, oceanic, and hydrologic conditions in Florida have influenced and can influence human behavior, both individually and collectively.<br>Remarks/Examples |
| | Describe and discuss the conditions that bring about floods, droughts, wildfires, thunderstorms, hurricanes, rip currents, and tsunamis and how these conditions can influence human behavior (e.g. energy alternatives, conservation, migration, storm preparedness). |
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| **SC.912.E.7.9:** | Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.<br>Remarks/Examples |
| | Explain how the oceans act as sources/sinks of heat energy, store carbon dioxide mostly as dissolved HCO3– and CaCO3 as precipitate or biogenic carbonate deposits, which have an impact on climate change. |
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| **SC.912.L.15.1:** | Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.<br>Remarks/Examples |
| | Annually Assessed on Biology EOC. Also assesses SC.912.L.15.10; SC.912.N.1.3; SC.912.N.1.4; SC.912.N.1.6; SC.912.N.2.1; SC.912.N.3.1; and SC.912.N.3.4. |
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| **SC.912.L.15.10:** | Identify basic trends in hominid evolution from early ancestors six million years ago to modern humans, including brain size, jaw size, language, and manufacture of tools. |
| **SC.912.L.15.13:** | Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. Also assesses SC.912.L.15.14, SC.912.L.15.15, and SC.912.N.1.3. |
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| **SC.912.L.15.14:** | Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow. |
| **SC.912.L.15.15:** | Describe how mutation and genetic recombination increase genetic variation. |
| **SC.912.L.15.2:** | Discuss the use of molecular clocks to estimate how long ago various groups of organisms diverged evolutionarily from one another. |
| **SC.912.L.15.3:** | Describe how biological diversity is increased by the origin of |

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| | new species and how it is decreased by the natural process of extinction. |
| **SC.912.L.15.4:** | Describe how and why organisms are hierarchically classified and based on evolutionary relationships. |
| **SC.912.L.15.5:** | Explain the reasons for changes in how organisms are classified. |
| **SC.912.L.15.6:** | Discuss distinguishing characteristics of the domains and kingdoms of living organisms.<br>Remarks/Examples<br>Annually Assessed on Biology EOC. Also assesses SC.912.L.15.4; SC.912.L.15.5; SC.912.N.1.3; and SC.912.N.1.6. |
| **SC.912.L.15.8:** | Describe the scientific explanations of the origin of life on Earth.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.N.1.3, SC.912.N.1.4, and SC.912.N.2.1. |
| **SC.912.L.16.10:** | Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| **SC.912.L.16.13:** | Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| **SC.912.L.16.4:** | Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring. |
| **SC.912.L.16.8:** | Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.<br>Remarks/Examples<br>Integrate HE.912.C.1.7. Analyze how heredity and family history can impact personal health. |

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| SC.912.L.17.11: | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| SC.912.L.17.13: | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| SC.912.L.17.16: | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br>Remarks/Examples<br>Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |
| SC.912.L.17.2: | Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature. |
| SC.912.L.17.20: | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.L.17.11, SC.912.L.17.13, SC.912.N.1.3. |
| SC.912.L.17.4: | Describe changes in ecosystems resulting from seasonal variations, climate change and succession. |
| SC.912.L.17.5: | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.L.17.2; SC.912.L.17.4; SC.912.L.17.8; SC.912.N.1.4. |
| SC.912.L.17.6: | Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism. |

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| **SC.912.L.17.8:** | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species. |
| **SC.912.L.17.9:** | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.E.7.1. |
| **SC.912.L.18.10:** | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell. |
| **SC.912.L.18.11:** | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity. |
| **SC.912.L.18.12:** | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be |

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| | interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to |

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| | support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples<br><br>Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification. |

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| | Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but |

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| | does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation |

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| | scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
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| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.<br>Remarks/Examples |
| | Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
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| SC.912.P.10.13: | Relate the configuration of static charges to the electric field, electric force, electric potential, and electric potential energy.<br>Remarks/Examples |
| | Using Coulomb's law, determine the force on a stationary charge due to other stationary charges, and explain that this force is many times greater than the gravitational force. Recognize the relationship between forces and their associated potential energies and that the electric field is directly related to the rate of change of the electric potential from point to point in space. |
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| SC.912.P.10.16: | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br>Remarks/Examples |
| | Explain that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize the Lorentz force is the force on a point charge due to electromagnetic fields and occurs in many devices, including mass spectrometers. |
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| SC.912.P.10.17: | Explore the theory of electromagnetism by explaining electromagnetic waves in terms of oscillating electric and magnetic fields.<br>Remarks/Examples |
| | Recognize that an oscillating charge creates an oscillating electric field which gives rise to electromagnetic waves. Recognize a changing magnetic field makes an electric field, and a changing electric field makes a magnetic field, and these phenomena are expressed mathematically through the Faraday law and the Ampere-Maxwell law. |
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| SC.912.P.10.18: | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| SC.912.P.10.2: | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the |

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| | total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy.  Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
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| **SC.912.P.10.22:** | Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.<br>Remarks/Examples |
| | Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size. |
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| **SC.912.P.10.3:** | Compare and contrast work and power qualitatively and quantitatively. |
| **SC.912.P.10.6:** | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
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| **SC.912.P.10.9:** | Describe the quantization of energy at the atomic level.<br>Remarks/Examples |
| | Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between |

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| | levels (Planck's relationship $E = hv$). |
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| **SC.912.P.12.10:** | Interpret the behavior of ideal gases in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and number of particles in a gas sample (Avogadro's hypothesis). |
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| **SC.912.P.12.11:** | Describe phase transitions in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Explain, at the molecular level, the behavior of matter as it undergoes phase transitions. |
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| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br>Remarks/Examples |
| | Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
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| **SC.912.P.12.13:** | Explain the concept of dynamic equilibrium in terms of reversible processes occurring at the same rates.<br>Remarks/Examples |
| | Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing). Explain that equilibrium is established when forward and reverse-reaction rates are equal. |
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| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples |
| | (e.g. elastic and completely inelastic collisions). |

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| SC.912.P.12.6: | Qualitatively apply the concept of angular momentum.<br>Remarks/Examples |
| | Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]). |
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| SC.912.P.12.7: | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br>Remarks/Examples |
| | Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
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| SC.912.P.12.9: | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples |
| | The energy $E$ and the momentum $p$ depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
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| SC.912.P.8.10: | Describe oxidation-reduction reactions in living and non-living systems.<br>Remarks/Examples |
| | Identify the substance(s) losing and gaining electrons in oxidation-reduction reactions. Discuss voltaic cells, various types of batteries, electrolysis of water, smelting and purification of metals, electrolysis of brine versus molten NaCl, neutralization reactions, electrolytic cells, and living systems (photosynthesis and cellular respiration). |
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## RELATED GLOSSARY TERM DEFINITIONS (90)

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| **Abiotic:** | An environmental factor not associated with or derived from living organisms. |
| **Acid:** | A substance that increases the H+ concentration when added to a |

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| | water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |
| **Adenosine triphosphate (ATP):** | An organic compound that is composed of adenosine and three phosphate groups. It serves as a source of energy for many metabolic processes. ATP releases energy when it is broken down into ADP and phosphate by hydrolysis during cell metabolism. |
| **Anatomy:** | The scientific study of the shape and structure of organisms and their parts. |
| **Angular momentum:** | A vector quantity that is a measure of the rotational momentum of a rotating body or system, that is equal in classical physics to the product of the angular velocity of the body or system and its moment of inertia with respect to the rotation axis, and that is directed along the rotation axis. |
| **Aquatic:** | In or on the water |
| **Atmosphere:** | The layers of gas that surround Earth, other planets, or stars. |
| **Axis:** | The imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph. |
| **Biotechnology:** | The manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals). |
| **Biotic:** | Factors in an environment relating to, caused by, or produced by living organisms. |
| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |

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| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Consumer:** | An organism that feeds on other organisms for food. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Decomposer :** | Any organism that feeds or obtains nutrients by breaking down organic matter from dead organisms. |
| **Dissolve:** | To cause to pass into solution. |
| **Diversity:** | The different species in a given area or specific period of time. |
| **DNA:** | Deoxyribonucleic acid; a nucleic acid that is genetic material; present in all organisms. |
| **Dune:** | A hill or ridge of sand piled up by the wind. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electric potential:** | A measure of the work required by an electric field to move electric charges. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of $9.107 \times 10^{-28}$ grams and an electric charge of approximately $-1.602 \times 10^{-19}$ coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Embryology:** | The branch of biology that deals with the formation, early growth, and development of living organisms. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, |

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| | soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |
| **Erosion:** | The wearing away of Earth's surface by the breakdown and transportation of rock and soil. |
| **Evolution :** | A theory that the various types of species arise from pre-existing species and that distinguishable characteristics are due to modifications through successive generations. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fertilization:** | The process by which the female reproductive cell (egg) is united with the male reproductive cell (sperm). |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |
| **Gamete:** | A reproductive cell having the haploid number of chromosomes, especially a mature sperm or egg capable of fusing with a gamete of the opposite sex to produce the fertilized egg. |
| **Gas:** | One of the fundamental states of matter in which the molecules |

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| | do not have a fixed volume or shape. |
| **Genetic:** | Affecting or determined by genes. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Heredity:** | The passage of biological traits or characteristics from parents to offspring through the inheritance of genes. |
| **Hominid:** | A group of primates of the family Hominidae, which includes modern humans. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Latitude:** | A measure of relative position north or south on the Earth's surface, measured in degrees from the equator, which has a latitude of 0°, with the poles having a latitude of 90° north and south. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Magnet:** | An object that produces a magnetic field and that has the property, either natural or induced, of attracting iron or steel. |
| **Magnetic:** | Having the property of attracting iron and certain other materials by virtue of a field of force. |
| **Magnetic field:** | The region where magnetic force exists around magnets or electric currents. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |

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| **Metal:** | Any of a category of electropositive elements that usually have a shiny surface, are generally good conductors of heat and electricity, and can be melted or fused, hammered into thin sheets, or drawn into wires. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Mutation:** | A change in genetic sequence. |
| **Natural selection:** | The theory stating every organism displays slight variations from related organisms, and these variations make an organism more or less suited for survival and reproduction in specific habitats. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Observation :** | What one has observed using senses or instruments. |
| **Offspring:** | The progeny or descendants of an animal or plant considered as a group. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |

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| **Physiology:** | The scientific study of an organism's vital functions, including growth, development, reproduction, the absorption and processing of nutrients, the synthesis and distribution of proteins and other organic molecules, and the functioning of different tissues, organs, and other anatomic structures. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Producer :** | An organism, usually a plant or bacterium, that produces organic compounds from simple inorganic molecules and energy (typically light energy) from the environment. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Reproductive system:** | The system of organs involved with animal reproduction, especially sexual reproduction. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |

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| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Volume:** | A measure of the amount of space an object takes up; also the loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Forensic Sciences 1- 2002480

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4935

## BASIC INFORMATION

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| **Course Number:** | 2002480 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated, Forensic Sciences 1, FOR SCI 1, Forensic |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Integrated Sciences |
| **Course Title:** | Forensic Sciences 1 |
| **Course Abbreviated Title:** | FOR SCI 1 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Elective |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices**<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (82)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |

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| LAFS.1112.RST.3.8: | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| LAFS.1112.RST.3.9: | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| LAFS.1112.RST.4.10: | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| LAFS.1112.SL.1.1: | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| LAFS.1112.SL.1.2: | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the |

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| | credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.910.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. |

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| | b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the |

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| | discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **LAFS.910.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. |
| **LAFS.910.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. |
| **LAFS.910.RST.2.5:** | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). |
| **LAFS.910.RST.3.7:** | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. |

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| **LAFS.910.RST.4.10:** | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. |
| **LAFS.910.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.<br>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.<br>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). |
| **LAFS.910.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **SC.912.L.14.11:** | Classify and state the defining characteristics of epithelial tissue, connective tissue, muscle tissue, and nervous tissue. |
| **SC.912.L.14.12:** | Describe the anatomy and histology of bone tissue. |
| **SC.912.L.14.2:** | Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport). |

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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and |

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| | exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-VM.1.3:** | Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.E.5.8:** | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.<br>Remarks/Examples<br>Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
| **SC.912.L.14.1:** | Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.<br>Remarks/Examples<br>Describe how continuous investigations and/or new scientific information influenced the development of the cell theory. Recognize |

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| | the contributions of scientists in the development of the cell theory. |
| **SC.912.L.14.34:** | Describe the composition and physiology of blood, including that of the plasma and the formed elements. |
| **SC.912.L.14.35:** | Describe the steps in hemostasis, including the mechanism of coagulation. Include the basis for blood typing and transfusion reactions. |
| **SC.912.L.14.4:** | Compare and contrast structure and function of various types of microscopes. |
| **SC.912.L.14.51:** | Describe the function of the vertebrate integumentary system. |
| **SC.912.L.14.6:** | Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health. |
| **SC.912.L.15.15:** | Describe how mutation and genetic recombination increase genetic variation. |
| **SC.912.L.16.10:** | Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues. Remarks/Examples<br>Annually assessed on Biology EOC. |
| **SC.912.L.16.11:** | Discuss the technologies associated with forensic medicine and DNA identification, including restriction fragment length polymorphism (RFLP) analysis. |
| **SC.912.L.16.12:** | Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning). |
| **SC.912.L.16.2:** | Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles. |
| **SC.912.L.16.9:** | Explain how and why the genetic code is universal and is common to almost all organisms. |
| **SC.912.L.17.1:** | Discuss the characteristics of populations, such as number of individuals, age structure, density, and pattern of distribution. Remarks/Examples |

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| | Connections: MAFS.K12.MP.7: Look for and make use of structure. |
| [SC.912.L.18.1:](#) | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.<br>Remarks/Examples<br><br>Annually assessed on Biology EOC. Also assesses SC.912.L.18.11. |
| [SC.912.N.1.1:](#) | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,** |

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| | 10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, |

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| | or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |

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| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |

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| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |

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| SC.912.N.4.1: | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.4.2: | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.P.10.1: | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
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| SC.912.P.10.18: | Explore the theory of electromagnetism by comparing and |

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| | contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| **SC.912.P.10.20:** | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.<br>Remarks/Examples |
| | Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
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| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
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| **SC.912.P.12.1:** | Distinguish between scalar and vector quantities and assess which should be used to describe an event.<br>Remarks/Examples |
| | Distinguish between vector quantities (e.g., displacement, velocity, acceleration, force, and linear momentum) and scalar quantities (e.g., distance, speed, energy, mass, work).<br><br>MAFS.912.N-VM.1.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
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| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a |

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| | chemical reaction.<br>Remarks/Examples |
| | Various factors could include:  temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
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| **SC.912.P.12.2:** | Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.<br>Remarks/Examples |
| | Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.<br><br>Connections: MAFS.912.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
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| **SC.912.P.12.3:** | Interpret and apply Newton's three laws of motion.<br>Remarks/Examples |
| | Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton’s first law). Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton’s second law, F = ma). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = –F1 on 1 (Newton’s third law). |
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| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples |
| | (e.g. elastic and completely inelastic collisions). |
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| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they |

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| | or the light source are moving.<br>Remarks/Examples |
| | Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
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| SC.912.P.12.9: | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples |
| | The energy *E* and the momentum *p* depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
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| SC.912.P.8.1: | Differentiate among the four states of matter.<br>Remarks/Examples |
| | Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
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| SC.912.P.8.11: | Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH.<br>Remarks/Examples |
| | Use experimental data to illustrate and explain the pH scale to characterize acid and base solutions. Compare and contrast the strengths of various common acids and bases. |
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| SC.912.P.8.12: | Describe the properties of the carbon atom that make the diversity of carbon compounds possible.<br>Remarks/Examples |
| | Explain how the bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules. |
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| SC.912.P.8.2: | Differentiate between physical and chemical properties and physical and chemical changes of matter.<br>Remarks/Examples |
| | Discuss volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting and boiling points. Describe simple laboratory |

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| | techniques that can be used to separate homogeneous and heterogeneous mixtures (e.g. filtration, distillation, chromatography, evaporation). |
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| SC.912.P.8.7: | Interpret formula representations of molecules and compounds in terms of composition and structure.<br>Remarks/Examples |
| | Write chemical formulas for simple covalent (HCl, SO2, CO2, and CH4), ionic (Na+ + Cl– → NaCl) and molecular (O2, H2O) compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions. |
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## RELATED GLOSSARY TERM DEFINITIONS (85)

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| **Acceleration:** | Rate of change in velocity, usually expressed in meters per second per second; involves an increase or decrease in speed and/or a change in direction. |
| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |
| **Anatomy:** | The scientific study of the shape and structure of organisms and their parts. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Base:** | A substance that increases the OH– concentration of a solution; a proton acceptor. |
| **Biotechnology:** | The manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals). |
| **Boil:** | To change from a liquid to a vapor by the application of heat. |

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| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Chemical change:** | A reaction or a change in a substance produced by chemical means that results in producing a different chemical. |
| **Clone:** | To produce genetic material or produce or grow a cell, group of cells, or organism from a single original cell. |
| **Coagulation:** | The process of changing from a liquid to a gel or solid state by a series of chemical reactions, especially the process that results in the formation of a blood clot. |
| **Codominant:** | Relating to two alleles of a gene pair in a heterozygote that are both fully expressed. |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductivity:** | The ability or power to conduct or transmit heat, electricity, or sound. |
| **Connective tissue:** | Tissue that connects, supports, binds, or encloses the structures of the body. Connective tissues are made up of cells embedded in an extracellular matrix and include bones, cartilage, mucous membranes, fat, and blood. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Diversity:** | The different species in a given area or specific period of time. |
| **DNA:** | Deoxyribonucleic acid; a nucleic acid that is genetic material; present in all organisms. |

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| **Dominance:** | Tendency of certain (dominant) alleles to mask the expression of their corresponding (recessive) alleles. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Electrophoresis:** | The migration of electrically charged molecules through a fluid or gel under the influence of an electric field. Electrophoresis is used especially to separate combinations of compounds, such as fragments of DNA, for the purpose of studying their components. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |
| **Epithelial tissue:** | Membranous tissue covering internal organs and other internal surfaces of the body. |
| **Evaporation:** | The process by which a liquid is converted to its vapor phase by heating the liquid. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Forensic:** | Relating to the use of science or technology in the investigation |

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| | and establishment of facts or evidence in a court of law. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Genetic:** | Affecting or determined by genes. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hemostasis:** | The stoppage of blood flow through a blood vessel or body part. |
| **Histology:** | The scientific study of the microscopic structure of organism tissues. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Ligation:** | Binding. In genetics, refers to binding fragments of DNA together. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |

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| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Melt:** | To be changed from a solid to a liquid state especially by the application of heat. |
| **Membrane:** | A thin layer of tissue that surrounds or lines a cell, a group of cells, or a cavity; any barrier separating two fluids. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Mutation:** | A change in genetic sequence. |
| **Observation :** | What one has observed using senses or instruments. |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Physiology:** | The scientific study of an organism's vital functions, including growth, development, reproduction, the absorption and processing of nutrients, the synthesis and distribution of proteins and other organic molecules, and the functioning of different tissues, organs, and other anatomic structures. |
| **Plasma :** | The pale yellow or gray-yellow, protein-containing fluid portion of the blood in which the blood cells and platelets are normally suspended. |
| **Polygenic:** | Any of a group of nonallelic genes that collectively control the inheritance of a quantitative character or modify the expression of a qualitative character. |
| **Polymorphism:** | The existence of two or more, usually discrete, different forms in |

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| | an adult organism of the same species in the same habitat at the same time. In bees, the presence of queen, worker, and drone is an example of polymorphism. Differences between the sexes and between breeds of domesticated animals are not considered examples of polymorphism. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Recessive:** | An allele for a trait that will be masked unless the organism is homozygous for this trait. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Tissue:** | Similar cells acting to perform a specific function. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Vertebrate:** | Any of a large group of chordates of the subphylum Vertebrata (or Craniata), characterized by having a backbone. Vertebrates include fish, amphibians, reptiles, birds, and mammals. |
| **Vibration:** | A periodic and repetitive movement around an equilibrium point. |
| **Volume:** | A measure of the amount of space an object takes up; also the |

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| | loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Forensic Sciences 2- 2002490

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4936

## BASIC INFORMATION

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| **Course Number:** | 2002490 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated, Forensic Sciences 2, FOR SCI 2, Forensic |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Integrated Sciences |
| **Course Title:** | Forensic Sciences 2 |
| **Course Abbreviated Title:** | FOR SCI 2 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Elective |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices**<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (90)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |

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| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **SC.912.L.14.13:** | Distinguish between bones of the axial skeleton and the appendicular skeleton. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and |

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| | deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.910.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. |
| **LAFS.910.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. |

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| **LAFS.910.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. |
| **LAFS.910.RST.2.5:** | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, |

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| | tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **LAFS.910.RST.3.7:** | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and |

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| | translate information expressed visually or mathematically (e.g., in an equation) into words. |
| LAFS.910.RST.4.10: | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. |
| LAFS.910.WHST.1.2: | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.<br>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.<br>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). |
| LAFS.910.WHST.3.9: | Draw evidence from informational texts to support analysis, reflection, and research. |
| SC.912.L.14.14: | Identify the major bones of the axial and appendicular skeleton. |
| SC.912.L.14.15: | Identify major markings (such as foramina, fossae, tubercles, etc.) on a skeleton. Explain why these markings are important. |
| SC.912.L.14.16: | Describe the anatomy and histology, including ultrastructure, of |

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| | muscle tissue. |
| SC.912.L.14.36: | Describe the factors affecting blood flow through the cardiovascular system. |
| SC.912.L.14.4: | Compare and contrast structure and function of various types of microscopes. |
| SC.912.L.14.43: | Describe the histology of the respiratory system. |
| SC.912.L.14.44: | Describe the physiology of the respiratory system including the mechanisms of ventilation, gas exchange, gas transport and the mechanisms that control the rate of ventilation. |
| MAFS.912.F-IF.3.7: | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end** |

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| | behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples<br>Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-VM.1.3:** | Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.E.5.8:** | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed |

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| | observational tools.<br>Remarks/Examples |
| | Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
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| **SC.912.L.14.11:** | Classify and state the defining characteristics of epithelial tissue, connective tissue, muscle tissue, and nervous tissue. |
| **SC.912.L.14.12:** | Describe the anatomy and histology of bone tissue. |
| **SC.912.L.14.46:** | Describe the physiology of the digestive system, including mechanical digestion, chemical digestion, absorption and the neural and hormonal mechanisms of control. |
| **SC.912.L.14.47:** | Describe the physiology of urine formation by the kidney. |
| **SC.912.L.14.6:** | Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health. |
| **SC.912.L.16.10:** | Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. |
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| **SC.912.L.16.11:** | Discuss the technologies associated with forensic medicine and DNA identification, including restriction fragment length polymorphism (RFLP) analysis. |
| **SC.912.L.16.12:** | Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning). |
| **SC.912.L.16.3:** | Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.<br>Remarks/Examples |
| | Integrate HE.912.C.1.7. Analyze how heredity and family history can impact personal health. Annually assessed on Biology EOC. Also assesses SC.912.L.16.4; SC.912.L.16.5; SC.912.L.16.9. |
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| SC.912.L.16.4: | Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring. |
| SC.912.L.16.5: | Explain the basic processes of transcription and translation, and how they result in the expression of genes. |
| SC.912.L.16.9: | Explain how and why the genetic code is universal and is common to almost all organisms. |
| SC.912.L.17.6: | Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism. |
| SC.912.L.17.9: | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.E.7.1. |
| SC.912.L.18.10: | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell. |
| SC.912.L.18.11: | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity. |
| SC.912.L.18.12: | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| SC.912.L.18.3: | Describe the structures of fatty acids, triglycerides, phospholipids, and steroids. Explain the functions of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membranes. |
| SC.912.L.18.4: | Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and |

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| | function of enzymes. |
| SC.912.N.1.5: | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.1.1: | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific |

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| | concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br>For Students in Grades 9-10<br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing |

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| | technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
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| SC.912.N.1.2: | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.1.3: | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
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| SC.912.N.1.4: | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| SC.912.N.3.5: | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |

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| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.13:** | Relate the configuration of static charges to the electric field, electric force, electric potential, and electric potential energy.<br>Remarks/Examples |
| | Using Coulomb's law, determine the force on a stationary charge due to other stationary charges, and explain that this force is many times greater than the gravitational force. Recognize the relationship between forces and their associated potential energies and that the electric field is directly related to the rate of change of the electric |

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| | potential from point to point in space. |
| SC.912.P.10.14: | Differentiate among conductors, semiconductors, and insulators.<br>Remarks/Examples |
| | Describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators. |
| SC.912.P.10.15: | Investigate and explain the relationships among current, voltage, resistance, and power.<br>Remarks/Examples |
| | Use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |
| SC.912.P.10.18: | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
| SC.912.P.10.4: | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| SC.912.P.10.7: | Distinguish between endothermic and exothermic chemical processes.<br>Remarks/Examples |
| | Classify chemical reactions and phase changes as exothermic (release thermal energy) or endothermic (absorb thermal energy). |
| SC.912.P.12.1: | Distinguish between scalar and vector quantities and assess which should be used to describe an event.<br>Remarks/Examples |
| | Distinguish between vector quantities (e.g., displacement, velocity, acceleration, force, and linear momentum) and scalar quantities (e.g., distance, speed, energy, mass, work). |

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| | MAFS.912.N-VM.1.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br>Remarks/Examples |
| | Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
| **SC.912.P.12.2:** | Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.<br>Remarks/Examples |
| | Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.<br><br>Connections: MAFS.912.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.P.12.3:** | Interpret and apply Newton's three laws of motion.<br>Remarks/Examples |
| | Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law). Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton's second law, F = ma). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = –F1 on 1 (Newton's third law). |
| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to |

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| | interactions, such as collisions between objects.<br>Remarks/Examples<br>(e.g. elastic and completely inelastic collisions). |
| SC.912.P.12.6: | Qualitatively apply the concept of angular momentum.<br>Remarks/Examples<br>Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]). |
| SC.912.P.8.10: | Describe oxidation-reduction reactions in living and non-living systems.<br>Remarks/Examples<br>Identify the substance(s) losing and gaining electrons in oxidation-reduction reactions. Discuss voltaic cells, various types of batteries, electrolysis of water, smelting and purification of metals, electrolysis of brine versus molten NaCl, neutralization reactions, electrolytic cells, and living systems (photosynthesis and cellular respiration). |
| SC.912.P.8.13: | Identify selected functional groups and relate how they contribute to properties of carbon compounds.<br>Remarks/Examples<br>Recognize functional groups in structural formulas of carbon molecules (e.g. sugars, proteins, nucleotides, amino acids, hydroxyl groups which form alcohols, carbonyl groups which form aldehydes / ketones, carboxyl groups which form carboxylic acids, etc.). |
| SC.912.P.8.7: | Interpret formula representations of molecules and compounds in terms of composition and structure.<br>Remarks/Examples<br>Write chemical formulas for simple covalent (HCl, $SO_2$, $CO_2$, and $CH_4$), ionic ($Na^+ + Cl^- \rightarrow NaCl$) and molecular ($O_2$, $H_2O$) compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions. |

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| SC.912.P.8.8: | Characterize types of chemical reactions, for example: redox, acid-base, synthesis, and single and double replacement reactions.<br>Remarks/Examples |
| | Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. |
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## RELATED GLOSSARY TERM DEFINITIONS (95)

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| **Absorption :** | 1-The taking up and storing of energy, such as radiation, light, or sound, without it being reflected or transmitted. 2- The movement of a substance, such as a liquid or solute, across a cell membrane by means of diffusion or osmosis.- The process by which one substance, such as a solid or liquid, takes up another substance, such as a liquid or gas, through minute pores or spaces between its molecules. A paper towel takes up water, and water takes up carbon dioxide, by absorption. |
| **Acceleration:** | Rate of change in velocity, usually expressed in meters per second per second; involves an increase or decrease in speed and/or a change in direction. |
| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |
| **Adenosine triphosphate (ATP):** | An organic compound that is composed of adenosine and three phosphate groups. It serves as a source of energy for many metabolic processes. ATP releases energy when it is broken down into ADP and phosphate by hydrolysis during cell metabolism. |
| **Amino acid:** | An organic molecule containing an amino group (-NH2), a carboxyl (-COOH) group, and a variable side chain (R group) that distinguishes the amino acid. Proteins are synthesized from amino acids. |
| **Anatomy:** | The scientific study of the shape and structure of organisms and |

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| | their parts. |
| **Angular momentum:** | A vector quantity that is a measure of the rotational momentum of a rotating body or system, that is equal in classical physics to the product of the angular velocity of the body or system and its moment of inertia with respect to the rotation axis, and that is directed along the rotation axis. |
| **Axial skeleton:** | The bones constituting the head and trunk of a vertebrate body. |
| **Axis:** | The imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph. |
| **Biotechnology:** | The manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals). |
| **Cardiovascular system:** | The bodily system consisting of the heart, blood vessels, and blood that circulates blood throughout the body, delivers nutrients and other essential materials to cells, and removes waste products. |
| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Circuit:** | An interconnection of electrical elements forming a complete path for the flow of current. |
| **Clone:** | To produce genetic material or produce or grow a cell, group of cells, or organism from a single original cell. |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |

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| **Conductor:** | A material or an object that conducts heat, electricity, light, or sound. |
| **Connective tissue:** | Tissue that connects, supports, binds, or encloses the structures of the body. Connective tissues are made up of cells embedded in an extracellular matrix and include bones, cartilage, mucous membranes, fat, and blood. |
| **Consumer:** | An organism that feeds on other organisms for food. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Decomposer :** | Any organism that feeds or obtains nutrients by breaking down organic matter from dead organisms. |
| **Digestive system:** | The alimentary canal and digestive glands regarded as an integrated system responsible for the ingestion, digestion, and absorption of food. |
| **DNA:** | Deoxyribonucleic acid; a nucleic acid that is genetic material; present in all organisms. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electric potential:** | A measure of the work required by an electric field to move electric charges. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |

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| **Electrophoresis:** | The migration of electrically charged molecules through a fluid or gel under the influence of an electric field. Electrophoresis is used especially to separate combinations of compounds, such as fragments of DNA, for the purpose of studying their components. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |
| **Epithelial tissue:** | Membranous tissue covering internal organs and other internal surfaces of the body. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fatty acid:** | Any of a large group of organic acids, especially those found in animal and vegetable fats and oils. Fatty acids are mainly composed of long chains of hydrocarbons ending in a carboxyl group. A fatty acid is saturated when the bonds between carbon atoms are all single bonds. It is unsaturated when any of these bonds is a double bond. |
| **Foramen:** | An opening or short passage, especially in the body. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Forensic:** | Relating to the use of science or technology in the investigation and establishment of facts or evidence in a court of law. |
| **Fossa:** | A small cavity or depression, as in a bone. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gamete:** | A reproductive cell having the haploid number of chromosomes, |

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| | especially a mature sperm or egg capable of fusing with a gamete of the opposite sex to produce the fertilized egg. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Genetic:** | Affecting or determined by genes. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Heredity:** | The passage of biological traits or characteristics from parents to offspring through the inheritance of genes. |
| **Histology:** | The scientific study of the microscopic structure of organism tissues. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Insulator:** | A material or an object that does not easily allow heat, electricity, light, or sound to pass through it. Air, cloth and rubber are good electrical insulators; feathers and wool make good thermal insulators. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Ligation:** | Binding. In genetics, refers to binding fragments of DNA together. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Membrane:** | A thin layer of tissue that surrounds or lines a cell, a group of cells, or a cavity; any barrier separating two fluids. |

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| **Metal:** | Any of a category of electropositive elements that usually have a shiny surface, are generally good conductors of heat and electricity, and can be melted or fused, hammered into thin sheets, or drawn into wires. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Observation :** | What one has observed using senses or instruments. |
| **Offspring:** | The progeny or descendants of an animal or plant considered as a group. |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Phospholipid:** | Any of various phosphorus-containing lipids, such as lecithin, that are composed mainly of fatty acids, a phosphate group, and a simple organic molecule such as glycerol. |
| **Physiology:** | The scientific study of an organism's vital functions, including growth, development, reproduction, the absorption and processing of nutrients, the synthesis and distribution of proteins and other organic molecules, and the functioning of different tissues, organs, and other anatomic structures. |
| **Polymorphism:** | The existence of two or more, usually discrete, different forms in an adult organism of the same species in the same habitat at the same time. In bees, the presence of queen, worker, and drone is an example of polymorphism. Differences between the sexes and between breeds of domesticated animals are not considered examples of polymorphism. |

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| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Producer :** | An organism, usually a plant or bacterium, that produces organic compounds from simple inorganic molecules and energy (typically light energy) from the environment. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Replication:** | In scientific research, conducting an experiment to confirm findings or to ensure accuracy. In molecular biology, the process by which genetic material is copied in cells. |
| **Resistance :** | The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. |
| **Respiratory system:** | The system of organs and structures in which gas exchange takes place, consisting of the lungs and airways in air-breathing vertebrates, gills in fish and many invertebrates, the outer covering of the body in worms, and specialized air ducts in insects. |
| **Semiconductor:** | Any of various solid crystalline substances, such as germanium or silicon, having electrical conductivity greater than insulators but less than good conductors, and used especially as a base material for computer chips and other electronic devices. |
| **Skeleton:** | The internal structure of vertebrate animals, composed of bone or cartilage, that supports the body, serves as a framework for the attachment of muscles, and protects the vital organs and associated structures. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Steroid:** | Any of numerous naturally occurring or synthetic fat-soluble organic compounds having, as a basis, 17 carbon atoms arranged in four rings and including the sterols and bile acids, adrenal and sex hormones, certain natural drugs such as digitalis compounds, and the precursors of certain vitamins. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |

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| **Tissue:** | Similar cells acting to perform a specific function. |
| **Triglyceride:** | A naturally occurring ester of three fatty acids and glycerol that is the chief constituent of fats and oils. |
| **Tubercle:** | A small rounded projecting part or outgrowth, such as a wartlike excrescence on the roots of some leguminous plants or a knoblike process in the skin or on a bone. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Voltage:** | A measure of the difference in electric potential between two points in space, a material, or an electric circuit, expressed in volts. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Marine Science 1- 2002500

**Direct link to this page:**[http://www.cpalms.org/Public/PreviewCourse/Preview/4334](http://www.cpalms.org/Public/PreviewCourse/Preview/4334)

## BASIC INFORMATION

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| **Course Number:** | 2002500 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated, Marine Science 1, MARINE SCI 1, Marine |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Integrated Sciences |
| **Course Title:** | Marine Science 1 |
| **Course Abbreviated Title:** | MARINE SCI 1 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices:** Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (62)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |

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| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative |

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| | discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, |

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| | audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |

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| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to |

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| | ongoing feedback, including new arguments or information. |
| LAFS.1112.WHST.3.7: | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| MAFS.912.F-IF.2.4: | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and |

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| | exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **SC.912.E.7.9:** | Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.<br>Remarks/Examples |
| | Explain how the oceans act as sources/sinks of heat energy, store carbon dioxide mostly as dissolved HCO3– and CaCO3 as precipitate or biogenic carbonate deposits, which have an impact on climate change. |
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| **SC.912.L.14.6:** | Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health. |
| **SC.912.L.15.13:** | Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success. |

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| | Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.L.15.14, SC.912.L.15.15, and SC.912.N.1.3. |
| **SC.912.L.17.1:** | Discuss the characteristics of populations, such as number of individuals, age structure, density, and pattern of distribution.<br>Remarks/Examples<br>Connections: MAFS.K12.MP.7: Look for and make use of structure. |
| **SC.912.L.17.10:** | Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle. |
| **SC.912.L.17.11:** | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| **SC.912.L.17.16:** | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br>Remarks/Examples<br>Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |
| **SC.912.L.17.2:** | Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature. |
| **SC.912.L.17.3:** | Discuss how various oceanic and freshwater processes, such as currents, tides, and waves, affect the abundance of aquatic organisms. |
| **SC.912.L.17.4:** | Describe changes in ecosystems resulting from seasonal variations, climate change and succession. |
| **SC.912.L.17.6:** | Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism. |
| **SC.912.L.17.7:** | Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems. |

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| **SC.912.L.17.8:** | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species. |
| **SC.912.L.17.9:** | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.E.7.1. |
| **SC.912.L.18.12:** | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables** |

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| | **and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure |

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| | when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br><br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented. |

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| | Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
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| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations |

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| | (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach. |

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| | MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental. Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity. Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| **SC.912.P.10.20:** | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another. Remarks/Examples |
| | Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
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## RELATED GLOSSARY TERM DEFINITIONS (39)

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| **Abiotic:** | An environmental factor not associated with or derived from living organisms. |
| **Aquatic:** | In or on the water |
| **Biotic:** | Factors in an environment relating to, caused by, or produced by living organisms. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Consumer:** | An organism that feeds on other organisms for food. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Decomposer :** | Any organism that feeds or obtains nutrients by breaking down organic matter from dead organisms. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Genetic:** | Affecting or determined by genes. |
| **Heat:** | Energy that transfers between substances because of a |

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| | temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Natural selection:** | The theory stating every organism displays slight variations from related organisms, and these variations make an organism more or less suited for survival and reproduction in specific habitats. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Observation :** | What one has observed using senses or instruments. |
| **Offspring:** | The progeny or descendants of an animal or plant considered as a group. |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |
| **Producer :** | An organism, usually a plant or bacterium, that produces organic compounds from simple inorganic molecules and energy (typically light energy) from the environment. |

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| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Tide:** | The regular rise and fall in the surface level of the Earth's oceans, seas, and bays caused by the gravitational attraction of the Moon and to a lesser extent of the Sun. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Vibration:** | A periodic and repetitive movement around an equilibrium point. |
| **Wavelength:** | The distance between crests of a wave. |

# Course: Marine Science 1 Honors- 2002510

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4337

## BASIC INFORMATION

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| **Course Number:** | 2002510 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated, Marine Science 1 Honors, MARINE SCI 1 HON, Marine, Honors |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Integrated Sciences |
| **Course Title:** | Marine Science 1 Honors |
| **Course Abbreviated Title:** | MARINE SCI 1 HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **General Notes:** | While the content focus of this course is consistent with the Marine Science I course, students will explore these concepts in |

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| | greater depth. In general, the academic pace and rigor will be greatly increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices:** Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (66)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a |

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| | thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization |

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| | that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to |

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| | manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |

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| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape |

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| | of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.** |

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| | c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples<br>Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course. |

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| | **Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
| **SC.912.E.7.6:** | Relate the formation of severe weather to the various physical factors.<br>Remarks/Examples<br>Identify the causes of severe weather. Compare and contrast physical factors that affect the formation of severe weather events (e.g. hurricanes, tornados, flash floods, thunderstorms, and drought). |
| **SC.912.E.7.9:** | Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.<br>Remarks/Examples<br>Explain how the oceans act as sources/sinks of heat energy, store carbon dioxide mostly as dissolved HCO3– and CaCO3 as precipitate or biogenic carbonate deposits, which have an impact on climate change. |
| **SC.912.L.14.6:** | Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health. |
| **SC.912.L.15.13:** | Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.L.15.14, |

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| | SC.912.L.15.15, and SC.912.N.1.3. |
| **SC.912.L.16.10:** | Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| **SC.912.L.17.1:** | Discuss the characteristics of populations, such as number of individuals, age structure, density, and pattern of distribution.<br>Remarks/Examples<br>Connections: MAFS.K12.MP.7: Look for and make use of structure. |
| **SC.912.L.17.10:** | Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle. |
| **SC.912.L.17.11:** | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| **SC.912.L.17.16:** | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br>Remarks/Examples<br>Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |
| **SC.912.L.17.17:** | Assess the effectiveness of innovative methods of protecting the environment. |
| **SC.912.L.17.18:** | Describe how human population size and resource use relate to environmental quality. |
| **SC.912.L.17.2:** | Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature. |
| **SC.912.L.17.3:** | Discuss how various oceanic and freshwater processes, such as currents, tides, and waves, affect the abundance of aquatic organisms. |

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| **SC.912.L.17.4:** | Describe changes in ecosystems resulting from seasonal variations, climate change and succession. |
| **SC.912.L.17.6:** | Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism. |
| **SC.912.L.17.7:** | Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems. |
| **SC.912.L.17.8:** | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species. |
| **SC.912.L.17.9:** | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.E.7.1. |
| **SC.912.L.18.12:** | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,** |

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| | 4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or |

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| | technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>For Students in Grades 11-12<br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br><br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs. |

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| | Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
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| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being |

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| | studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence. |

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| | Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| SC.912.N.4.1: | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.4.2: | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.P.10.2: | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| SC.912.P.10.20: | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another. |

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| | Remarks/Examples |
| | Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
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## RELATED GLOSSARY TERM DEFINITIONS (40)

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| **Abiotic:** | An environmental factor not associated with or derived from living organisms. |
| **Aquatic:** | In or on the water |
| **Biotechnology:** | The manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals). |
| **Biotic:** | Factors in an environment relating to, caused by, or produced by living organisms. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Consumer:** | An organism that feeds on other organisms for food. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Decomposer :** | Any organism that feeds or obtains nutrients by breaking down organic matter from dead organisms. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Experiment:** | A procedure that is carried out and repeated under controlled |

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| | conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Genetic:** | Affecting or determined by genes. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Natural selection:** | The theory stating every organism displays slight variations from related organisms, and these variations make an organism more or less suited for survival and reproduction in specific habitats. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |

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| **Observation :** | What one has observed using senses or instruments. |
| **Offspring:** | The progeny or descendants of an animal or plant considered as a group. |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |
| **Producer :** | An organism, usually a plant or bacterium, that produces organic compounds from simple inorganic molecules and energy (typically light energy) from the environment. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Tide:** | The regular rise and fall in the surface level of the Earth's oceans, seas, and bays caused by the gravitational attraction of the Moon and to a lesser extent of the Sun. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Vibration:** | A periodic and repetitive movement around an equilibrium point. |
| **Wavelength:** | The distance between crests of a wave. |

The alphanumeric coding scheme has changed –
Language Arts Common Core (LACC) is now Language Arts Florida Standards (LAFS)
Mathematics Common Core (MACC) is now Mathematics Florida Standards (MAFS)
Amended Standard

# Course: Marine Science 2- 2002520

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4348

## BASIC INFORMATION

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| **Course Number:** | 2002520 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated, Marine Science 2, MARINE SCI 2, Marine |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Integrated Sciences |
| **Course Title:** | Marine Science 2 |
| **Course Abbreviated Title:** | MARINE SCI 2 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices** Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (63)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |

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| LAFS.1112.RST.3.8: | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| LAFS.1112.RST.3.9: | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| LAFS.1112.RST.4.10: | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| LAFS.1112.WHST.3.8: | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| LAFS.1112.WHST.3.9: | Draw evidence from informational texts to support analysis, reflection, and research. |
| LAFS.1112.WHST.4.10: | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| LAFS.1112.SL.1.1: | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to |

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| | questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, |

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| | histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |

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| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to |

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| | ongoing feedback, including new arguments or information. |
| LAFS.1112.WHST.3.7: | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| MAFS.912.F-IF.2.4: | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and |

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| | exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, |

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| | and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.E.7.4:** | Summarize the conditions that contribute to the climate of a geographic area, including the relationships to lakes and oceans.<br>Remarks/Examples |
| | Describe how latitude, altitude, topography, prevailing winds, proximity to large bodies of water, vegetation and ocean currents determine the climate of a geographic area. |
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| SC.912.E.7.8: | Explain how various atmospheric, oceanic, and hydrologic conditions in Florida have influenced and can influence human behavior, both individually and collectively.<br>Remarks/Examples |
| | Describe and discuss the conditions that bring about floods, droughts, wildfires, thunderstorms, hurricanes, rip currents, and tsunamis and how these conditions can influence human behavior (e.g. energy alternatives, conservation, migration, storm preparedness). |
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| SC.912.E.7.9: | Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.<br>Remarks/Examples |
| | Explain how the oceans act as sources/sinks of heat energy, store carbon dioxide mostly as dissolved HCO3– and CaCO3 as precipitate or biogenic carbonate deposits, which have an impact on climate change. |
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| SC.912.L.17.10: | Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle. |
| SC.912.L.17.11: | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| SC.912.L.17.13: | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| SC.912.L.17.16: | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br>Remarks/Examples |
| | Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |
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| SC.912.L.17.4: | Describe changes in ecosystems resulting from seasonal variations, climate change and succession. |

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| **SC.912.L.17.5:** | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. Also assesses SC.912.L.17.2; SC.912.L.17.4; SC.912.L.17.8; SC.912.N.1.4. |
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| **SC.912.L.17.7:** | Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems. |
| **SC.912.L.18.2:** | Describe the important structural characteristics of monosaccharides, disaccharides, and polysaccharides and explain the functions of carbohydrates in living things. |
| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and |

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| | persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines). |

3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

Remarks/Examples

Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

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| | LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>For Students in Grades 11-12<br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that |

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| | results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
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| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |

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| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |

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| SC.912.N.4.2: | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.P.10.2: | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| SC.912.P.10.20: | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.<br>Remarks/Examples |
| | Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
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## RELATED GLOSSARY TERM DEFINITIONS (33)

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| **Abiotic:** | An environmental factor not associated with or derived from living organisms. |
| **Biotic:** | Factors in an environment relating to, caused by, or produced by living organisms. |
| **Carbohydrate:** | Any of a group of organic compounds that includes sugars, starches, celluloses, and gums and serves as a major energy source in the diet of animals. These compounds are produced by photosynthetic plants and contain only carbon, hydrogen, and oxygen, usually in the ratio 1:2:1. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Disaccharide:** | Any of a class of sugars, including lactose and sucrose, that are composed of two monosaccharides. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |

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| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Latitude:** | A measure of relative position north or south on the Earth's surface, measured in degrees from the equator, which has a latitude of 0°, with the poles having a latitude of 90° north and south. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Monosaccharide:** | Any of a class of carbohydrates that cannot be broken down to simpler sugars by hydrolysis and that constitute the building blocks of oligosaccharides and polysaccharides. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Observation :** | What one has observed using senses or instruments. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |
| **Polysaccharide:** | Any of a class of carbohydrates, such as starch and cellulose, consisting of a number of monosaccharides joined by glycosidic bonds. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |

# Course: Marine Science 2 Honors- 2002530

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4363

## BASIC INFORMATION

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| **Course Number:** | 2002530 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated, Marine Science 2 Honors, MARINE SCI 2 HON, Marine, Honors |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Integrated Sciences |
| **Course Title:** | Marine Science 2 Honors |
| **Course Abbreviated Title:** | MARINE SCI 2 HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **General Notes:** | While the content focus of this course is consistent with the Marine Science 2 course, students will explore these concepts in |

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| | greater depth. In general, the academic pace and rigor will be greatly increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices** Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (67)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a |

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| | science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, |

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| | building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence |

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| | and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |

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| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |

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| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed |

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| | symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions |

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| | presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. |

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| | a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.E.7.2:** | Analyze the causes of the various kinds of surface and deep water motion within the oceans and their impacts on the transfer of energy between the poles and the equator.<br>Remarks/Examples |
| | Explain how surface and deep-water circulation patterns (Coriolis effect, La Niña, El Niño, Southern Oscillation, upwelling, ocean surface cooling, freshwater influx, density differences, Labrador Current and Gulf Stream) impact energy transfer in the environment. |

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| SC.912.E.7.3: | Differentiate and describe the various interactions among Earth systems, including: atmosphere, hydrosphere, cryosphere, geosphere, and biosphere.<br>Remarks/Examples |
| | Interactions include transfer of energy (biogeochemical cycles, water cycle, ground and surface waters, photosynthesis, radiation, plate tectonics, conduction, and convection), storms, winds, waves, erosion, currents, deforestation and wildfires, hurricanes, tsunamis, volcanoes. |
| SC.912.E.7.4: | Summarize the conditions that contribute to the climate of a geographic area, including the relationships to lakes and oceans.<br>Remarks/Examples |
| | Describe how latitude, altitude, topography, prevailing winds, proximity to large bodies of water, vegetation and ocean currents determine the climate of a geographic area. |
| SC.912.E.7.5: | Predict future weather conditions based on present observations and conceptual models and recognize limitations and uncertainties of such predictions.<br>Remarks/Examples |
| | Use models, weather maps and other tools to predict weather conditions and differentiate between accuracy of short-range and long-range weather forecasts. |
| SC.912.E.7.8: | Explain how various atmospheric, oceanic, and hydrologic conditions in Florida have influenced and can influence human behavior, both individually and collectively.<br>Remarks/Examples |
| | Describe and discuss the conditions that bring about floods, droughts, wildfires, thunderstorms, hurricanes, rip currents, and tsunamis and how these conditions can influence human behavior (e.g. energy alternatives, conservation, migration, storm preparedness). |
| SC.912.E.7.9: | Cite evidence that the ocean has had a significant influence on |

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| | climate change by absorbing, storing, and moving heat, carbon, and water.<br>Remarks/Examples |
| | Explain how the oceans act as sources/sinks of heat energy, store carbon dioxide mostly as dissolved HCO3– and CaCO3 as precipitate or biogenic carbonate deposits, which have an impact on climate change. |
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| **SC.912.L.17.10:** | Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle. |
| **SC.912.L.17.11:** | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| **SC.912.L.17.13:** | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| **SC.912.L.17.15:** | Discuss the effects of technology on environmental quality. |
| **SC.912.L.17.16:** | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br>Remarks/Examples |
| | Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |
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| **SC.912.L.17.4:** | Describe changes in ecosystems resulting from seasonal variations, climate change and succession. |
| **SC.912.L.17.5:** | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. Also assesses SC.912.L.17.2; SC.912.L.17.4; SC.912.L.17.8; SC.912.N.1.4. |
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| **SC.912.L.17.7:** | Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems. |

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| **SC.912.L.18.12:** | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and** |

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| | 11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. |
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| | LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples<br>Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability |

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| | according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |

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| SC.912.N.2.1: | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.5: | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **[SC.912.N.3.1:]** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **[SC.912.N.3.5:]** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **[SC.912.N.4.1:]** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **[SC.912.N.4.2:]** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and |

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| | how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| **SC.912.P.10.20:** | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.<br>Remarks/Examples |
| | Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
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## RELATED GLOSSARY TERM DEFINITIONS (42)

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| **Abiotic:** | An environmental factor not associated with or derived from living organisms. |
| **Atmosphere:** | The layers of gas that surround Earth, other planets, or stars. |
| **Biosphere:** | The part of the earth and its atmosphere in which living organisms exist or that is capable of supporting life. |
| **Biotic:** | Factors in an environment relating to, caused by, or produced by |

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| | living organisms. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Deforestation:** | The cutting down and removal of all or most of the trees in a forested area. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Equator :** | An imaginary circle around Earth's surface located between the poles and a plane perpendicular to its axis of rotation that divides it into the Northern and Southern Hemispheres. |
| **Erosion:** | The wearing away of Earth's surface by the breakdown and transportation of rock and soil. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Geosphere:** | The solid part of the earth consisting of the crust and outer mantle. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of |

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| | energy is always from the warmer substance to the cooler substance |
| **Hydrosphere:** | All of the Earth's water, including surface water (water in oceans, lakes, and rivers), groundwater (water in soil and beneath the Earth's surface), snowcover, ice, and water in the atmosphere, including water vapor. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Latitude:** | A measure of relative position north or south on the Earth's surface, measured in degrees from the equator, which has a latitude of 0°, with the poles having a latitude of 90° north and south. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Observation :** | What one has observed using senses or instruments. |
| **Pole:** | Either of the points at which the Earth's axis of rotation intersects the Earth's surface; the North Pole or South Pole. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |

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| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Vibration:** | A periodic and repetitive movement around an equilibrium point. |
| **Water cycle:** | The path water takes as it is being cycled through the environment, including condensation, evaporation, and precipitation. |
| **Wavelength:** | The distance between crests of a wave. |

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| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
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# Course: Solar Energy Honors- 2002540

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4373

## BASIC INFORMATION

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| **Course Number:** | 2002540 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated, Solar Energy Honors, SOLAR ENERGY HON, Solar Energy, Solar, Energy, Honors |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Integrated Sciences |
| **Course Title:** | Solar Energy Honors |
| **Course Abbreviated Title:** | SOLAR ENERGY HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Elective |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus |

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| | and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices** Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (70)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a |

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| | process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **SC.912.L.17.15:** | Discuss the effects of technology on environmental quality. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; |

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| | synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate |

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| | to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. |

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| | a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; |

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| | synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. |

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| | a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ |

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| | and $y=100^2$ |
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| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. |

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| | S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.E.5.4:** | Explain the physical properties of the Sun and its dynamic nature and connect them to conditions and events on Earth.<br>Remarks/Examples |
| | Describe the physical properties of the Sun (sunspot cycles, solar flares, prominences, layers of the Sun, coronal mass ejections, and nuclear reactions) and the impact of the Sun as the main source of external energy for the Earth. |
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| **SC.912.E.6.6:** | Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.<br>Remarks/Examples |
| | Investigate and discuss how humans affect and are affected by geological systems and processes by describing the possible long-term consequences (costs and benefits) that increased human consumption (e.g. mining and extraction techniques; off-shore drilling; petrochemical refining) has placed on the environment (e.g. pollution, health, habitat destruction) and the impact on future energy production. |
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| **SC.912.E.7.1:** | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.<br>Remarks/Examples |
| | Describe that the Earth system contains fixed amounts of each |

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| | stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun. |
| **SC.912.E.7.2:** | Analyze the causes of the various kinds of surface and deep water motion within the oceans and their impacts on the transfer of energy between the poles and the equator.<br>Remarks/Examples<br>Explain how surface and deep-water circulation patterns (Coriolis effect, La Niña, El Niño, Southern Oscillation, upwelling, ocean surface cooling, freshwater influx, density differences, Labrador Current and Gulf Stream) impact energy transfer in the environment. |
| **SC.912.E.7.9:** | Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.<br>Remarks/Examples<br>Explain how the oceans act as sources/sinks of heat energy, store carbon dioxide mostly as dissolved $HCO_3^-$ and $CaCO_3$ as precipitate or biogenic carbonate deposits, which have an impact on climate change. |
| **SC.912.L.17.11:** | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| **SC.912.L.17.12:** | Discuss the political, social, and environmental consequences of sustainable use of land.<br>Remarks/Examples<br>Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated. |
| **SC.912.L.17.13:** | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| **SC.912.L.17.16:** | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, |

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| | greenhouse gases, ozone depletion, and surface and groundwater pollution.<br>Remarks/Examples |
| | Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |
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| **SC.912.L.17.17:** | Assess the effectiveness of innovative methods of protecting the environment. |
| **SC.912.L.17.18:** | Describe how human population size and resource use relate to environmental quality. |
| **SC.912.L.17.19:** | Describe how different natural resources are produced and how their rates of use and renewal limit availability. |
| **SC.912.L.17.20:** | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. Also assesses SC.912.L.17.11, SC.912.L.17.13, SC.912.N.1.3. |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, |

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| | measured, and tested through scientific experimentation. |
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| SC.912.N.1.1: | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |

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| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in |

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| | solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict |

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| | standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer. |

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| | Remarks/Examples<br>Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples<br>Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples<br>Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples<br>Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and |

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| | persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| SC.912.P.10.1: | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others. Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
| SC.912.P.10.2: | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity. Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
| SC.912.P.10.3: | Compare and contrast work and power qualitatively and quantitatively. |
| SC.912.P.10.4: | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| SC.912.P.10.9: | Describe the quantization of energy at the atomic level. Remarks/Examples |
| | Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship $E = hv$). |

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| **SC.912.P.8.12:** | Describe the properties of the carbon atom that make the diversity of carbon compounds possible.<br>Remarks/Examples |
| | Explain how the bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules. |
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| **SC.912.P.8.13:** | Identify selected functional groups and relate how they contribute to properties of carbon compounds.<br>Remarks/Examples |
| | Recognize functional groups in structural formulas of carbon molecules (e.g. sugars, proteins, nucleotides, amino acids, hydroxyl groups which form alcohols, carbonyl groups which form aldehydes / ketones, carboxyl groups which form carboxylic acids, etc.). |
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## RELATED GLOSSARY TERM DEFINITIONS (48)

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| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Amino acid:** | An organic molecule containing an amino group (-NH2), a carboxyl (-COOH) group, and a variable side chain (R group) that distinguishes the amino acid. Proteins are synthesized from amino acids. |
| **Atmosphere:** | The layers of gas that surround Earth, other planets, or stars. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |

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| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Diversity:** | The different species in a given area or specific period of time. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Equator :** | An imaginary circle around Earth's surface located between the poles and a plane perpendicular to its axis of rotation that divides it into the Northern and Southern Hemispheres. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Habitat:** | A place in an ecosystem where an organism normally lives. |
| **Heat:** | Energy that transfers between substances because of a |

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| | temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Natural resource:** | Something, such as a forest, a mineral deposit, or fresh water, that is found in nature and is necessary or useful to humans. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Observation :** | What one has observed using senses or instruments. |

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| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Pole:** | Either of the points at which the Earth's axis of rotation intersects the Earth's surface; the North Pole or South Pole. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Sun:** | The closest star to Earth and the center of our solar system. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |

# Course: Solar Energy 2 Honors- 2002550

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4937

## BASIC INFORMATION

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| **Course Number:** | 2002550 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Integrated Sciences, Integrated, Solar Energy 2 Honors, Solar Energy, Solar, Energy, Honors, SOLAR ENERGY 2 HON, Elective |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Integrated Sciences |
| **Course Title:** | Solar Energy 2 Honors |
| **Course Abbreviated Title:** | SOLAR ENERGY 2 HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Elective |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **Version Description:** | This course is designed to educate students more specifically on the generation of heat from solar energy. Building on concepts |

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| | from Solar Energy Honors, this course will focus largely on fluid mechanics and heat transfer in solar thermal systems (pool, space, and water heating), especially types of collectors, properties of suitable materials for collectors, open and closed loop systems, and types of heat storage.  The course covers scientifics, economic, and global impact analysis of current energy methods and new solar energy technologies for the generation of energy from heat, as well as careers in various areas of solar energy.  Students will be guided through the process of certification for a solar energy technician.<br><br>**Special Notes:**<br><br>**Instructional Practices**<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (67)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.

- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

**Career and Technical Education: Solar Energy Technician**

19.01 Define basic solar terms (e.g., irradiation, Langley, azimuth)
19.05 Describe angular effects on the irradiance of array
19.06 Identify factors that reduce/enhance solar irradiation
19.07 Determine average solar irradiation on various surfaces
19.08 Describe how a photovoltaic solar cell works
19.09 Draw and label a diagram of PV cells
19.10 Explain the differences between monocrystalline, polycrystalline, thin-film, and nano-solar cells
20.02 Identify personal and environmental safety hazards and acceptable practices
21.08 Estimate the peak load and average energy use in order to determine the size and amount of solar equipment needed
22.05 Select appropriate conductor types and rating for each electrical circuit in the open or closed system
22.09 Determine voltage drop for any electrical circuit based on size and length of conductors
29.01 Discuss the role of creativity in constructing scientific questions, methods, and explanations.
29.02 Formulate scientifically investigatable questions, construct investigations, college and evaluate data, and develop scientific recommendations based on findings.
31.04 Conduct technical research to gather information necessary for decision-making

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |

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| LAFS.1112.RST.2.5: | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| LAFS.1112.RST.2.6: | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| LAFS.1112.RST.3.7: | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| LAFS.1112.RST.3.8: | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| LAFS.1112.RST.3.9: | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| LAFS.1112.RST.4.10: | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| LAFS.1112.SL.1.1: | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and |

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| | promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and |

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| | audiences. |
| **LAFS.910.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most |

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| | significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| LAFS.1112.WHST.2.4: | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| LAFS.1112.WHST.2.5: | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| LAFS.1112.WHST.2.6: | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| LAFS.1112.WHST.3.7: | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| LAFS.910.RST.1.3: | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. |
| LAFS.910.RST.2.5: | Analyze the structure of the relationships among concepts in a |

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| | text, including relationships among key terms (e.g., force, friction, reaction force, energy). |
| **LAFS.910.RST.4.10:** | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. |
| **LAFS.910.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.<br>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.<br>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). |
| **LAFS.910.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **SC.912.L.17.13:** | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| **SC.912.L.17.15:** | Discuss the effects of technology on environmental quality. |
| **SC.912.L.17.16:** | Discuss the large-scale environmental impacts resulting from |

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| | human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br>Remarks/Examples<br>Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |
| **SC.912.L.17.17:** | Assess the effectiveness of innovative methods of protecting the environment. |
| **SC.912.L.17.18:** | Describe how human population size and resource use relate to environmental quality. |
| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value** |

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| | functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **SC.912.E.5.4:** | Explain the physical properties of the Sun and its dynamic nature and connect them to conditions and events on Earth.<br>Remarks/Examples |
| | Describe the physical properties of the Sun (sunspot cycles, solar flares, prominences, layers of the Sun, coronal mass ejections, and nuclear reactions) and the impact of the Sun as the main source of external energy for the Earth. |
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| **SC.912.E.6.6:** | Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.<br>Remarks/Examples |
| | Investigate and discuss how humans affect and are affected by |

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| | geological systems and processes by describing the possible long-term consequences (costs and benefits) that increased human consumption (e.g. mining and extraction techniques; off-shore drilling; petrochemical refining) has placed on the environment (e.g. pollution, health, habitat destruction) and the impact on future energy production. |
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| **SC.912.E.7.1:** | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon. Remarks/Examples |
| | Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun. |
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| **SC.912.L.17.11:** | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| **SC.912.L.17.20:** | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability. Remarks/Examples |
| | Annually assessed on Biology EOC. Also assesses SC.912.L.17.11, SC.912.L.17.13, SC.912.N.1.3. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see** |

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| | **what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the |

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| | narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
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| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and |

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| | coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
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| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific |

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| | observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled |

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| | variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |

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| SC.912.N.3.1: | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.3.5: | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| SC.912.N.4.1: | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.4.2: | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |

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| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
| **SC.912.P.10.14:** | Differentiate among conductors, semiconductors, and insulators.<br>Remarks/Examples |
| | Describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators. |
| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
| **SC.912.P.10.3:** | Compare and contrast work and power qualitatively and |

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| | quantitatively. |
| SC.912.P.10.4: | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| SC.912.P.10.5: | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
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| SC.912.P.10.8: | Explain entropy's role in determining the efficiency of processes that convert energy to work.<br>Remarks/Examples |
| | Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy). Describe entropy as a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system. |
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| SC.912.P.8.12: | Describe the properties of the carbon atom that make the diversity of carbon compounds possible.<br>Remarks/Examples |
| | Explain how the bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules. |
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| SS.912.W.9.1: | Identify major scientific figures and breakthroughs of the 20th century, and assess their impact on contemporary life.<br>Remarks/Examples |
| | Examples are Marie Curie, Albert Einstein, Enrico Fermi, Sigmund Freud, Wright Brothers, Charles R. Drew, mass vaccination, atomic energy, transistor, microchip, space exploration, Internet, discovery of DNA, Human Genome Project. |
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## RELATED GLOSSARY TERM DEFINITIONS (45)

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| **Atmosphere:** | The layers of gas that surround Earth, other planets, or stars. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductor:** | A material or an object that conducts heat, electricity, light, or sound. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Diversity:** | The different species in a given area or specific period of time. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Entropy:** | A measure of the unavailable energy in a closed thermodynamic system that is also usually considered to be a measure of the system's disorder, that is a property of the system's state, and that varies directly with any reversible change in heat in the system and inversely with the temperature of the system. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Experiment:** | A procedure that is carried out and repeated under controlled |

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| | conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Habitat:** | A place in an ecosystem where an organism normally lives. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Insulator:** | A material or an object that does not easily allow heat, electricity, light, or sound to pass through it. Air, cloth and rubber are good electrical insulators; feathers and wool make good thermal insulators. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. |

# Course: Principles of Technology 2- 2003610

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4287

## BASIC INFORMATION

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| **Course Number:** | 2003610 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Principles of Technology 2, Principles of Technology, Technology, PRINC TECH 2 |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Physical Sciences |
| **Course Title:** | Principles of Technology 2 |
| **Course Abbreviated Title:** | PRINC TECH 2 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety |

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| | procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes**<br><br>**Instructional Practices**<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence).<br><br>**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models. |

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| | • Planning and carrying out investigations.<br>• Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (68)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| LAFS.910.RST.1.1: | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. |
| LAFS.910.RST.1.2: | Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. |
| LAFS.910.RST.1.3: | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. |
| LAFS.910.RST.2.4: | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. |
| LAFS.910.RST.2.5: | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, |

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| | friction, reaction force, energy). |
| **LAFS.910.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. |
| **LAFS.910.RST.3.7:** | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. |
| **LAFS.910.RST.3.8:** | Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. |
| **LAFS.910.RST.3.9:** | Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. |
| **LAFS.910.RST.4.10:** | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. |
| **LAFS.910.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.<br>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.<br>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when |

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| | warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented. |
| **LAFS.910.SL.1.2:** | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. |
| **LAFS.910.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence. |
| **LAFS.910.SL.2.4:** | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. |
| **LAFS.910.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.910.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.<br>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows |

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| | from or supports the argument presented. |
| LAFS.910.WHST.1.2: | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.<br>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.<br>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). |
| LAFS.910.WHST.2.4: | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| LAFS.910.WHST.2.5: | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| LAFS.910.WHST.2.6: | Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage |

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| | of technology's capacity to link to other information and to display information flexibly and dynamically. |
| LAFS.910.WHST.3.7: | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| LAFS.910.WHST.3.8: | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. |
| LAFS.910.WHST.3.9: | Draw evidence from informational texts to support analysis, reflection, and research. |
| LAFS.910.WHST.4.10: | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| MAFS.912.N-Q.1.1: | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| MAFS.912.N-Q.1.3: | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| SC.912.E.5.7: | Relate the history of and explain the justification for future space |

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| | exploration and continuing technology development.<br>Remarks/Examples |
| | Identify examples of historical space exploration (e.g. telescopes, high altitude balloons, lunar landers, deep-space probes, space station) that had significant impact on current space exploration and recognize the importance of continued exploration in space. |
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| **SC.912.E.5.8:** | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.<br>Remarks/Examples |
| | Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
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| **SC.912.E.5.9:** | Analyze the broad effects of space exploration on the economy and culture of Florida.<br>Remarks/Examples |
| | Recognize the economic, technical and social benefits of spinoff technology developed through the space program. |
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| **SC.912.E.6.6:** | Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.<br>Remarks/Examples |
| | Investigate and discuss how humans affect and are affected by geological systems and processes by describing the possible long-term consequences (costs and benefits) that increased human consumption (e.g. mining and extraction techniques; off-shore drilling; petrochemical refining) has placed on the environment (e.g. pollution, health, habitat destruction) and the impact on future energy production. |
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| **SC.912.L.17.11:** | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| **SC.912.L.17.15:** | Discuss the effects of technology on environmental quality. |

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| SC.912.N.1.5: | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| SC.912.N.1.7: | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.2.1: | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| SC.912.N.1.1: | Define a problem based on a specific body of knowledge, for |

example: biology, chemistry, physics, and earth/space science, and do the following:

1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).
2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).
3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

Remarks/Examples

Connections for 6-12 Literacy in Science

For Students in Grades 9-10

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| | LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics. |

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| | MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples<br>Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples<br>Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |

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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations |

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| | (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes |

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| | how something behaves. |
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| SC.912.N.3.4: | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |
| | Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
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| SC.912.N.3.5: | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| SC.912.N.4.1: | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.4.2: | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices). |

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| | Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
| **SC.912.P.10.13:** | Relate the configuration of static charges to the electric field, electric force, electric potential, and electric potential energy.<br>Remarks/Examples |
| | Using Coulomb's law, determine the force on a stationary charge due to other stationary charges, and explain that this force is many times greater than the gravitational force. Recognize the relationship between forces and their associated potential energies and that the electric field is directly related to the rate of change of the electric potential from point to point in space. |
| **SC.912.P.10.15:** | Investigate and explain the relationships among current, voltage, resistance, and power.<br>Remarks/Examples |
| | Use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |

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| SC.912.P.10.16: | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br>Remarks/Examples<br>Explain that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize the Lorentz force is the force on a point charge due to electromagnetic fields and occurs in many devices, including mass spectrometers. |
| SC.912.P.10.17: | Explore the theory of electromagnetism by explaining electromagnetic waves in terms of oscillating electric and magnetic fields.<br>Remarks/Examples<br>Recognize that an oscillating charge creates an oscillating electric field which gives rise to electromagnetic waves. Recognize a changing magnetic field makes an electric field, and a changing electric field makes a magnetic field, and these phenomena are expressed mathematically through the Faraday law and the Ampere-Maxwell law. |
| SC.912.P.10.18: | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples<br>Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
| SC.912.P.10.2: | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples<br>Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
| SC.912.P.10.20: | Describe the measurable properties of waves and explain the |

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| | relationships among them and how these properties change when the wave moves from one medium to another.<br>Remarks/Examples |
| | Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
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| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
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| **SC.912.P.10.22:** | Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.<br>Remarks/Examples |
| | Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size. |
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| **SC.912.P.10.4:** | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| **SC.912.P.10.5:** | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
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| **SC.912.P.10.6:** | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |

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| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects.<br>Describe the transformation of energy as a pendulum swings. |
| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br>Remarks/Examples |
| | Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples |
| | Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples |
| | Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |

## RELATED GLOSSARY TERM DEFINITIONS (60)

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| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Circuit:** | An interconnection of electrical elements forming a complete path for the flow of current. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electric potential:** | A measure of the work required by an electric field to move electric charges. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |

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| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Habitat:** | A place in an ecosystem where an organism normally lives. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |

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| **Magnet:** | An object that produces a magnetic field and that has the property, either natural or induced, of attracting iron or steel. |
| **Magnetic:** | Having the property of attracting iron and certain other materials by virtue of a field of force. |
| **Magnetic field:** | The region where magnetic force exists around magnets or electric currents. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Power:** | The rate at which work is done, expressed as the amount of work |

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| | per unit time and commonly measured in units such as the watt and horsepower. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Resistance :** | The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Vibration:** | A periodic and repetitive movement around an equilibrium point. |
| **Voltage:** | A measure of the difference in electric potential between two points in space, a material, or an electric circuit, expressed in volts. |
| **Wavelength:** | The distance between crests of a wave. |

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| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

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# Course: Physical Science- 2003310

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4273

## BASIC INFORMATION

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| **Course Number:** | 2003310 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Physical Science, PHY SCI, Physical |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Physical Sciences<br>**Section:**<br>Career and Technical Education (under development)<br>**Cluster:**<br>Government & Public Administration<br>**Career Path:**<br>Governance<br>**Program:**<br>8744000<br>**Program Version:**<br>Public Works » |
| **Course Title:** | Physical Science |
| **Course Abbreviated Title:** | PHY SCI |
| **Number of Credits:** | One credit (1) |

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| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>Instructional Practices: Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text. |

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| | 5. Providing extensive research and writing opportunities (claims and evidence).<br><br>**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations.<br>• Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (74)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.910.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. |

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| **LAFS.910.RST.1.2:** | Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. |
| **LAFS.910.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. |
| **LAFS.910.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. |
| **LAFS.910.RST.2.5:** | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). |
| **LAFS.910.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. |
| **LAFS.910.RST.3.7:** | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. |
| **LAFS.910.RST.3.8:** | Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. |
| **LAFS.910.RST.3.9:** | Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. |
| **LAFS.910.RST.4.10:** | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. |

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| | Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **SC.912.E.7.1:** | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.<br>Remarks/Examples<br>Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun. |
| **LAFS.910.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.<br>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and |

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| | conclusions.<br>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented. |
| **LAFS.910.SL.1.2:** | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. |
| **LAFS.910.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence. |
| **LAFS.910.SL.2.4:** | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. |
| **LAFS.910.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.910.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.<br>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the |

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| | discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.910.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.<br>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.<br>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). |
| **LAFS.910.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.910.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |

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| LAFS.910.WHST.2.6: | Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically. |
| LAFS.910.WHST.3.7: | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| LAFS.910.WHST.3.8: | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. |
| LAFS.910.WHST.3.9: | Draw evidence from informational texts to support analysis, reflection, and research. |
| LAFS.910.WHST.4.10: | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| SC.912.L.18.12: | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| SC.912.L.18.7: | Identify the reactants, products, and basic functions of photosynthesis. |
| SC.912.L.18.8: | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration. |
| SC.912.N.1.1: | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts). |

2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).
3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

Remarks/Examples

Connections for 6-12 Literacy in Science

<u>For Students in Grades 9-10</u>

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the

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| | text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>For Students in Grades 11-12<br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
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| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
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| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have |

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| | been made by people from all over the world. |
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| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| SC.912.N.1.7: | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.2.1: | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| SC.912.N.2.2: | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by |

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| | experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific |

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| | knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.4:** | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |

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| | Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples<br>Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples<br>Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples<br>Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize |

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| | that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
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| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
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| **SC.912.P.10.12:** | Differentiate between chemical and nuclear reactions.<br>Remarks/Examples |
| | Describe how chemical reactions involve the rearranging of atoms to form new substances, while nuclear reactions involve the change of atomic nuclei into entirely new atoms. Identify real-world examples where chemical and nuclear reactions occur every day. |
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| **SC.912.P.10.14:** | Differentiate among conductors, semiconductors, and insulators.<br>Remarks/Examples |
| | Describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators. |
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| **SC.912.P.10.15:** | Investigate and explain the relationships among current, voltage, resistance, and power.<br>Remarks/Examples |
| | Use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |
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| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum |

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| | in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
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| **SC.912.P.10.3:** | Compare and contrast work and power qualitatively and quantitatively. |
| **SC.912.P.10.4:** | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| **SC.912.P.10.5:** | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
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| **SC.912.P.10.7:** | Distinguish between endothermic and exothermic chemical processes.<br>Remarks/Examples |
| | Classify chemical reactions and phase changes as exothermic (release thermal energy) or endothermic (absorb thermal energy). |
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| **SC.912.P.12.10:** | Interpret the behavior of ideal gases in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and number of particles in a gas sample (Avogadro's |

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| | hypothesis). |
| **SC.912.P.12.11:** | Describe phase transitions in terms of kinetic molecular theory.<br>Remarks/Examples<br><br>Explain, at the molecular level, the behavior of matter as it undergoes phase transitions. |
| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br>Remarks/Examples<br><br>Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts.<br>Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
| **SC.912.P.12.2:** | Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.<br>Remarks/Examples<br><br>Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.<br><br>Connections: MAFS.912.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.P.12.3:** | Interpret and apply Newton's three laws of motion.<br>Remarks/Examples<br><br>Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law).<br>Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton's second law, F = ma).<br>Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = –F1 on 1 (Newton's third law). |

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| **SC.912.P.12.4:** | Describe how the gravitational force between two objects depends on their masses and the distance between them.<br>Remarks/Examples |
| | Describe Newton's law of universal gravitation in terms of the attraction between two objects, their masses, and the inverse square of the distance between them. |
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| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br>Remarks/Examples |
| | Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
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| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples |
| | Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
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| **SC.912.P.8.11:** | Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH.<br>Remarks/Examples |
| | Use experimental data to illustrate and explain the pH scale to characterize acid and base solutions. Compare and contrast the strengths of various common acids and bases. |
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| **SC.912.P.8.2:** | Differentiate between physical and chemical properties and physical and chemical changes of matter.<br>Remarks/Examples |
| | Discuss volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting and boiling points. Describe simple laboratory techniques that can be used to separate homogeneous and heterogeneous mixtures (e.g. filtration, distillation, chromatography, evaporation). |
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| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples<br>Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| **SC.912.P.8.5:** | Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.<br>Remarks/Examples<br>Use the periodic table and electron configuration to determine an element's number of valence electrons and its chemical and physical properties. Explain how chemical properties depend almost entirely on the configuration of the outer electron shell. |
| **SC.912.P.8.7:** | Interpret formula representations of molecules and compounds in terms of composition and structure.<br>Remarks/Examples<br>Write chemical formulas for simple covalent (HCl, SO2, CO2, and CH4), ionic (Na+ + Cl− → NaCl) and molecular (O2, H2O) compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions. |
| **SC.912.P.8.8:** | Characterize types of chemical reactions, for example: redox, acid-base, synthesis, and single and double replacement reactions.<br>Remarks/Examples<br>Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. |

## RELATED GLOSSARY TERM DEFINITIONS (75)

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| **Acceleration:** | Rate of change in velocity, usually expressed in meters per second per second; involves an increase or decrease in speed and/or a change in direction. |
| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |
| **Aerobic:** | Occurring in the presence of oxygen or requiring oxygen to live. In aerobic respiration, which is the process used by the cells of most organisms, the production of energy from glucose metabolism requires the presence of oxygen. |
| **Anaerobic :** | Occurring in the absence of oxygen or not requiring oxygen to live. Anaerobic bacteria produce energy from food molecules without the presence of oxygen. |
| **Atmosphere:** | The layers of gas that surround Earth, other planets, or stars. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Base:** | A substance that increases the OH– concentration of a solution; a proton acceptor. |
| **Boil:** | To change from a liquid to a vapor by the application of heat. |
| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Chemical change:** | A reaction or a change in a substance produced by chemical means that results in producing a different chemical. |

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| **Circuit:** | An interconnection of electrical elements forming a complete path for the flow of current. |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductivity:** | The ability or power to conduct or transmit heat, electricity, or sound. |
| **Conductor:** | A material or an object that conducts heat, electricity, light, or sound. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |

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| **Evaporation:** | The process by which a liquid is converted to its vapor phase by heating the liquid. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Insulator:** | A material or an object that does not easily allow heat, electricity, light, or sound to pass through it. Air, cloth and rubber are good electrical insulators; feathers and wool make good thermal insulators. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |

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| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Melt:** | To be changed from a solid to a liquid state especially by the application of heat. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Periodic table:** | A tabular arrangement of the elements according to their atomic numbers so that elements with similar properties are in the same column. |
| **Photosynthesis:** | A chemical process by which plants use light energy to convert |

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| | carbon dioxide and water into carbohydrates (sugars). |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Resistance :** | The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Semiconductor:** | Any of various solid crystalline substances, such as germanium or silicon, having electrical conductivity greater than insulators but less than good conductors, and used especially as a base material for computer chips and other electronic devices. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |

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| **Voltage:** | A measure of the difference in electric potential between two points in space, a material, or an electric circuit, expressed in volts. |
| **Volume:** | A measure of the amount of space an object takes up; also the loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

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| | Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Observation :** | What one has observed using senses or instruments. |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Semiconductor:** | Any of various solid crystalline substances, such as germanium or silicon, having electrical conductivity greater than insulators but less than good conductors, and used especially as a base material for computer chips and other electronic devices. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Sun:** | The closest star to Earth and the center of our solar system. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |

# Course: Physical Science Honors- 2003320

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4344

## BASIC INFORMATION

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| **Course Number:** | 2003320 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Physical Science Honors, Physical Science, Honors, Physical, PHY SCI HON |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses<br>**Grade Group:** Grades 9 to 12 and Adult Education Courses<br>**Subject:** Science<br>**SubSubject:** Physical Sciences |
| **Course Title:** | Physical Science Honors |
| **Course Abbreviated Title:** | PHY SCI HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **General Notes:** | While the content focus of this course is consistent with the Physical Science course, students will explore these concepts in |

greater depth. In general, the academic pace and rigor will be greatly increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

**Special Notes:**

Instructional Practices: Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

**Science and Engineering Practices** (NRC *Framework for K-12*

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| | *Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations.<br>• Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (93)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.910.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. |
| **LAFS.910.RST.1.2:** | Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. |
| **LAFS.910.RST.1.3:** | Follow precisely a complex multistep procedure when carrying |

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| | out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. |
| LAFS.910.RST.2.4: | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. |
| LAFS.910.RST.2.5: | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). |
| LAFS.910.RST.2.6: | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. |
| LAFS.910.RST.3.7: | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. |
| LAFS.910.RST.3.8: | Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. |
| LAFS.910.RST.3.9: | Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. |
| LAFS.910.RST.4.10: | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. |
| LAFS.910.SL.1.1: | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to set rules for collegial discussions and |

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| | decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.<br>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.<br>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented. |
| **LAFS.910.SL.1.2:** | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. |
| **LAFS.910.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence. |
| **LAFS.910.SL.2.4:** | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. |
| **LAFS.910.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.910.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns. |

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| | c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.910.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.<br>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.<br>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). |
| **LAFS.910.WHST.2.4:** | Produce clear and coherent writing in which the development, |

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| | organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.910.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.910.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. |
| **LAFS.910.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **LAFS.910.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. |
| **LAFS.910.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.910.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **MAFS.912.A-CED.1.4:** | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*<br>Remarks/Examples |
| | Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest.<br><br>Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables. |
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| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two |

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| | quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value |

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| | functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples<br>Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |

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| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-VM.1.1:** | Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $\boldsymbol{v}$, $\lvert\boldsymbol{v}\rvert$, $\lVert\mathbf{v}\rVert$, $\boldsymbol{v}$). |
| **MAFS.912.N-VM.1.3:** | Solve problems involving velocity and other quantities that can be represented by vectors. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of |

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| | the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. |

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| | S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
| **SC.912.E.7.1:** | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.<br>Remarks/Examples<br><br>Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun. |
| **SC.912.L.18.12:** | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br><br>Annually assessed on Biology EOC. |
| **SC.912.L.18.7:** | Identify the reactants, products, and basic functions of photosynthesis. |
| **SC.912.L.18.8:** | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration. |
| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same |

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| | outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| SC.912.N.1.7: | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.2.1: | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| SC.912.N.1.1: | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: |

1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).
2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).
3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

Remarks/Examples

Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of

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| | explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>For Students in Grades 11-12<br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision. |

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| | MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples<br>Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples<br>Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific |

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| | investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new |

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| | evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.4:** | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples<br>Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples<br>Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples<br>Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples<br>Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason |

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| | abstractly and quantitatively. |
| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.<br>Remarks/Examples |
| | Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
| **SC.912.P.10.12:** | Differentiate between chemical and nuclear reactions.<br>Remarks/Examples |
| | Describe how chemical reactions involve the rearranging of atoms to form new substances, while nuclear reactions involve the change of atomic nuclei into entirely new atoms. Identify real-world examples |

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| | where chemical and nuclear reactions occur every day. |
| **SC.912.P.10.14:** | Differentiate among conductors, semiconductors, and insulators.<br>Remarks/Examples |
| | Describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators. |
| **SC.912.P.10.15:** | Investigate and explain the relationships among current, voltage, resistance, and power.<br>Remarks/Examples |
| | Use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |
| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |

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| SC.912.P.10.3: | Compare and contrast work and power qualitatively and quantitatively. |
| SC.912.P.10.4: | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| SC.912.P.10.5: | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
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| SC.912.P.10.6: | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
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| SC.912.P.10.7: | Distinguish between endothermic and exothermic chemical processes.<br>Remarks/Examples |
| | Classify chemical reactions and phase changes as exothermic (release thermal energy) or endothermic (absorb thermal energy). |
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| SC.912.P.12.1: | Distinguish between scalar and vector quantities and assess which should be used to describe an event.<br>Remarks/Examples |
| | Distinguish between vector quantities (e.g., displacement, velocity, acceleration, force, and linear momentum) and scalar quantities (e.g., distance, speed, energy, mass, work).<br><br>MAFS.912.N-VM.1.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
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| SC.912.P.12.10: | Interpret the behavior of ideal gases in terms of kinetic molecular theory. |

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| | Remarks/Examples<br><br>Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and number of particles in a gas sample (Avogadro's hypothesis). |
| **SC.912.P.12.11:** | Describe phase transitions in terms of kinetic molecular theory.<br>Remarks/Examples<br><br>Explain, at the molecular level, the behavior of matter as it undergoes phase transitions. |
| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br>Remarks/Examples<br><br>Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
| **SC.912.P.12.2:** | Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.<br>Remarks/Examples<br><br>Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.<br><br>Connections: MAFS.912.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.P.12.3:** | Interpret and apply Newton's three laws of motion.<br>Remarks/Examples<br><br>Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law). Explain that when a net force is applied to an object its motion will |

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| | change, or accelerate (according to Newton's second law, F = ma). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = –F1 on 1 (Newton's third law). |
| **SC.912.P.12.4:** | Describe how the gravitational force between two objects depends on their masses and the distance between them.<br>Remarks/Examples<br><br>Describe Newton's law of universal gravitation in terms of the attraction between two objects, their masses, and the inverse square of the distance between them. |
| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples<br><br>(e.g. elastic and completely inelastic collisions). |
| **SC.912.P.12.6:** | Qualitatively apply the concept of angular momentum.<br>Remarks/Examples<br><br>Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]). |
| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br>Remarks/Examples<br><br>Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples<br><br>Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |

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| **SC.912.P.8.11:** | Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH.<br>Remarks/Examples |
| | Use experimental data to illustrate and explain the pH scale to characterize acid and base solutions. Compare and contrast the strengths of various common acids and bases. |
| **SC.912.P.8.2:** | Differentiate between physical and chemical properties and physical and chemical changes of matter.<br>Remarks/Examples |
| | Discuss volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting and boiling points. Describe simple laboratory techniques that can be used to separate homogeneous and heterogeneous mixtures (e.g. filtration, distillation, chromatography, evaporation). |
| **SC.912.P.8.3:** | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence.<br>Remarks/Examples |
| | Describe the development and historical importance of atomic theory from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus and "gold foil" experiment), and Bohr (planetary model of atom), and understand how each discovery leads to modern atomic theory.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples |
| | Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses. |

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| | Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.5:** | Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.<br>Remarks/Examples |
| | Use the periodic table and electron configuration to determine an element's number of valence electrons and its chemical and physical properties. Explain how chemical properties depend almost entirely on the configuration of the outer electron shell. |
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| **SC.912.P.8.7:** | Interpret formula representations of molecules and compounds in terms of composition and structure.<br>Remarks/Examples |
| | Write chemical formulas for simple covalent (HCl, SO2, CO2, and CH4), ionic (Na+ + Cl− → NaCl) and molecular (O2, H2O) compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions. |
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| **SC.912.P.8.8:** | Characterize types of chemical reactions, for example: redox, acid-base, synthesis, and single and double replacement reactions.<br>Remarks/Examples |
| | Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. |
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## RELATED GLOSSARY TERM DEFINITIONS (82)

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| **Acceleration:** | Rate of change in velocity, usually expressed in meters per second per second; involves an increase or decrease in speed and/or a change in direction. |
| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical |

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| | reaction. |
| **Aerobic:** | Occurring in the presence of oxygen or requiring oxygen to live. In aerobic respiration, which is the process used by the cells of most organisms, the production of energy from glucose metabolism requires the presence of oxygen. |
| **Anaerobic :** | Occurring in the absence of oxygen or not requiring oxygen to live. Anaerobic bacteria produce energy from food molecules without the presence of oxygen. |
| **Angular momentum:** | A vector quantity that is a measure of the rotational momentum of a rotating body or system, that is equal in classical physics to the product of the angular velocity of the body or system and its moment of inertia with respect to the rotation axis, and that is directed along the rotation axis. |
| **Atmosphere:** | The layers of gas that surround Earth, other planets, or stars. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Axis:** | The imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph. |
| **Base:** | A substance that increases the OH– concentration of a solution; a proton acceptor. |
| **Boil:** | To change from a liquid to a vapor by the application of heat. |
| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Chemical change:** | A reaction or a change in a substance produced by chemical means that results in producing a different chemical. |

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| **Circuit:** | An interconnection of electrical elements forming a complete path for the flow of current. |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductivity:** | The ability or power to conduct or transmit heat, electricity, or sound. |
| **Conductor:** | A material or an object that conducts heat, electricity, light, or sound. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |

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| **Evaporation:** | The process by which a liquid is converted to its vapor phase by heating the liquid. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Insulator:** | A material or an object that does not easily allow heat, electricity, light, or sound to pass through it. Air, cloth and rubber are good |

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| | electrical insulators; feathers and wool make good thermal insulators. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Melt:** | To be changed from a solid to a liquid state especially by the application of heat. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Nucleus:** | The center region of an atom where protons and neutrons are |

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| | located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Periodic table:** | A tabular arrangement of the elements according to their atomic numbers so that elements with similar properties are in the same column. |
| **Photosynthesis:** | A chemical process by which plants use light energy to convert carbon dioxide and water into carbohydrates (sugars). |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Resistance :** | The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Semiconductor:** | Any of various solid crystalline substances, such as germanium or silicon, having electrical conductivity greater than insulators but less than good conductors, and used especially as a base material for computer chips and other electronic devices. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters |

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| | per second. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Voltage:** | A measure of the difference in electric potential between two points in space, a material, or an electric circuit, expressed in volts. |
| **Volume:** | A measure of the amount of space an object takes up; also the loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

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| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |

# Course: Chemistry 1- 2003340

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4360

## BASIC INFORMATION

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| **Course Number:** | 2003340 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Chemistry 1, CHEM 1, Chemistry |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Physical Sciences |
| **Course Title:** | Chemistry 1 |
| **Course Abbreviated Title:** | CHEM 1 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>**Instructional Practices**<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence).<br><br>**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations. |

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| | • Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (69)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| LAFS.1112.RST.1.1: | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| LAFS.1112.RST.1.2: | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| LAFS.1112.RST.1.3: | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| LAFS.1112.RST.2.4: | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| LAFS.1112.RST.2.5: | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| LAFS.1112.RST.2.6: | Analyze the author's purpose in providing an explanation, |

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| | describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research |

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| | is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the |

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| | significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts. |

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| | d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples<br><br>**Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions. |

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| | **Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed** |

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| | symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples<br><br>Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples<br><br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |

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| | Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context |

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| | of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.L.18.12:** | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and |

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| | versatility as a solvent.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.** |

| | Remarks/Examples |
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| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research. |
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| | Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br><br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples<br><br>Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples<br><br>Recognize that contributions to science can be made and have |

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| | been made by people from all over the world. |
| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples<br>Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples<br>Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples<br>Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |

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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.5: | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| SC.912.N.3.2: | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.3.3: | Explain that scientific laws are descriptions of specific |

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| | relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |

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| SC.912.P.10.12: | Differentiate between chemical and nuclear reactions.<br>Remarks/Examples |
| | Describe how chemical reactions involve the rearranging of atoms to form new substances, while nuclear reactions involve the change of atomic nuclei into entirely new atoms. Identify real-world examples where chemical and nuclear reactions occur every day. |
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| SC.912.P.10.18: | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| SC.912.P.10.5: | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
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| SC.912.P.10.6: | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
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| SC.912.P.10.7: | Distinguish between endothermic and exothermic chemical processes.<br>Remarks/Examples |
| | Classify chemical reactions and phase changes as exothermic (release thermal energy) or endothermic (absorb thermal energy). |
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| SC.912.P.10.9: | Describe the quantization of energy at the atomic level. |

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| | Remarks/Examples |
| | Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship $E = hv$). |
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| **SC.912.P.12.10:** | Interpret the behavior of ideal gases in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and number of particles in a gas sample (Avogadro's hypothesis). |
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| **SC.912.P.12.11:** | Describe phase transitions in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Explain, at the molecular level, the behavior of matter as it undergoes phase transitions. |
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| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br>Remarks/Examples |
| | Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
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| **SC.912.P.12.13:** | Explain the concept of dynamic equilibrium in terms of reversible processes occurring at the same rates.<br>Remarks/Examples |
| | Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing). Explain that equilibrium is established when forward and reverse-reaction rates are equal. |
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| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples |
| | Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
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| **SC.912.P.8.11:** | Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH.<br>Remarks/Examples |
| | Use experimental data to illustrate and explain the pH scale to characterize acid and base solutions. Compare and contrast the strengths of various common acids and bases. |
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| **SC.912.P.8.2:** | Differentiate between physical and chemical properties and physical and chemical changes of matter.<br>Remarks/Examples |
| | Discuss volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting and boiling points. Describe simple laboratory techniques that can be used to separate homogeneous and heterogeneous mixtures (e.g. filtration, distillation, chromatography, evaporation). |
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| **SC.912.P.8.3:** | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence.<br>Remarks/Examples |
| | Describe the development and historical importance of atomic theory from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus and "gold foil" experiment), and Bohr (planetary model of atom), and understand how each discovery leads to modern atomic theory.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of |

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| | protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples |
| | Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.5:** | Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.<br>Remarks/Examples |
| | Use the periodic table and electron configuration to determine an element's number of valence electrons and its chemical and physical properties. Explain how chemical properties depend almost entirely on the configuration of the outer electron shell. |
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| **SC.912.P.8.6:** | Distinguish between bonding forces holding compounds together and other attractive forces, including hydrogen bonding and van der Waals forces.<br>Remarks/Examples |
| | Describe how atoms combine to form molecules through ionic, covalent, and hydrogen bonding. Compare and contrast the characteristics of the interactions between atoms in ionic and covalent compounds and how these bonds form. Use electronegativity to explain the difference between polar and nonpolar covalent bonds. |
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| **SC.912.P.8.7:** | Interpret formula representations of molecules and compounds in terms of composition and structure.<br>Remarks/Examples |
| | Write chemical formulas for simple covalent (HCl, SO2, CO2, and CH4), ionic (Na+ + Cl− → NaCl) and molecular (O2, H2O) compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions. |
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| **SC.912.P.8.8:** | Characterize types of chemical reactions, for example: redox, |

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| | acid-base, synthesis, and single and double replacement reactions.<br>Remarks/Examples |
| | Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. |
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| SC.912.P.8.9: | Apply the mole concept and the law of conservation of mass to calculate quantities of chemicals participating in reactions.<br>Remarks/Examples |
| | Recognize one mole equals 6.02 x 10^23 particles (atoms or molecules). Determine number of particles for elements and compounds using the mole concept, in terms of number of particles, mass, and the volume of an ideal gas at specified conditions of temperature and pressure. Use experimental data to determine percent yield, empirical formulas, molecular formulas, and calculate the mass-to-mass stoichiometry for a chemical reaction. |
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## RELATED GLOSSARY TERM DEFINITIONS (61)

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| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Base:** | A substance that increases the OH– concentration of a solution; a proton acceptor. |
| **Boil:** | To change from a liquid to a vapor by the application of heat. |

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| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Chemical change:** | A reaction or a change in a substance produced by chemical means that results in producing a different chemical. |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductivity:** | The ability or power to conduct or transmit heat, electricity, or sound. |
| **Conservation of Mass:** | The principle that mass cannot be created or destroyed; also conservation of matter. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Dissolve:** | To cause to pass into solution. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of $9.107 \times 10^{-28}$ grams and an electric charge of approximately $-1.602 \times 10^{-19}$ coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |

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| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |
| **Evaporation:** | The process by which a liquid is converted to its vapor phase by heating the liquid. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |

# Course: Chemistry 1 for Credit Recovery-2003345

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4367

## BASIC INFORMATION

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| **Course Number:** | 2003345 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Chemistry 1 for Credit Recovery, Chemistry, Credit Recovery, CHEM 1 CR, CR |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Physical Sciences |
| **Course Title:** | Chemistry 1 for Credit Recovery |
| **Course Abbreviated Title:** | CHEM 1 CR |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Multiple (M) - Course length can vary |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, |

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| | research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:** *Credit Recovery courses are credit bearing courses with specific content requirements defined by Florida's Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery courses are exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.*<br><br><u>Instructional Practices:</u><br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis: |

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| | 1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (69)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 |

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| | texts and topics. |
| LAFS.1112.RST.2.5: | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| LAFS.1112.RST.2.6: | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| LAFS.1112.RST.3.7: | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| LAFS.1112.RST.3.8: | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| LAFS.1112.RST.3.9: | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| LAFS.1112.RST.4.10: | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| MAFS.912.S-ID.1.1: | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| MAFS.912.S-ID.1.2: | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape |

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| | of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the |

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| | credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a |

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| | discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation |

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| | provided (e.g., articulating implications or the significance of the topic). |
| LAFS.1112.WHST.2.4: | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| LAFS.1112.WHST.2.5: | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| LAFS.1112.WHST.2.6: | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| LAFS.1112.WHST.3.7: | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| MAFS.912.F-IF.2.4: | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. |

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| | Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value** |

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| | functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. |

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| | Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not |

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| | in the integers and trigonometric functions. |
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| SC.912.L.18.12: | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. |
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| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| SC.912.N.1.7: | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.2.2: | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but |

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| | does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and** |

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| | 11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. |
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| | LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br><br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples<br><br>Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome. |

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| | Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events. |

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| | Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in |

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| | battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
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| **SC.912.P.10.12:** | Differentiate between chemical and nuclear reactions.<br>Remarks/Examples |
| | Describe how chemical reactions involve the rearranging of atoms to form new substances, while nuclear reactions involve the change of atomic nuclei into entirely new atoms. Identify real-world examples where chemical and nuclear reactions occur every day. |
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| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| **SC.912.P.10.5:** | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
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| **SC.912.P.10.6:** | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
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| **SC.912.P.10.7:** | Distinguish between endothermic and exothermic chemical processes.<br>Remarks/Examples |
| | Classify chemical reactions and phase changes as exothermic |

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| | (release thermal energy) or endothermic (absorb thermal energy). |
| **SC.912.P.10.9:** | Describe the quantization of energy at the atomic level.<br>Remarks/Examples |
| | Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship $E = hv$). |
| **SC.912.P.12.10:** | Interpret the behavior of ideal gases in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and number of particles in a gas sample (Avogadro's hypothesis). |
| **SC.912.P.12.11:** | Describe phase transitions in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Explain, at the molecular level, the behavior of matter as it undergoes phase transitions. |
| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br>Remarks/Examples |
| | Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
| **SC.912.P.12.13:** | Explain the concept of dynamic equilibrium in terms of reversible processes occurring at the same rates.<br>Remarks/Examples |
| | Identify and explain the factors that affect the rate of dissolving (e.g., |

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| | temperature, concentration, surface area, pressure, mixing). Explain that equilibrium is established when forward and reverse-reaction rates are equal. |
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| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples |
| | Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
| | |
| **SC.912.P.8.11:** | Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH.<br>Remarks/Examples |
| | Use experimental data to illustrate and explain the pH scale to characterize acid and base solutions. Compare and contrast the strengths of various common acids and bases. |
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| **SC.912.P.8.2:** | Differentiate between physical and chemical properties and physical and chemical changes of matter.<br>Remarks/Examples |
| | Discuss volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting and boiling points. Describe simple laboratory techniques that can be used to separate homogeneous and heterogeneous mixtures (e.g. filtration, distillation, chromatography, evaporation). |
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| **SC.912.P.8.3:** | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence.<br>Remarks/Examples |
| | Describe the development and historical importance of atomic theory from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus and “gold foil” experiment), and Bohr (planetary model of atom), and understand how each discovery leads to modern atomic theory. |

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| | Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples |
| | Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.5:** | Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.<br>Remarks/Examples |
| | Use the periodic table and electron configuration to determine an element's number of valence electrons and its chemical and physical properties. Explain how chemical properties depend almost entirely on the configuration of the outer electron shell. |
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| **SC.912.P.8.6:** | Distinguish between bonding forces holding compounds together and other attractive forces, including hydrogen bonding and van der Waals forces.<br>Remarks/Examples |
| | Describe how atoms combine to form molecules through ionic, covalent, and hydrogen bonding. Compare and contrast the characteristics of the interactions between atoms in ionic and covalent compounds and how these bonds form. Use electronegativity to explain the difference between polar and nonpolar covalent bonds. |
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| **SC.912.P.8.7:** | Interpret formula representations of molecules and compounds in terms of composition and structure.<br>Remarks/Examples |
| | Write chemical formulas for simple covalent (HCl, SO2, CO2, and CH4), ionic (Na+ + Cl− → NaCl) and molecular (O2, H2O) |

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| | compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions. |
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| **SC.912.P.8.8:** | Characterize types of chemical reactions, for example: redox, acid-base, synthesis, and single and double replacement reactions.<br>Remarks/Examples |
| | Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. |
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| **SC.912.P.8.9:** | Apply the mole concept and the law of conservation of mass to calculate quantities of chemicals participating in reactions.<br>Remarks/Examples |
| | Recognize one mole equals 6.02 x 10^23 particles (atoms or molecules). Determine number of particles for elements and compounds using the mole concept, in terms of number of particles, mass, and the volume of an ideal gas at specified conditions of temperature and pressure. Use experimental data to determine percent yield, empirical formulas, molecular formulas, and calculate the mass-to-mass stoichiometry for a chemical reaction. |
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## RELATED GLOSSARY TERM DEFINITIONS (61)

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| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |

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| **Base:** | A substance that increases the OH– concentration of a solution; a proton acceptor. |
| **Boil:** | To change from a liquid to a vapor by the application of heat. |
| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Chemical change:** | A reaction or a change in a substance produced by chemical means that results in producing a different chemical. |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductivity:** | The ability or power to conduct or transmit heat, electricity, or sound. |
| **Conservation of Mass:** | The principle that mass cannot be created or destroyed; also conservation of matter. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Dissolve:** | To cause to pass into solution. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |

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| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |
| **Evaporation:** | The process by which a liquid is converted to its vapor phase by heating the liquid. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |

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| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Melt:** | To be changed from a solid to a liquid state especially by the application of heat. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Mole :** | The amount of a substance that contains as many atoms, molecules, ions, or other elementary units as the number of atoms in 0.012 kilogram of carbon 12. The number is 6.0225 × 10^23, Avogadro's number. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |

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| **Periodic table:** | A tabular arrangement of the elements according to their atomic numbers so that elements with similar properties are in the same column. |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **van der Waals Force:** | A weak force of attraction between electrically neutral molecules that collide with or pass very close to each other. The van der Waals force is caused by the attraction between electron-rich regions of one molecule and electron-poor regions of another (the attraction between the molecules seen as electric dipoles). |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Volume:** | A measure of the amount of space an object takes up; also the loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

The alphanumeric coding scheme has changed –
Language Arts Common Core (LACC) is now Language Arts Florida Standards (LAFS)
Mathematics Common Core (MACC) is now Mathematics Florida Standards (MAFS)
Amended Standard

# Course: Chemistry 1 Honors- 2003350

**Direct link to this page:**[http://www.cpalms.org/Public/PreviewCourse/Preview/4380](http://www.cpalms.org/Public/PreviewCourse/Preview/4380)

## BASIC INFORMATION

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| **Course Number:** | 2003350 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Chemistry 1 Honors, Chemistry, Honors, CHEM 1 HON |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses<br>**Grade Group:** Grades 9 to 12 and Adult Education Courses<br>**Subject:** Science<br>**SubSubject:** Physical Sciences |
| **Course Title:** | Chemistry 1 Honors |
| **Course Abbreviated Title:** | CHEM 1 HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **General Notes:** | While the content focus of this course is consistent with the Chemistry I course, students will explore these concepts in greater depth. In general, the academic pace and rigor will be |

greatly increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

**Special Notes:**

Instructional Practices:
Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)

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| | • Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations.<br>• Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (83)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.910.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. |
| **LAFS.910.RST.1.2:** | Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. |
| **LAFS.910.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. |
| **LAFS.910.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. |

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| **LAFS.910.RST.2.5:** | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). |
| **LAFS.910.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. |
| **LAFS.910.RST.3.7:** | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. |
| **LAFS.910.RST.3.8:** | Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. |
| **LAFS.910.RST.3.9:** | Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. |
| **LAFS.910.RST.4.10:** | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to |

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| | compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **LAFS.910.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.<br>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.<br>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented. |
| **LAFS.910.SL.1.2:** | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. |
| **LAFS.910.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence. |

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| LAFS.910.SL.2.4: | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. |
| LAFS.910.SL.2.5: | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| LAFS.910.WHST.1.1: | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.<br>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| LAFS.910.WHST.1.2: | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic with well-chosen, relevant, and |

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| | sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.<br>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.<br>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). |
| **LAFS.910.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.910.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.910.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. |
| **LAFS.910.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **LAFS.910.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a |

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| | standard format for citation. |
| **LAFS.910.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.910.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |

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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples |

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| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |

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| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.L.17.15:** | Discuss the effects of technology on environmental quality. |
| **SC.912.L.17.19:** | Describe how different natural resources are produced and how their rates of use and renewal limit availability. |
| **SC.912.L.18.12:** | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and |

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| | versatility as a solvent.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. |
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| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| SC.912.N.1.7: | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.1.1: | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** |

(Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).

5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

Remarks/Examples

Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

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| | LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br><br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |

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| SC.912.N.1.4: | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| SC.912.N.1.5: | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| SC.912.N.2.2: | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.3: | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, |

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| | measured, and tested through scientific experimentation. |
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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.5: | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| SC.912.N.3.1: | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence. |

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| | Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in |

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| | solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
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| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
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| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues. |

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| | Remarks/Examples |
| | Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
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| **SC.912.P.10.12:** | Differentiate between chemical and nuclear reactions.<br>Remarks/Examples |
| | Describe how chemical reactions involve the rearranging of atoms to form new substances, while nuclear reactions involve the change of atomic nuclei into entirely new atoms. Identify real-world examples where chemical and nuclear reactions occur every day. |
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| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| **SC.912.P.10.5:** | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to |

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| | as thermal energy. |
| **SC.912.P.10.6:** | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples<br>Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
| **SC.912.P.10.7:** | Distinguish between endothermic and exothermic chemical processes.<br>Remarks/Examples<br>Classify chemical reactions and phase changes as exothermic (release thermal energy) or endothermic (absorb thermal energy). |
| **SC.912.P.10.8:** | Explain entropy's role in determining the efficiency of processes that convert energy to work.<br>Remarks/Examples<br>Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy). Describe entropy as a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system. |
| **SC.912.P.10.9:** | Describe the quantization of energy at the atomic level.<br>Remarks/Examples<br>Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship $E = hv$). |
| **SC.912.P.12.10:** | Interpret the behavior of ideal gases in terms of kinetic molecular theory.<br>Remarks/Examples<br>Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and number of particles in a gas sample (Avogadro's hypothesis). |

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| **SC.912.P.12.11:** | Describe phase transitions in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Explain, at the molecular level, the behavior of matter as it undergoes phase transitions. |
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| **SC.912.P.12.12:** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br>Remarks/Examples |
| | Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel. |
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| **SC.912.P.12.13:** | Explain the concept of dynamic equilibrium in terms of reversible processes occurring at the same rates.<br>Remarks/Examples |
| | Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing). Explain that equilibrium is established when forward and reverse-reaction rates are equal. |
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| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples |
| | Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
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| **SC.912.P.8.10:** | Describe oxidation-reduction reactions in living and non-living systems.<br>Remarks/Examples |
| | Identify the substance(s) losing and gaining electrons in oxidation-reduction reactions. Discuss voltaic cells, various types of batteries, electrolysis of water, smelting and purification of metals, electrolysis of brine versus molten NaCl, neutralization reactions, electrolytic cells, and living systems (photosynthesis |

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| | and cellular respiration). |
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| SC.912.P.8.11: | Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH.<br>Remarks/Examples |
| | Use experimental data to illustrate and explain the pH scale to characterize acid and base solutions. Compare and contrast the strengths of various common acids and bases. |
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| SC.912.P.8.12: | Describe the properties of the carbon atom that make the diversity of carbon compounds possible.<br>Remarks/Examples |
| | Explain how the bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules. |
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| SC.912.P.8.13: | Identify selected functional groups and relate how they contribute to properties of carbon compounds.<br>Remarks/Examples |
| | Recognize functional groups in structural formulas of carbon molecules (e.g. sugars, proteins, nucleotides, amino acids, hydroxyl groups which form alcohols, carbonyl groups which form aldehydes / ketones, carboxyl groups which form carboxylic acids, etc.). |
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| SC.912.P.8.2: | Differentiate between physical and chemical properties and physical and chemical changes of matter.<br>Remarks/Examples |
| | Discuss volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting and boiling points. Describe simple laboratory techniques that can be used to separate homogeneous and heterogeneous mixtures (e.g. filtration, distillation, chromatography, evaporation). |
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| SC.912.P.8.3: | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence. |

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| | Remarks/Examples |
| | Describe the development and historical importance of atomic theory from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus and "gold foil" experiment), and Bohr (planetary model of atom), and understand how each discovery leads to modern atomic theory.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples |
| | Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.5:** | Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.<br>Remarks/Examples |
| | Use the periodic table and electron configuration to determine an element's number of valence electrons and its chemical and physical properties. Explain how chemical properties depend almost entirely on the configuration of the outer electron shell. |
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| **SC.912.P.8.6:** | Distinguish between bonding forces holding compounds together and other attractive forces, including hydrogen bonding and van der Waals forces.<br>Remarks/Examples |
| | Describe how atoms combine to form molecules through ionic, covalent, and hydrogen bonding. Compare and contrast the characteristics of the interactions between atoms in ionic and covalent compounds and how these bonds form. Use electronegativity to explain the difference between polar and |

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| | nonpolar covalent bonds. |
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| SC.912.P.8.7: | Interpret formula representations of molecules and compounds in terms of composition and structure.<br>Remarks/Examples |
| | Write chemical formulas for simple covalent (HCl, $SO_2$, $CO_2$, and $CH_4$), ionic ($Na^+ + Cl^- \rightarrow NaCl$) and molecular ($O_2$, $H_2O$) compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions. |
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| SC.912.P.8.8: | Characterize types of chemical reactions, for example: redox, acid-base, synthesis, and single and double replacement reactions.<br>Remarks/Examples |
| | Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. |
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| SC.912.P.8.9: | Apply the mole concept and the law of conservation of mass to calculate quantities of chemicals participating in reactions.<br>Remarks/Examples |
| | Recognize one mole equals $6.02 \times 10^{23}$ particles (atoms or molecules). Determine number of particles for elements and compounds using the mole concept, in terms of number of particles, mass, and the volume of an ideal gas at specified conditions of temperature and pressure. Use experimental data to determine percent yield, empirical formulas, molecular formulas, and calculate the mass-to-mass stoichiometry for a chemical reaction. |
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## RELATED GLOSSARY TERM DEFINITIONS (69)

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| **Acid:** | A substance that increases the $H^+$ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |

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| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |
| **Amino acid:** | An organic molecule containing an amino group (-NH2), a carboxyl (-COOH) group, and a variable side chain (R group) that distinguishes the amino acid. Proteins are synthesized from amino acids. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Base:** | A substance that increases the OH– concentration of a solution; a proton acceptor. |
| **Boil:** | To change from a liquid to a vapor by the application of heat. |
| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Chemical change:** | A reaction or a change in a substance produced by chemical means that results in producing a different chemical. |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |
| **Concentration:** | The relative amount of a particular substance, a solute, or mixture. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductivity:** | The ability or power to conduct or transmit heat, electricity, or sound. |
| **Conservation of Mass:** | The principle that mass cannot be created or destroyed; also conservation of matter. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |

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| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Dissolve:** | To cause to pass into solution. |
| **Diversity:** | The different species in a given area or specific period of time. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Entropy:** | A measure of the unavailable energy in a closed thermodynamic system that is also usually considered to be a measure of the system's disorder, that is a property of the system's state, and that varies directly with any reversible change in heat in the system and inversely with the temperature of the system. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |
| **Evaporation:** | The process by which a liquid is converted to its vapor phase by heating the liquid. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |
| **Force:** | A vector quantity that exists between two objects and, when |

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| | unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Melt:** | To be changed from a solid to a liquid state especially by the application of heat. |

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| **Metal:** | Any of a category of electropositive elements that usually have a shiny surface, are generally good conductors of heat and electricity, and can be melted or fused, hammered into thin sheets, or drawn into wires. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Mole :** | The amount of a substance that contains as many atoms, molecules, ions, or other elementary units as the number of atoms in 0.012 kilogram of carbon 12. The number is 6.0225 × 10^23, Avogadro's number. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Natural resource:** | Something, such as a forest, a mineral deposit, or fresh water, that is found in nature and is necessary or useful to humans. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Periodic table:** | A tabular arrangement of the elements according to their atomic numbers so that elements with similar properties are in the same column. |

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| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **van der Waals Force:** | A weak force of attraction between electrically neutral molecules that collide with or pass very close to each other. The van der Waals force is caused by the attraction between electron-rich regions of one molecule and electron-poor regions of another (the attraction between the molecules seen as electric dipoles). |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Volume:** | A measure of the amount of space an object takes up; also the loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

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| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Melt:** | To be changed from a solid to a liquid state especially by the application of heat. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Mole :** | The amount of a substance that contains as many atoms, molecules, ions, or other elementary units as the number of atoms in 0.012 kilogram of carbon 12. The number is 6.0225 × 10^23, Avogadro's number. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Periodic table:** | A tabular arrangement of the elements according to their atomic |

# Course: Chemistry 2- 2003360

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4391

## BASIC INFORMATION

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| **Course Number:** | 2003360 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Chemistry 2, Chemistry, CHEM 2 |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Physical Sciences |
| **Course Title:** | Chemistry 2 |
| **Course Abbreviated Title:** | CHEM 2 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br><u>Instructional Practices:</u> Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence).<br><br>**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations.<br>• Analyzing and interpreting data. |

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| | • Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (69)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| LAFS.1112.RST.1.1: | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| LAFS.1112.RST.1.2: | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| LAFS.1112.RST.1.3: | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| LAFS.1112.RST.2.4: | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| LAFS.1112.RST.2.5: | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| LAFS.1112.RST.2.6: | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, |

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| | identifying important issues that remain unresolved. |
| LAFS.1112.RST.3.7: | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| LAFS.1112.RST.3.8: | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| LAFS.1112.RST.3.9: | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| LAFS.1112.RST.4.10: | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| LAFS.1112.WHST.3.8: | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| LAFS.1112.WHST.3.9: | Draw evidence from informational texts to support analysis, reflection, and research. |
| LAFS.1112.WHST.4.10: | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| LAFS.1112.SL.1.1: | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and |

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| | other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships |

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| | between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. |

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| | d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |

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| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and |

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| | trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing** |

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| | intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. |

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| | ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| SC.912.L.17.17: | Assess the effectiveness of innovative methods of protecting the environment. |
| SC.912.L.17.19: | Describe how different natural resources are produced and how their rates of use and renewal limit availability. |
| SC.912.L.17.20: | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. Also assesses SC.912.L.17.11, SC.912.L.17.13, SC.912.N.1.3. |
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| SC.912.L.18.1: | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. Also assesses SC.912.L.18.11. |
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| SC.912.L.18.11: | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity. |
| SC.912.L.18.12: | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. |
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| SC.912.L.18.2: | Describe the important structural characteristics of monosaccharides, disaccharides, and polysaccharides and explain the functions of carbohydrates in living things. |
| SC.912.L.18.3: | Describe the structures of fatty acids, triglycerides, phospholipids, and steroids. Explain the functions of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membranes. |

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| SC.912.L.18.4: | Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and function of enzymes. |
| SC.912.N.1.5: | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| SC.912.N.1.7: | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.2.1: | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or |

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| | tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** |

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| | (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. |
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| | LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br><br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and |

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| | critique the reasoning of others. |
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| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
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| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and |

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| | persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations. Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer. Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science. Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.3.3: | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples<br>Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
| SC.912.N.3.4: | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples<br>Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
| SC.912.N.3.5: | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples<br>Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| SC.912.N.4.1: | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples<br>Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| SC.912.N.4.2: | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and |

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| | benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.6:** | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
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| **SC.912.P.10.8:** | Explain entropy's role in determining the efficiency of processes that convert energy to work.<br>Remarks/Examples |
| | Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy). Describe entropy as a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system. |
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| **SC.912.P.8.10:** | Describe oxidation-reduction reactions in living and non-living systems.<br>Remarks/Examples |
| | Identify the substance(s) losing and gaining electrons in oxidation-reduction reactions. Discuss voltaic cells, various types of batteries, electrolysis of water, smelting and purification of metals, electrolysis of brine versus molten NaCl, neutralization reactions, electrolytic cells, and living systems (photosynthesis and cellular respiration). |
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| **SC.912.P.8.12:** | Describe the properties of the carbon atom that make the diversity of carbon compounds possible. |

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| | Remarks/Examples<br>Explain how the bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules. |
| SC.912.P.8.13: | Identify selected functional groups and relate how they contribute to properties of carbon compounds.<br>Remarks/Examples<br>Recognize functional groups in structural formulas of carbon molecules (e.g. sugars, proteins, nucleotides, amino acids, hydroxyl groups which form alcohols, carbonyl groups which form aldehydes / ketones, carboxyl groups which form carboxylic acids, etc.). |

## RELATED GLOSSARY TERM DEFINITIONS (45)

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| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Activation energy:** | The least amount of energy required to start a particular chemical reaction. |
| **Amino acid:** | An organic molecule containing an amino group (-NH2), a carboxyl (-COOH) group, and a variable side chain (R group) that distinguishes the amino acid. Proteins are synthesized from amino acids. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Carbohydrate:** | Any of a group of organic compounds that includes sugars, starches, celluloses, and gums and serves as a major energy source in the diet of animals. These compounds are produced by photosynthetic plants and contain only carbon, hydrogen, and oxygen, usually in the ratio 1:2:1. |
| **Catalyst:** | A substance that speeds up or slows down the rate of a reaction without being consumed or altered. |

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| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Compound:** | A substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Disaccharide:** | Any of a class of sugars, including lactose and sucrose, that are composed of two monosaccharides. |
| **Diversity:** | The different species in a given area or specific period of time. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Entropy:** | A measure of the unavailable energy in a closed thermodynamic system that is also usually considered to be a measure of the system's disorder, that is a property of the system's state, and that varies directly with any reversible change in heat in the system and inversely with the temperature of the system. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Enzyme:** | Any of numerous proteins produced in living cells that accelerate or catalyze chemical reactions. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fatty acid:** | Any of a large group of organic acids, especially those found in animal and vegetable fats and oils. Fatty acids are mainly composed of long chains of hydrocarbons ending in a carboxyl group. A fatty acid is saturated when the bonds between carbon |

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| | atoms are all single bonds. It is unsaturated when any of these bonds is a double bond. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Membrane:** | A thin layer of tissue that surrounds or lines a cell, a group of cells, or a cavity; any barrier separating two fluids. |
| **Metal:** | Any of a category of electropositive elements that usually have a shiny surface, are generally good conductors of heat and electricity, and can be melted or fused, hammered into thin sheets, or drawn into wires. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Monosaccharide:** | Any of a class of carbohydrates that cannot be broken down to simpler sugars by hydrolysis and that constitute the building blocks of oligosaccharides and polysaccharides. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Natural resource:** | Something, such as a forest, a mineral deposit, or fresh water, that is found in nature and is necessary or useful to humans. |

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| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Phospholipid:** | Any of various phosphorus-containing lipids, such as lecithin, that are composed mainly of fatty acids, a phosphate group, and a simple organic molecule such as glycerol. |
| **Polysaccharide:** | Any of a class of carbohydrates, such as starch and cellulose, consisting of a number of monosaccharides joined by glycosidic bonds. |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Steroid:** | Any of numerous naturally occurring or synthetic fat-soluble organic compounds having, as a basis, 17 carbon atoms arranged in four rings and including the sterols and bile acids, adrenal and sex hormones, certain natural drugs such as digitalis compounds, and the precursors of certain vitamins. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Triglyceride:** | A naturally occurring ester of three fatty acids and glycerol that is the chief constituent of fats and oils. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |

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| | numbers so that elements with similar properties are in the same column. |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **van der Waals Force:** | A weak force of attraction between electrically neutral molecules that collide with or pass very close to each other. The van der Waals force is caused by the attraction between electron-rich regions of one molecule and electron-poor regions of another (the attraction between the molecules seen as electric dipoles). |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Volume:** | A measure of the amount of space an object takes up; also the loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Physics 1- 2003380

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4401

## BASIC INFORMATION

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| **Course Number:** | 2003380 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Physics 1, Physics, PHYS 1 |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Physical Sciences |
| **Course Title:** | Physics 1 |
| **Course Abbreviated Title:** | PHYS 1 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br><u>Instructional Practices:</u><br><br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence).<br><br>**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models. |

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| | • Planning and carrying out investigations.<br>• Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (72)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| LAFS.1112.RST.1.1: | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| LAFS.1112.RST.1.2: | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| LAFS.1112.RST.1.3: | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| LAFS.1112.RST.2.4: | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| LAFS.1112.RST.2.5: | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |

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| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and |

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| | researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |

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| | Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-VM.1.3:** | Solve problems involving velocity and other quantities that can be represented by vectors. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |

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| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to |

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| | ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and |

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| | exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. |

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| | Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **SC.912.E.5.2:** | Identify patterns in the organization and distribution of matter in the universe and the forces that determine them.<br>Remarks/Examples |
| | Identify patterns that influence the formation, hierarchy, and motions of the various kinds of objects in the solar system and the role of gravity and inertia on these motions (include the Sun, Earth, and Moon, planets, satellites, comets, asteroids, star clusters, galaxies, galaxy clusters). Recognize that the universe contains many billions of galaxies, and each galaxy contains many billions of stars. Recognize that constellations are contrived associations of stars that do not reflect functional relationships in space.<br><br>Connections: MAFS.K12.MP.7: Look for and make use of structure. |
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| **SC.912.E.5.6:** | Develop logical connections through physical principles, including Kepler's and Newton's Laws about the relationships and the effects of Earth, Moon, and Sun on each other.<br>Remarks/Examples |
| | Explain that Kepler's laws determine the orbits of objects in the solar system and recognize that Kepler's laws are a direct consequence of Newton's Law of Universal Gravitation and Laws of Motion. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving). |

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| | Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| | |
| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this** |

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| | **includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis |

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| | of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br><br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same |

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| | outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.5: | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and |

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| | conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.4:** | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |
| | Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
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| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
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| **SC.912.P.10.13:** | Relate the configuration of static charges to the electric field, electric force, electric potential, and electric potential energy.<br>Remarks/Examples |
| | Using Coulomb's law, determine the force on a stationary charge due to other stationary charges, and explain that this force is many times greater than the gravitational force. Recognize the relationship between forces and their associated potential energies and that the electric field is directly related to the rate of change of the electric |

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| | potential from point to point in space. |
| SC.912.P.10.14: | Differentiate among conductors, semiconductors, and insulators.<br>Remarks/Examples<br>Describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators. |
| SC.912.P.10.15: | Investigate and explain the relationships among current, voltage, resistance, and power.<br>Remarks/Examples<br>Use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |
| SC.912.P.10.18: | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples<br>Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
| SC.912.P.10.2: | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples<br>Use calorimetry to illustrate conservation of energy.  Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
| SC.912.P.10.20: | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.<br>Remarks/Examples<br>Describe the measurable properties of waves (velocity, frequency, |

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| | wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
| **SC.912.P.10.22:** | Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.<br>Remarks/Examples |
| | Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size. |
| **SC.912.P.10.3:** | Compare and contrast work and power qualitatively and quantitatively. |
| **SC.912.P.10.4:** | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| **SC.912.P.10.5:** | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
| **SC.912.P.12.1:** | Distinguish between scalar and vector quantities and assess which should be used to describe an event.<br>Remarks/Examples |
| | Distinguish between vector quantities (e.g., displacement, velocity, acceleration, force, and linear momentum) and scalar quantities (e.g., distance, speed, energy, mass, work). |

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| | MAFS.912.N-VM.1.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.P.12.2:** | Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.<br>Remarks/Examples |
| | Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.<br><br>Connections: MAFS.912.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.P.12.3:** | Interpret and apply Newton's three laws of motion.<br>Remarks/Examples |
| | Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law). Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton's second law, F = ma). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = –F1 on 1 (Newton's third law). |
| **SC.912.P.12.4:** | Describe how the gravitational force between two objects depends on their masses and the distance between them.<br>Remarks/Examples |
| | Describe Newton's law of universal gravitation in terms of the attraction between two objects, their masses, and the inverse square of the distance between them. |
| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples |
| | (e.g. elastic and completely inelastic collisions). |

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| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br>Remarks/Examples<br>Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
| **SC.912.P.12.9:** | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples<br>The energy *E* and the momentum *p* depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples<br>Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
| **SC.912.P.8.3:** | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence.<br>Remarks/Examples<br>Describe the development and historical importance of atomic theory from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus and "gold foil" experiment), and Bohr (planetary model of atom), and understand how each discovery leads to modern atomic theory.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |

## RELATED GLOSSARY TERM DEFINITIONS (61)

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| **Acceleration:** | Rate of change in velocity, usually expressed in meters per second per second; involves an increase or decrease in speed and/or a change in direction. |
| **Asteroid:** | A rocky or metallic object that orbits the Sun and is much smaller than a planet. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Circuit:** | An interconnection of electrical elements forming a complete path for the flow of current. |
| **Comet:** | A celestial body that appears as a fuzzy head usually surrounding a bright nucleus, that has a usually highly eccentric orbit, that consists primarily of ice and dust, and that often develops one or more long tails when near the sun. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductor:** | A material or an object that conducts heat, electricity, light, or sound. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electric potential:** | A measure of the work required by an electric field to move electric charges. |

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| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Galaxy:** | A large collection of stars, gases, and dust that are part of the universe (e.g., the Milky Way galaxy) bound together by gravitational forces. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Gravity:** | The force of attraction between any two objects. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum |

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| | with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Insulator:** | A material or an object that does not easily allow heat, electricity, light, or sound to pass through it. Air, cloth and rubber are good electrical insulators; feathers and wool make good thermal insulators. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Moon:** | A natural satellite that revolves around a planet. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |

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| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Resistance :** | The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Semiconductor:** | Any of various solid crystalline substances, such as germanium or silicon, having electrical conductivity greater than insulators but less than good conductors, and used especially as a base material for computer chips and other electronic devices. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Sun:** | The closest star to Earth and the center of our solar system. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; |

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| | quantity whose magnitude is expressed in units of distance over time. |
| **Vibration:** | A periodic and repetitive movement around an equilibrium point. |
| **Voltage:** | A measure of the difference in electric potential between two points in space, a material, or an electric circuit, expressed in volts. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Physics 1 for Credit Recovery- 2003385

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4323

## BASIC INFORMATION

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| **Course Number:** | 2003385 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Physics 1 for Credit Recovery, Physics, Credit Recovery, PHYS 1 CR |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Physical Sciences |
| **Course Title:** | Physics 1 for Credit Recovery |
| **Course Abbreviated Title:** | PHYS 1 CR |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Multiple (M) - Course length can vary |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, |

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| | research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:** Credit Recovery courses are credit bearing courses with specific content requirements defined by Florida's Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery courses are exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.<br><br>Instructional Practices<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis: |

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| | 1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (72)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |

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| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and |

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| | researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |

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| | Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-VM.1.3:** | Solve problems involving velocity and other quantities that can be represented by vectors. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |

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| LAFS.1112.WHST.1.2: | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| LAFS.1112.WHST.2.4: | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| LAFS.1112.WHST.2.5: | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| LAFS.1112.WHST.2.6: | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to |

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| | ongoing feedback, including new arguments or information. |
| LAFS.1112.WHST.3.7: | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| MAFS.912.F-IF.2.4: | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and |

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| | exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. |

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| | Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **SC.912.E.5.2:** | Identify patterns in the organization and distribution of matter in the universe and the forces that determine them.<br>Remarks/Examples |
| | Identify patterns that influence the formation, hierarchy, and motions of the various kinds of objects in the solar system and the role of gravity and inertia on these motions (include the Sun, Earth, and Moon, planets, satellites, comets, asteroids, star clusters, galaxies, galaxy clusters). Recognize that the universe contains many billions of galaxies, and each galaxy contains many billions of stars. Recognize that constellations are contrived associations of stars that do not reflect functional relationships in space.<br><br>Connections: MAFS.K12.MP.7: Look for and make use of structure. |
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| **SC.912.E.5.6:** | Develop logical connections through physical principles, including Kepler's and Newton's Laws about the relationships and the effects of Earth, Moon, and Sun on each other.<br>Remarks/Examples |
| | Explain that Kepler's laws determine the orbits of objects in the solar system and recognize that Kepler's laws are a direct consequence of Newton's Law of Universal Gravitation and Laws of Motion. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving). |

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| | Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| [**SC.912.N.2.2:**]() | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| [**SC.912.N.1.1:**]() | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this** |

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| | **includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis |

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| | of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br><br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same |

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| | outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.5: | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and |

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| | conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.4:** | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |
| | Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| SC.912.N.4.1: | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.P.10.1: | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
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| SC.912.P.10.10: | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
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| SC.912.P.10.13: | Relate the configuration of static charges to the electric field, electric force, electric potential, and electric potential energy.<br>Remarks/Examples |
| | Using Coulomb's law, determine the force on a stationary charge due to other stationary charges, and explain that this force is many times greater than the gravitational force. Recognize the relationship between forces and their associated potential energies and that the electric field is directly related to the rate of change of the electric |

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| | potential from point to point in space. |
| **SC.912.P.10.14:** | Differentiate among conductors, semiconductors, and insulators.<br>Remarks/Examples<br>Describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators. |
| **SC.912.P.10.15:** | Investigate and explain the relationships among current, voltage, resistance, and power.<br>Remarks/Examples<br>Use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |
| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples<br>Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples<br>Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
| **SC.912.P.10.20:** | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.<br>Remarks/Examples<br>Describe the measurable properties of waves (velocity, frequency, |

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| | wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
| **SC.912.P.10.22:** | Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.<br>Remarks/Examples |
| | Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size. |
| **SC.912.P.10.3:** | Compare and contrast work and power qualitatively and quantitatively. |
| **SC.912.P.10.4:** | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| **SC.912.P.10.5:** | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
| **SC.912.P.12.1:** | Distinguish between scalar and vector quantities and assess which should be used to describe an event.<br>Remarks/Examples |
| | Distinguish between vector quantities (e.g., displacement, velocity, acceleration, force, and linear momentum) and scalar quantities (e.g., distance, speed, energy, mass, work). |

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| | MAFS.912.N-VM.1.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.P.12.2:** | Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.<br>Remarks/Examples |
| | Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.<br><br>Connections: MAFS.912.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
| **SC.912.P.12.3:** | Interpret and apply Newton's three laws of motion.<br>Remarks/Examples |
| | Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law). Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton's second law, F = ma). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = –F1 on 1 (Newton's third law). |
| **SC.912.P.12.4:** | Describe how the gravitational force between two objects depends on their masses and the distance between them.<br>Remarks/Examples |
| | Describe Newton's law of universal gravitation in terms of the attraction between two objects, their masses, and the inverse square of the distance between them. |
| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples |
| | (e.g. elastic and completely inelastic collisions). |

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| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br>Remarks/Examples |
| | Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
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| **SC.912.P.12.9:** | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples |
| | The energy *E* and the momentum *p* depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
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| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples |
| | Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
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| **SC.912.P.8.3:** | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence.<br>Remarks/Examples |
| | Describe the development and historical importance of atomic theory from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus and "gold foil" experiment), and Bohr (planetary model of atom), and understand how each discovery leads to modern atomic theory.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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## RELATED GLOSSARY TERM DEFINITIONS (61)

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| **Acceleration:** | Rate of change in velocity, usually expressed in meters per second per second; involves an increase or decrease in speed and/or a change in direction. |
| **Asteroid:** | A rocky or metallic object that orbits the Sun and is much smaller than a planet. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Circuit:** | An interconnection of electrical elements forming a complete path for the flow of current. |
| **Comet:** | A celestial body that appears as a fuzzy head usually surrounding a bright nucleus, that has a usually highly eccentric orbit, that consists primarily of ice and dust, and that often develops one or more long tails when near the sun. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductor:** | A material or an object that conducts heat, electricity, light, or sound. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electric potential:** | A measure of the work required by an electric field to move electric charges. |

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| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Galaxy:** | A large collection of stars, gases, and dust that are part of the universe (e.g., the Milky Way galaxy) bound together by gravitational forces. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Gravity:** | The force of attraction between any two objects. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum |

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| | with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Insulator:** | A material or an object that does not easily allow heat, electricity, light, or sound to pass through it. Air, cloth and rubber are good electrical insulators; feathers and wool make good thermal insulators. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Moon:** | A natural satellite that revolves around a planet. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |

# Course: Physics 1 Honors- 2003390

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4317

## BASIC INFORMATION

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| **Course Number:** | 2003390 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Physical, Physics 1 Honors, PHYS 1 HON, Honors, Physics |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Physical Sciences |
| **Course Title:** | Physics 1 Honors |
| **Course Abbreviated Title:** | PHYS 1 HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **General Notes:** | While the content focus of this course is consistent with the Physics I course, students will explore these concepts in greater depth. In general, the academic pace and rigor will be greatly |

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| | increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes**<br><br>**Instructional Practices**<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence).<br><br>**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models. |

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| | • Planning and carrying out investigations.<br>• Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (90)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |

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| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and |

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| | researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **MAFS.912.A-CED.1.4:** | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange* |

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| | *Ohm's law V = IR to highlight resistance R.*<br>Remarks/Examples<br>Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest.<br><br>Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-VM.1.1:** | Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., ***v***, ***\|v\|***, **\|\|v\|\|**, ***v***). |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the |

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| | discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on |

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| | addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. |

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| | Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and** |

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| | using phase shift.<br><br>Remarks/Examples<br>Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
| **MAFS.912.G-GMD.1.3:** | Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. |
| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-VM.1.2:** | Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. |
| **MAFS.912.N-VM.1.3:** | Solve problems involving velocity and other quantities that can be represented by vectors. |
| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |

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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a |

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| | linear association.<br><br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.E.5.2:** | Identify patterns in the organization and distribution of matter in the universe and the forces that determine them.<br>Remarks/Examples |
| | Identify patterns that influence the formation, hierarchy, and motions of the various kinds of objects in the solar system and the role of gravity and inertia on these motions (include the Sun, Earth, and Moon, planets, satellites, comets, asteroids, star clusters, galaxies, galaxy clusters). Recognize that the universe contains many billions of galaxies, and each galaxy contains many billions of stars. Recognize that constellations are contrived associations of stars that do not reflect functional relationships in space.<br><br>Connections: MAFS.K12.MP.7: Look for and make use of structure. |
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| SC.912.E.5.6: | Develop logical connections through physical principles, including Kepler's and Newton's Laws about the relationships and the effects of Earth, Moon, and Sun on each other.<br>Remarks/Examples |
| | Explain that Kepler's laws determine the orbits of objects in the solar system and recognize that Kepler's laws are a direct consequence of Newton's Law of Universal Gravitation and Laws of Motion. |
| | |
| SC.912.E.5.8: | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.<br>Remarks/Examples |
| | Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
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| SC.912.L.18.12: | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. |
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| SC.912.N.1.7: | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| SC.912.N.2.2: | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of |

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| | knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| | |
| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts). |

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| | 2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the |

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| | text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
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| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, |

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| | and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.4:** | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |
| | Recognize that theories do not become laws, theories explain |

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| | laws. Recognize that not all scientific laws have accompanying explanatory theories. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
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| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear). |

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| | Remarks/Examples<br><br>Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
| **SC.912.P.10.13:** | Relate the configuration of static charges to the electric field, electric force, electric potential, and electric potential energy.<br>Remarks/Examples<br><br>Using Coulomb's law, determine the force on a stationary charge due to other stationary charges, and explain that this force is many times greater than the gravitational force. Recognize the relationship between forces and their associated potential energies and that the electric field is directly related to the rate of change of the electric potential from point to point in space. |
| **SC.912.P.10.14:** | Differentiate among conductors, semiconductors, and insulators.<br>Remarks/Examples<br><br>Describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators. |
| **SC.912.P.10.15:** | Investigate and explain the relationships among current, voltage, resistance, and power.<br>Remarks/Examples<br><br>Use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |
| **SC.912.P.10.16:** | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br>Remarks/Examples<br><br>Explain that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize the Lorentz force is the force on a point charge due to electromagnetic fields and occurs in many devices, including mass spectrometers. |
| **SC.912.P.10.17:** | Explore the theory of electromagnetism by explaining electromagnetic waves in terms of oscillating electric and magnetic fields.<br>Remarks/Examples |

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| | Recognize that an oscillating charge creates an oscillating electric field which gives rise to electromagnetic waves. Recognize a changing magnetic field makes an electric field, and a changing electric field makes a magnetic field, and these phenomena are expressed mathematically through the Faraday law and the Ampere-Maxwell law. |
| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
| **SC.912.P.10.20:** | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.<br>Remarks/Examples |
| | Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source |

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| | or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
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| **SC.912.P.10.22:** | Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.<br>Remarks/Examples |
| | Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size. |
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| **SC.912.P.10.3:** | Compare and contrast work and power qualitatively and quantitatively. |
| **SC.912.P.10.4:** | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| **SC.912.P.10.5:** | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
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| **SC.912.P.10.6:** | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
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| **SC.912.P.10.7:** | Distinguish between endothermic and exothermic chemical processes.<br>Remarks/Examples |
| | Classify chemical reactions and phase changes as exothermic (release thermal energy) or endothermic (absorb thermal energy). |
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| **SC.912.P.10.8:** | Explain entropy's role in determining the efficiency of processes that convert energy to work.<br>Remarks/Examples |
| | Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy). Describe entropy as a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system. |
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| **SC.912.P.12.1:** | Distinguish between scalar and vector quantities and assess which should be used to describe an event.<br>Remarks/Examples |
| | Distinguish between vector quantities (e.g., displacement, velocity, acceleration, force, and linear momentum) and scalar quantities (e.g., distance, speed, energy, mass, work).<br><br>MAFS.912.N-VM.1.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
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| **SC.912.P.12.2:** | Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.<br>Remarks/Examples |
| | Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.<br><br>Connections: MAFS.912.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
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| **SC.912.P.12.3:** | Interpret and apply Newton's three laws of motion.<br>Remarks/Examples |
| | Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law). Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton's second law, F = ma). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = –F1 on 1 (Newton's third law). |

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| SC.912.P.12.4: | Describe how the gravitational force between two objects depends on their masses and the distance between them.<br>Remarks/Examples |
| | Describe Newton’s law of universal gravitation in terms of the attraction between two objects, their masses, and the inverse square of the distance between them. |
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| SC.912.P.12.5: | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples |
| | (e.g. elastic and completely inelastic collisions). |
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| SC.912.P.12.6: | Qualitatively apply the concept of angular momentum.<br>Remarks/Examples |
| | Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]). |
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| SC.912.P.12.7: | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br>Remarks/Examples |
| | Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
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| SC.912.P.12.8: | Recognize that Newton's Laws are a limiting case of Einstein's Special Theory of Relativity at speeds that are much smaller than the speed of light.<br>Remarks/Examples |
| | Recognize that the speed of light in any reference frame is the central postulate of the Special Theory of Relativity. As speeds approach zero, Special Relativity tends towards equivalence with Newton's Laws of Motion. |
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| SC.912.P.12.9: | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples |

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| | The energy *E* and the momentum *p* depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples |
| | Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
| **SC.912.P.8.3:** | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence.<br>Remarks/Examples |
| | Describe the development and historical importance of atomic theory from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus and "gold foil" experiment), and Bohr (planetary model of atom), and understand how each discovery leads to modern atomic theory.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples |
| | Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |

## RELATED GLOSSARY TERM DEFINITIONS (74)

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| **Acceleration:** | Rate of change in velocity, usually expressed in meters per second per second; involves an increase or decrease in speed and/or a change in direction. |
| **Angular momentum:** | A vector quantity that is a measure of the rotational momentum of a rotating body or system, that is equal in classical physics to the product of the angular velocity of the body or system and its moment of inertia with respect to the rotation axis, and that is directed along the rotation axis. |
| **Asteroid:** | A rocky or metallic object that orbits the Sun and is much smaller than a planet. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Axis:** | The imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Circuit:** | An interconnection of electrical elements forming a complete path for the flow of current. |
| **Comet:** | A celestial body that appears as a fuzzy head usually surrounding a bright nucleus, that has a usually highly eccentric orbit, that consists primarily of ice and dust, and that often develops one or more long tails when near the sun. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductor:** | A material or an object that conducts heat, electricity, light, or sound. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |

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| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electric potential:** | A measure of the work required by an electric field to move electric charges. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Entropy:** | A measure of the unavailable energy in a closed thermodynamic system that is also usually considered to be a measure of the system's disorder, that is a property of the system's state, and that varies directly with any reversible change in heat in the system and inversely with the temperature of the system. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be |

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| | mathematically stated. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Galaxy:** | A large collection of stars, gases, and dust that are part of the universe (e.g., the Milky Way galaxy) bound together by gravitational forces. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Gravity:** | The force of attraction between any two objects. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Insulator:** | A material or an object that does not easily allow heat, electricity, light, or sound to pass through it. Air, cloth and rubber are good electrical insulators; feathers and wool make good thermal insulators. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Magnet:** | An object that produces a magnetic field and that has the property, either natural or induced, of attracting iron or steel. |

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| **Magnetic:** | Having the property of attracting iron and certain other materials by virtue of a field of force. |
| **Magnetic field:** | The region where magnetic force exists around magnets or electric currents. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Moon:** | A natural satellite that revolves around a planet. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt |

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| | and horsepower. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Relativity (special theory of):** | The physical theory of space and time developed by Albert Einstein, based on the postulates that all the laws of physics are equally valid in all frames of reference moving at a uniform velocity and that the speed of light from a uniformly moving source is always the same, regardless of how fast or slow the source or its observer is moving. The theory has as consequences the relativistic mass increase of rapidly moving objects, the Lorentz-Fitzgerald contraction, time dilatation, and the principle of mass-energy equivalence. |
| **Resistance :** | The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Semiconductor:** | Any of various solid crystalline substances, such as germanium or silicon, having electrical conductivity greater than insulators but less than good conductors, and used especially as a base material for computer chips and other electronic devices. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Sun:** | The closest star to Earth and the center of our solar system. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |

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| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Vibration:** | A periodic and repetitive movement around an equilibrium point. |
| **Voltage:** | A measure of the difference in electric potential between two points in space, a material, or an electric circuit, expressed in volts. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

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| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Resistance :** | The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
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| | quantity whose magnitude is expressed in units of distance over time. |
| **Vibration:** | A periodic and repetitive movement around an equilibrium point. |
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# Course: Nuclear Radiation- 2003400

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4308

## BASIC INFORMATION

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| **Course Number:** | 2003400 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Nuclear Radiation, NUCLEAR RADI, Nuclear, Radiation |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Physical Sciences |
| **Course Title:** | Nuclear Radiation |
| **Course Abbreviated Title:** | NUCLEAR RADI |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:** Instructional Practices<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (79)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots). |

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| | Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples<br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a |

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| | hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection |

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| | and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and |

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| | examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* |

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| | Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, |

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| | and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships |

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| | between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br>Remarks/Examples<br>Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br>**Algebra 1 Assessment Limits and Clarifications**<br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br>**Algebra 2 Assessment Limits and Clarifications** |

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| | i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.E.5.1:** | Cite evidence used to develop and verify the scientific theory of the Big Bang (also known as the Big Bang Theory) of the origin of the universe.<br>Remarks/Examples |
| | Explain evidence to support the formation of the universe, which has been expanding for approximately 15 billion year (e.g. ratio of gases, red-shift from distant galaxies, and cosmic background radiation). |
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| **SC.912.E.5.2:** | Identify patterns in the organization and distribution of matter in the universe and the forces that determine them.<br>Remarks/Examples |
| | Identify patterns that influence the formation, hierarchy, and motions of the various kinds of objects in the solar system and the role of gravity and inertia on these motions (include the Sun, Earth, and Moon, planets, satellites, comets, asteroids, star clusters, galaxies, galaxy clusters). Recognize that the universe contains many billions of galaxies, and each galaxy contains many billions of stars. Recognize that constellations are contrived associations of stars that do not reflect functional relationships in space.<br><br>Connections: MAFS.K12.MP.7: Look for and make use of structure. |
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| **SC.912.E.5.3:** | Describe and predict how the initial mass of a star determines its evolution.<br>Remarks/Examples |
| | Compare and contrast the evolution of stars of different masses (include the three outcomes of stellar evolution based on mass: black hole, neutron star, white dwarf). Differentiate between the different types of stars found on the Hertzsprung-Russell diagram and the balance between gravitational collapse and nuclear fusion in determining the color, brightness, and life span of a star. |

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| SC.912.E.5.4: | Explain the physical properties of the Sun and its dynamic nature and connect them to conditions and events on Earth.<br>Remarks/Examples |
| | Describe the physical properties of the Sun (sunspot cycles, solar flares, prominences, layers of the Sun, coronal mass ejections, and nuclear reactions) and the impact of the Sun as the main source of external energy for the Earth. |
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| SC.912.E.5.7: | Relate the history of and explain the justification for future space exploration and continuing technology development.<br>Remarks/Examples |
| | Identify examples of historical space exploration (e.g. telescopes, high altitude balloons, lunar landers, deep-space probes, space station) that had significant impact on current space exploration and recognize the importance of continued exploration in space. |
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| SC.912.E.5.8: | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.<br>Remarks/Examples |
| | Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
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| SC.912.E.6.6: | Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.<br>Remarks/Examples |
| | Investigate and discuss how humans affect and are affected by geological systems and processes by describing the possible long-term consequences (costs and benefits) that increased human consumption (e.g. mining and extraction techniques; off-shore drilling; petrochemical refining) has placed on the environment (e.g. pollution, health, habitat destruction) and the impact on future energy production. |
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| **SC.912.E.7.1:** | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.<br>Remarks/Examples<br>Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun. |
| **SC.912.L.14.6:** | Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health. |
| **SC.912.L.15.2:** | Discuss the use of molecular clocks to estimate how long ago various groups of organisms diverged evolutionarily from one another. |
| **SC.912.L.16.10:** | Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| **SC.912.L.17.13:** | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| **SC.912.L.17.14:** | Assess the need for adequate waste management strategies. |
| **SC.912.L.17.15:** | Discuss the effects of technology on environmental quality. |
| **SC.912.L.17.16:** | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br>Remarks/Examples<br>Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |
| **SC.912.L.17.17:** | Assess the effectiveness of innovative methods of protecting the environment. |

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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science |

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.
MAFS.K12.MP.2: Reason abstractly and quantitatively.

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| | MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable |

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| | evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |

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| SC.912.N.2.5: | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| SC.912.N.3.1: | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.3.2: | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.3.3: | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships. |

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| | Remarks/Examples<br>Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
| SC.912.N.3.4: | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples<br>Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
| SC.912.N.3.5: | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples<br>Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| SC.912.N.4.1: | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples<br>Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| SC.912.N.4.2: | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples<br>Identify examples of technologies, objects, and processes that |

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| | have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
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| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.<br>Remarks/Examples |
| | Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
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| **SC.912.P.10.12:** | Differentiate between chemical and nuclear reactions.<br>Remarks/Examples |
| | Describe how chemical reactions involve the rearranging of atoms to form new substances, while nuclear reactions involve the change of atomic nuclei into entirely new atoms. Identify real-world examples where chemical and nuclear reactions occur every day. |
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| **SC.912.P.10.16:** | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br>Remarks/Examples |

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| | Explain that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize the Lorentz force is the force on a point charge due to electromagnetic fields and occurs in many devices, including mass spectrometers. |
| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples<br>Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
| **SC.912.P.10.2:** | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples<br>Use calorimetry to illustrate conservation of energy.  Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
| **SC.912.P.10.9:** | Describe the quantization of energy at the atomic level.<br>Remarks/Examples<br>Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship  $E = hv$). |
| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples<br>(e.g. elastic and completely inelastic collisions). |
| **SC.912.P.8.3:** | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time |

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| | and why those changes were necessitated by experimental evidence.<br>Remarks/Examples |
| | Describe the development and historical importance of atomic theory from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus and "gold foil" experiment), and Bohr (planetary model of atom), and understand how each discovery leads to modern atomic theory.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples |
| | Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.5:** | Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.<br>Remarks/Examples |
| | Use the periodic table and electron configuration to determine an element's number of valence electrons and its chemical and physical properties. Explain how chemical properties depend almost entirely on the configuration of the outer electron shell. |
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## RELATED GLOSSARY TERM DEFINITIONS (58)

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| **Asteroid:** | A rocky or metallic object that orbits the Sun and is much smaller than a planet. |
| **Atmosphere:** | The layers of gas that surround Earth, other planets, or stars. |

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| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Big Bang Theory:** | A cosmological theory holding that the universe originated approximately 20 billion years ago from the violent explosion of a very small agglomeration of matter of extremely high density and temperature. |
| **Biotechnology:** | The manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals). |
| **Comet:** | A celestial body that appears as a fuzzy head usually surrounding a bright nucleus, that has a usually highly eccentric orbit, that consists primarily of ice and dust, and that often develops one or more long tails when near the sun. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of $9.107 \times 10^{-28}$ grams and an electric charge of approximately $-1.602 \times 10^{-19}$ coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |

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| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Evolution :** | A theory that the various types of species arise from pre-existing species and that distinguishable characteristics are due to modifications through successive generations. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |
| **Galaxy:** | A large collection of stars, gases, and dust that are part of the universe (e.g., the Milky Way galaxy) bound together by gravitational forces. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Genetic:** | Affecting or determined by genes. |
| **Gravity:** | The force of attraction between any two objects. |
| **Habitat:** | A place in an ecosystem where an organism normally lives. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |

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| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Magnet:** | An object that produces a magnetic field and that has the property, either natural or induced, of attracting iron or steel. |
| **Magnetic:** | Having the property of attracting iron and certain other materials by virtue of a field of force. |
| **Magnetic field:** | The region where magnetic force exists around magnets or electric currents. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Moon:** | A natural satellite that revolves around a planet. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Organism:** | An individual form of life of one or more cells that maintains |

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| | various vital processes necessary for life. |
| **Periodic table:** | A tabular arrangement of the elements according to their atomic numbers so that elements with similar properties are in the same column. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Sun:** | The closest star to Earth and the center of our solar system. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Physics 2- 2003410

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4303

## BASIC INFORMATION

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| **Course Number:** | 2003410 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Physics 2, PHYS 2, Physics |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Physical Sciences |
| **Course Title:** | Physics 2 |
| **Course Abbreviated Title:** | PHYS 2 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety |

procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

**Special Notes**

**Instructional Practices**
Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:
1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)

- Asking questions (for science) and defining problems (for engineering).
- Developing and using models.
- Planning and carrying out investigations.
- Analyzing and interpreting data.
- Using mathematics, information and computer

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| | technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (87)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |

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| LAFS.1112.RST.3.7: | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| LAFS.1112.RST.3.8: | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| LAFS.1112.RST.3.9: | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| LAFS.1112.RST.4.10: | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| LAFS.1112.SL.1.1: | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |

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| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, |

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| | reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a |

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| | knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear |

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| | functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated** |

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| | cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples |
| | Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
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| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on |

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| | measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-VM.1.1:** | Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $\boldsymbol{v}$, $\lvert\boldsymbol{v}\rvert$, $\lVert\mathbf{v}\rVert$, $\boldsymbol{v}$). |
| **MAFS.912.N-VM.1.2:** | Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. |
| **MAFS.912.N-VM.1.3:** | Solve problems involving velocity and other quantities that can be represented by vectors. |
| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data |

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| | distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in |

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| | the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.E.5.10:** | Describe and apply the coordinate system used to locate objects in the sky.<br>Remarks/Examples |
| | Discuss how scientists determine the location of constellations, celestial spheres, and sky maps. Compare and contrast the celestial coordinate system (equatorial system) to the use of latitude and longitude to specify locations on Earth. Recognize the use of right ascension and declination in the location of objects in space, including stars and constellations. |
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| **SC.912.E.5.11:** | Distinguish the various methods of measuring astronomical distances and apply each in appropriate situations.<br>Remarks/Examples |
| | Determine which units of measurement are appropriate to describe distance (e.g. astronomical units, parallax, and light years).<br><br>Connections: MAFS.K12.MP.5: Use appropriate tools strategically; and MAFS.K12.MP.6: Attend to precision. |
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| **SC.912.E.5.7:** | Relate the history of and explain the justification for future space exploration and continuing technology development.<br>Remarks/Examples |
| | Identify examples of historical space exploration (e.g. telescopes, high altitude balloons, lunar landers, deep-space probes, space station) that had significant impact on current space exploration and recognize the importance of continued exploration in space. |
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| **SC.912.E.5.8:** | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed |

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| | observational tools.<br>Remarks/Examples |
| | Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
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| **SC.912.E.5.9:** | Analyze the broad effects of space exploration on the economy and culture of Florida.<br>Remarks/Examples |
| | Recognize the economic, technical and social benefits of spinoff technology developed through the space program. |
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| **SC.912.E.6.6:** | Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.<br>Remarks/Examples |
| | Investigate and discuss how humans affect and are affected by geological systems and processes by describing the possible long-term consequences (costs and benefits) that increased human consumption (e.g. mining and extraction techniques; off-shore drilling; petrochemical refining) has placed on the environment (e.g. pollution, health, habitat destruction) and the impact on future energy production. |
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| **SC.912.E.7.7:** | Identify, analyze, and relate the internal (Earth system) and external (astronomical) conditions that contribute to global climate change.<br>Remarks/Examples |
| | Explain the possible natural (e.g. increased global temperature, wildfires, volcanic dust) and anthropogenic mechanisms (e.g. air pollution, acid rain, greenhouse gases, burning of fossil fuels) and the effects of these mechanisms on global climate change. |
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| **SC.912.L.15.2:** | Discuss the use of molecular clocks to estimate how long ago various groups of organisms diverged evolutionarily from one another. |
| **SC.912.L.16.10:** | Evaluate the impact of biotechnology on the individual, society |

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| | and the environment, including medical and ethical issues.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| SC.912.L.17.11: | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| SC.912.L.17.15: | Discuss the effects of technology on environmental quality. |
| SC.912.L.18.12: | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br>Remarks/Examples<br>Annually assessed on Biology EOC. |
| SC.912.N.1.5: | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples<br>Recognize that contributions to science can be made and have been made by people from all over the world. |
| SC.912.N.1.6: | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples<br>Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
| SC.912.N.1.7: | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples<br>Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent |

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| | versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, |

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| | and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br>For Students in Grades 9-10<br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of |

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| | explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision. |

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| | MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |

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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.5: | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| SC.912.N.3.1: | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and |

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| | persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
| **SC.912.N.3.4:** | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |
| | Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an |

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| | empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
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| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.<br>Remarks/Examples |
| | Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope |

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| | (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
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| **SC.912.P.10.12:** | Differentiate between chemical and nuclear reactions.<br>Remarks/Examples |
| | Describe how chemical reactions involve the rearranging of atoms to form new substances, while nuclear reactions involve the change of atomic nuclei into entirely new atoms. Identify real-world examples where chemical and nuclear reactions occur every day. |
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| **SC.912.P.10.16:** | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br>Remarks/Examples |
| | Explain that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize the Lorentz force is the force on a point charge due to electromagnetic fields and occurs in many devices, including mass spectrometers. |
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| **SC.912.P.10.17:** | Explore the theory of electromagnetism by explaining electromagnetic waves in terms of oscillating electric and magnetic fields.<br>Remarks/Examples |
| | Recognize that an oscillating charge creates an oscillating electric field which gives rise to electromagnetic waves. Recognize a changing magnetic field makes an electric field, and a changing electric field makes a magnetic field, and these phenomena are expressed mathematically through the Faraday law and the Ampere-Maxwell law. |
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| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems |

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| | involving wavelength, frequency, and energy. |
| SC.912.P.10.19: | Explain that all objects emit and absorb electromagnetic radiation and distinguish between objects that are blackbody radiators and those that are not. |
| SC.912.P.10.21: | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
| SC.912.P.10.4: | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| SC.912.P.10.6: | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
| SC.912.P.10.8: | Explain entropy's role in determining the efficiency of processes that convert energy to work.<br>Remarks/Examples |
| | Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy). Describe entropy as a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system. |
| SC.912.P.10.9: | Describe the quantization of energy at the atomic level.<br>Remarks/Examples |
| | Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship $E = hv$). |

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| **SC.912.P.12.10:** | Interpret the behavior of ideal gases in terms of kinetic molecular theory.<br>Remarks/Examples |
| | Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and number of particles in a gas sample (Avogadro's hypothesis). |
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| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples |
| | (e.g. elastic and completely inelastic collisions). |
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| **SC.912.P.12.6:** | Qualitatively apply the concept of angular momentum.<br>Remarks/Examples |
| | Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]). |
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| **SC.912.P.12.8:** | Recognize that Newton's Laws are a limiting case of Einstein's Special Theory of Relativity at speeds that are much smaller than the speed of light.<br>Remarks/Examples |
| | Recognize that the speed of light in any reference frame is the central postulate of the Special Theory of Relativity. As speeds approach zero, Special Relativity tends towards equivalence with Newton's Laws of Motion. |
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| **SC.912.P.12.9:** | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples |
| | The energy *E* and the momentum *p* depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
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## RELATED GLOSSARY TERM DEFINITIONS (60)

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| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Angular momentum:** | A vector quantity that is a measure of the rotational momentum of a rotating body or system, that is equal in classical physics to the product of the angular velocity of the body or system and its moment of inertia with respect to the rotation axis, and that is directed along the rotation axis. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Axis:** | The imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph. |
| **Biotechnology:** | The manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals). |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is |

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| | near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Entropy:** | A measure of the unavailable energy in a closed thermodynamic system that is also usually considered to be a measure of the system's disorder, that is a property of the system's state, and that varies directly with any reversible change in heat in the system and inversely with the temperature of the system. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Freeze:** | To pass from the liquid to the solid state by loss of heat from the substance/system. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |

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| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Habitat:** | A place in an ecosystem where an organism normally lives. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Latitude:** | A measure of relative position north or south on the Earth's surface, measured in degrees from the equator, which has a latitude of 0°, with the poles having a latitude of 90° north and south. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Magnet:** | An object that produces a magnetic field and that has the property, either natural or induced, of attracting iron or steel. |
| **Magnetic:** | Having the property of attracting iron and certain other materials by virtue of a field of force. |
| **Magnetic field:** | The region where magnetic force exists around magnets or electric currents. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares |

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| | important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Relativity (special theory of):** | The physical theory of space and time developed by Albert Einstein, based on the postulates that all the laws of physics are equally valid in all frames of reference moving at a uniform velocity and that the speed of light from a uniformly moving source is always the same, regardless of how fast or slow the source or its observer is moving. The theory has as consequences the relativistic mass increase of rapidly moving objects, the Lorentz-Fitzgerald contraction, time dilatation, and the principle of mass-energy equivalence. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |

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| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Volume:** | A measure of the amount of space an object takes up; also the loudness of a sound or signal. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Renewable Energy 1- 2003500

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4938

## BASIC INFORMATION

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| **Course Number:** | 2003500 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Renewable Energy 1, RENEWABLE ENERGY 1, Renewable Energy, Renewable, Energy |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Physical Sciences |
| **Course Title:** | Renewable Energy 1 |
| **Course Abbreviated Title:** | RENEWABLE ENERGY 1 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Elective |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **Version Description:** | The course content includes: an introduction to energy technology, renewable energy in a sustainable future, the science |

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| | behind climate change, environmental impacts and economics, and careers in renewable energy. Students will be introduced to different types of renewable energy technologies, how they work, their advantages, disadvantages, and limitations. The types of renewable energies and technologies studied include: wind energy, solar (thermal and photovoltaic), hydro-electric, bio-energy, tidal power, wave energy, geothermal energy, ocean thermal, fuel cells, heat pump systems, and high voltage DC energy transport. The availability and integration of these energy types and technologies are also studied to understand how renewable energy can work as a compliment to and replacement for conventional technologies. |
| **General Notes:** | **Special Notes:**<br><br>**Instructional Practices**<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

## STANDARDS (74)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.

- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

**Career and Technical Education: Energy Foundations**

01.09 Discuss the history of the U.S. energy industry/infrastructure
01.11 Explain the role of regulatory bodies in the energy industry
01.12 Discuss environmental laws and regulations that impact the energy industry and explain importance of proper documentation to ensure compliance
03.01 Explain the conventional electric power generation systems and process
03.03 Identify various conventional electric power generation fuel sources and the cost/efficiency/environmental issues associated with each
03.04 Explain how oil was created and list its advantages and disadvantages
03.05 Explain how coal was created and what are its advantages and disadvantages
03.06 Explain how natural gas was created and what are is advantages and disadvantages
03.09 Discuss emerging and alternative electric power generation technologies and fuel sources
03.16 Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure
06.04 Explain the educational pathways available to gain training necessary for entry into energy careers at secondary and post-secondary levels

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| **HE.912.C.1.3:** | Evaluate how environment and personal health are interrelated.<br>Remarks/Examples |
| | Some examples may include food options within a community, prenatal care services, availability of recreational facilities. |
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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a |

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| | specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative |

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| | discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, |

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| | audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **SC.912.E.5.8:** | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.<br>Remarks/Examples |
| | Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
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| **SC.912.E.5.9:** | Analyze the broad effects of space exploration on the economy and culture of Florida.<br>Remarks/Examples |
| | Recognize the economic, technical and social benefits of spinoff technology developed through the space program. |
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| **SC.912.E.6.4:** | Analyze how specific geologic processes and features are expressed in Florida and elsewhere.<br>Remarks/Examples |
| | Describe the effect of ocean and Gulf water currents, gravel mining, beach erosion, dune development, aquifers and ground water, salt water intrusion, springs, and sink holes on the formation of the Florida peninsula. Explain the effects of latitude, elevation, topography (land surface type), proximity to large bodies of water, and temperature of ocean currents, on climate in Florida. |
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| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and |

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| | evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers. |

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| | e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **SC.912.E.6.6:** | Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.<br>Remarks/Examples |
| | Investigate and discuss how humans affect and are affected by geological systems and processes by describing the possible long-term consequences (costs and benefits) that increased human consumption (e.g. mining and extraction techniques; off-shore drilling; petrochemical refining) has placed on the environment (e.g. pollution, health, habitat destruction) and the impact on future energy production. |
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| **SC.912.E.7.1:** | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.<br>Remarks/Examples |
| | Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living |

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| | organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun. |
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| **SC.912.E.7.2:** | Analyze the causes of the various kinds of surface and deep water motion within the oceans and their impacts on the transfer of energy between the poles and the equator.<br>Remarks/Examples |
| | Explain how surface and deep-water circulation patterns (Coriolis effect, La Niña, El Niño, Southern Oscillation, upwelling, ocean surface cooling, freshwater influx, density differences, Labrador Current and Gulf Stream) impact energy transfer in the environment. |
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| **SC.912.E.7.3:** | Differentiate and describe the various interactions among Earth systems, including: atmosphere, hydrosphere, cryosphere, geosphere, and biosphere.<br>Remarks/Examples |
| | Interactions include transfer of energy (biogeochemical cycles, water cycle, ground and surface waters, photosynthesis, radiation, plate tectonics, conduction, and convection), storms, winds, waves, erosion, currents, deforestation and wildfires, hurricanes, tsunamis, volcanoes. |
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| **SC.912.E.7.4:** | Summarize the conditions that contribute to the climate of a geographic area, including the relationships to lakes and oceans.<br>Remarks/Examples |
| | Describe how latitude, altitude, topography, prevailing winds, proximity to large bodies of water, vegetation and ocean currents determine the climate of a geographic area. |
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| **SC.912.E.7.7:** | Identify, analyze, and relate the internal (Earth system) and external (astronomical) conditions that contribute to global climate change.<br>Remarks/Examples |
| | Explain the possible natural (e.g. increased global temperature, wildfires, volcanic dust) and anthropogenic mechanisms (e.g. air pollution, acid rain, greenhouse gases, burning of fossil fuels) |

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| | and the effects of these mechanisms on global climate change. |
| [SC.912.E.7.8:]() | Explain how various atmospheric, oceanic, and hydrologic conditions in Florida have influenced and can influence human behavior, both individually and collectively.<br>Remarks/Examples<br>Describe and discuss the conditions that bring about floods, droughts, wildfires, thunderstorms, hurricanes, rip currents, and tsunamis and how these conditions can influence human behavior (e.g. energy alternatives, conservation, migration, storm preparedness). |
| [SC.912.E.7.9:]() | Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.<br>Remarks/Examples<br>Explain how the oceans act as sources/sinks of heat energy, store carbon dioxide mostly as dissolved HCO3– and CaCO3 as precipitate or biogenic carbonate deposits, which have an impact on climate change. |
| [SC.912.L.17.11:]() | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |
| [SC.912.L.17.12:]() | Discuss the political, social, and environmental consequences of sustainable use of land.<br>Remarks/Examples<br>Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated. |
| [SC.912.L.17.13:]() | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| [SC.912.L.17.14:]() | Assess the need for adequate waste management strategies. |
| [SC.912.L.17.15:]() | Discuss the effects of technology on environmental quality. |
| [SC.912.L.17.16:]() | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and |

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| | groundwater pollution.<br>Remarks/Examples<br>Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |
| **SC.912.L.17.17:** | Assess the effectiveness of innovative methods of protecting the environment. |
| **SC.912.L.17.18:** | Describe how human population size and resource use relate to environmental quality. |
| **SC.912.L.17.19:** | Describe how different natural resources are produced and how their rates of use and renewal limit availability. |
| **SC.912.L.17.20:** | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br>Remarks/Examples<br>Annually assessed on Biology EOC. Also assesses SC.912.L.17.11, SC.912.L.17.13, SC.912.N.1.3. |
| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples<br>Recognize that contributions to science can be made and have been made by people from all over the world. |
| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples<br>Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific |

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| | questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the |

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| | purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure |

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| | when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |

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| SC.912.N.1.2: | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.1.3: | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
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| SC.912.N.1.4: | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and |

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| | open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |

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| SC.912.N.3.2: | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.3.3: | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| SC.912.N.3.4: | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |
| | Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
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| SC.912.N.3.5: | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| SC.912.N.4.1: | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making. |

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| | Remarks/Examples<br>Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples<br>Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples<br>Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.<br>Remarks/Examples |

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| | Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
| **SC.912.P.10.14:** | Differentiate among conductors, semiconductors, and insulators.<br>Remarks/Examples |
| | Describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators. |
| **SC.912.P.10.15:** | Investigate and explain the relationships among current, voltage, resistance, and power.<br>Remarks/Examples |
| | Use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |
| **SC.912.P.10.16:** | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br>Remarks/Examples |
| | Explain that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize the Lorentz force is the force on a point charge due to electromagnetic fields and occurs in many devices, including mass spectrometers. |
| **SC.912.P.10.17:** | Explore the theory of electromagnetism by explaining electromagnetic waves in terms of oscillating electric and magnetic fields.<br>Remarks/Examples |
| | Recognize that an oscillating charge creates an oscillating electric field which gives rise to electromagnetic waves. Recognize a changing magnetic field makes an electric field, and a changing electric field makes a magnetic field, and these phenomena are expressed mathematically through the Faraday law and the Ampere-Maxwell law. |

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| SC.912.P.10.18: | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| SC.912.P.10.2: | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| SS.912.C.2.8: | Analyze the impact of citizen participation as a means of achieving political and social change.<br>Remarks/Examples |
| | Examples are e-mail campaigns, boycotts, blogs, podcasts, protests, demonstrations, letters to editors. |
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## RELATED GLOSSARY TERM DEFINITIONS (68)

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| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Atmosphere:** | The layers of gas that surround Earth, other planets, or stars. |
| **Biosphere:** | The part of the earth and its atmosphere in which living organisms exist or that is capable of supporting life. |
| **Cell:** | The smallest structural unit of an organism that is capable of |

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| | independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, which in some cells, is surrounded by a cell wall |
| **Circuit:** | An interconnection of electrical elements forming a complete path for the flow of current. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductor:** | A material or an object that conducts heat, electricity, light, or sound. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Deforestation:** | The cutting down and removal of all or most of the trees in a forested area. |
| **Density:** | Concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume. |
| **Dune:** | A hill or ridge of sand piled up by the wind. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of $9.107 \times 10^{-28}$ grams and an electric charge of approximately $-1.602 \times 10^{-19}$ coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |

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| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Equator :** | An imaginary circle around Earth's surface located between the poles and a plane perpendicular to its axis of rotation that divides it into the Northern and Southern Hemispheres. |
| **Erosion:** | The wearing away of Earth's surface by the breakdown and transportation of rock and soil. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |
| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Geosphere:** | The solid part of the earth consisting of the crust and outer mantle. |
| **Habitat:** | A place in an ecosystem where an organism normally lives. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hydrosphere:** | All of the Earth's water, including surface water (water in oceans, lakes, and rivers), groundwater (water in soil and beneath the |

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| | Earth's surface), snowcover, ice, and water in the atmosphere, including water vapor. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Insulator:** | A material or an object that does not easily allow heat, electricity, light, or sound to pass through it. Air, cloth and rubber are good electrical insulators; feathers and wool make good thermal insulators. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Latitude:** | A measure of relative position north or south on the Earth's surface, measured in degrees from the equator, which has a latitude of 0°, with the poles having a latitude of 90° north and south. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Magnet:** | An object that produces a magnetic field and that has the property, either natural or induced, of attracting iron or steel. |
| **Magnetic:** | Having the property of attracting iron and certain other materials by virtue of a field of force. |
| **Magnetic field:** | The region where magnetic force exists around magnets or electric currents. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares |

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| | important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Natural resource:** | Something, such as a forest, a mineral deposit, or fresh water, that is found in nature and is necessary or useful to humans. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Observation :** | What one has observed using senses or instruments. |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Pole:** | Either of the points at which the Earth's axis of rotation intersects the Earth's surface; the North Pole or South Pole. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Resistance :** | The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Semiconductor:** | Any of various solid crystalline substances, such as germanium or silicon, having electrical conductivity greater than insulators but less than good conductors, and used especially as a base material for computer chips and other electronic devices. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |

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| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Voltage:** | A measure of the difference in electric potential between two points in space, a material, or an electric circuit, expressed in volts. |
| **Water cycle:** | The path water takes as it is being cycled through the environment, including condensation, evaporation, and precipitation. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Principles of Technology 1- 2003600

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4292

## BASIC INFORMATION

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| **Course Number:** | 2003600 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Principles of Technology 1, PRINC TECH 1, Technology |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Physical Sciences |
| **Course Title:** | Principles of Technology 1 |
| **Course Abbreviated Title:** | PRINC TECH 1 |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 2 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National |

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| | Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes**<br><br>**Instructional Practices**<br>Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence).<br><br>**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations. |

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| | • Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (64)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.910.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. |
| **LAFS.910.RST.1.2:** | Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. |
| **LAFS.910.RST.1.3:** | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. |
| **LAFS.910.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. |
| **LAFS.910.RST.2.5:** | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). |

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| **LAFS.910.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. |
| **LAFS.910.RST.3.7:** | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. |
| **LAFS.910.RST.3.8:** | Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. |
| **LAFS.910.RST.3.9:** | Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. |
| **LAFS.910.RST.4.10:** | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **SC.912.L.17.11:** | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. |

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| **SC.912.L.17.15:** | Discuss the effects of technology on environmental quality. |
| **LAFS.910.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.<br>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.<br>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented. |
| **LAFS.910.SL.1.2:** | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. |
| **LAFS.910.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence. |
| **LAFS.910.SL.2.4:** | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. |
| **LAFS.910.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and |

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| | to add interest. |
| **LAFS.910.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.<br>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.910.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.<br>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style |

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| | appropriate to the discipline and context as well as to the expertise of likely readers.<br>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). |
| **LAFS.910.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.910.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.910.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. |
| **LAFS.910.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **LAFS.910.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. |
| **LAFS.910.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |
| **LAFS.910.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |

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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science |

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Connections for Mathematical Practices

- MAFS.K12.MP.1: Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2: Reason abstractly and quantitatively.

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| | MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples<br>Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples<br>Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification. |

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| | Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |

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| SC.912.N.2.2: | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.3: | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.5: | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the |

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| | explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation |

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| | of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.4:** | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |
| | Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical |

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| | development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.1:** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br>Remarks/Examples |
| | Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground. |
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| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
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| **SC.912.P.10.13:** | Relate the configuration of static charges to the electric field, electric force, electric potential, and electric potential energy.<br>Remarks/Examples |
| | Using Coulomb's law, determine the force on a stationary charge due to other stationary charges, and explain that this force is many times greater than the gravitational force. Recognize the relationship between forces and their associated potential energies and that the electric field is directly related to the rate of change of the electric potential from point to point in space. |
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| **SC.912.P.10.14:** | Differentiate among conductors, semiconductors, and insulators.<br>Remarks/Examples |
| | Describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators. |

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| SC.912.P.10.15: | Investigate and explain the relationships among current, voltage, resistance, and power.<br>Remarks/Examples |
| | Use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |
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| SC.912.P.10.2: | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| SC.912.P.10.3: | Compare and contrast work and power qualitatively and quantitatively. |
| SC.912.P.10.4: | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| SC.912.P.10.5: | Relate temperature to the average molecular kinetic energy.<br>Remarks/Examples |
| | Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. |
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| SC.912.P.10.6: | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br>Remarks/Examples |
| | Construct and interpret potential energy diagrams for endothermic and exothermic chemical reactions, and for rising or falling objects. Describe the transformation of energy as a pendulum swings. |
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| SC.912.P.12.1: | Distinguish between scalar and vector quantities and assess which should be used to describe an event. |

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| | Remarks/Examples |
| | Distinguish between vector quantities (e.g., displacement, velocity, acceleration, force, and linear momentum) and scalar quantities (e.g., distance, speed, energy, mass, work).<br><br>MAFS.912.N-VM.1.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
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| **SC.912.P.12.2:** | Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.<br>Remarks/Examples |
| | Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.<br><br>Connections: MAFS.912.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
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| **SC.912.P.12.3:** | Interpret and apply Newton's three laws of motion.<br>Remarks/Examples |
| | Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law). Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton's second law, F = ma). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = –F1 on 1 (Newton's third law). |
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| **SC.912.P.12.4:** | Describe how the gravitational force between two objects depends on their masses and the distance between them.<br>Remarks/Examples |
| | Describe Newton's law of universal gravitation in terms of the attraction between two objects, their masses, and the inverse square of the distance between them. |
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| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects. |

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| | Remarks/Examples<br>(e.g. elastic and completely inelastic collisions). |
| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples<br>Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples<br>Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |

## RELATED GLOSSARY TERM DEFINITIONS (52)

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| **Acceleration:** | Rate of change in velocity, usually expressed in meters per second per second; involves an increase or decrease in speed and/or a change in direction. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Cell:** | The smallest structural unit of an organism that is capable of independent functioning, consisting of cytoplasm and various organelles, all surrounded by a semipermeable cell membrane, |

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| | which in some cells, is surrounded by a cell wall |
| **Circuit:** | An interconnection of electrical elements forming a complete path for the flow of current. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Conductor:** | A material or an object that conducts heat, electricity, light, or sound. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electric potential:** | A measure of the work required by an electric field to move electric charges. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |

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| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Insulator:** | A material or an object that does not easily allow heat, electricity, light, or sound to pass through it. Air, cloth and rubber are good electrical insulators; feathers and wool make good thermal insulators. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Kinetic energy:** | The energy possessed by a body because of its motion. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Molecule:** | The smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together. |

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| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |
| **Motion:** | The act or process of changing position and/or direction. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nonrenewable resource:** | A resource that can only be replenished over millions of years. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Orbit:** | A path described by one body in its revolution about another (as by the earth about the sun or by an electron about an atomic nucleus). |
| **Potential energy:** | Energy stored in a physical system due to the object's configuration and position. |
| **Power:** | The rate at which work is done, expressed as the amount of work per unit time and commonly measured in units such as the watt and horsepower. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Resistance :** | The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Semiconductor:** | Any of various solid crystalline substances, such as germanium or silicon, having electrical conductivity greater than insulators but less than good conductors, and used especially as a base material for computer chips and other electronic devices. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Theory :** | A set of statements or principles devised to explain a group of |

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| | facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Voltage:** | A measure of the difference in electric potential between two points in space, a material, or an electric circuit, expressed in volts. |

# Course: Nuclear Radiation Honors- 2020710

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4259

## BASIC INFORMATION

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| **Course Number:** | 2020710 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Physical Sciences, Nuclear Radiation Honors, Nuclear Radiation, Honors, Nuclear, Radiation, NUCLEAR RADI HON |
| **Course Path:** | **Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Science **SubSubject:** Physical Sciences |
| **Course Title:** | Nuclear Radiation Honors |
| **Course Abbreviated Title:** | NUCLEAR RADI HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **Honors?** | Yes |
| **General Notes:** | While the content focus of this course is consistent with the Nuclear Radiation course, students will explore these concepts in |

greater depth. In general, the academic pace and rigor will be greatly increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

**Special Notes:**

**Instructional Practices**
Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

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| | **Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations.<br>• Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (85)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| LAFS.1112.RST.1.1: | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| LAFS.1112.RST.1.2: | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| LAFS.1112.RST.1.3: | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| LAFS.1112.RST.2.4: | Determine the meaning of symbols, key terms, and other |

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| | domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| LAFS.1112.RST.2.5: | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| LAFS.1112.RST.2.6: | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| LAFS.1112.RST.3.7: | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| LAFS.1112.RST.3.8: | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| LAFS.1112.RST.3.9: | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| LAFS.1112.RST.4.10: | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| LAFS.1112.SL.1.1: | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to |

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| | questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| **LAFS.1112.SL.2.5:** | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |

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| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.WHST.1.1:** | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, |

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| | concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and* |

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| | *minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
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| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and |

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| | asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**<br><br>**a. Graph linear and quadratic functions and show intercepts, maxima, and minima.**<br>**b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**<br>**c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.**<br>**d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.**<br>**e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.**<br><br>Remarks/Examples<br>Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the |

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| | origin in graphs and data displays.<br><br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.N-Q.1.3:** | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| **MAFS.912.S-IC.2.6:** | Evaluate reports based on data. |
| **MAFS.912.S-ID.1.1:** | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.2:** | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data |

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| | distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br><br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br><br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.<br><br>**Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in |

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| | the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
| **SC.912.E.5.1:** | Cite evidence used to develop and verify the scientific theory of the Big Bang (also known as the Big Bang Theory) of the origin of the universe.<br>Remarks/Examples |
| | Explain evidence to support the formation of the universe, which has been expanding for approximately 15 billion year (e.g. ratio of gases, red-shift from distant galaxies, and cosmic background radiation). |
| **SC.912.E.5.2:** | Identify patterns in the organization and distribution of matter in the universe and the forces that determine them.<br>Remarks/Examples |
| | Identify patterns that influence the formation, hierarchy, and motions of the various kinds of objects in the solar system and the role of gravity and inertia on these motions (include the Sun, Earth, and Moon, planets, satellites, comets, asteroids, star clusters, galaxies, galaxy clusters). Recognize that the universe contains many billions of galaxies, and each galaxy contains many billions of stars. Recognize that constellations are contrived associations of stars that do not reflect functional relationships in space.<br><br>Connections: MAFS.K12.MP.7: Look for and make use of structure. |
| **SC.912.E.5.3:** | Describe and predict how the initial mass of a star determines its evolution.<br>Remarks/Examples |
| | Compare and contrast the evolution of stars of different masses (include the three outcomes of stellar evolution based on mass: black hole, neutron star, white dwarf). Differentiate between the different types of stars found on the Hertzsprung-Russell |

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| | diagram and the balance between gravitational collapse and nuclear fusion in determining the color, brightness, and life span of a star. |
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| **SC.912.E.5.4:** | Explain the physical properties of the Sun and its dynamic nature and connect them to conditions and events on Earth.<br>Remarks/Examples |
| | Describe the physical properties of the Sun (sunspot cycles, solar flares, prominences, layers of the Sun, coronal mass ejections, and nuclear reactions) and the impact of the Sun as the main source of external energy for the Earth. |
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| **SC.912.E.5.7:** | Relate the history of and explain the justification for future space exploration and continuing technology development.<br>Remarks/Examples |
| | Identify examples of historical space exploration (e.g. telescopes, high altitude balloons, lunar landers, deep-space probes, space station) that had significant impact on current space exploration and recognize the importance of continued exploration in space. |
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| **SC.912.E.5.8:** | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.<br>Remarks/Examples |
| | Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
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| **SC.912.E.6.6:** | Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.<br>Remarks/Examples |
| | Investigate and discuss how humans affect and are affected by geological systems and processes by describing the possible long-term consequences (costs and benefits) that increased human consumption (e.g. mining and extraction techniques; off-shore drilling; petrochemical refining) has placed on the |

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| | environment (e.g. pollution, health, habitat destruction) and the impact on future energy production. |
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| **SC.912.E.7.1:** | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.<br>Remarks/Examples |
| | Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun. |
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| **SC.912.L.14.6:** | Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health. |
| **SC.912.L.15.2:** | Discuss the use of molecular clocks to estimate how long ago various groups of organisms diverged evolutionarily from one another. |
| **SC.912.L.16.10:** | Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.<br>Remarks/Examples |
| | Annually assessed on Biology EOC. |
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| **SC.912.L.17.13:** | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| **SC.912.L.17.14:** | Assess the need for adequate waste management strategies. |
| **SC.912.L.17.15:** | Discuss the effects of technology on environmental quality. |
| **SC.912.L.17.16:** | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br>Remarks/Examples |
| | Integrate HE.912.C.1.3. Evaluate how environment and personal health are interrelated; and, HE.912.C.1.5. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases. |

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| **SC.912.L.17.17:** | Assess the effectiveness of innovative methods of protecting the environment. |
| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br>1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.** |

| | Remarks/Examples |
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| | Connections for 6-12 Literacy in Science<br><br>For Students in Grades 9-10<br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>For Students in Grades 11-12<br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research. |
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| | Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision.<br>MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples<br>Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples<br>Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |

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| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |
| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what |

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| | superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |
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| **SC.912.N.2.2:** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.2.3:** | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| **SC.912.N.2.4:** | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence. |

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| | Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.2.5:** | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and |

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| | critique the reasoning of others. |
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| SC.912.N.3.3: | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves. |
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| SC.912.N.3.4: | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |
| | Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
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| SC.912.N.3.5: | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| SC.912.N.4.1: | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples |
| | Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
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| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.<br>Remarks/Examples |
| | Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
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| **SC.912.P.10.12:** | Differentiate between chemical and nuclear reactions.<br>Remarks/Examples |
| | Describe how chemical reactions involve the rearranging of atoms to form new substances, while nuclear reactions involve the change of atomic nuclei into entirely new atoms. Identify real-world examples where chemical and nuclear reactions occur every day. |

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| SC.912.P.10.16: | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br>Remarks/Examples |
| | Explain that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize the Lorentz force is the force on a point charge due to electromagnetic fields and occurs in many devices, including mass spectrometers. |
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| SC.912.P.10.18: | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples |
| | Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
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| SC.912.P.10.2: | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br>Remarks/Examples |
| | Use calorimetry to illustrate conservation of energy. Differentiate between the different types of systems and solve problems involving conservation of energy in simple systems (Physics).Explain how conservation of energy is important in chemical reactions with bond formation and bond breaking (Chemistry). |
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| SC.912.P.10.8: | Explain entropy's role in determining the efficiency of processes that convert energy to work.<br>Remarks/Examples |
| | Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy). Describe entropy as a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system. |
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| SC.912.P.10.9: | Describe the quantization of energy at the atomic level.<br>Remarks/Examples |

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| | Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship $E = hv$). |
| **SC.912.P.12.5:** | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br>Remarks/Examples<br>(e.g. elastic and completely inelastic collisions). |
| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br>Remarks/Examples<br>Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
| **SC.912.P.12.9:** | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples<br>The energy *E* and the momentum *p* depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
| **SC.912.P.8.3:** | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence.<br>Remarks/Examples<br>Describe the development and historical importance of atomic theory from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus and "gold foil" experiment), and Bohr (planetary model of atom), and understand how each discovery leads to modern atomic theory.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic |

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| | theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples |
| | Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.P.8.5:** | Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.<br>Remarks/Examples |
| | Use the periodic table and electron configuration to determine an element's number of valence electrons and its chemical and physical properties. Explain how chemical properties depend almost entirely on the configuration of the outer electron shell. |
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## RELATED GLOSSARY TERM DEFINITIONS (62)

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| **Asteroid:** | A rocky or metallic object that orbits the Sun and is much smaller than a planet. |
| **Atmosphere:** | The layers of gas that surround Earth, other planets, or stars. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Big Bang Theory:** | A cosmological theory holding that the universe originated approximately 20 billion years ago from the violent explosion of a very small agglomeration of matter of extremely high density and temperature. |
| **Biotechnology:** | The manipulation (as through genetic engineering) of living organisms or their components to produce useful usually commercial products (as pest resistant crops, new bacterial strains, or novel pharmaceuticals). |
| **Comet:** | A celestial body that appears as a fuzzy head usually surrounding a bright nucleus, that has a usually highly eccentric orbit, that consists primarily of ice and dust, and that often develops one or more long tails when near the sun. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Electric field:** | A region associated with a distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |
| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |

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| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of 9.107 × 10^-28 grams and an electric charge of approximately -1.602 × 10^-19 coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Entropy:** | A measure of the unavailable energy in a closed thermodynamic system that is also usually considered to be a measure of the system's disorder, that is a property of the system's state, and that varies directly with any reversible change in heat in the system and inversely with the temperature of the system. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Evolution :** | A theory that the various types of species arise from pre-existing species and that distinguishable characteristics are due to modifications through successive generations. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |
| **Galaxy:** | A large collection of stars, gases, and dust that are part of the universe (e.g., the Milky Way galaxy) bound together by gravitational forces. |

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| **Gas:** | One of the fundamental states of matter in which the molecules do not have a fixed volume or shape. |
| **Genetic:** | Affecting or determined by genes. |
| **Gravity:** | The force of attraction between any two objects. |
| **Habitat:** | A place in an ecosystem where an organism normally lives. |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Magnet:** | An object that produces a magnetic field and that has the property, either natural or induced, of attracting iron or steel. |
| **Magnetic:** | Having the property of attracting iron and certain other materials by virtue of a field of force. |
| **Magnetic field:** | The region where magnetic force exists around magnets or electric currents. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Momentum:** | A vector quantity that is the product of an object's mass and |

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| | velocity. |
| **Moon:** | A natural satellite that revolves around a planet. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Organism:** | An individual form of life of one or more cells that maintains various vital processes necessary for life. |
| **Periodic table:** | A tabular arrangement of the elements according to their atomic numbers so that elements with similar properties are in the same column. |
| **Pollution:** | Any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Sun:** | The closest star to Earth and the center of our solar system. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions |

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| | about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |

# Course: Astronomy Solar/Galactic Honors- 2020910

**Direct link to this page:**http://www.cpalms.org/Public/PreviewCourse/Preview/4252

## BASIC INFORMATION

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| **Course Number:** | 2020910 |
| **Grade Levels:** | 9,10,11,12 |
| **Keyword:** | PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Science, Earth/Space Sciences, Astronomy Solar/Galactic Honors, ASTR S/G HON, Astronomy, Solar, Galactic, Honors |
| **Course Path:** | **Section:**<br>Grades PreK to 12 Education Courses<br>**Grade Group:**<br>Grades 9 to 12 and Adult Education Courses<br>**Subject:**<br>Science<br>**SubSubject:**<br>Earth/Space Sciences |
| **Course Title:** | Astronomy Solar/Galactic Honors |
| **Course Abbreviated Title:** | ASTR S/G HON |
| **Number of Credits:** | One credit (1) |
| **Course length:** | Year (Y) |
| **Course Type:** | Core |
| **Course Level:** | 3 |
| **Status:** | Draft - Board Approval Pending |
| **General Notes:** | While the content focus of this course is consistent with the |

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| | Astronomy Solar/Galactic course, students will explore these concepts in greater depth. In general, the academic pace and rigor will be greatly increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).<br><br>**Special Notes:**<br><br>Instructional Practices Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:<br><br>1. Ensuring wide reading from complex text that varies in length.<br>2. Making close reading and rereading of texts central to lessons.<br>3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.<br>4. Emphasizing students supporting answers based upon evidence from the text.<br>5. Providing extensive research and writing opportunities (claims and evidence). |

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| | **Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)<br><br>• Asking questions (for science) and defining problems (for engineering).<br>• Developing and using models.<br>• Planning and carrying out investigations.<br>• Analyzing and interpreting data.<br>• Using mathematics, information and computer technology, and computational thinking.<br>• Constructing explanations (for science) and designing solutions (for engineering).<br>• Engaging in argument from evidence.<br>• Obtaining, evaluating, and communicating information. |

## STANDARDS (80)

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

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| **LAFS.1112.RST.1.1:** | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. |
| **LAFS.1112.RST.1.2:** | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| **LAFS.1112.RST.1.3:** | Follow precisely a complex multistep procedure when carrying |

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| | out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. |
| **LAFS.1112.RST.2.4:** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. |
| **LAFS.1112.RST.2.5:** | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. |
| **LAFS.1112.RST.2.6:** | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. |
| **LAFS.1112.RST.3.7:** | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| **LAFS.1112.RST.3.8:** | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. |
| **LAFS.1112.RST.3.9:** | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. |
| **LAFS.1112.RST.4.10:** | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently. |
| **LAFS.1112.WHST.3.8:** | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| **LAFS.1112.WHST.3.9:** | Draw evidence from informational texts to support analysis, reflection, and research. |

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| **LAFS.1112.WHST.4.10:** | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **LAFS.1112.SL.1.1:** | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.<br>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.<br>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. |
| **LAFS.1112.SL.1.2:** | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. |
| **LAFS.1112.SL.1.3:** | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. |
| **LAFS.1112.SL.2.4:** | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners |

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| | can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| LAFS.1112.SL.2.5: | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |
| MAFS.912.N-Q.1.3: | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.<br>Remarks/Examples |
| | Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
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| MAFS.912.S-IC.2.6: | Evaluate reports based on data. |
| MAFS.912.S-ID.1.1: | Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| MAFS.912.S-ID.1.2: | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| LAFS.1112.WHST.1.1: | Write arguments focused on *discipline-specific content.*<br><br>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization |

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| | that logically sequences the claim(s), counterclaims, reasons, and evidence.<br>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.<br>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.<br>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.<br>e. Provide a concluding statement or section that follows from or supports the argument presented. |
| **LAFS.1112.WHST.1.2:** | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.<br>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.<br>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.<br>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to |

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| | manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.<br>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.1112.WHST.2.4:** | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
| **LAFS.1112.WHST.2.5:** | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |
| **LAFS.1112.WHST.2.6:** | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| **LAFS.1112.WHST.3.7:** | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| **MAFS.912.F-IF.2.4:** | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*<br><br>Remarks/Examples |
| | **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions.<br><br>**Algebra 1 Assessment Limits and Clarifications** |

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| | i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context<br>ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.<br><br>Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9. |
| **MAFS.912.F-IF.3.7:** | MACC.912.F-IF.3.7 (2013-2014): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br><br>**MAFS.912.F-IF.3.7 (2014-2015): Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated** |

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| | cases.<br><br>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.<br>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.<br><br>Remarks/Examples<br>Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ |
| **MAFS.912.G-MG.1.2:** | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). |
| **MAFS.912.N-Q.1.1:** | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br><br>Remarks/Examples<br>Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. |
| **MAFS.912.S-ID.1.3:** | Interpret differences in shape, center, and spread in the context |

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| | of the data sets, accounting for possible effects of extreme data points (outliers).<br>Remarks/Examples |
| | In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points. |
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| **MAFS.912.S-ID.1.4:** | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| **MAFS.912.S-ID.2.6:** | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br>Remarks/Examples |
| | Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.<br><br>S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course. |

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| | **Algebra 1 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Exponential functions are limited to those with domains in the integers.<br><br>**Algebra 2 Assessment Limits and Clarifications**<br><br>i) Tasks have a real-world context.<br>ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions. |
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| **SC.912.E.5.10:** | Describe and apply the coordinate system used to locate objects in the sky.<br>Remarks/Examples |
| | Discuss how scientists determine the location of constellations, celestial spheres, and sky maps. Compare and contrast the celestial coordinate system (equatorial system) to the use of latitude and longitude to specify locations on Earth. Recognize the use of right ascension and declination in the location of objects in space, including stars and constellations. |
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| **SC.912.E.5.11:** | Distinguish the various methods of measuring astronomical distances and apply each in appropriate situations.<br>Remarks/Examples |
| | Determine which units of measurement are appropriate to describe distance (e.g. astronomical units, parallax, and light years).<br><br>Connections: MAFS.K12.MP.5: Use appropriate tools strategically; and MAFS.K12.MP.6: Attend to precision. |
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| **SC.912.E.5.7:** | Relate the history of and explain the justification for future space exploration and continuing technology development.<br>Remarks/Examples |
| | Identify examples of historical space exploration (e.g. telescopes, high altitude balloons, lunar landers, deep-space probes, space station) that had significant impact on current space exploration and recognize the importance of continued exploration in space. |

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| **SC.912.E.5.8:** | Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.<br>Remarks/Examples |
| | Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources. |
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| **SC.912.E.5.9:** | Analyze the broad effects of space exploration on the economy and culture of Florida.<br>Remarks/Examples |
| | Recognize the economic, technical and social benefits of spinoff technology developed through the space program. |
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| **SC.912.E.6.2:** | Connect surface features to surface processes that are responsible for their formation.<br>Remarks/Examples |
| | Identify various landforms (e.g. dunes, lakes, sinkholes, aquifers) and describe how they form (erosion, physical/chemical weathering, and deposition). Explain how sea level changes over time have exposed and inundated continental shelves, created and destroyed inland seas, and shaped the surface of the Earth. |
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| **SC.912.E.7.7:** | Identify, analyze, and relate the internal (Earth system) and external (astronomical) conditions that contribute to global climate change.<br>Remarks/Examples |
| | Explain the possible natural (e.g. increased global temperature, wildfires, volcanic dust) and anthropogenic mechanisms (e.g. air pollution, acid rain, greenhouse gases, burning of fossil fuels) and the effects of these mechanisms on global climate change. |
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| **SC.912.N.1.1:** | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: |

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| | 1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).<br>2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).<br>3. **Examine books and other sources of information to see what is already known,**<br>4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).<br>5. **Plan investigations,** (Design and evaluate a scientific investigation).<br>6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).<br>7. **Pose answers, explanations, or descriptions of events,**<br>8. **Generate explanations that explicate or describe natural phenomena (inferences),**<br>9. **Use appropriate evidence and reasoning to justify these explanations to others,**<br>10. **Communicate results of scientific investigations, and**<br>11. **Evaluate the merits of the explanations produced by others.**<br><br>Remarks/Examples |
| | Connections for 6-12 Literacy in Science<br><br><u>For Students in Grades 9-10</u><br><br>LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of |

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| | explanations or descriptions.<br><br>LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.<br><br>LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.<br><br>LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br><u>For Students in Grades 11-12</u><br><br>LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.<br><br>LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.<br><br>LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.<br><br>LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.<br><br>LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.<br><br>Connections for Mathematical Practices<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them.<br>MAFS.K12.MP.2: Reason abstractly and quantitatively.<br>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]<br>MAFS.K12.MP.4: Model with mathematics.<br>MAFS.K12.MP.5: Use appropriate tools strategically.<br>MAFS.K12.MP.6: Attend to precision. |

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| | MAFS.K12.MP.7: Look for and make use of structure.<br>MAFS.K12.MP.8: Look for and express regularity in repeated reasoning. |
| **SC.912.N.1.2:** | Describe and explain what characterizes science and its methods.<br>Remarks/Examples |
| | Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
| **SC.912.N.1.3:** | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.<br>Remarks/Examples |
| | Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.<br><br>Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others |
| **SC.912.N.1.4:** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation.<br>Remarks/Examples |
| | Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.<br><br>Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1. |

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| **SC.912.N.1.5:** | Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.<br>Remarks/Examples |
| | Recognize that contributions to science can be made and have been made by people from all over the world. |
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| **SC.912.N.1.6:** | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.<br>Remarks/Examples |
| | Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them. |
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| **SC.912.N.1.7:** | Recognize the role of creativity in constructing scientific questions, methods and explanations.<br>Remarks/Examples |
| | Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.2.1:** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).<br>Remarks/Examples |
| | Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.) |

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| SC.912.N.2.2: | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.<br>Remarks/Examples |
| | Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.3: | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br>Remarks/Examples |
| | Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation. |
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| SC.912.N.2.4: | Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.<br>Remarks/Examples |
| | Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| SC.912.N.2.5: | Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus |

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| | the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.<br>Remarks/Examples |
| | Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis. |
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| **SC.912.N.3.1:** | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.<br>Remarks/Examples |
| | Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.2:** | Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.<br>Remarks/Examples |
| | Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.<br><br>Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. |
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| **SC.912.N.3.3:** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.<br>Remarks/Examples |
| | Recognize that a scientific theory provides a broad explanation |

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| | of many observed phenomena while a scientific law describes how something behaves. |
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| **SC.912.N.3.4:** | Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.<br>Remarks/Examples |
| | Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories. |
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| **SC.912.N.3.5:** | Describe the function of models in science, and identify the wide range of models used in science.<br>Remarks/Examples |
| | Describe how models are used by scientists to explain observations of nature.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |
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| **SC.912.N.4.1:** | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br>Remarks/Examples |
| | Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.<br><br>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
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| **SC.912.N.4.2:** | Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.<br>Remarks/Examples |
| | Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to |

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| | advance society (e.g. global climate change, historical development of medicine and medical practices).<br><br>Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively. |
| **SC.912.P.10.10:** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br>Remarks/Examples<br><br>Recognize and discuss the effect of each force on the structure of matter and the evidence for it. |
| **SC.912.P.10.11:** | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.<br>Remarks/Examples<br><br>Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation E=mc^2. |
| **SC.912.P.10.18:** | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br>Remarks/Examples<br><br>Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy. |
| **SC.912.P.10.19:** | Explain that all objects emit and absorb electromagnetic radiation and distinguish between objects that are blackbody radiators and those that are not. |

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| **SC.912.P.10.20:** | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.<br>Remarks/Examples |
| | Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates. |
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| **SC.912.P.10.21:** | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br>Remarks/Examples |
| | Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect). |
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| **SC.912.P.10.22:** | Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.<br>Remarks/Examples |
| | Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size. |
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| **SC.912.P.10.4:** | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. |
| **SC.912.P.10.9:** | Describe the quantization of energy at the atomic level.<br>Remarks/Examples |
| | Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship $E = hv$). |
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| **SC.912.P.12.2:** | Analyze the motion of an object in terms of its position, |

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| | velocity, and acceleration (with respect to a frame of reference) as functions of time.<br>Remarks/Examples |
| | Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.<br><br>Connections: MAFS.912.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors. |
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| **SC.912.P.12.3:** | Interpret and apply Newton's three laws of motion.<br>Remarks/Examples |
| | Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law). Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton's second law, F = ma). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = –F1 on 1 (Newton's third law). |
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| **SC.912.P.12.4:** | Describe how the gravitational force between two objects depends on their masses and the distance between them.<br>Remarks/Examples |
| | Describe Newton's law of universal gravitation in terms of the attraction between two objects, their masses, and the inverse square of the distance between them. |
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| **SC.912.P.12.6:** | Qualitatively apply the concept of angular momentum.<br>Remarks/Examples |
| | Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]). |
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| **SC.912.P.12.7:** | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving. |

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| | Remarks/Examples<br>Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*. |
| **SC.912.P.12.8:** | Recognize that Newton's Laws are a limiting case of Einstein's Special Theory of Relativity at speeds that are much smaller than the speed of light.<br>Remarks/Examples<br>Recognize that the speed of light in any reference frame is the central postulate of the Special Theory of Relativity. As speeds approach zero, Special Relativity tends towards equivalence with Newton's Laws of Motion. |
| **SC.912.P.12.9:** | Recognize that time, length, and energy depend on the frame of reference.<br>Remarks/Examples<br>The energy $E$ and the momentum $p$ depend on the frame of reference in which they are measured (e.g. Lorentz contraction). |
| **SC.912.P.8.1:** | Differentiate among the four states of matter.<br>Remarks/Examples<br>Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.) |
| **SC.912.P.8.4:** | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br>Remarks/Examples<br>Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.<br><br>Connections: MAFS.K12.MP.4: Model with mathematics. |

## RELATED GLOSSARY TERM DEFINITIONS (58)

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| **Acceleration:** | Rate of change in velocity, usually expressed in meters per second per second; involves an increase or decrease in speed and/or a change in direction. |
| **Acid:** | A substance that increases the H+ concentration when added to a water solution Acids turn blue litmus paper red, have a pH of less than 7, and their aqueous solutions react with bases and certain metals to form salts. |
| **Angular momentum:** | A vector quantity that is a measure of the rotational momentum of a rotating body or system, that is equal in classical physics to the product of the angular velocity of the body or system and its moment of inertia with respect to the rotation axis, and that is directed along the rotation axis. |
| **Atom:** | The smallest unit of a chemical element that can still retain the properties of that element. |
| **Attraction :** | A term used to describe the electric or magnetic force exerted by oppositely charged objects or to describe the gravitational force that pulls objects toward each other. |
| **Axis:** | The imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph. |
| **Conduction:** | To transmit heat, sound, or electricity through a medium. |
| **Convection:** | Heat transfer in a gas or liquid by the circulation of currents from one region to another. |
| **Current :** | The amount of electric charge flowing past a specified circuit point per unit time. |
| **Deposition:** | The process by which sediment is carried by forces (e.g., wind, rain, or water currents) and left in a certain area. |
| **Dune:** | A hill or ridge of sand piled up by the wind. |
| **Electromagnetic radiation:** | The emission and propagation of the entire range of the electromagnetic spectrum, including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves. |

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| **Electromagnetic spectrum:** | The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. |
| **Electron:** | A stable elementary particle in the lepton family having a mass at rest of $9.107 \times 10^{-28}$ grams and an electric charge of approximately $-1.602 \times 10^{-19}$ coulombs. Electrons orbit about the positively charged nuclei of atoms in distinct orbitals of different energy levels, called shells. |
| **Energy:** | The capacity to do work. |
| **Environment:** | The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air. |
| **Erosion:** | The wearing away of Earth's surface by the breakdown and transportation of rock and soil. |
| **Experiment:** | A procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis. |
| **Fission :** | The process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy; or, a process by which single-cell organisms reproduce asexually. |
| **Force:** | A vector quantity that exists between two objects and, when unbalanced by another force, causes changes in velocity of objects in the direction of its application; a push or pull. |
| **Fossil:** | A whole or part of an organism that has been preserved in sedimentary rock. |
| **Frame of reference:** | A set of coordinate axes in terms of which position or movement may be specified or with reference to which physical laws may be mathematically stated. |
| **Frequency:** | The number of cycles or waves per unit time. |
| **Fusion :** | The process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy. |
| **Gas:** | One of the fundamental states of matter in which the molecules |

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| | do not have a fixed volume or shape. |
| **Heat:** | Energy that transfers between substances because of a temperature difference between the substances; the transfer of energy is always from the warmer substance to the cooler substance |
| **Hypothesis :** | A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. |
| **Inference :** | The act of reasoning from factual knowledge or evidence. |
| **Infrared :** | Relating to the invisible part of the electromagnetic spectrum with wavelengths longer than those of visible red light but shorter than those of microwaves. |
| **Investigation :** | A systematic process that uses various types of data and logic and reasoning to better understand something or answer a question. |
| **Latitude:** | A measure of relative position north or south on the Earth's surface, measured in degrees from the equator, which has a latitude of 0°, with the poles having a latitude of 90° north and south. |
| **Law :** | A statement that describes invariable relationships among phenomena under a specified set of conditions. |
| **Light:** | Electromagnetic radiation that lies within the visible range. |
| **Liquid:** | One of the fundamental states of matter with a definite volume but no definite shape. |
| **Mass:** | The amount of matter an object contains. |
| **Matter:** | Substance that possesses inertia and occupies space, of which all objects are constituted. |
| **Microscope:** | An instrument with lenses and light that is used to observe objects too small to be visible with only the eyes. |
| **Model :** | A systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. Scientific models can be material, visual, mathematical, or computational and are often used in the construction of scientific theories. |
| **Momentum:** | A vector quantity that is the product of an object's mass and velocity. |

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| **Motion:** | The act or process of changing position and/or direction. |
| **Neutron:** | A subatomic particle having zero charge, found in the nucleus of an atom. |
| **Nuclear reaction:** | A process, such as fission, fusion, or radioactive decay, in which the structure of an atomic nucleus is altered through release of energy or mass or by being broken apart. |
| **Nucleus:** | The center region of an atom where protons and neutrons are located; also a cell structure that contains the cell genetic material of the cell. |
| **Observation :** | What one has observed using senses or instruments. |
| **Proton:** | A subatomic particle having a positive charge and which is found in the nucleus of an atom. |
| **Radiation:** | Emission of energy in the form of rays or waves. |
| **Relativity (special theory of):** | The physical theory of space and time developed by Albert Einstein, based on the postulates that all the laws of physics are equally valid in all frames of reference moving at a uniform velocity and that the speed of light from a uniformly moving source is always the same, regardless of how fast or slow the source or its observer is moving. The theory has as consequences the relativistic mass increase of rapidly moving objects, the Lorentz-Fitzgerald contraction, time dilatation, and the principle of mass-energy equivalence. |
| **Scientist:** | A person with expert knowledge of one or more sciences, that engages in processes to acquire and communicate knowledge. |
| **Space:** | The limitless expanse where all objects and events occur. Outer space is the region of the universe beyond Earth's atmosphere. |
| **Speed of light:** | A fundamental physical constant that is the speed at which electromagnetic radiation propagates in a vacuum and that has a value fixed by international convention of 299,792,458 meters per second. |
| **Theory :** | A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena. |
| **Ultraviolet :** | Relating to electromagnetic radiation having frequencies higher than those of visible light but lower than those of x-rays, |

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| | approximately 1015 -1016 hertz. |
| **Vacuum:** | A space empty of matter. |
| **Variable:** | An event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment. |
| **Velocity:** | The time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time. |
| **Vibration:** | A periodic and repetitive movement around an equilibrium point. |
| **Wavelength:** | The distance between crests of a wave. |
| **X-ray:** | A high-energy stream of electromagnetic radiation having a frequency higher than that of ultraviolet light but less than that of a gamma ray (in the range of approximately 1016 - 1019 hertz). |