Cognia Science Alternate Assessment

Elementary Grade-Level Standards and Extended Performance Expectations (EPEs) for Maine Department of Education

FINAL

December 2019

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NGSS Performance Expectation 3-ESS2-1	
3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. [Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]	
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.
Disciplinary Core Ideas (DCI)	**ESS2.D: Weather and Climate** ● Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.
Crosscutting Concepts (CCC)	**Patterns** ● Patterns of change can be used to make predictions.

Extended Performance Expectation 3-ESS2-1			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	3-ESS2-1.1 Use observations to describe weather conditions.	**3-ESS2-1.2** Use tables or graphical displays of data to describe patterns of typical weather conditions in a particular season.	**3-ESS2-1.3** Use tables and/or graphical displays of data to predict patterns of typical weather conditions for a particular season.
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. **Supporting:** **Planning and Carrying Out Investigations**		
Disciplinary Core Ideas (DCI)	**ESS2.D: Weather and Climate** ● Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.		
Crosscutting Concepts (CCC)	**Patterns** ● Patterns of change can be used to make predictions.		

NGSS Performance Expectation 3-LS3-1	
3-LS3-1 Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]	
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** ● Analyze and interpret data to make sense of phenomena using logical reasoning.
Disciplinary Core Ideas (DCI)	**LS3.A: Inheritance of Traits** ● Many characteristics of organisms are inherited from their parents. **LS3.B: Variation of Traits** ● Different organisms vary in how they look and function because they have different inherited information.
Crosscutting Concepts (CCC)	**Patterns** ● Similarities and differences in patterns can be used to sort and classify natural phenomena.

Extended Performance Expectation 3-LS3-1			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	3-LS3-1.1 Use media (e.g., drawings, photographs) to identify or show pairs of parents and their offspring.	**3-LS3-1.2** Use observations to identify patterns of similarities and differences in traits of groups of organisms (e.g., parents and their offspring, siblings, populations of similar organisms).	**3-LS3-1.3** Use data to show that plants and animals inherit traits from their parents, and that there are differences in these traits in groups of similar organisms.
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** ● Analyze and interpret data to make sense of phenomena using logical reasoning. **Supporting: Obtaining, Evaluating, and Communicating Information**		
Disciplinary Core Ideas (DCI)	**LS3.A: Inheritance of Traits** ● Many characteristics of organisms are inherited from their parents. **LS3.B: Variation of Traits** ● Different organisms vary in how they look and function because they have different inherited information.		
Crosscutting Concepts (CCC)	**Patterns** ● Similarities and differences in patterns can be used to sort and classify natural phenomena.		

NGSS Performance Expectation 3-LS4-1	
3-LS4-1 Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.]	
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** ● Analyze and interpret data to make sense of phenomena using logical reasoning.
Disciplinary Core Ideas (DCI)	**LS4.A: Evidence of Common Ancestry and Diversity** ● Some kinds of plants and animals that once lived on Earth are no longer found anywhere. ● Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.
Crosscutting Concepts (CCC)	**Scale, Proportion, and Quantity** ● Observable phenomena exist from very short to very long time periods.

Extended Performance Expectation 3-LS4-1			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	3-LS4-1.1 Use text and media (e.g., drawings, diagrams, photographs) to recognize that there was life on Earth long ago.	**3-LS4-1.2** Use observations from fossils to describe plants and animals that lived long ago or compare fossils to their modern-day relatives.	**3-LS4-1.3** Use data from fossils to describe the type of environment in which the plants or animals lived long ago.
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** ● Analyze and interpret data to make sense of phenomena using logical reasoning. **Supporting:** **Obtaining, Evaluating, and Communicating Information**		
Disciplinary Core Ideas (DCI)	**LS4.A: Evidence of Common Ancestry and Diversity** ● Some kinds of plants and animals that once lived on Earth are no longer found anywhere. ● Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.		
Crosscutting Concepts (CCC)	**Scale, Proportion, and Quantity** ● Observable phenomena exist from very short to very long time periods.		

NGSS Performance Expectation 3-PS2-2	
3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.]	
Science and Engineering Practices (SEP)	**Planning and Carrying Out Investigations** ● Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
Disciplinary Core Ideas (DCI)	**PS2.A: Forces and Motion** ● The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)
Crosscutting Concepts (CCC)	**Patterns** ● Patterns of change can be used to make predictions.

Extended Performance Expectation 3-PS2-2			
	Level 1	*Level 2*	*Level 3*
	Less Complex	←→	*More Complex*
	3-PS2-2.1 Use observations or data to identify patterns in the motion of an object.	**3-PS2-2.2** Use observations or measurements of patterns of an object's motion to predict the object's future motion.	**3-PS2-2.3** Describe observations or measurements that can be made to determine predictable patterns in the motion of an object.
Science and Engineering Practices (SEP)	**Planning and Carrying Out Investigations** ● Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. **Supporting:** **Analyzing and Interpreting Data**		
Disciplinary Core Ideas (DCI)	**PS2.A: Forces and Motion** ● The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)		
Crosscutting Concepts (CCC)	**Patterns** ● Patterns in the natural and human and designed world can be observed. ● Patterns of change can be used to make predictions.		

NGSS Performance Expectation 4-LS1-1	
4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]	
Science and Engineering Practices (SEP)	**Engaging in Argument from Evidence** ● Construct an argument with evidence, data, and/or a model.
Disciplinary Core Ideas (DCI)	**LS1.A: Structure and Function** ● Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
Crosscutting Concepts (CCC)	**Systems and System Models** ● A system can be described in terms of its components and their interactions.

Extended Performance Expectation 4-LS1-1			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	4-LS1-1.1 Use a model to identify major internal or external structures of plants or animals that are used for specific functions (e.g. thorns, stems, roots, colored petals, heart, stomach, lung, brain, skin).	**4-LS1-1.2** Use data or observations to describe how internal or external structures help a plant or animal survive, grow, or reproduce.	**4-LS1-1.3** Describe the evidence that would be needed to support a claim that plants or animals have internal or external structures that function to support survival, growth, behavior, and/or reproduction.
Science and Engineering Practices (SEP)	**Engaging in Argument from Evidence** ● Construct an argument with evidence, data, and/or a model. **Supporting:** **Developing and Using Models** **Analyzing and Interpreting Data**		
Disciplinary Core Ideas (DCI)	**LS1.A: Structure and Function** ● Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.		
Crosscutting Concepts (CCC)	**Systems and System Models** ● A system can be described in terms of its components and their interactions. **Supporting:** **Structure and Function**		

NGSS Performance Expectation 4-PS3-4	
4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.* [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]	
Science and Engineering Practices (SEP)	**Constructing Explanations and Designing Solutions** ● Apply scientific ideas to solve design problems.
Disciplinary Core Ideas (DCI)	**PS3.B: Conservation of Energy and Energy Transfer** ● Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. **PS3.D: Energy in Chemical Processes and Everyday Life** ● The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. **ETS1.A: Defining Engineering Problems** ● Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary)
Crosscutting Concepts (CCC)	**Energy and Matter** ● Energy can be transferred in various ways and between objects.

Extended Performance Expectation 4-PS3-4			
	Level 1	*Level 2*	*Level 3*
	Less Complex	← →	*More Complex*
	4-PS3-4.1 Identify forms of energy present in a system.	**4-PS3-4.2** Describe the energy transfer that occurs in an everyday object or device.	**4-PS3-4.3** Identify which design or improvement will work best to transfer energy from one form to another.
Science and Engineering Practices (SEP)	**Constructing Explanations and Designing Solutions** ● Apply scientific ideas to solve design problems.		
Disciplinary Core Ideas (DCI)	**PS3.B: Conservation of Energy and Energy Transfer** ● Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. **PS3.D: Energy in Chemical Processes and Everyday Life** ● The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. **ETS1.A: Defining Engineering Problems** ● Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary)		
Crosscutting Concepts (CCC)	**Energy and Matter** ● Energy can be transferred in various ways and between objects.		

NGSS Performance Expectation 5-ESS1-2	
5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.][*Assessment Boundary: Assessment does not include causes of seasons.*]	
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** • Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.
Disciplinary Core Ideas (DCI)	**ESS1.B: Earth and the Solar System** • The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.
Crosscutting Concepts (CCC)	**Patterns** • Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.

Extended Performance Expectation 5-ESS1-2			
	Level 1	*Level 2*	*Level 3*
	Less Complex	←→	*More Complex*
	5-ESS1-2.1 Identify or label a model that shows the positions of the Sun, the Moon, and Earth in the solar system.	**5-ESS1-2.2** Use models or data to identify patterns of change related to the rotation of Earth, Earth's orbit around the Sun, and/or the Moon's orbit around Earth (e.g., length and direction of shadows, day and night, seasonal appearance of stars).	**5-ESS1-2.3** Use models or data to predict or infer patterns of change related to the rotation of Earth, Earth's orbit around the Sun, and the Moon's orbit around Earth (e.g., length and direction of shadows, day and night, seasonal appearance of stars).
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** • Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. **Supporting: Developing and Using Models**		
Disciplinary Core Ideas (DCI)	**ESS1.B: Earth and the Solar System** • The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.		
Crosscutting Concepts (CCC)	**Patterns** • Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. **Supporting:** **Systems and System Models**		

NGSS Performance Expectation 5-ESS2-1	
5-ESS2-1 . Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]	
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Develop a model using an example to describe a scientific principle.
Disciplinary Core Ideas (DCI)	**ESS2.A: Earth Materials and Systems** ● Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.
Crosscutting Concepts (CCC)	**Systems and System Models** ● A system can be described in terms of its components and their interactions.

Extended Performance Expectation 5-ESS2-1			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	5-ESS2-1.1 Use a model (diagram) to identify parts of various Earth systems (e.g., geosphere, hydrosphere, atmosphere, biosphere).	**5-ESS2-1.2** Use a model to describe how any two Earth systems interact.	**5-ESS2-1.3** Develop a model to show ways in which any two Earth systems interact.
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Use a model as an example to describe a scientific principle.		
Disciplinary Core Ideas (DCI)	**ESS2.A: Earth Materials and Systems** ● Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.		
Crosscutting Concepts (CCC)	**Systems and System Models** ● A system can be described in terms of its components and their interactions.		

NGSS Performance Expectation 5-ESS3-1	
5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.	
Science and Engineering Practices (SEP)	**Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.
Disciplinary Core Ideas (DCI)	**ESS3.C: Human Impacts on Earth Systems** ● Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.
Crosscutting Concepts (CCC)	**Systems and System Models** ● A system can be described in terms of its components and their interactions.

Extended Performance Expectation 5-ESS3-1			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	5-ESS3-1.1 Identify or describe natural or human impacts on the environment.	**5-ESS3-1.2** Use text or media information to describe an effect (positive or negative) of human activities on the environment.	**5-ESS3-1.3** Use text or media information to describe how people are using science ideas to protect Earth's resources and/or the environment.
Science and Engineering Practices (SEP)	**Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.		
Disciplinary Core Ideas (DCI)	**ESS3.C: Human Impacts on Earth Systems** ● Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.		
Crosscutting Concepts (CCC)	**Systems and System Models** ● A system can be described in terms of its components and their interactions. **Supporting:** **Cause and Effect**		

NGSS Performance Expectation 5-PS1-2	
5-PS1-2 Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]	
Science and Engineering Practices (SEP)	**Using Mathematics and Computational Thinking** ● Measure and graph quantities such as weight to address scientific and engineering questions and problems.
Disciplinary Core Ideas (DCI)	**PS1.A: Structure and Properties of Matter** ● The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. **PS1.B: Chemical Reactions** ● No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.)
Crosscutting Concepts (CCC)	**Scale, Proportion, and Quantity** ● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Extended Performance Expectation 5-PS1-2			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	5-PS1-2.1 Match the appropriate tools or standard units of measurement to physical quantities such as weight, time, temperature, or volume to complete a scientific task.	**5-PS1-2.2** Use data to compare the weight of substances before and after they are heated, cooled, or mixed.	**5-PS1-2.3** Measure, graph, or use mathematical relationships to show that the weight of substances (in standard units) does not change when they are heated, cooled, or mixed.
Science and Engineering Practices (SEP)	**Using Mathematics and Computational Thinking** ● Measure and graph quantities such as weight to address scientific and engineering questions and problems.		
Disciplinary Core Ideas (DCI)	**PS1.A: Structure and Properties of Matter** ● The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. **PS1.B: Chemical Reactions** ● No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.)		
Crosscutting Concepts (CCC)	**Scale, Proportion, and Quantity** ● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.		

NGSS Performance Expectation 5-PS2-1	
5-PS2-1 Support an argument that the gravitational force exerted by Earth on objects is directed down. [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]	
Science and Engineering Practices (SEP)	**Engaging in Argument from Evidence** ● Support an argument with evidence, data, or a model.
Disciplinary Core Ideas (DCI)	**PS2.B: Types of Interactions** ● The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.
Crosscutting Concepts (CCC)	**Cause and Effect** ● Cause and effect relationships are routinely identified and used to explain change.

Extended Performance Expectation 5-PS2-1			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	5-PS2-1.1 Use observations to identify patterns in the motion of objects when they are released on Earth.	**5-PS2-1.2** Select or complete a model that shows the direction objects move when they are released on Earth (downward).	**5-PS2-1.3** Describe observations, data, or a model that supports the claim that Earth's gravity pulls objects down (toward Earth's center).
Science and Engineering Practices (SEP)	**Engaging in Argument from Evidence** ● Support an argument with evidence, data, or a model. **Supporting:** **Planning and Carrying Out Investigations** **Developing and Using Models**		
Disciplinary Core Ideas (DCI)	**PS2.B: Types of Interactions** ● The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.		
Crosscutting Concepts (CCC)	**Cause and Effect** ● Cause and effect relationships are routinely identified and used to explain change. **Supporting:** **Patterns**		

NGSS Performance Expectation 5-PS3-1	
5-PS3-1 Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. [Clarification Statement: Examples of models could include diagrams and flow charts.]	
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Use models to describe phenomena.
Disciplinary Core Ideas (DCI)	**PS3.D: Energy in Chemical Processes and Everyday Life** ● The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). **LS1.C: Organization for Matter and Energy Flow in Organisms** ● Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary)
Crosscutting Concepts (CCC)	**Energy and Matter** ● Energy can be transferred in various ways and between objects.

Extended Performance Expectation 5-PS3-1			
	Level 1	*Level 2*	*Level 3*
	Less Complex	←→	*More Complex*
	5-PS3-1.1 Identify food chains or drawings of ecosystems that show the Sun as the common source of energy for ecosystems.	**5-PS3-1.2** Use a model to describe or show the direction of energy transfer between two organisms (e.g., plant-animal, animal-animal) or between the Sun and a plant.	**5-PS3-1.3** Use a model to describe or show how the energy animals obtain from food comes from the Sun.
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Use models to describe phenomena.		
Disciplinary Core Ideas (DCI)	**PS3.D: Energy in Chemical Processes and Everyday Life** ● The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). *Note: ecosystems that derive energy from chemicals are excluded at the elementary level.*		
Crosscutting Concepts (CCC)	**Energy and Matter** ● Energy can be transferred in various ways and between objects. **Supporting:** **Patterns**		

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FINAL

December 2019

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NGSS Performance Expectation MS-ESS1-1	
MS-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, and seasons. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]	
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Develop and use a model to describe phenomena.
Disciplinary Core Ideas (DCI)	**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. **ESS1.B: Earth and the Solar System** ● This model of the solar system can explain 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.
Crosscutting Concepts (CCC)	**Patterns:** ● Patterns can be used to identify cause-and-effect relationships.

Extended Performance Expectation MS-ESS1-1			
	Level 1	***Level 2***	***Level 3***
	Less Complex	←····←····←····←····←···· ········→····→····→····→····→	***More Complex***
	MS-ESS1-1.1 Identify a model that shows the positions of Earth (with its tilt), the Sun, and the Moon as Earth revolves around the Sun and the Moon orbits Earth in the solar system.	**MS-ESS1-1.2** Use a model to describe or compare the positions of objects or amount or path of light in the cyclic patterns of seasons, lunar phases, or eclipses.	**MS-ESS1-1.3** Develop or use a model of the Earth-Sun-Moon system to compare or show patterns in seasons, lunar phases, or eclipses.
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Develop and/or use a model to describe phenomena.		
Disciplinary Core Ideas (DCI)	**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. **ESS1.B: Earth and the Solar System** ● This model of the solar system can explain 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.		
Crosscutting Concepts (CCC)	**Target:** **Patterns** ● Patterns can be used to identify cause-and-effect relationships. **Supporting:** **Systems and System Models**		

NGSS Performance Expectation MS-ESS2-2	
MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]	
Science and Engineering Practices (SEP)	**Constructing Explanations and Designing Solutions** ● 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 nature operate today as they did in the past and will continue to do so in the future.
Disciplinary Core Ideas (DCI)	**ESS2.A: Earth's Materials and Systems** ● The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. **ESS2.C: The Roles of Water in Earth's Surface Processes** ● Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.
Crosscutting Concepts (CCC)	**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.

Extended Performance Expectation MS-ESS2-2			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	MS-ESS2-2.1 Use observations to identify the process or agent that causes a particular change to Earth's surface.	**MS-ESS2-2.2** Use charts or other graphic organizers to identify whether a process or event was small/large scale and/or whether a process or event happened gradually/rapidly.	**MS-ESS2-2.3** Explain how geoscience processes have caused changes to Earth's surface at various time or spatial scales.
Science and Engineering Practices (SEP)	**Target:** **Constructing Explanations** ● Construct a scientific explanation based on valid and reliable evidence obtained from sources and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. **Supporting:** **Obtaining, Evaluating, and Communicating Information**		
Disciplinary Core Ideas (DCI)	**SS2.A: Earth's Materials and Systems** ● The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. **ESS2.C: The Roles of Water in Earth's Surface Processes** ● Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.		
Crosscutting Concepts (CCC)	**Target:** **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. **Supporting:** **Cause and Effect**		

NGSS Performance Expectation MS-ESS2-4	
MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the Sun and the force of gravity. [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]	
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Develop a model to describe unobservable mechanisms.
Disciplinary Core Ideas (DCI)	**ESS2.C: The Roles of Water in Earth's Surface Processes** ● Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. ● Global movements of water and its changes in form are propelled by sunlight and gravity.
Crosscutting Concepts (CCC)	**Energy and Matter** ● Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

Extended Performance Expectation MS-ESS2-4			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	MS-ESS2-4.1 Use a model to trace the path of water through Earth's systems.	**MS-ESS2-4.2** Use a model to describe the state of water or state changes in various parts of the water cycle.	**MS-ESS2-4.3** Develop a model to describe how the Sun's energy or the force of gravity moves water through the water cycle.
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Develop a model to describe unobservable mechanisms.		
Disciplinary Core Ideas (DCI)	**ESS2.C: The Roles of Water in Earth's Surface Processes** ● Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. ● Global movements of water and its changes in form are propelled by sunlight and gravity.		
Crosscutting Concepts (CCC)	**Energy and Matter** ● Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.		

NGSS Performance Expectation MS-ESS3-3	
MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. * [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]	
Science and Engineering Practices (SEP)	**Constructing Explanations and Designing Solutions** ● Apply scientific principles to design an object, tool, process, or system.
Disciplinary Core Ideas (DCI)	**ESS3.C: Human Impacts on Earth Systems** ● Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. ● Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.
Crosscutting Concepts (CCC)	**Cause and Effect** ● Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

Extended Performance Expectation MS-ESS3-3			
	Level 1	***Level 2***	***Level 3***
	Less Complex	←····→	***More Complex***
	MS-ESS3-3.1 Identify an environmental problem caused by human activities/impact.	**MS-ESS3-3.2** Make a claim about how a particular method would work to reduce human impact on the environment.	**MS-ESS3-3.3** Select or evaluate a design for a method for minimizing a human impact on the environment.
Science and Engineering Practices (SEP)	**Target:** **Constructing Explanations and Designing Solutions** ● Apply scientific principles to design an object, tool, process, or system. **Supporting:** **Engaging in Argument from Evidence** **Asking Questions and Defining Problems**		
Disciplinary Core Ideas (DCI)	**ESS3.C: Human Impacts on Earth Systems** ● Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. ● Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.		
Crosscutting Concepts (CCC)	**Cause and Effect** ● Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.		

NGSS Performance Expectation MS-LS1-3	
MS-LS1-3 Use an argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]	
Science and Engineering Practices (SEP)	**Engaging in Argument from Evidence** ● Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon.
Disciplinary Core Ideas (DCI)	**LS1.A: Structure and Function** ● In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.
Crosscutting Concepts (CCC)	**Systems and System Models** ● Systems may interact with other systems; they may have subsystems and be a part of larger complex systems.

Extended Performance Expectation MS-LS1-3			
	Level 1	***Level 2***	***Level 3***
	Less Complex	←→	***More Complex***
	MS-LS1-3.1 Use charts or other graphic organizers to identify the classification of structures that are part of human body systems and those that are not.	**MS-LS1-3.2** Use a model to identify or show parts that belong to a *particular* body system and the organization of those parts.	**MS-LS1-3.3** Use evidence to make a claim about two body systems (e.g., circulatory, respiratory, muscular, digestive, nervous, excretory) working together to carry out various functions.
Science and Engineering Practices (SEP)	**Target:** **Engaging in Argument from Evidence** ● Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. **Supporting:** **Developing and Using Models** **Obtaining, Evaluating, and Communicating Information**		
Disciplinary Core Ideas (DCI)	**LS1.A: Structure and Function** ● In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.		
Crosscutting Concepts (CCC)	**Systems and System Models** ● Systems may interact with other systems; they may have subsystems and be a part of larger complex systems.		

NGSS Performance Expectation MS-LS1-5	
MS-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 drought decreasing 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.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]	
Science and Engineering Practices (SEP)	**Constructing Explanations and Designing Solutions** ● 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.
Disciplinary Core Ideas (DCI)	**LS1.B: Growth and Development of Organisms** ● Genetic factors as well as local conditions affect the growth of the adult plant.
Crosscutting Concepts (CCC)	**Cause and Effect** ● Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

Extended Performance Expectation MS-LS1-5			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	MS-LS1-5.1 Ask questions to help identify factors that could be affecting the growth of an organism.	**MS-LS1-5.2** Analyze data to determine whether a particular factor is affecting the growth of organisms.	**MS-LS1-5.3** Use provided information to explain how the growth of organisms is influenced by various environmental and/or genetic factors.
Science and Engineering Practices (SEP)	**Target:** **Constructing Explanations and Designing Solutions** ● 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. **Supporting:** **Analyzing and Interpreting Data** **Asking Questions and Defining Problems**		
Disciplinary Core Ideas (DCI)	**LS1.B: Growth and Development of Organisms** ● Genetic factors as well as local conditions affect the growth of the adult plant.		
Crosscutting Concepts (CCC)	**Cause and Effect** ● Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability.		

NGSS Performance Expectation MS-LS2-1	
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause-and-effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]	
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** ● Analyze and interpret data to provide evidence for phenomena.
Disciplinary Core Ideas (DCI)	**LS2.A: Interdependent Relationships in Ecosystems** ● Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. ● In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. ● Growth of organisms and population increases are limited by access to resources.
Crosscutting Concepts (CCC)	**Cause and Effect** ● Cause-and-effect relationships may be used to predict phenomena in natural or designed systems.

Extended Performance Expectation MS-LS2-1			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	MS-LS2-1.1 Use data or observations to identify resources (e.g., food, water, nutrients, space) that are necessary for organisms and populations of organisms to grow and survive.	**MS-LS2-1.2** Use data or observations to describe the effects of resource availability on organisms and/or populations of organisms.	**MS-LS2-1.3** Analyze data to identify evidence for a cause-effect relationship between resource availability and growth of organisms and/or populations of organisms.
Science and Engineering Practices (SEP)	**Target:** **Analyzing and Interpreting Data** ● Analyze and interpret data to provide evidence for phenomena.		
Disciplinary Core Ideas (DCI)	**LS2.A: Interdependent Relationships in Ecosystems** ● Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. ● In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. ● Growth of organisms and population increases are limited by access to resources.		
Crosscutting Concepts (CCC)	**Cause and Effect** ● Cause-and-effect relationships may be used to predict phenomena in natural or designed systems.		

NGSS Performance Expectation MS-LS2-3	
MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.][Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]	
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Develop a model to describe phenomena.
Disciplinary Core Ideas (DCI)	**LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** ● Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.
Crosscutting Concepts (CCC)	**Energy and Matter** ● The transfer of energy can be tracked as energy flows through a natural system.

Extended Performance Expectation MS-LS2-3			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	MS-LS2-3.1 Use a model to identify the role of organisms (e.g., producer, consumer, decomposer) or nonliving things (e.g., the Sun, water, minerals, air) in cycling energy or matter in an ecosystem.	**MS-LS2-3.2** Use a model to identify that energy is transferred or matter is cycled from one specific part of an ecosystem to another specific part.	**MS-LS2-3.3** Develop a model to describe how energy is transferred or how matter is cycled among living and nonliving parts of ecosystems.
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Develop a model to describe phenomena.		
Disciplinary Core Ideas (DCI)	**LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** ● Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.		
Crosscutting Concepts (CCC)	**Energy and Matter** ● The transfer of energy can be tracked as energy flows through a natural system.		

NGSS Performance Expectation MS-PS1-2	
MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]	
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** ● Analyze and interpret data to determine similarities and differences in findings.
Disciplinary Core Ideas (DCI)	**PS1.A: Structure and Properties of Matter** ● Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. **PS1.B: Chemical Reactions** ● Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.
Crosscutting Concepts (CCC)	**Patterns** ● Macroscopic patterns are related to the nature of microscopic and atomic-level structure.

Extended Performance Expectation MS-PS1-2			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	MS-PS1-2.1 Use observations or informational resources (e.g., charts, data tables) to identify properties of a substance.	**MS-PS1-2.2** Use data on the properties of two or more substances to determine if the samples are the same or different substances.	**MS-PS1-2.3** Use data or observations on the properties of substances before and after an interaction to determine if a chemical reaction occurred.
Science and Engineering Practices (SEP)	**Target:** **Analyzing and Interpreting Data** ● Analyze and interpret data to determine similarities and differences in findings. **Supporting:** **Planning and Carrying Out Investigations**		
Disciplinary Core Ideas (DCI)	**PS1.A: Structure and Properties of Matter** ● Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. **PS1.B: Chemical Reactions** ● Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.		
Crosscutting Concepts (CCC)	**Target:** **Patterns** ● Macroscopic patterns are related to the nature of microscopic and atomic-level structure. **Supporting:** **Scale, Proportion and Quantity**		

NGSS Performance Expectation MS-PS2-2	
MS-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.] [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 (SEP)	**Planning and Carrying Out Investigations** ● 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 data are needed to support a claim.
Disciplinary Core Ideas (DCI)	**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. 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. ● All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.
Crosscutting Concepts (CCC)	**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.

Extended Performance Expectation MS-PS2-2			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	MS-PS2-2.1 Use observations to identify the effects of pushes and pulls on objects.	**MS-PS2-2.2** Use data from an investigation or observations to describe patterns of change in an object's motion that take place when the force on an object changes or the mass of an object is changed.	**MS-PS2-2.3** Describe necessary parts of an investigation to show how differences in the mass of an object or the force on an object will change the motion of the object.
Science and Engineering Practices (SEP)	**Target:** **Planning and Carrying Out Investigations** ● 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 data are needed to support a claim. **Supporting:** **Analyzing and Interpreting Data**		
Disciplinary Core Ideas (DCI)	**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. 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.		
Crosscutting Concepts (CCC)	**Target:** **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. **Supporting:** **Cause and Effect**		

NGSS Performance Expectation MS-PS3-5	
MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]	
Science and Engineering Practices (SEP)	**Engaging in Argument from Evidence** • Construct, use, 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.
Disciplinary Core Ideas (DCI)	**PS3.B: Conservation of Energy and Energy Transfer** • When the motion energy of an object changes, there is inevitably some other change in energy at the same time.
Crosscutting Concepts (CCC)	**Energy and Matter** • Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion).

Extended Performance Expectation MS-PS3-5			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	MS-PS3-5.1 Identify questions that can help determine whether energy is being transferred in a system.	**MS-PS3-5.2** Use observations or data to identify the forms of energy that increase or decrease when the kinetic energy of an object changes.	**MS-PS3-5.3** Use evidence to make or support a claim that a transfer of energy occurs when the kinetic energy of an object changes.
Science and Engineering Practices (SEP)	**Target:** **Engaging in Argument from Evidence** • Construct, use, 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. **Supporting:** **Asking Questions and Defining Problems** **Analyzing and Interpreting Data**		
Disciplinary Core Ideas (DCI)	**PS3.B: Conservation of Energy and Energy Transfer** • When the motion energy of an object changes, there is inevitably some other change in energy at the same time.		
Crosscutting Concepts (CCC)	**Energy and Matter** • Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion).		

NGSS Performance Expectation MS-PS4-2	
MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]	
Science and Engineering Practices (SEP)	**Developing and Using Models** • Develop and use a model to describe phenomena.
Disciplinary Core Ideas (DCI)	**PS4.A: Wave Properties** • A sound wave needs a medium through which it is transmitted. **PS4.B: Electromagnetic Radiation** • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. • The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. • A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. • However, because light can travel through space, it cannot be a matter wave, like sound or water waves.
Crosscutting Concepts (CCC)	**Structure and Function** • Structures can be designed to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.

Extended Performance Expectation MS-PS4-2			
	Level 1	***Level 2***	***Level 3***
	Less Complex	←←←←← →→→→→	***More Complex***
	MS-PS4-2.1 Use observations to identify whether a wave is being reflected, absorbed, or transmitted through a material.	**MS-PS4-2.2** Use a model to describe the path of a wave that is reflected, absorbed, or transmitted through different materials.	**MS-PS4-2.3** Develop a model to represent what happens to waves when they are reflected, absorbed, or transmitted through different materials.
Science and Engineering Practices (SEP)	**Target:** **Developing and Using Models** • Develop and use a model to describe phenomena. **Supporting:** **Planning and Carrying Out Investigations**		
Disciplinary Core Ideas (DCI)	**PS4.A: Wave Properties** • A sound wave needs a medium through which it is transmitted. **PS4.B: Electromagnetic Radiation** • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. • The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.		
Crosscutting Concepts (CCC)	**Structure and Function** • Structures can be designed to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.		

Cognia Science Alternate Assessment

High School Grade-Level Standards and Extended Performance Expectations (EPEs) for Maine Department of Education

FINAL

December 2019

AdvancED and Measured Progress are now cognia

NGSS Performance Expectation HS-ESS1-6	
HS-ESS1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. [Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.]	
Science and Engineering Practices (SEP)	**Constructing Explanations and Designing Solutions** ● Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
Disciplinary Core Ideas (DCI)	**ESS1.C: The History of Planet Earth** ● Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history. **PS1.C: Nuclear Processes** ● Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. (secondary)
Crosscutting Concepts (CCC)	**Stability and Change** ● Much of science deals with constructing explanations of how things change and how they remain stable.

Extended Performance Expectation HS-ESS1-6			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	HS-ESS1-6.1 Use data to identify patterns about ancient Earth materials, meteorites, or other planetary surfaces.	**HS-ESS1-6.2** Ask questions about ancient Earth materials, meteorites, or other planetary surfaces that can be used to construct an account of Earth's formation and early history.	**HS-ESS1-6.3** Use evidence (e.g., data about ancient Earth materials, meteorites, other planetary surfaces) to explain Earth's formation and early history.
Science and Engineering Practices (SEP)	**Target:** **Constructing Explanations and Designing Solutions** ● Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. **Supporting:** **Asking Questions and Defining Problems** **Analyzing and Interpreting Data**		
Disciplinary Core Ideas (DCI)	**ESS1.C: The History of Planet Earth** ● Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history.		
Crosscutting Concepts (CCC)	**Target:** **Stability and Change** ● Much of science deals with constructing explanations of how things change and how they remain stable. **Supporting:** **Patterns**		

NGSS Performance Expectation HS-ESS2-4	
HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] [Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]	
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Use a model to provide mechanistic accounts of phenomena.
Disciplinary Core Ideas (DCI)	**ESS1.B: Earth and the Solar System** ● Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. **ESS2.A: Earth Materials and Systems** ● The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. **ESS2.D: Weather and Climate** ● The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.
Crosscutting Concepts (CCC)	**Cause and Effect** ● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Extended Performance Expectation HS-ESS2-4			
	Level 1	***Level 2***	***Level 3***
	Less Complex		***More Complex***
	HS-ESS2-4.1 Use a model to trace the flow of energy between two Earth systems.	**HS-ESS2-4.2** Use a model to describe how energy from the Sun drives Earth's climate system.	**HS-ESS2-4.3** Use models to predict and/or make conclusions about how various activities (e.g., large volcanic eruptions, human activity, solar output, changes to Earth's orbit and axis, changes to atmospheric composition, etc.) cause changes in climate (which can be measured as changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, biosphere distribution).
Science and Engineering Practices (SEP)	**Target:** **Developing and Using Models** ● Use a model to provide mechanistic accounts of phenomena.		
Disciplinary Core Ideas (DCI)	**ESS1.B: Earth and the Solar System** ● Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. **ESS2.A: Earth Materials and Systems** ● The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. **ESS2.D: Weather and Climate** ● The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.		
Crosscutting Concepts (CCC)	**Target:** **Cause and Effect** ● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **Supporting**: **Energy and Matter**		

NGSS Performance Expectation HS-ESS2-5	
HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. [Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).]	
Science and Engineering Practices (SEP)	**Planning and Carrying Out Investigations** ● Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
Disciplinary Core Ideas (DCI)	**ESS2.C: The Roles of Water in Earth's Surface Processes** ● The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve, and transport materials, and lower the viscosities and melting points of rocks.
Crosscutting Concepts (CCC)	**Structure and Function** ● The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Extended Performance Expectation HS-ESS2-5			
	Level 1	*Level 2*	*Level 3*
	Less Complex	←→	*More Complex*
	HS-ESS2-5.1 Identify testable questions about the effect of water on Earth's materials and surface processes.	**HS-ESS2-5.2** Use data or observations to draw conclusions or make predictions about the effects of water on Earth materials and surface processes.	**HS-ESS2-5.3** Plan or conduct an investigation of the properties of water and its effects on Earth materials and surface processes (e.g., stream transportation and deposition using a stream table, or frost wedging by the expansion of water as it freezes, or chemical weathering and recrystallization by testing the solubility of different materials).
Science and Engineering Practices (SEP)	**Target:** **Planning and Carrying Out Investigations** ● Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. **Supporting:** **Analyzing and Interpreting Data** **Asking Questions and Defining Problems**		
Disciplinary Core Ideas (DCI)	**ESS2.C: The Roles of Water in Earth's Surface Processes** ● The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve, and transport materials, and lower the viscosities and melting points of rocks.		
Crosscutting Concepts (CCC)	**Target:** **Structure and Function** ● The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. **Supporting:** **Cause and Effect**		

NGSS Performance Expectation HS-ESS3-4	
HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.* [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or area changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]	
Science and Engineering Practices (SEP)	**Constructing Explanations and Designing Solutions** ● Design or refine a solution to a complex real-world problem based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations.
Disciplinary Core Ideas (DCI)	**ESS3.C: Human Impacts on Earth Systems** ● Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. **ETS1.B: Developing Possible Solutions** ● When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary)
Crosscutting Concepts (CCC)	**Stability and Change** ● Feedback (negative or positive) can stabilize or destabilize a system.

Extended Performance Expectation HS-ESS3-4			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	HS-ESS3-4.1 Use data to identify the impact of human activities (local) on natural systems.	**HS-ESS3-4.2** Make a claim about how a technological solution (local effort) works to reduce impacts of human activities on natural systems.	**HS-ESS3-4.3** Select, evaluate, or change the design of a technological solution (local effort) that reduces impacts of human activities on natural systems.
Science and Engineering Practices (SEP)	**Target:** **Constructing Explanations and Designing Solutions** ● Design or refine a solution to a complex real-world problem based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations. **Supporting:** **Engaging in Argument from Evidence** **Analyzing and Interpreting Data**		
Disciplinary Core Ideas (DCI)	**ESS3.C: Human Impacts on Earth Systems** ● Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. **ETS1.B: Developing Possible Solutions** ● When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.		
Crosscutting Concepts (CCC)	**Target:** **Stability and Change** ● Feedback (negative or positive) can stabilize or destabilize a system. **Supporting:** **Cause and Effect**		

NGSS Performance Expectation HS-LS2-2	
HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [*Assessment Boundary: Assessment is limited to provided data.*]	
Science and Engineering Practices (SEP)	**Using Mathematics and Computational Thinking** ● Use mathematical representations of phenomena or design solutions to support and revise explanations.
Disciplinary Core Ideas (DCI)	**LS2.A: Interdependent Relationships in Ecosystems** ● Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** ● A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.
Crosscutting Concepts (CCC)	**Scale, Proportion, and Quantity** ● Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.

Extended Performance Expectation HS-LS2-2			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	HS-LS2-2.1 Use the provided information to identify factors that affect population size and/or biodiversity.	**HS-LS2-2.2** Interpret data to describe the effect of a factor in a specific ecosystem.	**HS-LS2-2.3** Use mathematical representations (e.g., averages, trends, graphs) to explain how a specific factor affects the biodiversity or sizes of populations in ecosystems of different scales.
Science and Engineering Practices (SEP)	**Target:** **Using Mathematics and Computational Thinking** ● Use mathematical representations of phenomena or design solutions to support and revise explanations. **Supporting:** **Obtaining, Evaluating, and Communicating Information**		
Disciplinary Core Ideas (DCI)	**LS2.A: Interdependent Relationships in Ecosystems** ● Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.		
Crosscutting Concepts (CCC)	**Target:** **Scale, Proportion, and Quantity** ● Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. **Supporting:** **Cause and Effect**		

NGSS Performance Expectation HS-LS3-1	
HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]	
Science and Engineering Practices (SEP)	**Asking Questions and Defining Problems** ● Ask questions that arise from examining models or a theory to clarify relationships.
Disciplinary Core Ideas (DCI)	**LS1.A: Structure and Function** ● All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.) **LS3.A: Inheritance of Traits** ● Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.
Crosscutting Concepts (CCC)	**Cause and Effect** ● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Extended Performance Expectation HS-LS3-1			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	HS-LS3-1.1 Use provided reference information to identify the function of DNA or chromosomes.	**HS-LS3-1.2** Describe what a particular model shows about the way genes or traits are inherited.	**HS-LS3-1.3** Ask questions that will provide information about the cause-and-effect relationships among DNA/chromosomes and/or the traits passed from parents to offspring.
Science and Engineering Practices (SEP)	**Target:** **Asking Questions and Defining Problems** ● Ask questions that arise from examining models or a theory to clarify relationships. **Supporting:** **Developing and Using Models** **Obtaining, Evaluating, and Communicating Information**		
Disciplinary Core Ideas (DCI)	**LS1.A: Structure and Function** ● All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. **LS3.A: Inheritance of Traits** ● Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. ``The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.		
Crosscutting Concepts (CCC)	**Target:** **Cause and Effect** ● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **Supporting:** **Patterns** **Structure and Function**		

NGSS Performance Expectation HS-LS4-1	
HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]	
Science and Engineering Practices (SEP)	**Obtaining, Evaluating, and Communicating Information** ● Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).
Disciplinary Core Ideas (DCI)	**LS4.A: Evidence of Common Ancestry and Diversity** ● Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.
Crosscutting Concepts (CCC)	**Patterns:** ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

Extended Performance Expectation HS-LS4-1			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	HS-LS4-1.1 Use the provided information to identify how organisms have changed over time.	**HS-LS4-1.2** Use various types of data (DNA sequences, amino acid sequences, structures found in organisms, embryos, fossils) to draw conclusions about patterns of relatedness among organisms.	**HS-LS4-1.3** Describe how patterns in data comparing DNA sequences, amino acid sequences, or structures found in organisms, embryos, and/or fossils are evidence for biological evolution and common ancestry of living things.
Science and Engineering Practices (SEP)	**Target:** **Obtaining, Evaluating, and Communicating Information** ● Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). **Supporting:** **Analyzing and Interpreting Data**		
Disciplinary Core Ideas (DCI)	**LS4.A: Evidence of Common Ancestry and Diversity** ● Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.		
Crosscutting Concepts (CCC)	**Target:** **Patterns** ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Supporting:** **Stability and Change**		

NGSS Performance Expectation HS-LS4-3	
HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.]	
Science and Engineering Practices (SEP)	**Analyzing and Interpreting Data** ● Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
Disciplinary Core Ideas (DCI)	**LS4.B: Natural Selection** ● Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. ● The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. **LS4.C: Adaptation** ● Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. ● Adaptation also means that the distribution of traits in a population can change when conditions change.
Crosscutting Concepts (CCC)	**Patterns:** ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

Extended Performance Expectation HS-LS4-3			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	HS-LS4-3.1 Use the provided information to identify traits that can vary for a given organism.	**HS-LS4-3.2** Use graphs to describe changes in the distribution of traits in a population in a given environment.	**HS-LS4-3.3** Use data comparing distributions of traits in a population as evidence that organisms with advantageous traits increase in proportion to organisms lacking the trait.
Science and Engineering Practices (SEP)	**Target:** **Analyzing and Interpreting Data** ● Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. **Supporting:** **Obtaining, Evaluating, and Communicating Information**		
Disciplinary Core Ideas (DCI)	**LS4.B: Natural Selection** ● Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. **LS4.C: Adaptation** ● Natural selection leads to adaptation that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. Adaptation also means that the distribution of traits in a population can change when conditions change.		
Crosscutting Concepts (CCC)	**Patterns** ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.		

NGSS Performance Expectation HS-PS1-2	
HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.]	
Science and Engineering Practices (SEP)	**Constructing Explanations and Designing Solutions** ● Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) 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.
Disciplinary Core Ideas (DCI)	**PS1.A: Structure and Properties of Matter** ● The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. **PS1.B: Chemical Reactions** ● The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.
Crosscutting Concepts (CCC)	**Patterns** ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

Extended Performance Expectation HS-PS1-2			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	HS-PS1-2.1 Use provided information to complete a model of a chemical reaction.	**HS-PS1-2.2** Use the periodic table as a model to identify or classify elements that will behave similarly in chemical reactions.	**HS-PS1-2.3** Use the periodic table to construct an explanation for specific chemical reactions.
Science and Engineering Practices (SEP)	**Target:** **Constructing Explanations and Designing Solutions** ● Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) 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. **Supporting:** **Obtaining, Evaluating, and Communicating Information** **Developing and Using Models**		
Disciplinary Core Ideas (DCI)	**PS1.A Structure and Properties of Matter** ● The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. **PS1.B: Chemical Reactions** ● The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe, and predict chemical reactions.		
Crosscutting Concepts (CCC)	**Target:** **Patterns** ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Supporting:** **Energy and Matter**		

NGSS Performance Expectation HS-PS2-3	
HS-PS2-3 Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.* [Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.] [Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.]	
Science and Engineering Practices (SEP)	**Constructing Explanations and Designing Solutions** ● Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.
Disciplinary Core Ideas (DCI)	**PS2.A: Forces and Motion** ● If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. **ETS1.A: Defining and Delimiting an Engineering Problem** ● Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. **ETS1.C: Optimizing the Design Solution** ● Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.
Crosscutting Concepts (CCC)	**Cause and Effect** ● Systems can be designed to cause a desired effect.

Extended Performance Expectation HS-PS2-3			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	HS-PS2-3.1 Use a model to identify how forces are acting in a collision system.	**HS-PS2-3.2** Make a claim about how a particular device functions to minimize the forces on a macroscopic object during a collision.	**HS-PS2-3.3** Select, evaluate, or change a design to a device that minimizes the forces on a macroscopic object during a collision.
Science and Engineering Practices (SEP)	**Target:** **Constructing Explanations and Designing Solutions** ● Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. **Supporting:** **Engaging in Argument from Evidence** **Developing and Using Models**		
Disciplinary Core Ideas (DCI)	**PS2.A: Forces and Motion** ● If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. **ETS1.A: Defining and Delimiting an Engineering Problem** ● Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. **ETS1.C: Optimizing the Design Solution** ● Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.		
Crosscutting Concepts (CCC)	**Target:** **Cause and Effect** ● Systems can be designed to cause a desired effect. **Supporting:** ● Systems and System Models		

NGSS Performance Expectation HS-PS2-5	
HS-PS2-5 Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. [Assessment Boundary: Assessment is limited to designing and conducting investigations with provided materials and tools.]	
Science and Engineering Practices (SEP)	**Planning and Carrying Out Investigations** ● Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
Disciplinary Core Ideas (DCI)	**PS2.B: Types of Interactions** ● Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4) ● Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. **PS3.A: Definitions of Energy** ● "Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (secondary)
Crosscutting Concepts (CCC)	**Cause and Effect** ● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

<table>
<tr><th colspan="4">Extended Performance Expectation HS-PS2-5</th></tr>
<tr><td></td><td>Level 1</td><td>Level 2</td><td>Level 3</td></tr>
<tr><td></td><td colspan="3">Less Complex ⇠ ⇢ More Complex</td></tr>
<tr><td></td><td>HS-PS2-5.1
Use observations and data to identify examples of electric current producing magnetic fields or magnetic fields producing electric current.</td><td>HS-PS2-5.2
Use data to make predictions or draw conclusions about changes in systems or devices that involve the interaction of magnetic fields and electric current.</td><td>HS-PS2-5.3
Plan or conduct an investigation to study cause-and-effect relationships between magnetic fields and electric current.</td></tr>
<tr><td>Science and Engineering Practices (SEP)</td><td colspan="3">Target:
Planning and Carrying Out Investigations
● Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
Supporting:
Analyzing and Interpreting Data
Planning and Carrying Out Investigations</td></tr>
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● Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields.
PS3.A: Definitions of Energy
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<tr><td>Crosscutting Concepts (CCC)</td><td colspan="3">Target:
Cause and Effect
● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
Supporting:
Stability and Change</td></tr>
</table>

NGSS Performance Expectation HS-PS3-2	
HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). [Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.]	
Science and Engineering Practices (SEP)	**Developing and Using Models** ● Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.
Disciplinary Core Ideas (DCI)	**PS3.A: Definitions of Energy** ● Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. ● At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. ● These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases, the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space.
Crosscutting Concepts (CCC)	**Energy and Matter** ● Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.

Extended Performance Expectation HS-PS3-2			
	Level 1	*Level 2*	*Level 3*
	Less Complex		*More Complex*
	HS-PS3-2.1 Identify questions that would determine if an object's kinetic energy is changing or if an object's potential energy is changing in a system.	**HS-PS3-2.2** Use models to show how energy changes when an object's position is moved or when the particles making up an object change their motion.	**HS-PS3-2.3** Develop or use models to describe how energy is conserved at the macroscopic or particle level when energy is transferred or converted from one form to another.
Science and Engineering Practices (SEP)	**Target:** **Developing and Using Models** ● Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. **Supporting:** **Asking Questions and Defining Problems**		
Disciplinary Core Ideas (DCI)	**PS3.A: Definitions of Energy** ● Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. ● At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases, the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space.		
Crosscutting Concepts (CCC)	**Target:** **Energy and Matter** ● Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.		