Eighth Grade

South Carolina eighth-grade students engage in thinking and solving problems the way scientists and engineers do to help them better see how science is relevant to their lives. To capitalize on the natural curiosity all students have about the world around them, learning experiences are built around the three dimensions of science: **Science and Engineering Practices (SEPs)**, **Crosscutting Concepts (CCCs)**, and **Disciplinary Core Ideas (DCIs)**. This three-dimensional approach to teaching and learning helps educators provide meaningful learning experiences that offer varied entry points for students from diverse backgrounds.

The **performance expectations** in eighth grade help students engage in inquiry questions such as, **but not limited to:**

How can one describe physical interactions between objects and within systems of objects? Students apply Newton's third law of motion to related forces to explain the motion of objects colliding. Students also construct arguments, and analyze and interpret data on gravitational, electrical, and magnetic forces to explain a variety of phenomena including ideas about why some materials attract each other while others repel. Students investigate and evaluate evidence that objects exert force even without contact.	**How has life changed throughout Earth's history?** Students analyze and interpret data for patterns in how the fossil record documents Earth's history with existence, diversity, extinction and changing of life forms as well as construct an explanation for similarities and differences in modern day and ancestral organisms.
What are the characteristic properties of waves and how can they be used? Students describe characteristic properties of a wave and the behavior related to energy. Students communicate evidence that digital devices use waves to transmit information.	**How do organisms grow, develop, and reproduce?** Students explain based on evidence and reasoning how genetic factors, the environment, and an organism's behaviors and structures influence its growth, development, and reproduction.
How do changes to genes affect an organism? Students describe how genetic changes can affect the structure and function of an organism.	**How does the energy of an object change related to its mass, speed, and position in a system?** Students investigate for evidence that an object's motion depends on mass and sum of forces.
How does genetic variation among organisms in a species affect survival and reproduction? How does the environment and humans influence genetic traits in populations over multiple generations? Students use information and begin constructing an explanation of genetic variation in natural selection and how this leads to traits in a population changing.	**What is Earth's place in the Universe? What makes up our solar system and how can the motion of Earth explain seasons and eclipses?** Students describe Earth's place in relation to the solar system, Milky Way galaxy and universe, and evaluate information on scale properties of objects.

***The PEs should be bundled to design classroom experiences. There are multiple ways to bundle the PEs to help students lead inquiry and see connections between ideas, and help teachers facilitate phenomenon-driven learning with efficient use of instructional time.**

Eighth Grade

Through the eighth-grade performance expectations, students demonstrate grade-appropriate proficiency in each of three dimensions. When students explore **Disciplinary Core Ideas** (Dimension 3), they will do so by engaging in **Science and Engineering Practices** (Dimension 1) and should be supported in making connections to the **Crosscutting Concepts** (Dimension 2) to link their understanding across the four disciplinary core domains.

Each performance expectation contains one **SEP** and one **CCC** to be assessable and represents the student performance goal for the end of instruction; however, other **SEPs** and **CCCs** should be applied by students to support their progress leading up to the end of instruction. In eighth grade, these **end-of-instruction** **SEPs**, **DCIs**, and **CCCs** include:

SEPs	DCIs	CCCs
• Developing and Using Models • Planning and Carrying Out Investigations • Analyzing and Interpreting Data • Using mathematics and Computational Thinking • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • Obtaining, Evaluating, and Communicating Information	• Physical Science (PS2, PS4) • Life Science (LS1, LS3, LS4) • Earth and Space Science (ESS1, ESS2) • Engineering, Technology, and Applications of Science (ETS1, ETS2)	• Patterns • Cause and Effect • Scale, Proportion, and Quantity • Systems and System Models • Structure and Function • Stability and Change

Hyperlinks within the Standards Document

SC Conceptual Vertical Articulation links: Hover over the above underlined and hyperlinked titles to view links for all SEPs, DCIs, and CCCs.

A Framework for K-12 Science Education links: Hover over titles found within the foundation boxes under each PE to link the guiding research for all SEPs, DCIs, and CCCs.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in K-2 builds on prior experiences and progresses to collecting, recording, and sharing observations. Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. NRC Framework Link	**LS1.C: Organization for Matter and Energy Flow in Organisms** All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. NRC Framework Link	**Patterns** Patterns in the natural and human designed world can be observed and used as evidence. NRC Framework Link

*Equity in science education requires that all students are provided with equitable opportunities to learn science and become engaged in science and engineering practices; with access to quality space, equipment, and teachers to support and motivate that learning and engagement; and adequate time spent on science. In addition, the issue of connecting to students' interests and experiences is particularly important for broadening participation in science (NRC Framework, p. 28).

Motion and Stability: Forces and Interactions (PS2) 8

8-PS2-1. Apply Newton's third law to design a solution to a problem involving the motion of two colliding objects.

***Clarification Statement**: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.*
***State Assessment Boundary**: Assessment is limited to vertical or horizontal interactions in one dimension.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Apply scientific ideas, principles, to design an object, tool, process, or system. NRC Framework Link	**PS2.A: Forces and Motion** For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). NRC Framework Link **ETS1.B: Developing Possible Solutions** A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. NRC Framework Link (continued on next page)	**Systems and System Models** Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. NRC Framework Link

	ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. *(secondary)* NRC Framework Link	

Motion and Stability: Forces and Interactions (PS2)

8

8-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Clarification Statement: *Emphasis is on balanced (Newton's first law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's second law), frame of reference, and specification of units.*
State Assessment Boundary: *Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions. Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many examples of data are needed to support a claim. NRC Framework Link	**PS2.A: Forces and Motion** The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change (inertia). The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. The positions of objects and the directions of forces and motions must be described using a qualitative comparison and scalar quantities. In order to share information with other people, a reference frame must also be shared. NRC Framework Link	**Stability and Change** Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. NRC Framework Link

Motion and Stability: Forces and Interactions (PS2)

8

8-PS2-3. Analyze and interpret data to determine the factors that affect the strength of electric and magnetic forces.

Clarification Statement: *Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.*
State Assessment Boundary: *Assessment is limited to data examples using proportional reasoning and algebraic thinking, rather than mathematical computations.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Analyze displays of data to identify linear and nonlinear relationships. NRC Framework Link	**PS2.B: Types of Interactions** Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. NRC Framework Link	**Cause and Effect** Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. NRC Framework Link

Motion and Stability: Forces and Interactions (PS2)

8-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects and the distance between them.

Clarification Statement: *Examples of evidence for arguments could include data generated from simulations or digital tools, and charts displaying mass, strength of interaction, distance between objects, and orbital periods of objects within the solar system.*
State Assessment Boundary: *Assessment does not include Newton's law of gravitation or Kepler's laws.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence Engaging in argument from evidence in 6-8 builds from K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. NRC Framework Link	**PS2.B: Types of Interactions** The magnitude of the gravitational force depends on the masses and distances between interacting objects. Long-range gravitational interactions govern the evolution and maintenance of large-scale structures in the universe and the patterns of motion within them. NRC Framework Link	**Systems and System Models** Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. NRC Framework Link

Motion and Stability: Forces and Interactions (PS2)

8

8-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

Clarification Statement*: Examples of this phenomenon could include the interactions of magnets and electrically charged objects. Examples of investigations could include first-hand experiences or simulations.*
State Assessment Boundary: *Assessment is limited to electric and magnetic fields and limited to qualitative evidence for the existence of fields.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. NRC Framework Link	**PS2.B: Types of Interactions** Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be illustrated by their effect on a test object (a charged object, or a ball, respectively). NRC Framework Link	**Cause and Effect** Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. NRC Framework Link

Waves and Their Applications in Technologies for Information Transfer (PS4)		
8-PS4-1. Using mathematical representations, describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. ***Clarification Statement:*** *Emphasis is on describing waves with both qualitative and quantitative thinking.* ***State Assessment Boundary:*** *Assessment does not include electromagnetic waves and is limited to standard repeating waves. Assessment does not include relationships between the speed of waves and their frequency or wavelength.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Using Mathematics and Computational Thinking Mathematical and computational thinking at the 6-8 level builds on K-5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments. Use mathematical representations to describe and/or support scientific conclusions and design solutions. NRC Framework Link	**PS4.A: Wave Properties** A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. NRC Framework Link	**Patterns** Graphs and charts can be used to identify patterns in data. NRC Framework Link

Waves and Their Applications in Technologies for Information Transfer (PS4)		
8-PS4-3. Communicate information to support the claim that digital devices are used to improve our understanding of how waves transmit information. ***Clarification Statement:*** *Emphasis is on a basic understanding that waves can be used for communication purposes and digitized signals are a more reliable way to encode and transmit information than analog. When in digitized form, information can be recorded, stored for future recovery, and transmitted over long distances without significant degradation. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in Wi-Fi devices, and conversion of stored binary patterns to make sound or text on a computer screen.* ***State Assessment Boundary:*** *Assessment does not include binary counting nor the specific mechanism of any given device.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 6-8 builds on K-5 and progresses to evaluating the merit and validity of ideas and methods. Integrate qualitative scientific and technical information in different forms of text that are contained in media and visual displays to clarify claims and findings. NRC Framework Link	**PS4.C: Information Technologies and Instrumentation** Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. NRC Framework Link **ETS2.B: Influence of Science, Engineering, and Technology on Society and the Natural World** Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. NRC Framework Link	**Structure and Function** Structures can be designed to serve particular functions. NRC Framework Link

From Molecules to Organisms: Structures and Processes (LS1)

8

8-LS1-4. Use arguments, based on empirical evidence and scientific reasoning, to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

Clarification Statement: *Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence Engaging in argument from evidence in 6-8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. NRC Framework Link	**LS1.B: Growth and Development of Organisms** Animals engage in characteristic behaviors that increase the odds of reproduction. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. NRC Framework Link	**Cause and Effect** Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. NRC Framework Link

From Molecules to Organisms: Structures and Processes (LS1) 8		
8-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. ***Clarification Statement:*** *Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include how drought or flooding affects plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.* ***State Assessment Boundary:*** *Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. NRC Framework Link	**LS1.B: Growth and Development of Organisms** Genetic factors as well as local conditions affect the growth of the adult plant. The growth of an animal is controlled by genetic factors, food intake, and interactions with other organisms, and each species has a typical adult size range. NRC Framework Link	**Cause and Effect** Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. NRC Framework Link

Heredity: Inheritance and Variation of Traits (LS3)

8-LS3-1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

Clarification Statement: *Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.*
State Assessment Boundary: *Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena. NRC Framework Link	**LS3.A: Inheritance of Traits** Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. NRC Framework Link **LS3.B: Variation of Traits** In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. NRC Framework Link	**Structure and Function** Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. NRC Framework Link

Heredity: Inheritance and Variation of Traits (LS3)

8

8-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

Clarification Statement: *Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause-and-effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.*
State Assessment Boundary: *Assessment should be limited to Punnett squares of monohybrid cross.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena. NRC Framework Link	**LS1.B: Growth and Development of Organisms** Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. *(secondary)* NRC Framework Link **LS3.A: Inheritance of Traits** Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. NRC Framework Link **LS3.B: Variation of Traits** In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. In asexual reproduction, an organism's DNA is replicated and passed to its offspring creating a genetic copy of the parent. NRC Framework Link	**Cause and Effect** Cause-and-effect relationships may be used to predict phenomena in natural systems. NRC Framework Link

Biological Evolution: Unity and Diversity (LS4)

8-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operated in the past as they do today.

Clarification Statement: *Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.*
State Assessment Boundary: *Assessment does not include the names of individual species or geological eras in the fossil record.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Analyze and interpret data to determine similarities and differences in findings. NRC Framework Link	**LS4.A: Evidence of Common Ancestry and Diversity** The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. NRC Framework Link **ESS2.E: Biogeology** Sudden changes in conditions (e.g., meteor impacts, major volcanic eruptions) have caused mass extinctions, but these changes, as well as more gradual ones, have ultimately allowed other life forms to flourish. *(secondary)* NRC Framework Link	**Patterns** Graphs, charts, and images can be used to identify patterns in data. NRC Framework Link

Biological Evolution: Unity and Diversity (LS4) 8		
8-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer their ancestral relationships. ***Clarification Statement:*** *Emphasis is on explanations of the ancestral relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.* ***State Assessment Boundary:*** *Assessment of comparisons is limited to gross appearance of anatomical structures.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. NRC Framework Link	**LS4.A: Evidence of Common Ancestry and Diversity** Anatomical similarities and differences among modern organisms and between modern and fossil organisms in the fossil record enable the reconstruction of the history and the inference of lines of ancestral relationships. NRC Framework Link	**Patterns** Patterns can be used to identify cause-and-effect relationships. NRC Framework Link

Biological Evolution: Unity and Diversity (LS4) 8		
8-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individual's probability of surviving and reproducing in a specific environment. ***Clarification statement:*** *In a specific environment impacted by different factors, some traits provide advantages that make it more probable that an organism will be able to survive and reproduce there.* ***State Assessment boundary:*** *Assessment is limited to using simple probability statements and proportional reasoning to construct explanations.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. NRC Framework Link	**LS4.B: Natural Selection** Natural selection leads to the predominance of certain traits in a population, and the suppression of others. NRC Framework Link	**Cause and Effect** Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. NRC Framework Link

Biological Evolution: Unity and Diversity (LS4)

8-LS4-5. Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.

Clarification Statement: *Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and on the impacts these technologies have on society and scientific discoveries.*
State Assessment Boundary: *Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods. Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. NRC Framework Link	**LS4.B: Natural Selection** In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. NRC Framework Link **ETS2.A: Interdependence of Science, Engineering, and Technology** Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. NRC Framework Link	**Cause and Effect** Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. NRC Framework Link

Biological Evolution: Unity and Diversity (LS4)		
8-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. ***Clarification Statement:*** *Emphasis on student explanation of trends in data using mathematical models, probability statements, and proportional reasoning to support explanations of trends of population changes.* ***State Assessment Boundary:*** *Assessment does not include Hardy Weinberg calculations.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Using Mathematics and Computational Thinking Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments. Use mathematical representations to support scientific conclusions and design solutions. NRC Framework Link	**LS4.C: Adaptation** Adaptation by natural selection occurring over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not, become less common. Thus, the distribution of traits in a population changes. NRC Framework Link	**Cause and Effect** Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. NRC Framework Link

Earth's Place in the Universe (ESS1) 8		
8-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, tides, and seasons. ***Clarification Statement:*** *Examples of models can be physical, graphical, or conceptual.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Developing and Using Models Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena. NRC Framework Link	**ESS1.A: The Universe and Its Stars** Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. NRC Framework Link **ESS1.B: Earth and the Solar System** This model of the solar system can explain tides (including spring and neap), eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. NRC Framework Link	**Patterns** Patterns can be used to identify cause- and-effect relationships. NRC Framework Link

Earth's Place in the Universe (ESS1) 8

8-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

Clarification Statement*: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).*
State Assessment Boundary: *Assessment does not include Kepler's laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena. NRC Framework Link	**ESS1.A: The Universe and Its Stars** Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. NRC Framework Link **ESS1.B: Earth and the Solar System** The solar system consists of the sun, planets, their moons, and other celestial objects that are held in orbit around the sun by its gravitational pull on them. The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. NRC Framework Link	**Systems and System Models** Models can be used to represent systems and their interactions. NRC Framework Link

Earth's Place in the Universe (ESS1)

8

8-ESS1-3. Evaluate information to determine scale properties of objects in the solar system.

Clarification Statement: *Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of a celestial object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.*
State Assessment Boundary*: Assessment does not include recalling facts about properties of the planets and other solar system bodies.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods. Integrate qualitative and/or quantitative scientific and/or technical information in text with that contained in media and visual displays to clarify claims and findings. NRC Framework Link	**ESS1.B: Earth and the Solar System** The solar system consists of the sun, planets, their moons, and other celestial objects that are held in orbit around the sun by its gravitational pull on them. NRC Framework Link **ETS2.A: Interdependence of Science, Engineering, and Technology** Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. NRC Framework Link	**Scale, Proportion, and Quantity** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. NRC Framework Link