CMAS Science 2023 Performance Level Descriptors
Grade 11 Science
Based on the 2020 Colorado Academic Standards for High School Science

Partially Met Expectations
Students who demonstrate a limited command of the concepts, skills, and practices embodied by the Colorado Academic Standards assessed at their grade level. They will need additional academic support to engage successfully in further studies in this content area.

Approached Expectations
Students who demonstrate a moderate command of the concepts, skills, and practices embodied by the Colorado Academic Standards assessed at their grade level. They will likely need additional academic support to engage successfully in further studies in this content area.

Met Expectations
Students who demonstrate a strong command of the concepts, skills, and practices embodied by the Colorado Academic Standards assessed at their grade level. They are academically prepared to engage successfully in further studies in this content area.

Exceeded Expectations
Students who demonstrate a distinguished command of the concepts, skills, and practices embodied by the Colorado Academic Standards assessed at their grade level. They are academically well prepared to engage successfully in further studies in this content area.

Color Legend for Three-Dimensional Alignment

Colorado Essential Skills and Science and Engineering Practice

Grade Level Expectation

Cross Cutting Concept

Physical Science				
	Partially Met Expectations	**Approached Expectations**	**Met Expectations**	**Exceeded Expectations**
1.	**Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding structure, properties, and interactions of matter.**			
GLE 1.1, 1.2, 1.3	Describe the periodic table as a model that is based on patterns in chemical properties. Apply those patterns with inconsistent success to interpret familiar, simple chemical reactions. [1.1.a, 1.2.a]	Identify patterns in atomic electron configurations and chemical properties based on the periodic table as a model and apply those patterns to interpret familiar, simple chemical reactions. [1.1.a, 1.2.a]	Predict chemical properties based on patterns in atomic electron configurations using the periodic table as a model and apply those patterns to explain the outcomes of simple chemical reactions. [1.1.a, 1.2.a]	Use and explain the periodic table as a model, including how to predict chemical properties based on patterns in atomic electron configurations and how to apply those patterns to anticipate and explain the outcomes of simple chemical reactions. [1.1.a, 1.2.a]
	Use models of chemical reactions, chemical reaction systems, reaction rates that are affected by temperature or reactant concentration, reactions at equilibrium, and apply mathematical representations to changes in mass during reactions. **OR** Describe a limited number of basic characteristics of chemical reactions, including some, but most likely not all, of these: flow of energy into and out of a chemical reaction system, reaction rates that are affected by temperature or reactant concentration, stability of reactions at equilibrium, and the conservation of mass during reactions. [1.1.c, 1.2.b, 1.2.c, 1.2.d, 1.2.e]	Use simple models or mathematical representations to describe basic characteristics of chemical reactions, such as flows of energy, patterns in reaction rates that are affected by different conditions, stability of reactions at equilibrium, and the conservation of mass during reactions. [1.1.c, 1.2.b, 1.2.c, 1.2.d, 1.2.e]	For phenomena referenced and emphasized in the EO, develop models and use mathematical representations to describe and explain characteristics and outcomes of chemical reactions, such as flow of energy into and out of a chemical reaction system based on bond energy, patterns in reaction rates that are affected by temperature or reactant concentration, stability of reactions at equilibrium, and the conservation of mass during reactions. [1.1.c, 1.2.b, 1.2.c, 1.2.d, 1.2.e]	For phenomena not referenced or emphasized in the EO, develop models and mathematical representations to describe and explain characteristics and outcomes of chemical reactions, such as flow of energy into and out of a chemical reaction system based on bond energy, patterns in reaction rates that are affected by temperature or reactant concentration, stability of reactions at equilibrium, changes that will alter equilibrium, and the conservation of mass during reactions. [1.1.c, 1.2.b, 1.2.c, 1.2.d, 1.2.e]

Physical Science				
	Partially Met Expectations	**Approached Expectations**	**Met Expectations**	**Exceeded Expectations**
	Follow provided steps in an investigation of structural properties of materials that relate to forces between particles. **OR** Describe patterns of structural properties of materials that relate to forces between particles. [1.1.b]	Follow provided steps to investigate patterns of structural properties of materials that relate to forces between particles. [1.1.b]	For phenomena referenced in the EO, plan and conduct routine investigations of bulk-scale structural properties of materials and use patterns in the results to infer the strength of electrical forces between particles. [1.1.b]	For phenomena not referenced in the EO, plan and conduct novel investigations into bulk-scale properties of substances and use patterns in the results to infer the strength of electrical forces between particles. [1.1.b]
	Use models to illustrate nuclear processes due to changes in nuclear composition. **OR** Describe nuclear processes as releasing energy due to changes in nuclear composition. [1.3.a]	Use models to illustrate how changes in nuclear composition accompany the release of energy during nuclear processes. [1.3.a]	Develop and use models described in the EO to illustrate changes in nuclear composition during nuclear processes and the accompanying release of energy. [1.3.a]	Develop and use models beyond those described in the EO to illustrate and compare changes in nuclear composition during nuclear processes and the accompanying release of energy. [1.3.a]
PG 2.	**Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding interactions between objects and within systems of objects.**			
GLE 1.4, 1.5	Use mathematics to calculate forces by substituting simple values into one or more of these laws: Newton's second law of motion, Newton's law of universal gravitation, and Coulomb's law. **OR** Describe these equations as predicting the effects of interactions between objects. [1.4.a, 1.5.a]	Apply mathematical representations or use patterns in simple sets of data related to Newton's second law of motion and Newton's law of universal gravitation to predict the effects of interactions between objects in clearly defined, well-known scenarios. [1.4.a, 1.5.a]	When presented with phenomena referenced in the EO, use mathematical representations of Newton's second law of motion, Newton's law of universal gravitation, and Coulomb's law to analyze data showing patterns in the effects of interactions between objects or systems of objects. [1.4.a, 1.5.a]	When presented with phenomena not referenced in the EO regarding the effects of interactions between objects or systems of objects, determine patterns in the data or use mathematical representations of Newton's second law of motion, Newton's law of universal gravitation, or Coulomb's law to explain or predict the outcomes. [1.4.a, 1.5.a]

Physical Science				
	Partially Met Expectations	**Approached Expectations**	**Met Expectations**	**Exceeded Expectations**
	Carry out procedural aspects of investigations of the interactions between electric currents and magnetic fields. **OR** Describe effects caused by interactions between electric currents and magnetic fields. [1.5.b]	Conduct guided investigations of the interactions between electric currents and magnetic fields and describe cause and effect relationships in those interactions. [1.5.b]	Plan and conduct routine investigations of cause and effect relationships in the interactions between electric currents and magnetic fields. [1.5.b]	Plan and conduct novel investigations of cause and effect relationships in the interactions between electric currents and magnetic fields. [1.5.b]
	Perform tests on a simple device that minimizes force in a collision. **OR** Explain how the force caused by a collision can be reduced. [1.4.c]	Design a device from provided familiar components that is intended to minimize the force caused by a collision. [1.4.c]	Design, evaluate, and refine a device that minimizes the force caused by a collision. [1.4.c]	Use sophisticated scientific reasoning to design, construct, test, and evaluate nontypical devices that minimize the effects of forces experienced by an object in a collision. [1.4.c]
	Perform basic calculations to describe the momentum of objects that are experiencing no net force. **OR** Describe total momentum in a system of objects that is experiencing no net force. [1.4.b]	Perform calculations using a basic mathematical model to describe total momentum in a system of objects that is experiencing no net force. [1.4.b]	Support, with computational models, routine claims about conservation of momentum in systems of objects experiencing no net forces. [1.4.b]	Recognize and define systems of objects experiencing uncertain net forces, and support, with computational models, claims about conservation of momentum in such systems. [1.4.b]
	Identify that molecular-level structure is important to designed materials. [1.5.c]	Describe molecular-level structure as an important factor in the function of designed materials. [1.5.c]	Use a variety of formats to communicate scientific information on the importance of molecular-level structure to the function of designed materials. [1.5.c]	Obtain, synthesize, and communicate unfamiliar scientific information on the importance of molecular-level structure to the function of designed materials. [1.5.c]

PG. 3	**Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding of how energy is transferred and conserved.**			
GLE 1.6, 1.7, 1.8, 1.9	Perform simple calculations related to energy flows, such as thermal energy transfers to or from an object. **OR** Describe energy flows into or out of a system, such as thermal energy transfers to or from an object. [1.6.a, 1.7.a, 1.7.b, 1.9.b]	Use provided mathematical representations to identify the direction and relative magnitude of energy flows into, out of, or between components of a system, such as thermal energy transfers that lead to a more uniform energy distribution within the system. [1.6.a, 1.7.a, 1.7.b, 1.9.b]	Create a computational model to calculate the change in energy of one component of a system, when given the change in energy of another component and energy flows into and out of the system. Plan and conduct investigations of thermal energy transfers that lead to a more uniform energy distribution within a closed system. [1.6.a, 1.7.a, 1.7.b, 1.9.b]	Create a complex computational model to calculate the change in energy of various components of an unfamiliar system, accounting for multiple changes in energy of other components and energy flows into and out of the system. Plan and conduct investigations of thermal energy transfers to demonstrate how the second law of thermodynamics applies to energy distribution within or between closed or open systems. [1.6.a, 1.7.a, 1.7.b, 1.9.b]
	Use familiar models to illustrate motion or relative position of objects, including those interacting through electric or magnetic fields. **OR** Identify familiar examples of energy that are associated with the motion or relative position of objects or changes in the energy of objects caused by electric or magnetic field interactions. [1.6.b, 1.8.a]	Use familiar models to illustrate that energy is associated with the motion or relative position of objects or that two objects interacting through electric or magnetic fields will be affected by predictable forces and changes in energy. [1.6.b, 1.8.a]	Develop and use models to illustrate that energy is associated with the motion or relative position of objects and to predict forces and changes in energy that are caused when two objects interact through electric or magnetic fields. [1.6.b, 1.8.a]	Develop and use novel models to illustrate changes in energy associated with the motion or relative position of objects and to predict changes in forces and energy that are caused when two objects interact through electric or magnetic fields. [1.6.b, 1.8.a]

	Observe the performance of a familiar device that converts one form of energy to another and make general comparisons of that performance to a list of design criteria for the device. [1.6.c, 1.9.a]	Test the performance of a device that converts one form of energy to another against specified design criteria and constraints. [1.6.c, 1.9.a]	Design, build, and refine a device that converts one form of energy to another within given design criteria and constraints. [1.6.c, 1.9.a]	Establish a set of design criteria and constraints and use them to design, build, and refine a device that converts one form of energy to another. [1.6.c, 1.9.a]

PG 4.	Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding of how waves are used to transfer energy and information.			
GLE 1.10, 1.11, 1.12	Use provided mathematical formulas to make specified calculations of one wave characteristic (frequency, wavelength, or speed) when given others. **OR** Describe how a change to one wave characteristic (frequency, wavelength, or speed) will cause another characteristic to change as well. [1.10.a]	Use mathematical representations to answer familiar questions about cause and effect relationships among wave characteristics (frequency, wavelength, and speed). [1.10.a]	Use mathematical representations to engage in sense-making about cause and effect relationships among wave characteristics (frequency, wavelength, and speed) for waves traveling in various media for phenomena referenced in the EO. [1.10.a]	Create novel mathematical representations to engage in nonroutine sense-making about cause and effect relationships among wave characteristics (frequency, wavelength, and speed) for waves traveling in various media for phenomena not referenced in the EO. [1.10.a]
	Identify electromagnetic radiation as being a kind of wave. Identify one or more effects of electromagnetic radiation on matter. [1.11.a, 1.11.b]	Describe electromagnetic radiation using a wave model. Identify some effects of different frequencies of electromagnetic radiation on matter. [1.11.a, 1.11.b]	Evaluate familiar claims about the usefulness of describing electromagnetic radiation with a wave model versus a particle model in the transfer of energy within systems. Obtain and evaluate routine information on the effects of different frequencies of electromagnetic radiation on matter. [1.11.a, 1.11.b]	Evaluate claims about the applicability, in unfamiliar or unconventional situations, of wave models and particle models for describing electromagnetic radiation in the transfer of energy within systems. Obtain and evaluate complex or challenging information on the effects of different frequencies of electromagnetic radiation on matter. [1.11.a, 1.11.b]

	Provide an example of a technological device that uses electromagnetic waves to transmit information. **OR** Describe technological devices that capture energy or information. Describe digital transmission and storage of information as being very stable or as being superior to analog methods. [1.10.b, 1.11.c]	Provide common examples of technological devices that use electromagnetic waves to capture or transmit energy or information. List one or more advantages of the stability of digital transmission and storage of information. [1.10.b, 1.11.c]	Obtain, evaluate, and communicate information on technological devices referenced in the EO that use electromagnetic waves to capture or transmit energy or information. Ask questions around the advantages of digital transmission and storage of information over analog methods, including stability of signal. [1.10.b, 1.11.c]	Obtain, evaluate, and communicate information on technological devices not referenced in the EO that use electromagnetic waves to capture or transmit energy or information. Ask questions and define problems around the advantages of digital transmission and storage of information over analog methods, including stability of signal. [1.10.b, 1.11.c]

Life Science				
	Partially Met Expectations	**Approached Expectations**	**Met Expectations**	**Exceeded Expectations**
PG 5.	**Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding of how individual organisms are configured and how these structures function to support life, growth, behavior, and reproduction.**			
GLE 2.1, 2.2, 2.3	Label familiar models of a limited range of structures and processes that carry out life's functions. **OR** Describe the systems of structures and processes that carry out life's functions. [2.1.b]	Use familiar models of systems to describe a limited range of structures and processes in the hierarchical organization that carries out life's functions. [2.1.b]	Develop and use models and apply well-practiced concepts of systems and system models to make routine sense of the hierarchical organization of structures that carry out life functions as referenced in the EO. [2.1.b]	Develop and use models and apply complex concepts of systems and system models to analyze unfamiliar aspects of the hierarchical organization of structures that carry out life functions not referenced in the EO. [2.1.b]
	With varying degrees of success, follow explicit procedures to make observations in simple investigations into processes within organisms that allow the organism to survive. **OR** Describe how systems and processes within organisms allow the organism to survive and deal with change. Use models or familiar explanations to describe DNA and cell division as important for growth and development. **OR** Describe DNA structure and cell division as important for growth and development of organisms' systems. [2.1.a, 2.1.c, 2.2.a]	Use familiar models of or follow clearly enumerated procedures to conduct simple investigations into interrelated systems within organisms, such as the ability of feedback mechanisms to respond to change and maintain homeostasis. Communicate familiar explanations about how the structure of DNA codes for protein or how cell division results in growth and development in the overall system of the body. [2.1.a, 2.1.c, 2.2.a]	Connect multiple familiar ideas to model, explain, or conduct investigations into systems within organisms, from the structure of DNA that codes for proteins, to the process of cell division that results in growth and development, to the ability of feedback mechanisms to compensate for changes and maintain stability through homeostasis. [2.1.a, 2.1.c, 2.2.a]	Connect multiple ideas to model, explain, or design and conduct original investigations into interrelated systems within organisms, from the structure of DNA that codes for proteins, to the processes of mitosis and differentiation that result in growth and development, to the ability of feedback mechanisms to compensate for changes and maintain stability through homeostasis. [2.1.a, 2.1.c, 2.2.a]

Life Science				
	Partially Met Expectations	**Approached Expectations**	**Met Expectations**	**Exceeded Expectations**
	Communicate an explanation for one or more ways that organisms use matter and energy to live and grow. [2.3.a, 2.3.b, 2.3.c]	Use models and identify typical evidence that illustrates how organisms use matter and energy to live and grow. Describe in general terms changes of matter and energy in living systems, including photosynthesis, cellular respiration, and the rearrangement of food molecules to form other life-sustaining molecules. [2.3.a, 2.3.b, 2.3.c]	Develop and use models and explanations of the familiar changes of matter and energy in living systems, including photosynthesis, cellular respiration, and the rearrangement of carbon, oxygen, and hydrogen from sugar molecules with other elements to form large carbon-based molecules. [2.3.a, 2.3.b, 2.3.c]	Construct models or evidence-based explanations that illustrate how organisms use matter and energy to live and grow, including chemical energy from photosynthesis, net energy transfer from the breaking and creation of chemical bonds in cellular respiration, and the rearrangement of carbon, oxygen, and hydrogen from sugar molecules to form large carbon-based molecules. [2.3.a, 2.3.b, 2.3.c]
PG 6.	**Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding of how living systems interact with the biotic and abiotic environment.**			
GLE 2.4, 2.5, 2.6, 2.7	Process routine information to identify one or more factors affecting the scale of biodiversity, populations, or carrying capacities of ecosystems. [2.4.a, 2.4.b]	Use provided mathematical representations to support familiar explanations of factors affecting the scale of biodiversity, populations, or carrying capacities of ecosystems. [2.4.a, 2.4.b]	Use mathematical and computational representations as referenced in the EO to support and revise straightforward explanations of factors such as boundaries, resources, climate, and competition affecting scales and proportions of biodiversity, populations, and carrying capacities of ecosystems. [2.4.a, 2.4.b]	Use, develop, and combine mathematical and computational representations, including and beyond those referenced in the EO, to support and revise novel explanations of factors such as boundaries, resources, climate, and competition affecting scales and proportions of biodiversity, populations, and carrying capacities of ecosystems. [2.4.a, 2.4.b]

Life Science				
	Partially Met Expectations	**Approached Expectations**	**Met Expectations**	**Exceeded Expectations**
	Label, with varying degrees of success, familiar models of ways that matter cycles and flows among organisms in an ecosystem. Use simple models showing the importance of photosynthesis or cellular respiration as important to the cycling of matter or energy. **OR** Describe the importance of photosynthesis or cellular respiration to the cycling of matter or energy in an ecosystem. [2.5.a, 2.5.b, 2.5.c]	Use models and communicate familiar explanations of ways that matter cycles and flows among organisms in an ecosystem with aerobic conditions, including the importance of photosynthesis and cellular respiration to various matter and energy cycles in an ecosystem. [2.5.a, 2.5.b, 2.5.c]	Develop models, construct and revise explanations, and use mathematical representations to perform routine sense-making of ways that matter cycles and flows among organisms in an ecosystem, in aerobic and anaerobic conditions, and, in the form of carbon that is cycled by photosynthesis and cellular respiration, among Earth's systems (i.e., the atmosphere, hydrosphere, biosphere, and geosphere). [2.5.a, 2.5.b, 2.5.c]	Analyze nonintuitive relationships between models, construct and revise original explanations that make use of multiple science ideas, and use mathematical representations to perform complex sense-making of ways that matter cycles and flows among Earth's systems (i.e., the atmosphere, hydrosphere, biosphere, and geosphere) and among organisms in conventional ecosystems (aerobic and anaerobic conditions, carbon cycled by photosynthesis and cellular respiration), or unusual ones (e.g., chemosynthetic). [2.5.a, 2.5.b, 2.5.c]
	Describe evidence that specific conditions are a necessary part of the normal state of an ecosystem. **OR** Identify one or more changing conditions that might affect the stability of a familiar ecosystem. [2.6.a]	Describe evidence that the normal state of an ecosystem is one of stability and identify one or more changing conditions that might result in a new ecosystem. [2.6.a]	Use reasoning to connect multiple routine ideas when making and evaluating claims about how complex interactions among organisms promote stability in an ecosystem, and how changing conditions, including those referenced in the EO, can result in a new ecosystem. [2.6.a]	Use reasoning to connect multiple unfamiliar ideas when making and evaluating claims about how complex interactions among organisms promote stability in and between ecosystems, and how changing conditions, including conditions not referenced in the EO, can result in a new ecosystem. [2.6.a]

<table>
<tr><th colspan="5">Life Science</th></tr>
<tr><th></th><th>Partially Met Expectations</th><th>Approached Expectations</th><th>Met Expectations</th><th>Exceeded Expectations</th></tr>
<tr><td></td><td>Describe the usefulness of science ideas in designing solutions to reduce environmental effects of human activity.
OR
Identify changes to the environment caused by human activity.
[2.6.b]</td><td>Reproduce well-known solutions to reduce changes to the environment caused by human activity.
[2.6.b]</td><td>Design, evaluate, and revise common solutions to reduce changes to the environment and biodiversity caused by human activities such as those referenced in the EO.
[2.6.b]</td><td>Design, evaluate, and revise original solutions to reduce changes to the environment and biodiversity caused by human activities not referenced in the EO.
[2.6.b]</td></tr>
<tr><td></td><td>Describe evidence of group behavior having an important influence on the survival of individuals and species.
OR
Describe group behavior as an important cause of individual and species success in survival and reproduction.
[2.7.a]</td><td>Describe evidence of group behavior as an important cause of individual and species success in survival and reproduction.
[2.7.a]</td><td>Evaluate evidence from contexts such as those referenced in the EO that group behavior has a cause and effect relationship with individual success and species success in survival and reproduction.
[2.7.a]</td><td>Evaluate evidence from contexts not referenced in the EO that group behavior has a cause and effect relationship with individual success and species success in survival and reproduction and predict the effects of such behaviors across a variety of contexts.
[2.7.a]</td></tr>
<tr><td>PG 7.</td><td colspan="4">Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how genetic and environmental factors influence variation of organisms across generations.</td></tr>
<tr><td>GLE. 2.8</td><td>Ask questions about the importance of DNA and chromosomes in the passing of characteristic traits from parents to offspring.
OR
Describe how characteristic traits pass from parents to offspring because of DNA and chromosomes.
[2.8.a]</td><td>Ask questions and relate basic, familiar details about the causal role of DNA and chromosomes in the passing of characteristic traits from parents to offspring.
[2.8.a]</td><td>Ask questions about examples of trait expression and inheritance to clarify the causal role of DNA and chromosomes in the expression of characteristic traits and their passing from parents to offspring.
[2.8.a]</td><td>Ask questions about examples of trait expression and inheritance to clarify the causal role of DNA and chromosomes in the expression of characteristic traits and their passing from parents to offspring.
Use science ideas to creatively question the difference between cause and correlation in examples of inheritance of traits across generations.
[2.8.a]</td></tr>
</table>

PG 8.	Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding of how natural selection drives biological evolution, accounting for the unity and diversity of organisms.			
GLE 2.9, 2.10, 2.11, 2.12, 2.13	Describe, with varying degrees of success, the probability that advantageous heritable traits increase within a population. **OR** Describe how advantageous and disadvantageous heritable traits vary in proportion within a population. [2.9.a, 2.11.b]	Follow explicit procedures to apply concepts of statistics and probability to support familiar, well-practiced explanations of the tendency of advantageous heritable traits to increase in proportion within a population. [2.9.a, 2.11.b]	With scaffolding, apply concepts of statistics and probability to support explanations of patterns in variation and distribution of expressed traits in a population and the tendency of advantageous heritable traits to increase in proportion within that distribution. [2.9.a, 2.11.b]	Independently select and use concepts of statistics and probability to analyze to create explanations of patterns in variation and distribution of expressed traits in a population based on genetic and environmental factors, and the tendency of advantageous heritable traits to increase in proportion within that distribution. [2.9.a, 2.11.b]
	Identify simple evidence of one or more sources of genetic variation (e.g., genetic recombination during meiosis or mutations). **OR** Describe genetic variation as being caused by one or more sources (e.g., genetic recombination during meiosis or mutations). [2.9.b]	Describe familiar examples and identify empirical evidence in support of cause and effect relationships regarding one or more sources of genetic variation (e.g., genetic recombination during meiosis and mutations). [2.9.b]	Make and defend familiar claims of cause and effect, based on typical empirical evidence, regarding the sources of inheritable genetic variation (i.e., genetic recombination during meiosis, viable errors during replication, and mutations caused by external factors). [2.9.b]	Make and defend original claims of cause and effect, based on complex or multisource empirical evidence, regarding the sources of genetic variation (i.e., genetic recombination during meiosis, viable errors during replication, and mutations caused by a variety of specific external factors). [2.9.b]
	Define the rough outlines of either common ancestry or biological evolution. **OR** Identify patterns in common ancestry or biological evolution. [2.10.a]	Communicate basic, well-practiced summaries of patterns in common ancestry and biological evolution. [2.10.a]	Communicate patterns from multiple lines of routine scientific information in support of common ancestry and biological evolution. [2.10.a]	Obtain, analyze, and communicate patterns from multiple lines of unfamiliar scientific information to evaluate a variety of media regarding common ancestry and biological evolution to distinguish valid scientific claims from nonscientific ones. [2.10.a]

	Describe evolution as a process that explains why different species are alive now than were alive in the past. **OR** Identify evolution as a cause of changes in the variety of different species alive in the past and present. [2.11.a]	List one or more causal factors in the evolutionary process (competitive advantage of adaptive traits and their role in the survival, reproduction, and proliferation of individuals and species that carry them). [2.11.a]	Construct an evidence-based explanation of the primary causal factors in the evolutionary process (competitive advantage of adaptive traits and their role in the survival, reproduction, and proliferation of individuals and species that carry them). [2.11.a]	Construct an evidence-based explanation of the primary causal factors in the evolutionary process (competitive advantage of adaptive traits and their role in the survival, reproduction, and proliferation of individuals and species that carry them), as well as unique situational factors in nontypical contexts. [2.11.a]
	Identify natural selection as a cause of adaptation in populations. Identify extinction as a possible effect of the endangerment of species. [2.12.a, 2.12.b]	Relate a simple explanation of natural selection as a cause of adaptation in populations. Relate familiar evidence of how environmental conditions cause population increase or decrease and can affect extinction and emergence of species. [2.12.a, 2.12.b]	Explain or evaluate the evidence supporting claims about examples referenced in the EOs that changes in environmental conditions can cause population increase or decrease, extinction of existing species, adaptations of populations, or emergence of new species through the process of natural selection. [2.12.a, 2.12.b]	Explain or evaluate scientific information about changes in environmental conditions and predict their likely effects on population increase or decrease, extinction of existing species, adaptations of populations, or emergence of new species through the process of natural selection, including examples not referenced in the EOs. [2.12.a, 2.12.b]
	Use numbers to compare organism populations before and after the advent of a particular human activity. **OR** Identify human activity as a possible cause of decreased organism populations. [2.13.a]	Use a simple simulation to explore numerical outcomes of solutions related to endangered species. Identify human activity as a possible cause of decreased biodiversity. [2.13.a]	Propose or use revisions to simulations to test proposed solutions to straightforward problems of threatened or endangered species or biodiversity impacts caused by human activity. [2.13.a]	Create or revise simulations to test proposed solutions to complex problems of threatened or endangered species or of biodiversity impacts caused by human activity. [2.13.a]

Earth and Space Science				
	Partially Met Expectations	**Approached Expectations**	**Met Expectations**	**Exceeded Expectations**
PG 9.	**Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding the universe and Earth's place in it.**			
GLE. 3.1, 3.2, 3.3	Label portions of basic models and identify stars as sources of different forms of matter (elements) and energy (radiation). [3.1.a, 3.1.c]	Use familiar models and reproduce basic scientific ideas about the way nuclear fusion occurring in stars transforms atoms to produce different forms of matter (elements), as well as energy in the form of radiation. [3.1.a, 3.1.c]	Use evidence as referenced in the EO to develop appropriately scaled models and communicate routine scientific ideas about the way nuclear fusion, occurring in the cores of stars over their life cycles, transforms atoms to produce different forms of matter (elements), as well as energy that eventually reaches Earth in the form of radiation. [3.1.a, 3.1.c]	Use evidence not referenced in the EO to create, use, and evaluate appropriately scaled models and communicate sophisticated scientific ideas about the impact of star type and stage on the way stellar nuclear fusion transforms atoms to produce different forms of matter (elements), as well as energy that eventually reaches Earth in the form of radiation. [3.1.a, 3.1.c]
	Outline, with varying degrees of success, the major components of the Big Bang theory. **OR** Relate the Big Bang theory to the origins of matter and energy. [3.1.b]	List one or more pieces of common astronomical evidence (light spectra, motion of distant galaxies, and composition of matter in the universe) known to support an explanation of the Big Bang theory. [3.1.b]	Connect astronomical evidence, as referenced in the EO, of light spectra, motion of distant galaxies, and composition of matter in the universe to construct an explanation of the Big Bang theory. [3.1.b]	Connect astronomical evidence not referenced in the EO (including but not limited to light spectra, motion of distant galaxies, and composition of matter in the universe) to construct an explanation of the Big Bang theory or to explain and compare related phenomena and hypotheses (e.g., dark matter, heat death of the universe). [3.1.b]

Earth and Space Science				
	Partially Met Expectations	**Approached Expectations**	**Met Expectations**	**Exceeded Expectations**
	Identify the motion of objects in the solar system as repeating orbital patterns that scientists use mathematics to describe. **OR** Use simple models to show the proportions of orbital patterns in the solar system. [3.2.a]	Describe the motion of orbiting objects in the solar system as being calculable through mathematical or computational representations, including simple proportions of solar system phenomena. [3.2.a]	Predict the orbital motion of solar system objects referenced in the EO using well-practiced mathematical or computational representations, including algebraic thinking about the proportions of solar system phenomena. [3.2.a]	Predict the orbital motion of solar system objects not referenced in the EO using mathematical or computational representations, including algebraic thinking about the proportions of solar system phenomena. [3.2.a]
	Relate one or more familiar explanations or claims of Earth's formation and early history (e.g., the ages of crustal rocks). **OR** Discuss patterns or changes from Earth's formation and early history (e.g., the ages of crustal rocks). [3.3.a, 3.3.b] Relate a rudimentary explanation of the theory of plate tectonics and communicate examples of related empirical evidence gathered by scientists. **OR** Identify patterns and examples of changes in ancient Earth materials and past and current movements of continental and oceanic crust). [3.3.a, 3.3.b]	Identify familiar aspects of Earth's formation and early history, including the ages of crustal rocks, as examples of stability or change. Relate well-practiced explanations of the theory of plate tectonics and describe unsophisticated patterns in empirical evidence such as ancient Earth materials and past and current movements of continental and oceanic crust. [3.3.a, 3.3.b]	Engage in routine sense-making about concepts of stability and change to explain or support claims about familiar ways that Earth's formation and early history, including the ages of crustal rocks, can be reconstructed and explained through use of scientific ideas such as the theory of plate tectonics and patterns in empirical evidence as referenced in the EO. [3.3.a, 3.3.b]	Combine multiple science ideas while engaging in complex sense-making about concepts of stability and change to explain or support claims about Earth's formation and early history, the ages of crustal rocks, the theory of plate tectonics and patterns in empirical evidence not referenced in the EO. [3.3.a, 3.3.b]
PG. 10	**Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.**			
GLE. 3.4, 3.5, 3.6, 3.7,	Label simple models of Earth's internal processes (e.g., thermal convection) and surface processes (e.g., effects of water), and	Use models to illustrate straightforward, previously developed ideas of how Earth's internal processes (e.g.,	Use models as referenced in the EO to illustrate how Earth's internal processes (e.g., cycling	Develop models not referenced in the EO to illustrate how Earth's internal processes (e.g., cycling of matter by

Earth and Space Science				
	Partially Met Expectations	**Approached Expectations**	**Met Expectations**	**Exceeded Expectations**
3.8	relate the fact that continental and ocean-floor features developed over time. **OR** Describe cycling of matter by internal and surface processes and describe continental and ocean-floor features as having changed over time. [3.4.a, 3.4.c, 3.5.a, 3.5.b]	cycling of matter by thermal convection) and surface processes (e.g., effects of water) operate to form continental and ocean-floor features. [3.4.a, 3.4.c, 3.5.a, 3.5.b]	of matter by thermal convection) and surface processes (e.g., effects of water) form continental and ocean-floor features that experience stability and change at different spatial and temporal scales. [3.4.a, 3.4.c, 3.5.a, 3.5.b]	thermal convection) and surface processes (e.g., effects of water) form continental and ocean-floor features that experience stability and change at different spatial and temporal scales. [3.4.a, 3.4.c, 3.5.a, 3.5.b]
	Interpret simple data on Earth's surface or systems. OR Identify one or more causes of changes to Earth's surface or systems. [3.4.b, 3.7.a] Label or use simple models related to climate or the flow of energy into and out of Earth's systems. OR Describe climate as subject to changes caused by energy flow. [3.4.d, 3.7.b]	Use simple data or models to illustrate one or more changes to Earth's surface that cause changes to other Earth systems, including the effect of energy flow on climate. [3.4.b, 3.4.d, 3.7.a, 3.7.b]	Use models, tools, and data, including those referenced in the EO, about how one change to Earth's surface can create feedbacks that cause changes to other Earth systems, such as changes in climate caused by the flow of energy into and out of Earth's systems. [3.4.b, 3.4.d, 3.7.a, 3.7.b]	Use models, tools, and data not referenced in the EO about how changes to Earth's surface can cause complex, interrelated feedbacks with other Earth systems, such as changes in climate caused by the flow of energy into and out of Earth's systems. [3.4.b, 3.4.d, 3.7.a, 3.7.b]
	With varying degrees of success, use simple procedural or mechanical science skills during investigations of the unique properties of water and how it shapes Earth materials. OR Describe one or more unique properties of water and relate them to its function in shaping Earth structures. [3.6.a]	Following explicit procedures, conduct investigations of the unique properties of water and its function in shaping Earth structures and materials. [3.6.a]	Plan and conduct investigations of the unique properties of water and its function in shaping Earth structures and materials, as referenced in the EO. [3.6.a]	Plan and conduct investigations of the unique properties of water and its function in shaping Earth structures and materials, including examples not referenced in the EO. [3.6.a]

	Identify a model as showing biological, geological, or chemical cycling. Relate a basic claim that both Earth's systems and life on Earth have changed and evolved over time. [3.7.c, 3.7.d, 3.8.a]	Use familiar models of biogeochemical cycling of matter. Relate a claim or supporting evidence of Earth's systems and life on Earth having simultaneously changed over time in a process of coevolution. [3.7.c, 3.7.d, 3.8.a]	Connect science ideas such as those referenced in the EO to construct models and evidence-based arguments about stability and change in biogeochemical cycling of matter and feedbacks, as well as their impacts on the simultaneous coevolution of Earth's systems and life on Earth. [3.7.c, 3.7.d, 3.8.a]	Connect science ideas not referenced in the EO to construct models and evidence-based arguments about stability and change in biogeochemical cycling of matter and feedbacks, as well as their impacts on the simultaneous coevolution of Earth's systems and life on Earth. [3.7.c, 3.7.d, 3.8.a]

PG. 11	Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how human activities and the Earth's surface processes interact.			
GLE 3.9, 3.10, 3.11, 3.12	Communicate an understanding that availability of natural resources, occurrences of natural hazards, and changes in climate have affected human activity. Identify fundamental relationships among Earth systems. [3.9.a, 3.10.a, 3.12.b]	Relate familiar explanations about ways that availability of natural resources, occurrences of natural hazards, and changes in climate have affected human activity. Communicate limited, routine descriptions of relationships among Earth systems. [3.9.a, 3.10.a, 3.12.b]	Construct straightforward explanations to illustrate how availability of key natural resources, occurrences of natural hazards, and changes in climate (including the examples of each referenced in the EO) have affected human activity. [3.9.a, 3.10.a]	Construct complex explanations to illustrate how availability of natural resources, occurrences of natural hazards, and changes in climate (including examples not referenced in the EO) have affected human activity. [3.9.a, 3.10.a]
	Summarize one or more commonplace solutions for issues of energy and mineral resources, or for reducing impacts of human activities on nature. Describe resource use as affecting environmental systems and identify examples of related environmental changes. [3.9.b, 3.11.a, 3.11.b]	Relate commonplace solutions for developing, managing, and utilizing energy and mineral resources, or for reducing impacts of human activities on natural systems. Describe resource use as affecting sustainability of human populations and biodiversity and relate that some system changes are irreversible. [3.9.b, 3.11.a, 3.11.b]	Within the scope of examples referenced in the EO, use provided evidence to evaluate solutions for developing, managing, and utilizing energy and mineral resources, or for reducing impacts of human activities on natural systems, based on familiar cost-benefit ratios, including computational simulations of sustainability of human populations, biodiversity, and an understanding that some system changes are irreversible. [3.9.b, 3.11.a, 3.11.b]	For phenomena not referenced in the EO, connect scientific ideas and evidence to evaluate, refine, or propose novel solutions for developing, managing, and utilizing energy and mineral resources, or for reducing impacts of human activities on natural systems, based on complex cost-benefit ratios, including computational simulations of sustainability of human populations, biodiversity, and an understanding that some system changes are irreversible. [3.9.b, 3.11.a, 3.11.b]