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| Central florida assessment collaborative |
| Individual Test Item Specifications |
| Physical Science 1 |
| 2014 |

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Table of Contents

[I. Guide to the Individual Benchmark Specifications 1](#_Toc362246932)

[Benchmark Classification System 1](#_Toc362246933)

[Definitions of Benchmark Specifications 3](#_Toc362246934)

[II. Individual Benchmark Specifications 4](#_Toc362246935)

**I. Guide to the Individual Benchmark Specifications**

Content specific guidelines are given in the *Individual Benchmark Specifications* for each course. The *Specifications* contains specific information about the alignment of items with the NGSSS and Florida Standards. It identifies the manner in which each benchmark is assessed, provides content limits and stimulus attributes for each benchmark, and gives specific information about content, item types, and response attributes.

**Benchmark Classification System**

Each NGSSS benchmark is labeled with a system of letters and numbers.

* The two letters in the *first position* of the label identify the **Subject Area**.
* The number(s) in the *second position* represents the **Grade Level**.
* The letter in the *third position* represents the **Strand** or **Body of Knowledge.**
* The number in the *fourth position* represents the **Standard**.
* The number in the *last position* identifies the specific **Benchmark**.



Each MAFS benchmark is labeled with a system of letters and numbers.

* The four letters in the *first position* of the label identify the **Subject**.
* The number(s) in the *second position* represents the **Grade Level**.
* The letter(s) in the *third position* represents the **Category**.
* The number in the *fourth position* shows the **Domain**.
* The number in the *fifth position* identifies the **Cluster**.
* The number in the *last position* identifies the specific **Benchmark**.



**Definitions of Benchmark Specifications**

The *Individual Benchmark Specifications* provides standard-specific guidance for assessment item development for CFAC item banks. For each benchmark assessed, the following information is provided:

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| **Reporting Category** | is a grouping of related benchmarks that can be used to summarize and report achievement. |
| **Standard** | refers to the standard statement presented in the NGSSS or domain in the Florida Standards.  |
| **Benchmark** | refers to the benchmark statement presented in the NGSSS or standard statement in the Florida Standards. In some cases, two or more related benchmarks are grouped together because the assessment of one benchmark addresses another benchmark. Such groupings are indicated in the Also Assesses statement. |
| **Item Types** **Cognitive Complexity** | are used to assess the benchmark or group of benchmark. ideal complexity level at which the item should be assessed. |
| **Benchmark Clarifications** | explain how achievement of the benchmark will be demonstrated by students. In other words, the clarification statements explain what the student will do when responding to questions. |
| **Content Limits** | define the range of content knowledge and that should be assessed in the items for the benchmark.  |
| **Stimulus Attributes** | define the types of stimulus materials that should be used in the items, including the appropriate use of graphic materials and item context or content. |
| **Response Attributes****Content Focus** | define the characteristics of the answers that a student must choose or provide.defines the content measured by each test item. Content focus addresses the broad content and skills associated with the examples found in the standards, benchmarks, or benchmark clarifications |
| **Sample Items** | are provided for each type of question assessed. The correct answer for all sample items is provided.  |

**II. Individual Benchmark Specifications**

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| **Reporting Category** | Nature of Science  |
| **Standard** | Practice of Science  |
| **Benchmark Number** | SC.912.N.1.2 |
| **Benchmark** | Describe and explain what characterizes science and its methods. |
| **Also Assesses** | 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: pose questions about the natural world, conduct systematic observations, examine books and other sources of information to see what is already known, review what is known in light of empirical evidence,plan investigations, use tools to gather, analyze, and interpret data, pose answers, explanations, or descriptions of events, generate explanations that explicate or describe natural phenomena (inferences), use appropriate evidence and reasoning to justify these explanations to others, communicate results of scientific investigations, and evaluate the merits of the explanations produced by others. |
| **Item Types** | Multiple Choice  |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will be able to define science as a systematic process of investigation of observable phenomena using the scientific method. The student will be able to construct testable questions, form hypotheses, and experiments that result in stable and replicable results. The student will be able to relate what methods are used in scientific research.The student will be able to use inquiry to question scientific knowledge. |

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| **Content Limits** | The item does not require the students to recite the steps of the scientific method. The item does not require the knowledge of specific research methods or types of experiments. The item requires analyses of procedures that involve systematic study of observable phenomena.  |
| **Stimulus Attributes** | Text |
| **Response Attributes** | None Specified |
| **Content Focus**  | Observation, inference, data, analysis, evidence, research, evaluation, inquiry, procedures, interpret, problem, pose questions, examine, empirical evidence,plan investigations, tools, gather, analyze, interpret data, pose answers, generate explanations, inference, communicate results, data.  |
| **Sample Item** | A student notices that her local swimming hole has been getting warmer and warmer over the last two years and also notices that the water has become less clear due to algae that have appeared. She thinks the algae and the rising temperature are related. How would she go about testing this idea? A) measure the water temperature over two weeksB) pole local swimmers to determine what most believeC) conduct a video survey of the type and number of algae in the swimming hole over two weeks D) culture the algae and subject it to different temperatures of water to see impact on colony size Correct Answer: D |

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| **Reporting Category** | Nature of Science |
| **Standard** | Practice of Science |
| **Benchmark Number** | SC.912.N.1.3  |
| **Benchmark** | 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. |
| **Also Assesses** | 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. |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will be able to identify and explain the value of continuous testing of theories to determine validity and value of challenges to advance scientific understanding. The student will recognize and understand that data is not conclusive, comprehensive, and is interpreted.The student will assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions. |
| **Content Limits** | The student will not be required to provide an example of advancement from previous interpretation. The student will understand that the processes of science frequently do not correspond to the traditional portrayal of "the scientific method" |
| **Stimulus Attributes** | Illustrations, diagrams |

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| **Response Attributes** | None specified |
| **Content Focus**  | Science, non- science (pseudoscience), reliability, validity, bias, observation, inference, data, evidence, inquiry, analyze, evaluate data, results. |
| **Sample Item** | A researcher states that there is a link between cell phone radiation and cancer. Another researcher contends microwave ovens are responsible. What is the best method for resolving the issue? A) accept both as scientifically correct B) accept the original findings because they were first C) decide based on which researcher has the best credentials D) collaborate and gather additional data to find a factual conclusionCorrect Answer: D |

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| **Reporting Category** | Nature of Science  |
| **Standard** | Practice of Science  |
| **Benchmark Number** | SC.912.N.1.4  |
| **Benchmark** | Identify sources of information and assess their reliability according to the strict standards of scientific investigation. |
| **Also Assesses** | LAFS.910.RST.1.1 / LAFS.1112.RST.1.1: 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. |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will distinguish between authentic and reliable sources and opinion or conjecture. The student will identify sound scientific process within a given experiment. |
| **Content Limits** | Students will not be required to name specific sources of information (current journals, organizations, etc.). |
| **Stimulus Attributes** | List of resources, list of scientific procedures |
| **Response Attributes** | None Specified |
| **Content Focus**  | Reliability, validity, replication, research, scientific process. |

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| **Sample Item** | Which of the following methods would provide the most accurate information for students collecting data about local attitudes concerning the use of alternative fuels for automobiles? A) listen to local politicians B) opinion polls of local drivers C) study newspaper articlesD) track prices at local gas stations Correct Answer: B |

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| **Reporting Category** | Nature of Science |
| **Standard** | Characteristics of Scientific Knowledge  |
| **Benchmark Number** | SC.912.N.2.1  |
| **Benchmark** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science). |
| **Also Assesses** | 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. SC.912.N.2.3: Identify examples of pseudoscience (such as astrology and phrenology) in society.  |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Low |
| **Benchmark Clarification**  | The student will be able to identify a scientific claim versus one that is not scientific. The student will be able to identify why a seemingly scientific study fails to qualify as a scientific statement. The student will identify scientific questions that can be disproved by experimentation/testing. |
| **Content Limits** | The student will not address biological content but should instead focus on science as it relates to what is covered in a physical science class.The student will need limited knowledge of pseudoscience examples.  |
| **Stimulus Attributes** | Text |
| **Response Attributes** | None Specified |
| **Content Focus**  | Science, non- science (pseudoscience), validity, reliability. |
| **Sample Item** | Which of the following claims would be considered a valid scientific conclusion? A) Bees like red flowers because they are prettier. B) Elephants gain very little mass after they reach maturity. C) Two out of 100 people can communicate telepathically with each other. D) A monkey is happier when given bananas because they smile more than monkeys that do not get bananas. Correct Answer: B  |

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| **Reporting Category** | Nature of Science  |
| **Standard** | Role of Theories, Laws, Hypotheses & Models  |
| **Benchmark Number** | SC.912.N.3.3  |
| **Benchmark** | Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships. |
| **Also Assesses** | 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. |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves.The student will differentiate why theories do not become laws and laws do not become theories. |
| **Content Limits** | The item should not address laws or relationships in biology.  |
| **Stimulus Attributes** | Text |
| **Response Attributes** | None Specified |
| **Content Focus**  | Theories, laws, hypothesis, models. |

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| **Sample Item** | The law of gravity describes a relationship between two masses. The more massive an object is or the closer it is to another body, the more the gravitational attraction between the two objects. However, the law is limited because it cannot explain which of the following? A) what gives the larger object more mass B) why we experience gravity on earth and not in space C) why there is a gravitational attraction in the first place D) why does the smaller object also attract the larger objectCorrect Answer: C |

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| **Reporting Category** | Physics  |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.1 |
| **Benchmark** | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others. |
| **Also Assesses** | Not Applicable |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate, High |
| **Benchmark Clarification**  | The student will identify and/or name various forms of energy.The student will identify examples of energy transformations: electrical to sound in radios, mechanical to electrical in windmills, or light to heat in incandescent bulbs.  The student will recognize that one form of energy is transformed into another form of energy within the same system. The student will differentiate between kinetic and potential energy.The student will recognize that energy cannot be created or destroyed, only transformed. |
| **Content Limits** | Items assessing this benchmark should be limited to concepts of heat, electricity, electromagnetic and mechanical energy. |
| **Stimulus Attributes** | Diagram, graphics |
| **Response Attributes** | None Specified |
| **Content Focus**  | Energy, transformations, kinetic, potential, heat, electrical, mechanical, light, chemical, gravitational, sound, nuclear. |
| **Sample Item** | A student is conducting an experiment which involves dropping balls on different types of surfaces. What happens to the kinetic energy and gravitational potential energy of a ball during free fall? A) gravitational potential energy and kinetic energy both increaseB) gravitational potential energy and kinetic energy both decreaseC) gravitational potential energy decreases, and kinetic energy increases D) gravitational potential energy increases, and kinetic energy decreases Correct Answer: C  |

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| **Reporting Category** | Physics |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.3  |
| **Benchmark** | Compare and contrast work and power qualitatively and quantitatively. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice, Short Answer |
| **Cognitive Complexity Type** | Low, Moderate, High |
| **Benchmark Clarification**  | The student will compare and contrast the concepts of *work* and *power*. The student will be able to use the formula for work and power to compare and contrast the concepts of work and power. |
| **Content Limits** | The item does not address efficiency and should not use horsepower as part of the question or in the answer. The item should use *SI* units. |
| **Stimulus Attributes** | Chart, text, diagram, scenario |
| **Response Attributes** | None Specified |
| **Content Focus**  | Work, power, force, formula, mass, distance, Newtons, Joules, Watts, Kilowatts, qualitative, quantitative, formula. |
| **Sample Item** | Which of the following would have a power rating of 1kW? A) 5 seconds to move a 1000 N object 1 meter B) 5 seconds to move a 2500N object two (2) meters C) 10 seconds to move a 250N object 10 meters D) 1000 Joules of energy to move an object Correct Answer: B |

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| **Reporting Category** | Physics |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.4 |
| **Benchmark** | 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. |
| **Also Assesses** | Not Applicable  |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will describe energy transference through convection, conduction, and radiation.The student will differentiate between convection, conduction, and radiation.The student will identify that heat is the energy that is responsible for changing the temperature of matter.The student will identify that the addition of heat or the release of heat from matter is what is responsible for changing its state from one form to another. The student will explain how heat is transferred (energy in motion) from a region of higher temperature to a region of lower temperature until equilibrium is established.The student will solve problems involving heat flow and temperature changes by using known values of specific heat and/or phase change constants (latent heat). The student will explain the phase transitions and temperature changes demonstrated by a heating or cooling curve. |

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| **Content Limits** | The student will not address the kinetic theory of matter. The student will not address the relationship between kinetic energy and heat.Scenarios should be limited to materials and situations related to physical science concepts |
| **Stimulus Attributes** | Scenarios, text |
| **Response Attributes** | None Specified |
| **Content Focus**  | Conduction, convection, radiation, temperature, heat, matter, states of matter, phase change, kinetic energy, energy transformation, boiling, freezing, evaporation, condensation. |
| **Sample Item** | A student decides to do a science fair project on clouds. Through research he discovers that energy from the sun warms the water at the surface which causes it to evaporate. This evaporated water rises with warm rising air. As it rises, cold air above it flows down to fill the space left behind by the warmer rising air generating wind. The rising air begins to cool causing the water vapor to condense and clouds are formed. This cyclical process results in both wind and cloud formation. What processes are taking place to make this happen?  A) conduction and convection  B) conduction and radiation  C) conduction and thermal expansion  D) convection and radiation Correct Answer: D |

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| **Reporting Category** | Physics |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.5  |
| **Benchmark** | Relate temperature to the average molecular kinetic energy. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will identify that temperature is a measure of the average kinetic energy of the particles.The student will identify that the temperature of a substance increases or decreases with an increase or decrease in the average kinetic energy of the particles of the substance.The student will 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. |
| **Content Limits** | The student should not compare and contrast states of matter and the motion of their particles.The student should not address differences in the Kelvin, Celsius, and Fahrenheit scales.  |
| **Stimulus Attributes** | Illustrations, descriptions.  |
| **Response Attributes** | None Specified |
| **Content Focus**  | Temperature, heat, matter, atoms, molecules, energy, Fahrenheit, Celsius, Kelvin, particles, kinetic energy, thermal energy. |

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| **Sample Item** | The temperatures of two identical liquids are taken. Liquid A has a temperature of 25.5 degrees C and Liquid B has a temperature of 45.1 degrees C. What best describes the difference between the two liquids? A) There are more particles in Liquid B than there are in Liquid A. B) The particles in Liquid A are smaller than the particles in Liquid B. C) The particles in Liquid A are moving faster than the particles in Liquid B. D) The particles in Liquid A are moving slower than the particles in Liquid B.Correct Answer: D |

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| **Reporting Category** | Physical Science |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.6 (Physical Science Honors Only) |
| **Benchmark** | Create and interpret potential energy diagrams, or example: chemical reactions, orbits around a central body, motion of a pendulum. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice, Short Answer |
| **Cognitive Complexity Type** | Low, Moderate |
| **Benchmark Clarification**  | The student will be able to create a diagram relating the potential energy of an object in a defined system to its position given the necessary information.The student will be able to identify the changes in potential energy of an object in a particular diagram showing its changing position over time. |
| **Content Limits** | The item does not require the student to calculate potential energies.The item should not have the student describe the changes in energy as a function of energy loss due to heat.The item should not address energy transformations.  |
| **Stimulus Attributes** | Diagram, chart, text.  |
| **Response Attributes** | None Specified |

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| **Content Focus**  | Absorb, catalyst, change of state, chemical change, chemical reactions, combustion, concentration, decomposition, diagram, double replacement, electrons, endothermic, energy conservation, exothermic, matter, model, motion, pendulum, phase change, potential energy, precipitate, products, radioactive, rate of reaction, reactants, single replacement, synthesis, temperature. |
| **Sample Item** |

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| Using the diagram above, at which point does the pendulum have the most potential energy? A) Point A B) Point B C) Point C D) Both Points A & C Correct Answer: D  |

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| **Reporting Category** | Chemistry  |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.7 |
| **Benchmark** | Distinguish between endothermic and exothermic processes.  |
| **Also Assesses** | Not Applicable  |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate  |
| **Benchmark Clarification**  | The student will be able to distinguish between an endothermic and exothermic reactions. The student will describe a process that gives off heat (exothermic), such as burning. The student will describe a process that absorbs heat (endothermic), such as water coming to a boil. The student will recognize common processes that give off heat (exothermic), such as burning, and processes that absorb heat (endothermic), such as water coming to a boil. The student will classify phase changes as endothermic or exothermic reactions.  |
| **Content Limits** | The item should only focus on the classification of a chemical reaction related to endothermic or exothermic processes.The item does not have to involve catalysts in the reaction.The items will include classifying phase changes as endothermic or exothermic.  |
| **Stimulus Attributes** | The item should contain a chemical formula or chemical reaction.The item can include an energy diagram.  |
| **Response Attributes** | None Specified |
| **Content Focus**  | Energy, exothermic, endothermic, chemical change, physical change, chemical reaction, thermal energy, heat, release, absorb, phase change |

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| **Sample Item** | How is this reaction classified? CaO + 2H2O -> Ca(OH)2 + H2 + Heat 1. endothermic
2. exothermic
3. decomposition
4. double replacement

Correct Answer: B |

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| **Reporting Category** | Chemistry  |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.10 |
| **Benchmark** | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear). |
| **Also Assesses** | Not Applicable  |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate  |
| **Benchmark Clarification**  | The student will be able to list the four fundamental forces in order of magnitude from strongest to weakest. The student will recognize and discuss the effect of each force (gravitational, electromagnetic, weak nuclear, strong nuclear)The student will recognize that an object falls unless stopped (gravity). The student will identify fundamental forces, including gravitational and electromagnetic |
| **Content Limits** |  The item should not focus on the cause of forces.The item should not address the definitions of the forces. |
| **Stimulus Attributes** |  Test descriptions, graphs, charts  |
| **Response Attributes** | The student will choose which force is larger than the others, when prompted.  |
| **Content Focus**  | Force, electromagnetic force, gravitational force, weak nuclear force, strong nuclear force, matter, atoms, molecules, electrons, neutrons, protons |

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| **Sample Item** | Two protons are located next to each other in the nucleus of a carbon atom. Which of the four fundamental forces is greatest between them.1. The repulsion of their charges.
2. The weak nuclear force between them.
3. The gravitational attraction between them.
4. The strong nuclear force holding them together in the nucleus.

Correct Answer: D  |

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| **Reporting Category** | Chemistry |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.12 |
| **Benchmark** | Differentiate between chemical and nuclear reactions.  |
| **Also Assesses** | Not Applicable  |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will be able to 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.The student will be able to identify real-world examples where chemical and nuclear reactions occur every day.  |
| **Content Limits** |  The item should not require the students to balance or complete a reaction.  |
| **Stimulus Attributes** |  Reaction equations  |
| **Response Attributes** | None Specified  |
| **Content Focus**  | Energy, chemical change, physical change, energy conservation, atom, nucleus, proton, neutron, electron, endothermic, exothermic, fission, fusion, radioactivity, nuclear energy level |

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| **Sample Item** | A lab conducts two separate experiments that both release energy. IN the first experiment, they only allow the neutrons of atoms to react. In the second, they only let the electrons of atoms to react. What is the relationship between the two reactions?1. They are nuclear reactions.
2. They are chemical reactions.
3. Experiment 1 is a chemical reaction while 2 is a nuclear reaction.
4. Experiment 1 is a nuclear reaction while 2 is a chemical reaction.

Correct Answer: D |

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| **Reporting Category** | Physics |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.14  |
| **Benchmark** | Differentiate among conductors, semiconductors, and insulators. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will describe band structure, valence electrons, and how the charges flow or rearrange themselves between conductors and insulators.The student will describe the properties of conductors, semiconductors, and insulators.The student will identify the differences between materials that are conductors, semiconductors, and insulators.

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| **Content Limits** | The student should focus on materials and motion of electrons.The student should not focus on the transmission of heat energy. |
| **Stimulus Attributes** | None specified |
| **Response Attributes** | None specified |
| **Content Focus**  | Conductor, insulator, resistor, semiconductor, circuit, voltage, electrons, valence electrons. |

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| **Sample Item** | A student notices that when a certain material is used as a wire in a circuit and the circuit will work when the voltage is 10V. However, if the voltage is less than that, the circuit will not work. The material is most likely used in the circuit?A) conductor B) insulator C) resistor D) semiconductor Correct Answer: D |

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| **Reporting Category** | Physics |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.15  |
| **Benchmark** | Investigate and explain the relationships among current, voltage, resistance, and power. |
| **Also Assesses** | Not Applicable |
| **Item Types** | Multiple Choice, Short Answer |
| **Cognitive Complexity Type** | Low, Moderate, High |
| **Benchmark Clarification**  | The student will explain current, voltage, resistance, and power and the relationships between them.The student will apply the terms *current, voltage, resistance*, and *power* to an electrical circuit.The student will investigate current, voltage, resistance, and power using simple circuits.The student will use Ohm's and Kirchhoff's laws to explain the relationships among circuits. |
| **Content Limits** | The item should not address the differences between series and parallel circuits. |
| **Stimulus Attributes** | A circuit diagram, text and charts can be used. |
| **Response Attributes** | None Specified |
| **Content Focus**  | Current, voltage, resistance, power, circuit, Ohm’s Law, Kirchhoff’s Law, electron, Watts. |

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| **Sample Item** | Which circuit has the most current flowing through it? A) 5 V battery with a 9 Watt light B) 9 V battery with a 16 Watt light bulb C) 12 V battery with a 15 Watt light bulb D) 12 V battery with a 18 Watt light bulb Correct Answer: D |

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| **Reporting Category** | Physics |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.18  |
| **Benchmark** | 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. |
| **Also Assesses** | Not Applicable |
| **Item Types** | Multiple Choice, Extended Response |
| **Cognitive Complexity Type** | Moderate, High |
| **Benchmark Clarification**  | The student will describe that the electromagnetic spectrum is made up of many different types of waves such as infrared, visible, ultraviolet, radio, x-rays, and gamma waves.The student will distinguish between wavelength and frequency.The student will explain the relationship between frequency, wavelength and energy. The student will identify practical uses of each type of electromagnetic wave based on its energy.The student will solve problems involving wavelength, frequency, and energy. |
| **Content Limits** | The student should not have to demonstrate the ability to calculate the energy of an electromagnetic wave. The student should not be given scenarios or applications that would not be addressed in physical science class. |
| **Stimulus Attributes** | Electromagnetic Spectrum charts, graphs, text. |

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| **Response Attributes** | None Specified |
| **Content Focus**  | Electromagnetic wave, electromagnetic spectrum, wavelength, frequency, energy, microwaves, radio, infrared, visible light, ultraviolet, x-rays, gamma, radiation. |
| **Sample Item** | A student is using the different regions of the Electromagnetic Spectrum to learn about the various types of waves. Which of the following would be the best explanation of infrared waves? A) They have lower frequencies than microwaves.B) They have shorter wavelengths than gamma waves.C) They have longer wavelengths than ultraviolet waves. D) They have higher frequencies than visible light waves.Correct Answer: C |

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| **Reporting Category** | Physics |
| **Standard** | Motion |
| **Benchmark Number** | SC.912.P.12.1 (Physical Science Honors Only) |
| **Benchmark** | Distinguish between scalar and vector quantities and assess which should be used to describe an event. |
| **Also Assesses** | Not Applicable |
| **Item Types** | Multiple Choice, Short Answer  |
| **Cognitive Complexity Type** | Low, Moderate  |
| **Benchmark Clarification**  | The student will be able to define the terms *scalar* and *vector*. The student will be able to describe what measurements require a scalar quantity or vector quantity. |
| **Content Limits** | The item should address measurements typically made in physical science and limited to basic physics principles.  |
| **Stimulus Attributes** | Text, diagrams  |

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| **Response Attributes** | None Specified |
| **Content Focus**  | Chemical equilibrium, chemical reaction, dynamic state, gases, kinetic molecular theory, law of universal gravitation, molecules, momentum, motion, net force, rate, scalar quantities: (distance, speed, energy, mass, work) , theory of relativity, time, vector, vector quantities: (displacement, velocity, acceleration, force, linear momentum) |
| **Sample Item** | Which of the following would not be considered a vector measurement?1. The mass of a thrown baseball.
2. The momentum of a thrown baseball.
3. The force applied to the baseball while throwing it.
4. The velocity of a baseball as it travels through the air.

Correct Answer: B |

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| **Reporting Category** | Physics |
| **Standard** | Motion |
| **Benchmark Number** | SC.912.P.12.3 |
| **Benchmark** | Interpret and apply Newton's three laws of motion.  |
| **Also Assesses** | 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. |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate, High |
| **Benchmark Clarification**  | The student will able to explain Newton’s three laws.The student will able to apply Newton’s three laws of motion to a given scenario. The student will able to identify how Newton’s three laws govern an object’s behavior in a given scenario. The student will 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). The student will 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). The student will 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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| **Content Limits** | The student is not required to show knowledge or use of the concepts of momentum or impulse. |
| **Stimulus Attributes** | Diagram, text  |
| **Response Attributes** | None Specified |
| **Content Focus**  | Force, motion, net force, acceleration, Newton’s Laws, speed, inertia, velocity, initial, final, mass, Time, displacement, rest, position, rate, ratio, formula. |
| **Sample Item** | A diagram shows a balloon that is moving in one direction while escaping air is moving in the opposite direction. Which best explains what causes the balloon to move? A) action reaction forces B) friction forces C) gravitational forces D) inertia Correct Answer: A |

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| **Reporting Category** | Physics |
| **Standard** | Motion  |
| **Benchmark Number** | SC.912.P.12.5 (Physical Science Honors Only) |
| **Benchmark** | Apply the law of conservation of linear momentum of interactions, such as collisions between objects.  |
| **Also Assesses** | Not Applicable |
| **Item Types** | Multiple Choice, Short Answer |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will be able to define the concept of *momentum*.The student will be able to explain how momentum is conserved in a collision between objects.  |
| **Content Limits** | The item should not address differences between elastic and inelastic collisions.The item should not involve mathematical calculations of momentum beyond comparing initial and final momentums.  |
| **Stimulus Attributes** | Text, diagram |

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| **Response Attributes** | None Specified |
| **Content Focus**  | Acceleration, chemical equilibrium, chemical reactions, collisions, elastic collision, force, gases, gravitational force, inelastic collision, kinetic energy, kinetic molecular theory, law of conservation of momentum, law of universal gravitation, mass, molecules, motion, net force, object, position, size, speed, theory of relativity, time, velocity |
| **Sample Item** | A bullet is fired into a 3 Kg wood block that is sitting on top of the ice of a frozen lake. The bullet has a momentum of 450 Kgm/s. The bullet enters the wood block and stops. If we assume the ice is a frictionless surface, what should happen to the momentum of the wood block after the bullet enters it?A) The block will not change its momentum at all and will not move.B) The wood block would have a much smaller momentum then the bullet had and will barely move.C) The block will have nearly the same momentum as the bullet did and move in the same direction the bullet was moving.D) The wood block will have a larger momentum than the bullet did and move in the same direction as the bullet was moving.Correct Answer: C |

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| **Reporting Category** | Physics |
| **Standard** | Motion  |
| **Benchmark Number** | SC.912.P.12.6 (Physical Science Honors Only) |
| **Benchmark** | Qualitatively apply the concept of angular momentum.  |
| **Also Assesses** | Not Applicable |
| **Item Types** | Multiple Choice, Short Answer |
| **Cognitive Complexity Type** | Moderate, High  |
| **Benchmark Clarification**  | The student will be able to define angular momentum.The student will be able to describe words or with diagrams the momentums and velocities involved with an object traveling in a circular path.  |
| **Content Limits** | The item should not require any mathematical computations regarding this concept.The item does not extend to planetary bodies.The item does not require knowledge of centrifugal or centripetal forces.  |
| **Stimulus Attributes** | Text, diagram |

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| **Response Attributes** | Student may answer short response items with a diagram.  |
| **Content Focus**  | Angular momentum, angular velocity, axis of rotation, conservation of momentum, inertia, linear momentum, mass, moment of inertia, momentum, motion, rotation, shape, speed, torque, vector, velocity  |
| **Sample Item** | A motorcycle is traveling due south. What is the angular momentum vector of the front wheel of the motorcycle?1. East
2. North
3. South
4. West

Correct Answer: C |

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| **Reporting Category** | Chemistry |
| **Standard** | Motion |
| **Benchmark Number** | SC.912.P.12.10 |
| **Benchmark** | Interpret the behavior of ideal gases in terms of kinetic molecular theory. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice, Short Answer |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will be able to explain why gases exhibit unique behaviors using the kinetic molecular theory in their explanation. The student will explain the behavior of gases and the relationship between pressure and volume (Boyle’s law).The student will explain the behavior of gases and the relationship between volume and temperature (Charles’s law).The student will explain the behavior of gases and the relationship between pressure and temperature (Gay-Lussac’s law). The student will explain the behavior of gases and number of particles in a gas sample (Avogadro’s hypothesis). |
| **Content Limits** | The student is not required to use the ideal gas law. The student is not required to complete mathematical calculations involving Charles’ or Boyle’s law. |
| **Stimulus Attributes** | Text, chart |
| **Response Attributes** | None Specified |

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| **Content Focus**  | Gas, volume, temperature, pressure, particles, Boyle’s Law, Charles’s Law, Gay-Lussac’s Law, Avogadro’s Hypothesis, kinetic molecular theory, Kelvin, Celsius, compressibility, STP |
| **Sample Item** | A gas will increase in pressure inside of a sealed container when heated. Which of the following is the best explanation for this in terms of the kinetic theory of matter? A) The particles of the gas increase in size and take up more room as they gain heat energy. B) The kinetic energy of the particles decreases causing an expanding in the volume of the gas. C) The particles in the gas expand outward with the increase in heat and the volume of the gas increases. D) The particles gain more energy and therefore move faster, causing more collisions with the walls of the container. Correct Answer: D |

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| **Reporting Category** | Chemistry |
| **Standard** | Motion |
| **Benchmark Number** | SC.912.P.12.11  |
| **Benchmark** | Describe phase transitions in terms of kinetic molecular theory.  |
| **Also Assesses** | Not Applicable |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate, High  |
| **Benchmark Clarification**  | The student will be able to describe the process of phase changes in matter in terms of particle motion, energy, and attraction of the particles in the sample of matter. |
| **Content Limits** |  The item should not involve plasma as a phase.  |
| **Stimulus Attributes** | Diagram, table, text |
| **Response Attributes** | None Specified  |
| **Content Focus**  | Kinetic molecular theory, phase transition, molecules, matter, phase change, solid, liquid, gas, motion, particles, melting, boiling, vapor, temperature, heat, energy, kinetic energy |

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| **Sample Item** | A sample of water is heated in a beaker until it begins to boil and turn to steam. Which of the following best describes the transition of liquid water to steam?1. The particles gain so much energy, the attraction between them cannot hold them together and they leave the surface of the liquid to travel into the air.
2. The particles gain so little energy, the attraction between them cannot hold them together and they leave the surface of the liquid to travel into the air.
3. The particles in the water gain energy to begin to move in a more organized way, causing them to leave the surface of the water and travel into the atmosphere.
4. The particles’ motion becomes so random and chaotic there is not more room for them to vibrate and they are flung into the air above the surface of the water.

Correct Answer: A |

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| **Reporting Category** | Chemistry  |
| **Standard** | Energy |
| **Benchmark Number** | SC.912.P.10.11 (Physical Science Honors Only) |
| **Benchmark** | Explain and compare nuclear reactions (radioactive decay, fission, and fusion) and the energy changes associated with them and their associated safety issues.  |
| **Also Assesses** | Not Applicable |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will be able to distinguish between a fission reaction and a fusion reaction.The student will be able to explain the process of radioactive decay.The student will be able to describe the energy changes that take place with any nuclear reaction.The student will be able to list safety concerns that must be applied when working with nuclear reactions.  |
| **Content Limits** | The item should only focus on basic nuclear reactions such as uranium decay or the fusion reaction of the sun.  |
| **Stimulus Attributes** | Text, reaction equation  |

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| **Response Attributes** | None Specified |
| **Content Focus**  | Alpha decay, atom, beta decay, c-14, charge, composition, electron, endothermic, energy, entropy, exothermic, fission, fusion, gamma decay, half-life, isotope, mass, neutron, nuclear reaction, nucleus, proton, radioactive decay |
| **Sample Item** | A particular reaction is studied and it is found that two small atoms reacted to release energy and form a single larger atom. What is this type of reaction classified as?1. fission
2. fusion
3. radioactive decay
4. synthesis

Correct Answer: B |

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| **Reporting Category** | Chemistry |
| **Standard** | Matter |
| **Benchmark Number** | SC.912.P.12.12  |
| **Benchmark** | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Low, Moderate, High |
| **Benchmark Clarification**  | The student will able to explain how the concentration of reactants affects the rate of a chemical reaction.The student will able to explain how the temperature affects the rate of a chemical reaction. The student will able to explain how the presence of catalysts lowers the activation energy of a chemical reaction. |
| **Content Limits** | The student will not describe the concept of Le Chatelier's principle. The student will not identify molarity or other concentration units. The student will not address the concept of equilibrium. |
| **Stimulus Attributes** | Diagram, chart, text  |
| **Response Attributes** | None specified |
| **Content Focus**  | Chemical reaction, chemical change, concentration, temperature, catalyst, enzyme, products, reactants, temperature, equilibrium, rate, activation energy, rate of reaction. |

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| **Sample Item** | For the reaction:Magnesium + Hydrochloric Acid → Magnesium Chloride + Hydrogen, Which one of the following is most likely to cause an increase in the reaction rate? A) addition of a catalyst B) addition of more Magnesium Chloride C) performing the reaction in plastic beaker D) cooling the reaction vessel with ice on the outside of itCorrect Answer: A  |

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| **Reporting Category** | Chemistry |
| **Standard** | Matter |
| **Benchmark Number** | SC.912.P.8.1 |
| **Benchmark** | Differentiate among the four states of matter.  |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Low, Moderate |
| **Benchmark Clarification**  | The student will able to define the terms *solid, liquid*, *gas, and plasma*. The student will able to differentiate between solids, liquids, gases, and plasma given a picture of each. The student will able to differentiate between solids, liquids, gases, and plasma based on a physical description of each.The student will able to explain solids, liquids, gases, and plasma in terms of their volume or shape as a fixed or non-definite property. The student will differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. |
| **Content Limits** | The student will not address the kinetic theory of matter.The student will not address melting or boiling points of a particular type of matter such as water. |
| **Stimulus Attributes** | Picture, chart, text  |
| **Response Attributes** | None Specified |

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| **Content Focus**  | Solids, liquid, gas, plasma, temperature, energy, matter, thermal energy, kinetic energy, molecules, volume, particle, motion, phase transitions, matter, freezing point, boiling point, melting point. |
| **Sample Item** | Three samples of matter and their volume and shape are shown above. Of the three samples, which one(s) are not a liquid? A) A and B B) A and C C) B and C D) B only Correct Answer: C |

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| **Reporting Category** | Chemistry |
| **Standard** | Matter |
| **Benchmark Number** | SC.912.P.8.2 |
| **Benchmark** | Differentiate between physical and chemical properties and physical and chemical changes of matter. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Low |
| **Benchmark Clarification**  | The student will able to define physical properties of matter.The student will able to define chemical properties of matter.The student will able to distinguish between physical and chemical properties of a substance. The student will able to define chemical change. The student will able to define physical change. The student will able to distinguish between chemical and physical changes in matter. The student will discuss volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting and boiling points.The student will describe simple laboratory techniques that can be used to separate homogeneous and heterogeneous mixtures (e.g. filtration, distillation, chromatography, evaporation). |

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| **Content Limits** | The student will not use kinetic theory of matter to explain how matter undergoes physical changes in terms of melting or boiling. The student will deal with chemicals or physical processes familiar in the physical science classroom. |
| **Stimulus Attributes** | Text, chart, diagram.  |
| **Response Attributes** | None Specified |
| **Content Focus**  | Chemical change, physical changes, matter, volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting point, boiling point, homogeneous mixture, heterogeneous mixtures, filtration, distillation, chromatography, evaporation, condensation, temperature. |
| **Sample Item** | The melting of wax is a physical change, yet the burning of wax is a chemical change. What is the essential difference between a physical change and a chemical change of wax in a burning candle? A) Melted wax is in a different phase of matter than solid wax. B) A higher temperature is needed to burn wax then to melt wax. C) Melted wax can be separated into other substances, while solid wax cannot. D) The burning of wax forms new compounds while the melting of wax does not. Correct Answer: D |

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| **Reporting Category** | Chemistry |
| **Standard** | Matter |
| **Benchmark Number** | SC.912.P.8.4  |
| **Benchmark** | 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. |
| **Also Assesses** | SC.912.N.3.5: Describe the function of models in science, and identify the wide range of models used in science. |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will able to describe the structure of the atom in terms of nucleus and electron cloud.The student will able to identify the parts of the atom (proton, neutron, electron, electron cloud, nucleus) The student will able to explain the forces of attraction and repulsion consistent with their charges and masses. |
| **Content Limits** | The student will not identify the number of subatomic particles in a particular atom. The student will not memorize the periodic table |
| **Stimulus Attributes** | Text, diagram.  |
| **Response Attributes** | None Specified |
| **Content Focus**  | Atom, neutron, proton, electron, electron cloud, nucleus, periodic table, mass, charge, attraction, repulsion, atomic theory, electrical charge, models. |
| **Sample Item** | A student is asked to build a model of an atom with six protons and six electrons. Students will then be asked to make an identical model of the same atom, but make it an ion. What does the student have to do to be successful in this project? A) Put the electrons in the middle of the model and distribute the protons around it. The ion will have seven protons. B) Put six protons in the center of the model, and six electrons around the outside, then add one proton or take away a proton to make an ion. C) Place electrons and protons in the center of the atom, and then create an ion by adding one more proton and one more electron to the center of the atom. D) Put six protons in the center of the atom and distribute the electrons around the protons. The ion will look the same but have seven or five electrons.Correct Answer: D |

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| **Reporting Category** | Chemistry |
| **Standard** | Matter |
| **Benchmark Number** | SC.912.P.8.5  |
| **Benchmark** | Relate properties of atoms and their position in the periodic table to the arrangement of their electrons. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will explain how the position of an atom on the periodic table directly relates to its electron configuration.The student will identify that the electron configuration of an atom determines its physical and chemical properties.The student will identify that the group an atom is in on the periodic table corresponds to the number of valence electrons and the orbital those valence electrons occupy. The student will interpret that the atoms of a group on the periodic table have the same electron arrangements and therefore similar chemical and physical properties.The student will determine the number of valence electrons. |
| **Content Limits** | The student will not draw a Lewis dot structure or complete an orbital diagram and/or an electron diagram for a particular atom. The student may be required to know the chemical and physical properties of groups of elements on the periodic table.  |
| **Stimulus Attributes** | Text, periodic table  |

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| **Response Attributes** | None Specified |
| **Content Focus**  | Atom, electron, proton, neutron, nucleus, periodic table, group, period, chemical property, physical property, valence electrons, orbital, shells, periodic table, atomic mass, atomic number, metals, nonmetals, metalloids, gases, noble gases, alkali metals, alkaline earth metals, halogens. |
| **Sample Item** | Atom A has three valence electrons. Atom B also has three valence electrons. What would best describe their position on the periodic table relative to each other? A) both atoms would be in the same period as each other B) both atoms would be on the same row on the periodic table C) both atoms would be in the same group on the periodic tableD) the two atoms would have to be side by side on the periodic table Correct Answer: C |

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| **Reporting Category** | Chemistry |
| **Standard** | Matter |
| **Benchmark Number** | SC.912.P.8.7 |
| **Benchmark** | Interpret formula representations of molecules and compounds in terms of composition and structure. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Low; Moderate |
| **Benchmark Clarification**  | The student will write chemical formulas for simple covalent (HCl, SO2, CO2, and CH4), ionic (Na+ + Cl− → NaCl) and molecular (O2, H2O) compounds. The student will predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions.The student will able to read a formula representation of a molecule or compound and describe the elements in that compound, and the number of each atom in that compound.The student will write chemical formulas for simple covalent (HCl, SO2, CO2, and CH4), ionic (Na+ + Cl− → NaCl) and molecular (O2, H2O) compounds. |
| **Content Limits** | The student is not required to identify the formula weight or have knowledge of the molecule to solve the problem. The student is not required to distinguish the type of bonding between the atoms in a molecule or compound. The student is not required to predict what elements would bond to other elements and in what ratios. |

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| **Stimulus Attributes** | Chemical formula, text |
| **Response Attributes** | None Specified |
| **Content Focus**  | Bonding, molecule, atom, compound, element, ionic bonding, covalent bonding, formula, periodic table, electron pair, valance electrons, ion. |
| **Sample Item** | Which of the answer choices below best describes the components of the following compound (NH4)2 SO4? A) 1 Nitrogen, 4 Hydrogen, 2 Sulfur, 4 Oxygen B) 1 Nitrogen, 4 Hydrogen, 2 Sulfur, 8 Oxygen C) 2 Nitrogen, 8 Hydrogen, 1 Sulfur, 4 Oxygen D) 2 Nitrogen, 8 Hydrogen, 4 Sulfur, 4 Oxygen Correct Answer: C |

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| **Reporting Category** | Chemistry |
| **Standard** | Matter |
| **Benchmark Number** | SC.912.P.8.8  |
| **Benchmark** | Characterize types of chemical reactions, for example: redox, acid-base, synthesis, and single and double replacement reactions. |
| **Also Assesses** | None Specified |
| **Item Types** | Multiple Choice |
| **Cognitive Complexity Type** | Moderate |
| **Benchmark Clarification**  | The student will be able to recognize the following chemical reactions: reduction, oxidation, acid base, synthesis, single replacement and double replacement, given the complete reaction.The student will classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. |
| **Content Limits** | The student will not be required to balance the reaction. The student will not predict the products of a reaction.The student will not identify energy changes for a particular reaction. The student will not identify specific species in the reaction such as identifying which species is oxidized or which species is the base.  |
| **Stimulus Attributes** | Complete chemical reactions, text. |
| **Response Attributes** | None Specified |
| **Content Focus**  | Chemical reactions, reduction, oxidation, acid base, synthesis, single replacement, double replacement, decomposition, displacement, combustion. |

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| **Sample Item** | Look at the following reaction and determine the type of reaction it represents. This is an example of what type of reaction? 2Al(s) + 3CuCl2(aq) 2AlCl3(aq) + 3Cu(s) A) decomposition B) double replacement C) single replacement D) Synthesis Correct Answer: C |