(A) Grade	(B) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Extended Evidence Outcome
Standard 1: Physical Science – Students know and understand common properties, forms, and changes in matter and energy.				
Preschool	1. Physical Science	1. Recognize that physical properties of objects and/or materials help us understand the world.	a. Use senses to explore the properties of objects and materials (e.g., solids, liquids).	a. Explore by looking at, touching, listening to, tasting or smelling objects and materials in the environment.
Preschool	1. Physical Science	1. Recognize that physical properties of objects and/or materials help us understand the world.	b. Make simple observations, predictions, explanations, and generalizations based on real-life experiences.	b. Recognize familiar objects and materials by their properties (e.g., size, shape, color, texture, weight, temperature, smell, sound, flexibility).
Preschool	1. Physical Science	1. Recognize that physical properties of objects and/or materials help us understand the world.	c. Collect, describe, predict and record information using words, drawings, maps, graphs and charts.	c. Describe information about objects and materials.
Preschool	1. Physical Science	1. Recognize that physical properties of objects and/or materials help us understand the world.	d. Observe, describe, and discuss living things and natural processes.	d. Explore physical properties of familiar objects and materials.
Preschool	1. Physical Science	2. Recognize there are cause-and-effect relationships related to matter and energy.	a. Recognize and investigate cause-and-effect relationships in everyday experiences (pushing, pulling, kicking, rolling or blowing objects).	a. Recognize cause and effect relationships in everyday experiences (e.g., on/off, pushing, pulling, kicking, rolling, or blowing objects).
Preschool	1. Physical Science	2. Recognize there are cause-and-effect relationships related to matter and energy.	b. Notice changes in matter.	b. Notice familiar changes in matter (e.g., ice melts in the sun; water freezes in the freezer).
Preschool	1. Physical Science	2. Recognize there are cause-and-effect relationships related to matter and energy.	c. Observe, describe and discuss properties of materials and transformation of substances.	c. Explore properties of familiar materials before and after transformation.
Preschool	1. Physical Science	2. Recognize there are cause-and-effect relationships related to matter and energy.	d. Seek answers to questions and test predictions using simple experiments.	d. Participate in a simple experiment and make a prediction about a transformation.

(A) Grade	(B) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Extended Evidence Outcome
Standard 2: Life Science – Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and other living things in their environment.				
Preschool	2. Life Science	1. Recognize that living things have unique characteristics and basic needs that can be observed and studied.	a. Observe, describe and discuss living things.	a. Observe and describe living things.
Preschool	2. Life Science	1. Recognize that living things have unique characteristics and basic needs that can be observed and studied.	b. Observe similarities and differences in the needs of living things.	b. Observe and explore needs of living things (e.g., food, water).
Preschool	2. Life Science	1. Recognize that living things have unique characteristics and basic needs that can be observed and studied.	c. Observe and describe how natural habitats provide for the basic needs of plants and animals with respect to shelter, food, water, air and light.	c. Explore the basic needs of plants and animals.
Preschool	2. Life Science	1. Recognize that living things have unique characteristics and basic needs that can be observed and studied.	d. Ask and pursue questions through simple investigations and observations of living things.	d. Ask and pursue their questions through simple investigations and observations of living things.
Preschool	2. Life Science	1. Recognize that living things have unique characteristics and basic needs that can be observed and studied.	e. Collect, describe, and record information about living things through discussion, drawings, graphs, technology and charts.	e. Collect, describe and/or record information about living things.
Preschool	2. Life Science	1. Recognize that living things have unique characteristics and basic needs that can be observed and studied.	f. Identify differences between living and nonliving things.	f. Identify attributes of living things and nonliving things.

(A) Grade	(B) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Extended Evidence Outcome
Preschool	2. Life Science	2. Recognize that living things develop in predictable patterns.	a. Identify the common needs such as food, air and water of familiar living things.	a. Identify food, water, and air as needs of familiar living things.
Preschool	2. Life Science	2. Recognize that living things develop in predictable patterns.	b. Predict, explain and infer patterns based on observations and representations of living things, their needs and life cycles.	b. Identify attributes of living things that change over time (e.g., seeds grow into plants, baby animals grow and change).
Preschool	2. Life Science	2. Recognize that living things develop in predictable patterns.	c. Observe and document changes in living things over time using different modalities such as drawing, dramatization, describing or using technology.	c. Observe and identify changes in living things over time using familiar modalities such as drawing, dramatization, making choices, or using technology.
Preschool	2. Life Science	2. Recognize that living things develop in predictable patterns.	d. Recognize that plants and animals grow and change.	d. Recognize that plants and animals grow and change.
Standard 3 – Earth and Space Science - Students know and understand the processes of life, and how living things interact with each other and their environment.				
Preschool	3. Earth and Space Science	1. The acquisition of concepts and facts related to the Earth materials and their uses.	a. Use senses and tools, including technology, to investigate materials, and observe processes and relationships to gather information and explore the environment.	a. Gather information about the materials that make up an environment by using senses and tools, including technology.
Preschool	3. Earth and Space Science	1. The acquisition of concepts and facts related to the Earth materials and their uses.	b. Inquire about the natural and physical environment.	b. Demonstrate interest in the natural and physical environment.
Preschool	3. Earth and Space Science	1. The acquisition of concepts and facts related to the Earth materials and their uses.	c. Observe and discuss common properties, differences and comparisons among objects.	c. Identify and compare properties of common objects.
Preschool	3. Earth and Space Science	1. The acquisition of concepts and facts related to the Earth materials and their uses.	d. Participate in simple investigations to form hypothesis, gather observations, draw conclusions.	d. Participate in simple investigations to gather observations and identify results.
Preschool	3. Earth and Space Science	1. The acquisition of concepts and facts related	e. Record observations using words, drawings, maps, graphs and charts.	e. Identify illustrations or objects/tactual information that matches an observation.

(A) Grade	(B) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Extended Evidence Outcome
		to the Earth materials and their uses.		
Preschool	3. Earth and Space Science	2. The acquisition of concepts and facts related to the natural and physical world and the understanding of naturally occurring relationships.	a. Predict, explain and infer patterns based on observations and evidence.	a. Predict and explain patterns based on observations and evidence.
Preschool	3. Earth and Space Science	2. The acquisition of concepts and facts related to the natural and physical world and the understanding of naturally occurring relationships.	b. Articulate findings through a variety of modalities (e.g., drawings, words, dramatizations).	b. Identify or select illustrations or objects/tactual information that represents a finding.
Preschool	3. Earth and Space Science	2. The acquisition of concepts and facts related to the natural and physical world and the understanding of naturally occurring relationships.	c. Recognizes familiar elements of the natural world and demonstrates an understanding that these may change over time (e.g., sun and moon, weather).	c. Identify familiar elements and the ways they change (e.g., night/day, daily weather).
Preschool	3. Earth and Space Science	2. The acquisition of concepts and facts related to the natural and physical world and the understanding of naturally occurring relationships.	d. Observe and describe patterns observed over the course of a number of days and nights (e.g., differences in the activities or appearance of plants and animals).	d. Observe and describe patterns observed over time (e.g., days and nights, appearance of plants and animals).

(C) Grade	(D) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Standard 1: Physical Science – Students know and understand common properties, forms, and changes in matter and energy.				
Kindergarten	1. Physical Science	1. Pushes and pulls can have different strengths and directions, and can change the speed or direction of an object's motion or start or stop it.	a. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. (K-PS2-1) (Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball and two objects colliding and pushing on each other). (Boundary: Limited to different relative strengths or different directions, but not both at the same time. Does not include non-contact pushes or pulls such as those produced by magnets).	a. Investigate how different objects move when pushed or pulled.
Kindergarten	1. Physical Science	1. Pushes and pulls can have different strengths and directions, and can change the speed or direction of an object's motion or start or stop it.	b. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull. (K-PS2-2) (Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn) (Boundary: Does not include friction as a mechanism for change in speed).	b. Analyze cause and effect relationships (e.g., push/pull) designed to change the speed or direction of an object.
Kindergarten	1. Physical Science	2. Sunlight affects the Earth's surface.	a. Make observations to determine the effect of sunlight on Earth's surface. (K-PS3-1) (Clarification Statement: Examples of Earth's surface could include sand, soil, rocks and water) (Boundary: Temperature is limited to relative measures such as warmer/cooler).	a. Observe the relative difference in temperature between being in the sunlight and being in the shade.
Kindergarten	1. Physical Science	2. Sunlight affects the Earth's surface.	b. Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area. (K-PS3- 2) (Clarification Statement: Examples of structures could include umbrellas, canopies and tents that minimize the warming effect of the sun).	b. Use or identify tools to be used to build a structure to provide shade.

(E) Grade	(F) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Standard 2: Life Science – Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and other living things in their environment.				
Kindergarten	2. Life Science	1. To live and grow, animals obtain food they need from plants or other animals, and plants need water and light.	a. Use observations to describe patterns of what plants and animals (including humans) need to survive. (K-LS1-1) (Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and that all living things need water).	a. Identify that all living things need water and identify the kinds of food needed by familiar plants and animals
Standard 3 – Earth and Space Science - Students know and understand the processes of life, and how living things interact with each other and their environment.				
Kindergarten	3. Earth and Space Science	1. Patterns are observed when measuring the local weather, including how humans and other organisms impact their environment.	a. Use and share observations of local weather conditions to describe patterns over time. (K-ESS2-1) (Clarification Statement: Examples of qualitative observations could include descriptions of the weather [such as sunny, cloudy, rainy, and warm]; examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months). (Boundary: Quantitative observations limited to whole numbers and relative measures such as warmer/cooler).	a. Identify patterns of weather that happen across time (e.g., during different seasons). i. Use pictures or objects to observe and track weather across time to determine patterns of weather.
Kindergarten	3. Earth and Space Science	1. Patterns are observed when measuring the local weather, including how humans and other organisms impact their environment.	b. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. (K-ESS2-2) (Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete).	b. Identify a pattern plants and animals (including humans) use to change their environment (e.g., use air conditioning, turn on lights at night) to meet their needs.

(E) Grade	(F) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Kindergarten	3. Earth and Space Science	2. Plants and animals meet their needs in their habitats and impact one another; people can prepare for severe weather.	a. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live. (K-ESS3-1) (Clarification Statement: Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system).	a. Use a model to identify patterns to recognize the needs of familiar plants and animals and the places they live.
Kindergarten	3. Earth and Space Science	2. Plants and animals meet their needs in their habitats and impact one another; people can prepare for severe weather.	b. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather. (K-ESS3-2) (Clarification Statement: Emphasis is on local forms of severe weather).	b. Given a weather condition, use the local weather forecasts in print or other media (e.g., sound recording) to identify materials, clothing, recreation, transportation appropriate to the weather.
Kindergarten	3. Earth and Space Science	2. Plants and animals meet their needs in their habitats and impact one another; people can prepare for severe weather.	c. Communicate solutions that will reduce the impact of humans on the land, water, air and/or other living things in the local environment. (K-ESS3-3) (Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles).	c. Identify ways to conserve resources (e.g., turn off lights, turn off water when brushing teeth, when cold outside wear a sweater inside and keep temperature lower to save power).
Standard 1: Physical Science – Students know and understand common properties, forms, and changes in matter and energy.				
First Grade	1. Physical Science	1. Sound can make matter vibrate and vibrating matter can make sound.	a. Plan and conduct investigations to provide evidence that vibrating materials can make a sound and that sound can make materials vibrate. (1-PS4-1) (Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork).	a. Explore materials that vibrate to make sound by listening, touching, seeing (e.g., string or percussion instrument, tuning fork).

(E) Grade	(F) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
First Grade	1. Physical Science	1. Sound can make matter vibrate and vibrating matter can make sound.	b. Make observations to construct an evidence-based account that objects can be seen only when illuminated. (1-PS4-2) (Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light).	b. Show/describe a room with a light on and when the room is dark; identify that light allows us to see items in familiar environments and we need light to see items.
First Grade	1. Physical Science	1. Sound can make matter vibrate and vibrating matter can make sound.	c. Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. (1-PS4-3) (Clarification Statement: Examples of materials could include those that are transparent [such as clear plastic], translucent [such as wax paper], opaque [such as cardboard] and reflective [such as a mirror]).	c. Explore the effects of different materials put into the path of a beam of light.
First Grade	1. Physical Science	1. Sound can make matter vibrate and vibrating matter can make sound.	d. Use tools and materials to design and build a device that used light or sound to solve the problem of communicating over a distance. (1-PS4-4) (Clarification Statement: This performance expectation integrates transitional science content with engineering through a practice or disciplinary core idea).	d. Engage with tools and materials used to build devices that transmit sound or light over distances (e.g., telephone, TV, speakers, walkie/talkie, microphone).
Standard 2: Life Science – Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and other living things in their environment.				
First Grade	2. Life Science	1. All organisms have external parts that they use to perform daily functions.	a. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow and meet their needs. (1-LS1-1) (Clarification Statement: Examples of human problems that can be solved could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and detecting intruders by mimicking eyes and ears).	a. Identify parts of animals and plants that help them survive (e.g., thorns on roses, quills on porcupines). Identify parts of the body and how they help a person survive.

(E) Grade	(F) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
First Grade	2. Life Science	1. All organisms have external parts that they use to perform daily functions.	b. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. (1-LS1-2) (Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make [such as crying, cheeping and other vocalizations] and the responses of the parents [such as feeding, comforting and protecting the offspring]).	b. Use texts and media to identify behaviors of parents and offspring that help the offspring survive (e.g., a baby cries and the parents feed the baby or change diaper, a calf is hungry and drinks milk from its mother).
First Grade	2. Life Science	2. Young organisms are very much, but not exactly, like their parents, and also resemble other organisms of the same kind.	a. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents. (1-LS3-1) (Clarification Statement: Examples of patterns could include features that plants or animals share. Examples of observations could include leaves from the same kind of plant that are the same shape but can differ in size; and, a particular breed of dog looks like its parents but is not exactly the same. This performance expectation integrates traditional science content with engineering through a practice or disciplinary core idea).	a. Identify physical similarities between parents or adult animal and offspring. i. Identify physical differences between parents or adult animals and offspring.

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Standard 3 – Earth and Space Science - Students know and understand the processes of life, and how living things interact with each other and their environment.				
First Grade	3. Earth and Space Science	1. Patterns of movement of the sun, moon and stars as seen from Earth can be observed, described and predicted.	a. Use observations of the sun, moon, and stars to describe patterns that can be predicted. (1-ESS1-1) (Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky and set; and stars other than our sun are visible at night but not during the day).	a. Follow the movement of the sun across the sky for a period of time to predict a pattern (e.g., sun rises and sets and follows same path across time each day).
First Grade	3. Earth and Space Science	1. Patterns of movement of the sun, moon and stars as seen from Earth can be observed, described and predicted.	b. Make observations at different times of year to relate the amount of daylight to the time of year. (1-ESS1-2) (Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall). (Boundary Statement: Limited to relative amounts of daylight, not quantifying the hours or time of daylight).	b. Observe and track throughout the school year the amount of daylight and the changes at different times of the year.
Standard 1: Physical Science – Students know and understand common properties, forms, and changes in matter and energy.				
Second Grade	1. Physical Science	1. Matter exists as different substances that have observable different properties.	a. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. (2-PS1-1) (Clarification Statement: Observations could include color, texture, hardness and flexibility. Patterns could include the similar properties that different materials share).	a. Classify and sort different kinds of materials by their observable properties.
Second Grade	1. Physical Science	1. Matter exists as different substances that have observable different properties.	b. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. (2-PS1-2) (Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture and absorbency). (Boundary Statement: Quantitative measurement is limited to length).	b. Categorize different familiar materials based on data to determine which materials have the properties best suited for an intended purpose (e.g., a balloon and a plastic bag – the material of the balloon allows for it to be inflated and plastic bag will not inflate. What is plastic bag used for? Can balloon be used for same as plastic bag).
Second Grade	1. Physical Science	1. Matter exists as different substances that have observable different properties.	c. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. (2-PS1-3) (Clarification Statement: Examples of pieces could include blocks, building bricks or other assorted small objects).	c. Explore and/or identify how objects can be disassembled and recomposed using blocks, Lego's, etc.

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Second Grade	1. Physical Science	1. Matter exists as different substances that have observable different properties.	d. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. (2-PS1-4) (Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf and heating paper).	d. Identify changes of familiar objects by heating and cooling that can be reversed or not (e.g., water/ice/boiling water; egg/cooking egg).
Standard 2: Life Science – Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and other living things in their environment.				
Second Grade	2. Life Science	1. Plants depend on water and light to grow and on animals for pollination or to move their seeds around.	a. Plan and conduct an investigation to determine if plants need sunlight and water to grow. (2-LS2-1) (Boundary Statement: Limited to using one variable at a time).	a. Engage in investigations that show plants need sunlight and water to grow.
Second Grade	2. Life Science	1. Plants depend on water and light to grow and on animals for pollination or to move their seeds around.	b. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. (2-LS2-2)	b. Identify simple models that show how animals disperse seeds or pollinate plants.
Second Grade	2. Life Science	2. A range of different organisms lives in different places.	a. Make observations of plants and animals to compare the diversity of life in different habitats. (2-LS4-1) (Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats).	a. Match the living organism to its habitat. i. Identify characteristics needed in a habitat for specific animals.
Standard 3 – Earth and Space Science - Students know and understand the processes of life, and how living things interact with each other and their environment.				
Second Grade	3. Earth and Space Science	1. Some events on Earth occur quickly; others can occur very slowly.	a. Use information from several sources to provide evidence that Earth events can occur quickly or slowly. (2-ESS1-1) (Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly, and erosion of rocks, which occurs slowly).	a. Explore how Earth events occur over time (Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly, and erosion of rocks, which occurs slowly).
Second Grade	3. Earth and Space Science	2. Wind and water can change the shape of the land; models can show the shape and these changes to the land.	a. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. (2-ESS2-1) (Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land).	a. Compare and/or identify solutions designed to slow or prevent wind and water from changing the shape of the land.

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Second Grade	3. Earth and Space Science	2. Wind and water can change the shape of the land; models can show the shape and these changes to the land.	b. Develop a model to represent the shapes and kinds of land and bodies of water in an area. (2-ESS2-2) (Boundary Statement: Does not include quantitative scaling in models).	b. Identify different types of bodies of water on a model.
Second Grade	3. Earth and Space Science	2. Wind and water can change the shape of the land; models can show the shape and these changes to the land.	c. Obtain information to identify where water is found on Earth and that it can be solid or liquid. (2-ESS2-3)	c. Identify different places that water is found on Earth (e.g., lakes, rivers, oceans, glaciers).
Standard 1: Physical Science – Students know and understand common properties, forms, and changes in matter and energy.				
Third Grade	1. Physical Science	1. Patterns of motion can be used to predict future motion.	a. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. (3-PS2-1) (Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving and balanced forces pushing on a box from both sides will not produce any motion at all). (Boundary Statements: Limited to one variable at a time: number, size or direction of forces and to gravity being addressed as a force that pulls objects down. Does not include quantitative force size, only qualitative and relative).	a. Explore and identify how the direction or speed (fast/slow, straight, back and forth, push/pull) of an object will change due to a balanced or unbalanced outside forces (e.g., friction or gravity).
Third Grade	1. Physical Science	1. Patterns of motion can be used to predict future motion.	b. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. (3-PS2-2) (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). (Boundary Statement: Does not include technical terms such as period and frequency).	b. Observe a pattern of motion in familiar items (e.g., swing, ball rolling, kinetic toy) and use it to predict the future motion.

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Third Grade	1. Physical Science	2. Objects in contact exert forces on each other; electric and magnetic forces between a pair of objects do not require contact.	a. Ask questions to determine cause - and - effect relationships of electric or magnetic interactions between two objects not in contact with each other. (3-PS2-3) (Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause - and - effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force). (Boundary Statement: Limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity).	a. Identify questions to ask about the relationship of magnets with various materials, some of which result in magnetic interactions and some of which do not.
Third Grade	1. Physical Science	2. Objects in contact exert forces on each other; electric and magnetic forces between a pair of objects do not require contact.	b. Define a simple design problem that can be solved by applying scientific ideas about magnets. (3-PS2-4)(Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other).	b. Explore and engage in an activity designed to show how magnets are used in the environment.
Standard 2: Life Science – Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and other living things in their environment.				
Third Grade	2. Life Science	1. Organisms have unique and diverse life cycles.	Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction and death. (3-LS1-1) (Clarification Statement: Changes organisms go through during their life form a pattern). (Boundary Statement: Limited to those of flowering plants and does not include details of human reproduction).	a. Identify the life cycle of familiar living things. i. Use a model to sequence three stages of a life cycle of familiar organisms.
Third Grade	2. Life Science	2. Being part of a group helps animals obtain food, defend themselves and cope with changes	a. Construct an argument that some animals form groups that help members survive. (3-LS2-1)	a. Describe how being part of a group helps some animals obtain food.

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Third Grade	2. Life Science	3. Different organisms vary in how they look and function because they have different inherited information; the environment also affects the traits that an organism develops.	a. 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. (3-LS3-1) (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). (Boundary Statement: Does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples).	a. Examine data to identify observable traits inherited across generations of plants or animals (and not focused on humans). For example, plants from one generation to another have very similar physical traits.
Third Grade	2. Life Science	3. Different organisms vary in how they look and function because they have different inherited information; the environment also affects the traits that an organism develops.	b. Use evidence to support the explanation that traits can be influenced by the environment. (3-LS3-2) (Clarification Statement: Examples of the environment affecting a trait could that include normally tall plants grown with insufficient water are stunted; and a pet dog that is given too much food and little exercise may become overweight).	b. Identify a trait of a plant or animal that could be influenced by the environment (e.g., normally tall plants grown with insufficient water are stunted; and a pet dog that is given too much food and little exercise may become overweight).
Third Grade	2. Life Science	4. Some living organisms resemble organisms that once lived on Earth.	a. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. (3-LS4-1) (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). (Boundary Statement: Does not include identification of specific fossils or present plants and animals and is limited to major fossil types and relative ages).	a. Identify fossils and to connect fossils to organisms that lived long ago.

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Third Grade	2. Life Science	4. Some living organisms resemble organisms that once lived on Earth.	b. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates and reproducing. (3-LS4-2) (Clarification Statement: Examples of cause - and - effect relationships could be that plants that have larger thorns than other plants may be less likely to be eaten by predators; and animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring).	b. Identify characteristics of plants and animals that may have helped them survive (e.g., thorns on rose bushes, why some birds/frogs/animals survive, and others don't).
Third Grade	2. Life Science	5. Sometimes differences in characteristics between individuals of the same species provide advantages in survival and reproduction.	a. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well and some cannot survive at all. (3-LS4-3) (Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other).	a. Identify a pattern using images or other media that supports the claim some organisms can survive well, some survive less well, and some cannot survive at all.
Third Grade	2. Life Science	5. Sometimes differences in characteristics between individuals of the same species provide advantages in survival and reproduction.	b. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. (3-LS4-4) (Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food and other organisms). (Boundary Statement: Limited to a single environmental change. Assessment does not include the greenhouse effect or climate change).	b. Compare solutions to a problem caused when the environment changes and the types of plants and animals that live there may change (e.g., access to water for animals during a drought; loss of food source during a natural disaster).
Standard 3 – Earth and Space Science - Students know and understand the processes of life, and how living things interact with each other and their environment.				
Third Grade	3. Earth and Space Science	1. Climate describes patterns of typical weather conditions over different scales and variations; historical weather patterns can be analyzed.	a. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. (3-ESS2-1) *(Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction. Obtain and combine information to describe climates in different regions of the world.) (Boundary Statement: Graphical displays are limited to pictographs and bar graphs. Does not include climate change).*	a. Use a graphical representation to identify weather patterns and conditions.

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Third Grade	3. Earth and Space Science	1. Climate describes patterns of typical weather conditions over different scales and variations; historical weather patterns can be analyzed.	b. Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)	b. Identify patterns of typical weather conditions (using temperature and precipitation) in different regions of the world over time.
Third Grade	3. Earth and Space Science	2. A variety of weather hazards result from natural process; humans cannot eliminate weather-related hazards but can reduce their impacts.	a. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. (3-ESS3-1) (Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs and lightning rods).	a. Identify features of a design that helps reduce the impact of a weather-related hazard (e.g., sandbags to prevent flooding, garage for car to prevent hail damage).
Standard 1: Physical Science – Students know and understand common properties, forms, and changes in matter and energy.				
Fourth Grade	1. Physical Science	1. The faster an object moves the more energy it has.	a. Use evidence to construct an explanation relating the speed of an object to the energy of that object. (4-PS3-1) (Clarification Statement: Examples of evidence relating speed and energy could include change of shape on impact or other results of collisions). (Boundary Statement: Does not include quantitative measures of changes in speed of an object or on any precise or quantitative definition of energy).	a. Identify the relationship between speed and energy and how an object is changed (e.g., more damage is caused by a car crash when the cars' speed is higher)
Fourth Grade	1. Physical Science	2. Energy can be moved from place to place.	a. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat and electric currents. (4-PS3-2) (Boundary Statement: Does not include quantitative measurement of energy).	a. Explore and identify how energy can be transferred from place to place by light, heat, electricity, and sound (e.g., identify household devices that use electric current energy to operate).
Fourth Grade	1. Physical Science	3. When objects collide contact forces transfer so as to change objects' motion.	a. Ask questions and predict outcomes about the changes in energy that occur when objects collide. (4-PS3-3) (Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact). (Boundary Statement: Does not include quantitative measures of energy).	a. Identify questions to ask about the relationship between objects colliding at different speeds.

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Fourth Grade	1. Physical Science	4. Energy can be produced, used or released by converting stored energy.	a. Apply scientific ideas to design, test and refine a device that converts energy from one form to another. (4-PS3-4) (Clarification Statement: Examples of evidence relating speed and energy could include change of shape on impact or other results of collisions). (Boundary Statement: Does not include quantitative measures of changes in speed of an object or on any precise or quantitative definition of energy).	a. Collaborate with others to design, test, and refine a device to identify the change that happens with the transfer of energy from one object to another.
Fourth Grade	1. Physical Science	5. Waves are regular patterns of motion.	a. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. (4-PS4-1) (Clarification Statement: Examples of models could include diagrams, analogies and physical models using wire to illustrate wavelength and amplitude of waves). (Boundary Statement: Does not include interference effects, electromagnetic waves, non-periodic waves or quantitative models of amplitude and wavelength).	a. Use a model to demonstrate that waves can cause objects to move (e.g., using a physical model of what happens to floating objects when water is disturbed).
Fourth Grade	1. Physical Science	6. An object can be seen when light reflected from its surface enters the eyes.	a. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. (4-PS4-2) (Boundary Statement: Does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision or how the retina works).	a. Use or identify a model to demonstrate that light reflecting from objects and entering the eye allows objects to be seen.
Fourth Grade	1. Physical Science	7. Patterns can encode, send, receive and decode information.	a. Generate and compare multiple solutions that use patterns to transfer information. (4-PS4-3) (Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1s and 0s representing black and white to send information about a picture and using Morse code to send text).	a. Collaborate with others, to generate a pattern to transfer information (e.g., sounds like drums sending coded information [flashlight], or a series of symbols ([used to convey a message]).

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Standard 2: Life Science – Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and other living things in their environment.				
Fourth Grade	2. Life Science	1. Organisms have both internal and external structures that serve various functions.	a. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction. (4-LS1-1) (Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lungs, brain and skin). (Boundary Statement: Stress at this level is on understanding the macroscale systems and their functions, not the microscopic scale).	a. Identify basic parts of plants and animals. i. Identify common internal organs of the human body. ii. Explain what plants and animals need to survive.
Fourth Grade	2. Life Science	1. Organisms have both internal and external structures that serve various functions.	a. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. (4-LS1-2) (Clarification Statement: Emphasis is on systems information transfer). (Boundary Statement: Does not include the mechanisms by which the brain stores and recalls information or the mechanism of how sensory receptors function).	b. Explore the information received by animals through their senses and how they use it to guide their actions (e.g., seasonal migration, reproduction, survival).
c. **Standard 3 – Earth and Space Science - Students know and understand the processes of life, and how living things interact with each other and their environment.**				
Fourth Grade	3. Earth and Space Science	1. Earth has changed over time.	a. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (4-ESS1-1) (Clarification Statement: Examples of evidence from patterns could include rock layers with shell fossils above rock layers with plant fossils and no shells, indicating a change from water to land over time; and a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock). (Boundary Statement: Does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers, and should only include relative time).	a. Identify evidence of patterns in rock formations and fossils in rock layers to compare changes in a landscape over time.

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(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Fourth Grade	3. Earth and Space Science	2. Four major Earth systems interact.	a. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (4-ESS2-1) *(Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling and volume of water flow.) (Boundary Statement: Limited to a single form of weathering or erosion.)*	a. Identify forces that can change the Earth's surface (erosion, deposition, climate, and human activity).
Fourth Grade	3. Earth and Space Science	3. Earth's physical features occur in patterns.	a. Analyze and interpret data from maps to describe patterns of Earth's features. (4-ESS2-2) (Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes and earthquakes).	a. Using different types of maps, identify patterns in Earth's features (e.g., where Colorado is located on a map, major mountain chains form inside continents or near their edges).
Fourth Grade	3. Earth and Space Science	4. Energy and fuels that humans use are derived from natural sources and their use affects the environment in multiple ways.	a. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. (4-ESS3-1) (Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels).	a. Identify Earth's resources (water, wind, solar and some fossil fuels such as coal and gas). Distinguish how their use impacts the environment.
Fourth Grade	3. Earth and Space Science	5. A variety of hazards result from natural process; humans cannot eliminate natural hazards but can reduce their impacts' effect.	a. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. (4-ESS3-2) (Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity). (Boundary: Limited to earthquakes, floods, tsunamis, and volcanic eruptions).	a. Compare features of two designs that help reduce the impact of a natural Earth process on humans (e.g., earthquakes, floods, and volcanic eruptions). (Boundary: Limited to earthquakes, floods, tsunamis, and volcanic eruptions)

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Standard 1: Physical Science – Students know and understand common properties, forms, and changes in matter and energy.				
Fifth Grade	1. Physical Science	1. Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.	a. Develop a model to describe that matter is made of particles too small to be seen. (5-PS1-1) (Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water and evaporating salt water. Does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles).	a. Use a model to demonstrate that matter is made of particles too small to be seen (e.g., inflating a balloon, blowing up a ball).
Fifth Grade	1. Physical Science	1. Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.	b. Make observations and measurements to identify materials based on their properties. (5-PS1-3) (Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility; density is not intended as an identifiable property. Does not include density or distinguishing mass and weight). (Boundary Statement: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation).	b. Classify materials based on their properties (e.g., color, hardness, solubility, thermal conductivity)
Fifth Grade	1. Physical Science	2. Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.	a. 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. (5-PS1-1) (Clarification Statement: Examples of reactions or changes could include phase changes, dissolving and mixing that form new substances. Does not include distinguishing mass and weight). (Boundary Statement: Mass and weight are not distinguished at this grade level).	a. Use qualitative and/or quantitative observations, show evidence of how heating, cooling, or mixing substances, the total weight is conserved.

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Fifth Grade	1. Physical Science	2. Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.	b. Conduct an investigation to determine whether the mixing of two or more substances results in new substances. (5-PS1-4)	b. Identify and compare the properties of two substances before and after mixing.
Fifth Grade	1. Physical Science	3. The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.	a. Support an argument that the gravitational force exerted by Earth on objects is directed down. (5-PS2-1) (Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth). (Boundary Statement: Does not include mathematical representation of gravitational force).	a. Provide evidence by demonstration that the force of gravity pulls any object down toward the earth.
Fifth Grade	1. Physical Science	4. The energy released from food was once energy from the sun.	a. Use models to describe that energy in animals' food (used for body repair, growth and motion and to maintain body warmth) was once energy from the sun. (5-PS3-1) (Clarification Statement: Examples of models could include diagrams and flowcharts).	a. Using a model, describes that energy in animals' food was once energy from the sun.
Standard 2: Life Science – Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and other living things in their environment.				
Fifth Grade	2. Life Science	1. Plants acquire their material from growth chiefly from air and water.	a. Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1) (Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil).	a. Use evidence to show that plants get the materials they need to grow chiefly from air and water, but not soil (e.g., plant grown in water without soil and demonstrates growth).
Fifth Grade	2. Life Science	2. Matter cycles between air and soil and among plants, animals and microbes as these organisms live and die.	a. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (5-LS2-1) (Clarification Statement: Emphasis is on the idea that matter that is not food [air, water, decomposed materials in soil] is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth). (Boundary Statement: Does not include molecular explanations).	a. Develop a model to show the movement of matter among plants, animals, and the environment.

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Standard 3 – Earth and Space Science - Students know and understand the processes of life, and how living things interact with each other and their environment.				
Fifth Grade	3. Earth and Space Science	1. Stars range greatly in size and distance from Earth, and this can explain their relative brightness.	a. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth. (5-ESS1-1) (Clarification Statement: Limited to relative distances, not sizes, of stars. Does not include other factors that affect apparent brightness [such as stellar masses, age and stage]).	a. Identifies that the sun is a star that is brighter than their stars because of its relation to its distance from the Earth.
Fifth Grade	3. Earth and Space Science	2. Earth's orbit and rotation and the orbit of the moon around earth cause observable patterns.	a. 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. (5-ESS1-2) (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). (Boundary Statement: Does not include causes of seasons).	a. Observe and graph patterns of daily changes in the amount of daylight across seasons. i. Measures length of shadows of across time and at different times of the day.
Fifth Grade	3. Earth and Space Science	3. Earth's major systems interact in multiple ways to affect Earth's surface materials and processes.	a. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere and/or atmosphere interact. (5-ESS2-1) (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). (Boundary Statement: Limited to the interactions of two systems at a time).	a. Describe the interaction between any of the Earth's systems (e.g., the influence of the atmosphere on landforms through weather and climate; the influence of the ocean on ecosystems and the melting glaciers and rising sea-level).
Fifth Grade	3. Earth and Space Science	4. Most of Earth's water is in the ocean and much of Earth's freshwater in glaciers or underground.	a. Describe and graph the amounts and percentages of saltwater and freshwater in various reservoirs to provide evidence about the distribution of water on Earth. (5-ESS2-2) (Boundary Statement: Limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere).	a. Using a graph, compare the amounts of saltwater and freshwater on Earth found in oceans, lakes, rivers, glaciers, ground water, and polar ice caps.

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Fifth Grade	3. Earth and Space Science	5. Societal activities have had major effects on land, ocean, atmosphere and even outer space	a. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. (5-ESS3-1)	a. Use text and media to identify ways to protect the Earth's resources and environment (e.g., solar energy and wind energy).
Standard 1: Physical Science – Students know and understand common properties, forms, and changes in matter and energy.				
Middle School	1. Physical Science	1. Manipulating and using magnification tools 2. Following and giving directions related to a science lab	a. Develop models to describe the atomic composition of simple molecules and extended structures. (MS PS1-1) (Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms). (Boundary Statement: Does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure).	a. Create models of simple molecules and more complex structures such as water, oxygen, methane, etc. Models can include drawings, 3D ball and stick structures, or computer representations showing different molecules.
Middle School	1. Physical Science	1. The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter and phases changes.	b. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (MS-PS1-2) (Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride). (Boundary statement: Limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability and odor).	b. Analyze data to identify the similarities and differences of the properties of a substance before and after a chemical change. (e.g., wood burning, bake cake, burning sugar, vinegar & baking soda, Mentos/Coke)
Middle School	1. Physical Science	1. The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter and phases changes.	c. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. (MS-PS1-3) (Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods and alternative fuels). (Boundary Statement: Limited to qualitative information).	c. Use information to identify natural resources that are transformed to make new, synthetic materials (e.g., vitamin D is found in nature but as a pill form it is synthetic)

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Middle School	1. Physical Science	1. The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter and phases changes.	d. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. (MS-PS1-4) (Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawing and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide and helium).	d. Create a model to explain the relationship that happens when changes in temperature change the state of a pure substance (i.e., hot air balloon, why do balloons inflate/deflate, states of water).
	1. Physical Science	2. Reacting substances rearrange to form different molecules, but the number of atoms is conserved. Some reactions release energy and others absorb energy.	a. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (MS-PS1-2) (Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride). (Boundary statement: Limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability and odor).	a. Use graphical displays to identify the similarities and differences of the properties of a substance before and after a chemical change.
Middle School	1. Physical Science	2. Reacting substances rearrange to form different molecules, but the number of atoms is conserved. Some reactions release energy and others absorb energy.	b. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. (MS PS 1-5) (Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms). (Boundary Statement: Does not include the use of atomic masses, balancing symbolic equations or intermolecular forces).	b. Create a model to demonstrate how atoms do not change in a chemical reaction, they are just rearranged (e.g., turning wood into ash, baking a cake, etc. i. Reflects the law of conservation of mass).

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Middle School	1. Physical Science	2. Reacting substances rearrange to form different molecules, but the number of atoms is conserved. Some reactions release energy and others absorb energy.	c. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. (MS PS1-6) (Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride). (Boundary Statement: Limited to the criteria of amount, time and temperature of substance in testing the device).	c. Engage in a task to construct, test, or modify a device that either releases or absorbs thermal energy by chemical processes (e.g., wood burning, bake a cake, clothing as insulation, solar panels, solar ovens).
Middle School	1. Physical Science	3. Motion is described relative to a reference frame that must be shared with others and is determined by the sum of the forces acting on it. The greater the mass of the object, the greater the force needed to achieve the same change in motion.	a. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. (MS-PS-2-1) (Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle). (Boundary Statement: Limited to vertical or horizontal interactions in one dimension).	a. Engage in an exploration to design a solution to reduce the impact of a collision of two objects in motion or one in motion and one stationary (e.g., two cars).
Middle School	1. Physical Science	3. Motion is described relative to a reference frame that must be shared with others and is determined by the sum of the forces acting on it. The greater the mass of the object, the greater the force needed to achieve the same change in motion.	b. Plan an investigation to provide evidence that the change in an objects motion depends on the sum of the forces on the object and the mass of the object. (MS-PS-2-2) (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). (Boundary Statement: 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).	b. Engage in an investigation that provides evidence that objects with greater mass and greater force will change more than those with less mass and force.

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Middle School	1. Physical Science	4. Forces that act a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.	a. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (MS-PS2-3) (Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor). (Boundary Statement: Limited to questions that require quantitative answers is limited to proportional reasoning and algebraic thinking).	a. Provide evidence, using an investigation to determine factors that affect the strength of electromagnetic forces (e.g., a model that demonstrates that a piece of metal when magnetized by electricity, can pick up many times its own weight).
Middle School	1. Physical Science	4. Forces that act a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.	b. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. (MS-PS2-4) (Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system). (Boundary Statement: Does not include Newton's Law of Gravitation or Kepler's Laws).	b. Construct a graph, model, or visual representation to show evidence of gravitational forces on interacting objects of different mass. Examples of evidence for arguments could include data generated from simulations or digital tools. i. Charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.
Middle School	1. Physical Science	4. Forces that act a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.	c. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. (MS-PS2-5) (Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically charged strips of tape, and electrically-charged pith balls. Examples of investigations could include firsthand experiences or simulations). (Boundary Statement: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields).	c. Conduct or participate in an investigation to explore evidence that fields exist between objects exerting forces on each other even though the objects are no tin contact (e.g., electrically charged strips of tape, balloon/hair).

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	1. Physical Science	5. Kinetic energy can be distinguished from the various forms of potential energy.	a. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and the speed of an object. (MS-PS3-1) (Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a whiffle ball versus a tennis ball).	a. Use graphical displays of data to identify the relationship of the kinetic energy to the mass of an object and the speed of an object.
Middle School	1. Physical Science	5. Kinetic energy can be distinguished from the various forms of potential energy.	b. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (MS-PS-3-2) (Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster car at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.) (Boundary Statement: Limited to two objects and electric, magnetic, and gravitational interactions.)	b. Create a model to demonstrate that when the position of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
Middle School	1. Physical Science	5. Kinetic energy can be distinguished from the various forms of potential energy.	c. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (MS-PS3-3) (Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup). (Boundary Statement: Does not include calculating the total amount of thermal energy transferred).	c. Compare data to identify a device (e.g., foam cup, insulated box) that either minimizes or maximizes thermal energy transfer (e.g., keeping liquids hot or cold).

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	1. Physical Science	5. Kinetic energy can be distinguished from the various forms of potential energy.	d. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. (MS-PS3-4) (Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added). (Boundary Statement: Does not include calculating the total amount of thermal energy transferred).	d. Provide evidence of energy transfer as measured by change in temperature between different types and masses of materials.
Middle School	1. Physical Science	5. Kinetic energy can be distinguished from the various forms of potential energy.	e. 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. (MS-PS3–5) (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). (Boundary Statement: Does not include calculations of energy).	e. Using data from a sample in an investigation, provide evidence of the transfer of energy between two objects, as measured by temperature
Middle School	1. Physical Science	6. Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states and amounts of matter.	a. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (MS PS3-3) (Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup). (Boundary Statement: Does not include calculating the total amount of thermal energy transferred).	a. Engage in a task to construct, test, or modify a device to minimize or maximize thermal energy transfer from one object to another (i.e., identify devices that retain and/or lose heat).

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	1. Physical Science	6. Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states and amounts of matter.	b. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. (MS-PS3-4) (Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added). (Boundary Statement: Does not include calculating the total amount of thermal energy transferred).	b. Demonstrate understanding that the relationship between the energy transferred, they type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample (e.g., measure temperature when heat applied to water and ice added to water).
Middle School	1. Physical Science	6. Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states and amounts of matter.	c. Construct, use, and present arguments to support the claim that when kinetic energy of an object changes, energy is transferred to or from the object. (MS-PS3-5) (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). (Boundary Statement: Does not include calculations of energy).	c. Create or use a diagram to show evidence of kinetic energy transfer from one object or another (e.g., roller coaster from its peak to rest of track showing changes in kinetic energy; ball hitting another in pool and transferring energy to the ball that is hit).

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	1. Physical Science	7. When two objects interact, each one exerts a force on the other that can cause energy to be transferred to and from the object.	a. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (MS-PS3-2) (Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster car at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems). (Boundary Statement: Limited to two objects and electric, magnetic, and gravitational interactions).	a. Create a model to demonstrate that when the position of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
Middle School	1. Physical Science	8. A simple wave model has a repeating pattern with specific wavelength, frequency, and amplitude and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena which include light and sound.	a. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in the wave. (MS PS4-1) (Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking). (Boundary Statement: Does not include electromagnetic waves and is limited to standard repeating waves).	a. Use a visual representation, simple graph or table to show how the amplitude (strength/intensity) of a wave is related to the energy in the wave.

(G) Grade	(H) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	1. Physical Science	8. A simple wave model has a repeating pattern with specific wavelength, frequency, and amplitude and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena which include light and sound.	b. Develop and use a model to describe that waves are reflected, absorbed or transmitted through various materials. (MS-PS4-2) (Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions). (Boundary Statement: Limited to qualitative applications pertaining to light and mechanical waves).	b. Use multiple representations to demonstrate how light or sound waves are reflected, absorbed or transmitted through various materials (e.g., water, air, glass).
Middle School	1. Physical Science	9. A wave model of light is useful to explain how light interacts with objects through a variety of properties.	a. Develop and use a model to describe that waves are reflected, absorbed or transmitted through various materials. (MS-PS4-2) (Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions). (Boundary Statement: Limited to qualitative applications pertaining to light and mechanical waves).	a. Use multiple representations to demonstrate how light or sound waves are reflected, absorbed or transmitted through various materials (e.g., water, air, glass).
Middle School	1. Physical Science	10. Designed technologies can transmit digital information as wave pulses.	a. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. (MS-PS4-3) (Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in Wi-Fi devices, and conversion of stored binary patterns to make sound or text on a computer screen). (Boundary Statement: Does not include binary counting or the specific mechanism of any given device).	a. Explore how waves can be used for communication purposes and to support the claim that digitized signals are a more reliable way to encode and transmit information (e.g., radio, television, cell-phones, and computers) in order to determine that digitized signals are more reliable for transmitting information.

(I) Grade	(J) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Standard 2: Life Science – Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and other living things in their environment.				
Middle School	2. Life Science	1. All living things are made up of cells, which is the smallest unit that can be said to be alive.	a. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. (MS-LS1-1) (Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and nonliving things, and understanding that living things may be made of one cell or many and varied cells).	a. Use evidence from an investigation to show that living things are made of cells.
Middle School	2. Life Science	1. All living things are made up of cells, which is the smallest unit that can be said to be alive.	b. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function. (MS LS1-2) (Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall). (Boundary Statement: Organelle structure/function relationships is limited to the cell wall and cell membrane. Function of the other organelles is limited to their relationship to the whole cell. Does not include the biochemical function of cells or cell parts).	b. Develop or use a model to identify at least three major components of a plant or animal cell (e.g., nucleus, cell membrane/cell wall, and cytoplasm) and the primary role of each component.
Middle School	2. Life Science	1. All living things are made up of cells, which is the smallest unit that can be said to be alive.	c. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. (MS-LS1-3) (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). (Boundary Statement: Does not include the mechanism of one body system independent of others. Limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems).	c. Use evidence that shows the major organs that make up specific systems (e.g., respiratory, circulatory, and digestive), interact, and are composed of cells.

(I) Grade	(J) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	2. Life Science	2. Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.	a. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. (MS-LS1-4) (Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury).	a. Identify how characteristic animal behaviors and specialized plant structure help them survive and reproduce in a given environment (e.g., birds build a nest to protect young from cold, animals scatter pollen and seeds increasing the chance of plant reproduction).
Middle School	2. Life Science	2. Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.	b. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. (MS-LS1-5) (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). (Boundary Statement: Does not include genetic mechanisms, gene regulation or biochemical processes).	b. Collect data and construct a response to show different environmental factors influence growth of organisms (e.g., availability of food, light, space and water).

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(I) Grade	(J) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	2. Life Science	3. Sustaining life requires substantial energy and matter inputs.	a. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. (MS-LS1-6) (Clarification Statement: Emphasis is on tracing movement of matter and flow of energy). (Boundary Statement: Does not include the biochemical mechanisms of photosynthesis).	a. Identify how photosynthesis plays a role in the cycling of matter and the flow of energy between plants and animals (e.g., energy from the sun helps create food for plants and an animal eats the plant and gains energy from eating that plant).
Middle School	2. Life Science	3. Sustaining life requires substantial energy and matter inputs.	b. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. (MS-LS1-7) (Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released). (Boundary Statement: Assessment does not include details of the chemical reactions for photosynthesis or respiration).	b. Develop or use a model to show how food supports growth and/or releases energy in an organism.
Middle School	2. Life Science	4. Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain.	a. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. (MS-LS1-8) (Boundary Statement: Does not include mechanisms for the transmission of this information).	a. Gather information about how organisms detect, process, and use information via the nervous system for immediate use or to store information as a memory (e.g., predator/prey relationships; growth, reproduction, and survival).
Middle School	2. Life Science	5. Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving	a. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (MS-LS2-1) (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).	a. Use data to identify how environmental conditions such as resource availability can affect organisms and populations in an ecosystem.

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Middle School	2. Life Science	5. Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving	b. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (MS-LS2-2) (Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial).	b. Identify examples of competitive, predatory, and mutually beneficial relationships between organisms in at least three different ecosystems (e.g., urban, tundra, mountain, plains).
Middle School	2. Life Science	6. Ecosystems are sustained by the continuous flow of energy, originating primarily from the sun, and the recycling of matter and nutrients within the system.	a. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3) (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). (Boundary Statement: Assessment does not include the use of chemical reactions to describe the processes).	a. Develop or use a model (e.g. food web) to show how matter and energy are cycled among living and nonliving parts of an ecosystem.
Middle School	2. Life Science	7. Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem	a. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (MS-LS2-4) (Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems).	a. Identify examples of how changes to a physical or biological components of an ecosystem impact populations (e.g., eliminating an animal's food source).
Middle School	2. Life Science	7. Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem	b. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. (MS-LS2-5) (Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations).	b. Compare the economic costs, social considerations or scientific constraints of two design solutions for maintaining the health of an ecosystem (e.g., prevention of soil erosion, water purification).

(I) Grade	(J) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	2. Life Science	8. Heredity explains why offspring resemble, but are not identical to, their parents and is a unifying biological principle. Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes.	a. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. (MS-LS3-1) (Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins). (Boundary Statement: Does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations).	a. Develop a model of how structural changes to genes (mutations) may result in harmful, beneficial, or neutral effects for an organism (e.g., a fur on a brown bear vs. fur on a polar bear due to climate differences).
Middle School	2. Life Science	8. Heredity explains why offspring resemble, but are not identical to, their parents and is a unifying biological principle. Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes.	b. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. (MS-LS3-2) (Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause - and - effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation).	b. Develop a model to show how the genetic characteristics of asexual and sexual reproduction of one generation relate to the previous generation (e.g., sweet potato cutting, bacteria, animals).
Middle School	2. Life Science	9. Fossils are mineral replacements, preserved remains, or traces of organisms that lived in the past.	a. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. (MS-LS4-1) (Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers). (Boundary Statement: Does not include the names of individual species or geological eras in the fossil record).	a. Identify at least three examples of patterns in the fossil record that show changes in the level of complexity of anatomical structures in organisms and/or the chronological order of fossil appearance in the rock layers (e.g., change in the size of mammals heads over time; arms of humans and horses share the same overall structure).

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Middle School	2. Life Science	9. Fossils are mineral replacements, preserved remains, or traces of organisms that lived in the past.	b. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. (MS-LS4-2) (Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures).	b. Use scientific information to identify examples how the similarities and differences among modern organisms and fossil organisms lead to explanations of evolutionary relationships.
Middle School	2. Life Science	9. Fossils are mineral replacements, preserved remains, or traces of organisms that lived in the past.	c. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. (MS-LS4-3) (Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures). (Boundary Statement: Comparisons are limited to gross appearance of anatomical structures in embryological development).	c. Use pictorial or object data to compare embryonic development patterns across multiple species
Middle School	2. Life Science	10. Genetic variations among individuals in a population give some individuals an advantage in surviving and reproducing in their environment.	a. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. (MS-LS4-4) (Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations).	a. Identify how variations of traits in populations increase some individuals' probability of surviving and reproducing.
Middle School	2. Life Science	10. Genetic variations among individuals in a population give some individuals an advantage in surviving and reproducing in their environment.	b. Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. (MS-LS4-5) (Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries).	b. Gather information to identify how humans artificially influence the inheritance of desired traits (e.g., dog breeding).

(I) Grade	(J) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	2. Life Science	10. Genetic variations among individuals in a population give some individuals an advantage in surviving and reproducing in their environment.	c. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. (MS-LS4-6) *(Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.) (Boundary Statement: Does not include Hardy Weinberg calculations.)*	c. Explore the relationship between natural selection and the increase and decrease of specific traits in populations over time (e.g., insect camouflage providing protection from a predator resulting in a larger population of that insect).
Middle School	2. Life Science	11. Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions.	a. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. (MS-LS4-6) (Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time). (Boundary Statement: Does not include Hardy Weinberg calculations).	a. Explore the relationship between natural selection and the increase and decrease of specific traits in populations over time (e.g., insect camouflage providing protection from a predator resulting in a larger population of that insect).
Middle School	2. Life Science	12. Biodiversity is the wide range of existing life forms that have adapted to the variety of conditions on Earth, from terrestrial to marine ecosystems.	a. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. (MS-LS2-5) (Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations).	a. Compare the economic costs or social considerations of two design solutions for maintaining the health of an ecosystem (e.g., prevention of soil erosion, water purification).
Standard 3 – Earth and Space Science - Students know and understand the processes of life, and how living things interact with each other and their environment.				
Middle School	3. Earth and Space Science	1. Motion is predictable in both solar systems and galaxies.	a. 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. (MS-ESS1-1) (Clarification Statement: Examples of models can be physical, graphical, or conceptual).	a. Use a model of Earth-sun-moon system to show the cyclic patterns of the moon's common phases and seasons.

(I) Grade	(J) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	3. Earth and Space Science	1. Motion is predictable in both solar systems and galaxies.	b. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. (MS-ESS1-2) *(Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical [such as the analogy of distance along a football field or computer visualizations of elliptical orbits] or conceptual [such as mathematical proportions relative to the size of familiar objects such as students' school or state]). (Boundary Statement: Does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth).*	b. Use a model to demonstrate the role of gravity in the motion of the Earth.
Middle School	3. Earth and Space Science	2. The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.	a. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. (MS-ESS1-2) *(Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical [such as the analogy of distance along a football field or computer visualizations of elliptical orbits] or conceptual [such as mathematical proportions relative to the size of familiar objects such as students' school or state].) (Boundary Statement: Does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth).*	a. Use a model to demonstrate the role of gravity in the motion of the Earth.

(I) Grade	(J) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	3. Earth and Space Science	2. The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.	b. Analyze and interpret data to determine scale properties of objects in the solar system. (MS-ESS1-3) *(Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers [such as crust and atmosphere], surface features [such as volcanoes], and orbital radius. Examples of data include statistical information, drawings and photographs, and models). (Boundary Statement: Does not include recalling facts about properties of the planets and other solar system bodies).*	b. Use data to determine at least one similarity and one difference among solar system objects (e.g., statistical information, drawings and photographs, models).
Middle School	3. Earth and Space Science	2. The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.	c. 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. (MS-ESS1-1) *(Clarification Statement: Examples of models can be physical, graphical, or conceptual.)*	c. Develop or use a model of the Earth-sun-moon system to identify the different cyclic patterns of lunar phases, eclipses of sun and moon, and seasons.
Middle School	3. Earth and Space Science	3. Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.	a. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. (MS-ESS1-4) (Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent [such as the last Ice Age or the earliest fossils of homo sapiens] to very old [such as the formation of Earth or the earliest evidence of life]. Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions). (Boundary Statement: Does not include recalling the names of specific periods or epochs and events within them).	a. Identify evidence that supports the scientific explanation that rock strata can be used to establish relative ages in Earth's history.

(I) Grade	(J) Standard	(H) Grade Level Expectation	(J) 2020 CAS Evidence Outcome	(K) Proposed Extended Evidence Outcome
Middle School	3. Earth and Space Science	4. Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. Plate tectonics is one result of these processes.	a. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. (MS-ESS2-1) (Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials). (Boundary Statement: Does not include the identification and naming of minerals).	a. Use a model to show that energy from the sun and the Earth's hot interior act together to form minerals and rocks (i.e., melting, crystallization, weathering, deformation, sedimentation).
Middle School	3. Earth and Space Science	4. Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. Plate tectonics is one result of these processes.	b. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (MS-ESS2-2) (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).	b. Use scientific resources to describe the processes, both fast and slow, that have changed Earth's surface over time (e.g., floods, landslides, earthquakes, plate movements).
Middle School	3. Earth and Space Science	5. Plate tectonics is the unifying theory that explains movements of rocks at Earth's surface and geological history.	a. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. (MS-ESS2-3) (Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents [including continental shelves], and the locations of ocean structures [such as ridges, fracture zones, and trenches]). (Boundary Statement: Does not include paleomagnetic anomalies in oceanic and continental crust).	a. Use data on the shape of continents, ocean structure (ridges, fracture zones, and trenches) and distribution of fossils to represent the phenomenon of plate motions.

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Middle School	3. Earth and Space Science	6. Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.	a. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (MS-ESS2-2) (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).	a. Explain the fast and slow processes that have changed Earth's surface over time (e.g., floods, landslides, earthquakes, plate movement to create mountains, volcanos) with an emphasis on changes at the local level.
Middle School	3. Earth and Space Science	6. Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.	b. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. (MS-ESS2-4) (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). (Boundary Statement: Does not include a quantitative understanding of the latent heats of vaporization and fusion).	b. Use a model to show how water changes its state as it moves through the hydrologic cycle.

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Middle School	3. Earth and Space Science	6. Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.	c. Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. (MS-ESS2-5) (Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather [defined by temperature, pressure, humidity, precipitation, and wind] at a fixed location to change over time and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students [such as weather maps, diagrams, and visualizations] or obtained through laboratory experiments [such as with condensation]). (Boundary Statement: Does not include recalling the names of cloud types or weather symbols used on weather maps of the reported diagrams from weather stations).	c. Use data to show how the motion and interaction of air masses explain changes in weather conditions.
Middle School	3. Earth and Space Science	6. Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.	d. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. (MS-ESS2-6) *(Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps, and globes, or digital representations.) (Boundary Statement: Does not include the dynamics of the Coriolis effect.)*	d. Use a model to identify Earth's tilt, seasons, elevation, and proximity to oceans as factors that determine a location's climate.

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Middle School	3. Earth and Space Science	7. Complex interactions determine local weather patterns and influence climate, including the role of the ocean.	a. Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. (MS-ESS2-5) *(Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather [defined by temperature, pressure, humidity, precipitation, and wind] at a fixed location to change over time and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students [such as weather maps, diagrams, and visualizations] or obtained through laboratory experiments [such as with condensation].) (Boundary Statement: Does not include recalling the names of cloud types or weather symbols used on weather maps of the reported diagrams from weather stations.)*	a. Collect or use data to demonstrate how motions and interactions of air masses change weather conditions (i.e., temperature, pressure, condensation, humidity, tornado, weather maps). i. What causes severe weather?
Middle School	3. Earth and Space Science	7. Complex interactions determine local weather patterns and influence climate, including the role of the ocean.	b. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. (MS-ESS2-6) *(Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps, and globes, or digital representations.) (Boundary Statement: Does not include the dynamics of the Coriolis effect.)*	b. Develop or use a model to identify different regional climates related to Earth's rotation and unequal heating (i.e., Coriolis Effect, latitude, longitude, and landforms).

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Middle School	3. Earth and Space Science	8. Humans depend on Earth's land, ocean, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.	a. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. (MS-ESS3-1) (Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum [locations of the burial of organic marine sediments and subsequent geologic traps], metal ores [locations of past volcanic and hydrothermal activity associated with subduction zones], and soil locations of active weathering and/or deposition of rock).	a. Use scientific resources to show evidence of how Earth's resources are limited and uneven as a result of geoscience processes (e.g., petroleum, soil location).
Middle School	3. Earth and Space Science	9. Mapping the history of natural hazards in a region and understanding related geological forces.	a. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2) (Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes, such as earthquakes and volcanic eruptions, surface processes, such as mass wasting and tsunamis, or severe weather events, such as hurricanes, tornadoes, and floods. Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global, such as satellite systems to monitor hurricanes or forest fires, or local, such as building basements in tornado-prone regions or reservoirs to mitigate droughts).	a. Use data to show how some natural hazards can be predicted, prepared for, and mitigated.

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Middle School	3. Earth and Space Science	10. Human activities have altered the biosphere, sometimes damaging it, although changes to environments can have different impacts for different living things.	a. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (MS-ESS3-3) (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).	a. Identify an environmental problem caused by humans and generate a solution to minimize its impact (e.g., conserve, reuse, or recycle resources).
Middle School	3. Earth and Space Science	10. Human activities have altered the biosphere, sometimes damaging it, although changes to environments can have different impacts for different living things.	b. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. (MS-ESS3-4) (Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources [such as freshwater, mineral, and energy]. Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes).	b. Use data to show the effect of increases in human population and the use of natural resources impact Earth’s systems.

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Middle School	3. Earth and Space Science	11. Human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.	a. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (MS-ESS3-5) (Clarification Statement: Examples of factors include human activities [such as fossil fuel combustion, cement production, and agricultural activity] and natural processes [such as changes in incoming solar radiation or volcanic activity]. Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures).	a. When presented with evidence (e.g., Data, graphs, maps, tables), ask questions to understand the factors that human activities have played a role in climate change.
Standard 1: Physical Science – Students know and understand common properties, forms, and changes in matter and energy.				
High School	1. Physical Science	1. The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter.	a. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy levels of atoms. (HS-PS1-1)(Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen). (Boundary Statement: Limited to main group elements. Does not include quantitative understanding of ionization energy beyond relative trends).	a. Use at least the first 20 elements of the periodic table to identify properties of groups and families and uses of commonly found elements.

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High School	1. Physical Science	1. The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter.	b. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. (HS-PS1-3)(Clarification Statement: Emphasis is on understanding the difference intermolecular versus intramolecular forces and the strengths of forces between particles but not naming specific intermolecular forces, such as dipole-dipole. Examples of particles could include ions, atoms, molecules, and networked materials, such as graphite. Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension). (Boundary Statement: Does not include Raoult's law calculations of vapor pressure or the names, shapes, or bond angles associated with VSEPR theory).	b. Collaborate with peers to explore how the structure of a substance impacts the properties of a substance (e.g., melting point, boiling point.
High School	1. Physical Science	1. The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter.	c. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. (HS-PS1-4) (Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved). (Boundary Statement: Does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products).	c. Develop a model to illustrate how changes in temperature show evidence of energy transfer in a chemical reaction (e.g., hand warmers, ice pack, salt on ice/snow, video of fireworks exploding, salt to make ice cream).

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High School	1. Physical Science	2. Chemical processes, their rates, their outcomes, and whether or not energy is stored or released can be understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved.	a. 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. (HS-PS1-2) (Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen). (Boundary Statement: Limited to chemical reactions involving main group elements and combustion reactions).	a. Develop and model to represent at least three simple chemical reactions (e.g., sodium and chlorine [NaCl], carbon and oxygen [CO2], hydrogen and oxygen [H2O]).
High School	1. Physical Science	2. Chemical processes, their rates, their outcomes, and whether or not energy is stored or released can be understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved.	b. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. (HS-PS1-4) (Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved). (Boundary Statement: Does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products).	b. Develop a model to illustrate how changes in temperature show evidence of energy transfer in a chemical reaction (e.g., hand warmers, ice pack, salt on ice/snow, video of fireworks exploding, salt to make ice cream).
High School	1. Physical Science	2. Chemical processes, their rates, their outcomes, and whether or not energy is stored or released can be understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved.	c. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. (HS-PS1-5) (Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules). (Boundary Statement: Limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature).	c. Use evidence (e.g., temperature, concentration, rate) to describe the effects of changing the temperature or concentration of the two reacting particles on the rate at which a reaction occurs.

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High School	1. Physical Science	2. Chemical processes, their rates, their outcomes, and whether or not energy is stored or released can be understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved.	d. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. (HS-PS1-6) (Clarification Statement: Emphasis is on the application of Le Chatlier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products). (Boundary Statement: Limited to specifying the change in only one variable at a time. Does not include calculating equilibrium constants and concentrations).	d. Investigate with peers the relationship between changes in experimental conditions (e.g., temperature, amount of reactant) and an increased amount of product as a result of a chemical reaction.
High School	1. Physical Science	2. Chemical processes, their rates, their outcomes, and whether or not energy is stored or released can be understood in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved.	e. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. (HS-PS1-7) (Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques). (Boundary Statement: Does not include complex chemical reactions or calculations involving limiting and excess reactants).	e. Use a mathematical representation (e.g., table, graph, pictorial depictions) to show that mass is conserved during a chemical reaction.

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High School	1. Physical Science	3. The strong nuclear interaction provides the primary force that holds nuclei together. Nuclear processes including fusion, fission, and radioactive decays of unstable nuclei involve changes in nuclear binding energies.	a. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. (HS-PS1-8) (Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams and on the scale of energy released in nuclear processes relative to other kinds of transformations. Quantitative models for radioactive decay should not require mathematical manipulations of an exponential equation). (Boundary Statement: Does not include quantitative calculation of energy released. Limited to alpha, beta, and gamma radioactive decays).	a. Illustrate the composition of the nucleus and energy released for at least one of the following: nuclear fission, nuclear fusion, and radioactive decay.
High School	1. Physical Science	4. Newton's second law and the conservation of momentum can be used to predict changes in the motion of macroscopic objects.	a. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. (HS-PS2-1) (Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force). (Boundary Statement: Limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds).	a. Use data from an investigation to identify the relationship between mass, force and acceleration.
High School	1. Physical Science	4. Newton's second law and the conservation of momentum can be used to predict changes in the motion of macroscopic objects.	b. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. (HS-PS2-2) (Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle). (Boundary Statement: Limited to systems of two macroscopic bodies moving in one dimension).	b. Use data from an investigation to identify the relationship between the mass and speed of two colliding objects demonstrating conservation of momentum.

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High School	1. Physical Science	4. Newton's second law and the conservation of momentum can be used to predict changes in the motion of macroscopic objects.	c. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. (HS-PS2-3) (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). (Boundary Statement: Limited to qualitative evaluations and/or algebraic manipulations).	c. Compare and evaluate designs that minimize the force on an object during a collision.
High School	1. Physical Science	5. Forces at a distance are explained by fields that can transfer energy and can be described in terms of the arrangement and properties of the interacting objects and the distance between them.	a. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. (HS-PS2-4) (Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of gravitational and electric fields). (Boundary Statement: Limited to systems with two objects and basic algebraic substitution and/or manipulations).	a. Use data from an investigation or simulation to predict the relationship between two objects of different masses (Newton’s Law of Gravitation) and two charged objects (Coulomb’s Law).
High School	1. Physical Science	5. Forces at a distance are explained by fields that can transfer energy and can be described in terms of the arrangement and properties of the interacting objects and the distance between them.	b. 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. (HS-PS2-5) (Boundary Statement: Limited to designing and conducting investigations with provided materials and tools).	b. Participate in an investigation demonstrating the use of an electric current to produce a magnetic field (e.g., household appliances, cell phones).

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High School	1. Physical Science	5. Forces at a distance are explained by fields that can transfer energy and can be described in terms of the arrangement and properties of the interacting objects and the distance between them.	c. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. (HS-PS2-6) (Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors). (Boundary Statement: Limited to provided molecular structures of specific designed materials).	c. Gather evidence about the properties/molecular level structure of materials commonly used in industry such as conductive materials/metals, and plastics/polymers (e.g., why we use copper to make wire, why does plastic mold into different shapes and forms).
High School	1. Physical Science	6. Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system.	a. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. (HS-PS3-1) (Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model). (Boundary Statement: Limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields).	a. Use data from an investigation to determine the relationship between changes in energy and the impact on the components of a system.
High School	1. Physical Science	6. Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system.	b. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects). (HS-PS3-2) (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).	b. Develop or use models to illustrate the conversion of kinetic energy to thermal energy.

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High School	1. Physical Science	6. Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system.	c. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. (HS-PS3-3) (Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices and on the ability of energy to be transferred but not on the efficiency of energy transfer. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency). (Boundary Statement: Quantitative evaluations are limited to total output for a given input, and are limited to devices constructed with materials provided to students).	c. Collaborate with others to design, build, or identify features of a device showing the transformations of energy that occur (e.g., dams, solar cells, solar oven, ice cream maker, wind turbines, Rube Goldberg).
High School	1. Physical Science	7. Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.	a. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. (HS-PS3-1) *(Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.) (Boundary Statement: Limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.)*	a. Create an equation to show the change in energy of one component of a system when the energy of another component changes.

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High School	1. Physical Science	7. Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.	b. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). (HS-PS3-4) *(Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.) (Boundary Statement: Limited to investigations based on materials and tools provided to students.)*	b. Produce data to show evidence of uniform thermal energy distribution with the results from mixing two liquids at different initial temperatures.
High School	1. Physical Science	8. Force fields (gravitational, electric, and magnetic) contain energy and can transmit energy across space from one object to another.	a. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. (HS-PS3-5) (Clarification Statement: Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other). (Boundary Statement: Limited to systems containing two objects).	a. Develop or use a model (e.g., drawing, diagram) to show the cause-and-effect relationship between forces produced by electric or magnetic fields.
High School	1. Physical Science	9. Although energy cannot be destroyed, it can be converted to less useful forms as it is captured, stored and transferred.	a. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. (HS-PS3-3) (Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices, including the identification of different energy types [starting points] and how they are transferred. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency). (Boundary Statement: Quantitative evaluation is limited to total output for a given input. Limited to devices constructed with materials provided to students).	a. Design, build, or identify a device that converts one form of energy into another form of energy.

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High School	1. Physical Science	9. Although energy cannot be destroyed, it can be converted to less useful forms as it is captured, stored and transferred.	b. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). (HS-PS3-4) (Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water). (Boundary Statement: Limited to investigations based on materials and tools provided to students).	b. Collaborate in an investigation of the transfer of thermal energy (e.g., hot and cold water interaction).
High School	1. Physical Science	10. Waves have characteristic properties and behaviors.	a. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. (HS-PS4-1) (Clarification Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth). (Boundary Statement: Limited to algebraic relationships and describing those relationships qualitatively).	a. Identify that the frequency, wavelength, and speed of waves can vary when traveling through various media.
High School	1. Physical Science	10. Waves have characteristic properties and behaviors.	b. Evaluate questions about the advantages of using a digital transmission and storage of information. (HS-PS4-2) (Clarification Statement: Examples of advantages [compared to waves] could include that digital information is stable because it can be stored reliably in computer memory, transferred easily, and copied and shared rapidly. Disadvantages could include issues of easy deletion, security, and theft).	b. Examine the advantages and disadvantages of using and storing digital information (e.g., copying music, using the internet for research, using computers, taking pictures on a cell phone).

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High School	1. Physical Science	11. Both an electromagnetic wave model and a photon model explain features of electromagnetic radiation broadly and describe common applications of electromagnetic radiation.	a. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. (HS-PS4-3) (Clarification Statement: Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and photoelectric effect). (Boundary Statement: Does not include using quantum theory).	a. Compare the wave model and particle model of electromagnetic radiation and determine which is more useful in given situations (e.g., diffraction is an example of a wave model and photoelectric effects are examples of a particle model).
High School	1. Physical Science	11. Both an electromagnetic wave model and a photon model explain features of electromagnetic radiation broadly and describe common applications of electromagnetic radiation.	b. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. (HS-PS4-4) (Clarification Statement: Emphasis is on the idea that different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Some examples may include: sunscreen SPF, lasers stimulating particular material to resonate at a particular frequency, and a discussion of how color is perceived as it relates to frequency. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias).	b. Evaluate the validity of information about the effects of electromagnetic radiation on human (e.g., sunscreen, use of tanning beds, color perception related to frequency).
High School	1. Physical Science	11. Both an electromagnetic wave model and a photon model explain features of electromagnetic radiation broadly and describe common applications of electromagnetic radiation.	c. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. (HS-PS4-5) (Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology). (Boundary Statement: Limited to qualitative information and does not include band theory).	c. Gather and synthesize information from multiple sources about how a technological device uses waves to work (e.g., solar cells, cell phones, medical imaging).

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High School	1. Physical Science	12. Multiple technologies that are part of everyday experiences are based on waves and their interactions with matter.	a. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. (HS-PS4-5) (Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology). (Boundary Statement: Limited to qualitative information. Does not include band theory).	a. Create a model to show technology devices use waves to transmit and capture information and energy.
Standard 2: Life Science – Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and other living things in their environment.				
High School	2. Life Science	1. DNA codes for the complex hierarchical organization of systems that enable life's functions.	a. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. (HS-LS1-1) (Boundary Statement: Does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis).	a. Identify, based on evidence, how the structure of DNA determines the structure of proteins and how the DNA molecule helps different cells carry out essential life functions.
High School	2. Life Science	1. DNA codes for the complex hierarchical organization of systems that enable life's functions.	b. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. (HS-LS1-2) (Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system). (Boundary Statement: Does not include interactions and functions at the molecular or chemical reaction level).	b. Develop a model to illustrate the function of an organ system (e.g., muscular, skeletal, digestive, nervous, respiratory, reproductive). i. Identify common symptoms that show when a body system isn't functioning properly.

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High School	2. Life Science	1. DNA codes for the complex hierarchical organization of systems that enable life's functions.	c. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. (HS-LS1-3) (Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels). (Boundary Statement: Does not include the cellular processes involved in the feedback mechanism).	c. Use data from an investigation to identify different mechanisms a body uses to stay in balance during environmental changes (e.g., heart rate increases when exercising, sweating maintains body temperature).
High School	2. Life Science	2. Growth and division of cells in complex organisms occurs by mitosis, which differentiates specific cell types.	a. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. (HS-LS1-4) (Boundary Statement: Does not include specific gene control mechanisms or rote memorization of the steps of mitosis).	a. Use a model to show how cells divide and multiply to allow organisms to grow.
High School	2. Life Science	3. Organisms use matter and energy to live and grow.	a. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. (HS-LS1-5) (Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models). (Boundary Statement: Does not include specific biochemical steps).	a. Illustrate the process of photosynthesis transforming light into energy for plants.
High School	2. Life Science	3. Organisms use matter and energy to live and grow.	b. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. (HS-LS1-6) (Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations). (Boundary Statement: Does not include the details of the specific chemical reactions or identification of macromolecules).	b. Explain how organisms use the simple elements that make up sugar molecules to combine with other elements to make up proteins necessary for life.

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High School	2. Life Science	3. Organisms use matter and energy to live and grow.	c. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. (HS-LS1-7) (Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration).	c. Illustrate how food breaks down to provide energy to the cells to sustain life's processes.
High School	2. Life Science	4. Organisms interact with the living and nonliving components of the environment to obtain matter and energy.	a. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. (HS-LS2-1) (Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets).	a. Use a graphical representation to show how resources in an environment affect the organisms living there.
High School	2. Life Science	4. Organisms interact with the living and nonliving components of the environment to obtain matter and energy.	b. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. (HS-LS2-2) (Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data).	b. Use mathematical representations (e.g., trends, averages, graphs) to identify changes in an animal population when conditions in their environment change (e.g., availability of food or shelter, increase in predators).
High School	2. Life Science	5. Matter and energy necessary for life are conserved as they move through ecosystems.	a. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. (HS-LS2-3) (Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments).	a. Compare and contrast the use of oxygen and stored energy in aerobic and anaerobic exercise.

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High School	2. Life Science	5. Matter and energy necessary for life are conserved as they move through ecosystems.	b. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (HS-LS2-4) (Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem).	b. Use a graphical representation to identify the changes in the amount of matter or energy as it travels through an energy pyramid or food web.
High School	2. Life Science	5. Matter and energy necessary for life are conserved as they move through ecosystems.	c. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. (HS-LS2-5) (Clarification Statement: Examples of models could include simulations and mathematical models).	c. Illustrate how carbon is cycled through an ecosystem, using a carbon cycle model.
High School	2. Life Science	6. A complex set of interactions determine how ecosystems respond to disturbances.	a. Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. (HS-LS2-6) (Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise).	a. Compare the changes to organisms in an ecosystem in relatively stable conditions to the ecosystem after extreme events.
High School	2. Life Science	6. A complex set of interactions determine how ecosystems respond to disturbances.	b. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. (HS-LS2-7) (Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species).	b. Collaborate with others to develop a way people can reduce the impacts of human activity (e.g., pollution, overhunting, introduction of invasive species) to help protect the Earth's environment and biodiversity.

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High School	2. Life Science	7. Organisms interact in groups to benefit the species.	a. Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce. (HS-LS2-8) (Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming).	a. Identify examples of the role of group behavior on individuals and species (e.g., animals and humans) and describe how these behaviors benefit or harm the species.
High School	2. Life Science	8. The characteristics of one generation are dependent upon the genetic information inherited from previous generations.	a. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. (HS-LS3-1) (Clarification Statement: Does not include the phases of meiosis or the biochemical mechanism of specific steps in the process).	a. Ask questions about how DNA and chromosomes influence traits passed from parents and offspring.
High School	2. Life Science	9. Variation between individuals results from genetic and environmental factors.	a. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. (HS-LS3-3) (Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits).	a. Use data (e.g., number of individuals with a specific trait) to identify the distribution (number) of the trait within a population.
High School	2. Life Science	9. Variation between individuals results from genetic and environmental factors.	b. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. (HS-LS3-2) (Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs).	b. Describe/define factors that cause genetic variations during meiosis, and mutations or errors that occur during replication.

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High School	2. Life Science	10. Evidence of common ancestry and diversity between species can be determined by examining variations including genetic, anatomical and physiological differences.	a. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. (HS-LS4-1) (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).	a. Use evidence of similar anatomical structures to explain common ancestry and the evolution of a species (e.g., DNA sequencing, embryology).
High School	2. Life Science	11. Genetic variation among organisms affects survival and reproduction.	a. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. (HS-LS4-2) (Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning). (Boundary Statement: Does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution).	a. Provide evidence that the process of evolution primarily results from four factors.
High School	2. Life Science	11. Genetic variation among organisms affects survival and reproduction.	b. 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. (HS-LS4-3) (Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations). (Boundary Statement: Limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations).	b. Use mathematical representations to represent how organisms with advantageous heritable traits tend to increase in proportion to organisms lacking this trait (e.g., population traits and numbers over time).

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High School	2. Life Science	12. The environment influences survival and reproduction of organisms over multiple generations.	a. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. (HS-LS4-4) (Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations).	a. Use evidence to explain how changes in the environment over time have driven adaptations of living things.
High School	2. Life Science	12. The environment influences survival and reproduction of organisms over multiple generations.	b. Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. (HS-LS4-5) (Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species).	b. Identify or interpret evidence that shows that changes in the environment result in: i. increases in the number of some species. ii. the emergence of new species. iii. the extinction of other species.
High School	2. Life Science	13. Humans have complex interactions with ecosystems and have the ability to influence biodiversity on the planet.	a. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. (HS-LS4-6) (Clarification Statement: Emphasis is on testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species).	a. Propose a solution to protect a threatened or endangered species.
Standard 3 – Earth and Space Science - Students know and understand the processes of life, and how living things interact with each other and their environment.				

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High School	3. Earth and Space Science	1. All stars, including the sun, undergo stellar evolution, and the study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth.	a. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation. (HS-ESS1-1) (Clarification Statement: Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the sun's core to reach Earth. Examples of evidence for the model include observations of the masses and lifetimes of other stars, as well as the ways that the sun's radiation varies due to sudden solar flares ("space weather"), the 11-year sunspot cycle, and non-cyclic variations over centuries). (Boundary Statement: Does not include details of the atomic and subatomic processes involved with the sun's nuclear fusion).	a. Develop a model to: i. illustrate how energy from the sun's core reaches the Earth. ii. explain the life cycle of the sun.
High School	3. Earth and Space Science	1. All stars, including the sun, undergo stellar evolution, and the study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth.	b. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. (HS-ESS1-2) (Clarification Statement: Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases [from the spectra of electromagnetic radiation from stars], which matches that predicted by the Big Bang theory [3/4 hydrogen and 1/4 helium]).	b. Demonstrate that the universe is expanding (the Big Bang Theory) using evidence of astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
High School	3. Earth and Space Science	1. All stars, including the sun, undergo stellar evolution, and the study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth.	c. Communicate scientific ideas about the way stars, over their life cycle, produce elements. (HS-ESS1-3) (Clarification Statement: Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime). (Boundary Statement: Details of the many different nucleosynthesis pathways for stars of differing masses are not assessed).	c. Explain ideas about the way stars, over their life cycle, produce elements (e.g., match a star of a specific relative mass with its life cycle).

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High School	3. Earth and Space Science	2. Explanations of and predictions about the motions of orbiting objects are described by the laws of physics.	a. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. (HS-ESS1-4) (Clarification Statement: Emphasis is on Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons). (Boundary Statement: Mathematical representations for the gravitational attraction of bodies and Kepler's Laws of orbital motions should not deal with more than two bodies, nor involve calculus).	a. Create a table representing the patterns of orbiting objects in the solar system (e.g., the number of days it takes planets to orbit the sun, predict how a satellite or other man-made object would travel around the Earth).
High School	3. Earth and Space Science	3. The rock record resulting from tectonic and other geoscience processes as well as objects from the solar system can provide evidence of Earth's early history and the relative ages of major geologic formations.	a. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. (HS-ESS1-5) (Clarification Statement: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages oceanic crust increasing with distance from mid-ocean ridges, a result of plate spreading, and the ages of North American continental crust decreasing with distance away from a central ancient core of the continental plate, a result of past plate interactions).	a. Evaluate past and current movements of plate boundaries in order to explain the ages of crystal rock (e.g., convergent, divergent, transform).
High School	3. Earth and Space Science	3. The rock record resulting from tectonic and other geoscience processes as well as objects from the solar system can provide evidence of Earth's early history and the relative ages of major geologic formations.	b. 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. (HS-ESS1-6) (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).	b. Describe how scientists use evidence from within the solar system to reconstruct the early history of Earth.

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High School	3. Earth and Space Science	4. Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes, and these effects occur on different time scales, from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.	a. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. (HS-ESS2-1) (Clarification Statement: Emphasis is on how the appearance of land features [such as mountains, valleys, and plateaus] and seafloor features [such as trenches, ridges, and seamounts] are a result of both constructive forces [such as volcanism, tectonic uplift, and orogeny] and destructive mechanisms [such as weathering, mass wasting, and coastal erosion]). (Boundary Statement: Does not include memorization of the details of the formation of specific geographic features of Earth's surface).	a. Create a model to demonstrate the relationship between Earth's internal and external processes and the changes that occur on the Earth's surface resulting in continental and ocean floor features.
High School	3. Earth and Space Science	4. Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes, and these effects occur on different time scales, from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.	b. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. (HS-ESS2-2) (Clarification Statement: Examples should include climate feedback, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent).	b. Examine connections between Earth systems (causes and effects) using data (graph, table) to compare the changes in one aspect of the Earth's surface to another aspect of the Earth's surface (e.g., loss of ground vegetation causes increase in water runoff and soil erosion, increase in greenhouse gases causes a rise in global temperatures that melts ice).

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High School	3. Earth and Space Science	4. Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes, and these effects occur on different time scales, from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.	c. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. (HS-ESS2-3) (Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field [as constraints on convection in the outer core], and identification of the composition of Earth's layers from high-pressure laboratory experiments).	c. Develop or use a model to show how the movement of tectonic plates is part of the cycles of convection in the Earth's mantle (e.g., less dense material rises and more dense material sinks).
High School	3. Earth and Space Science	4. Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes, and these effects occur on different time scales, from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.	d. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. (HS-ESS2-4) *(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.) (Boundary Statement: Results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.)*	d. Use a timeline to illustrate the causes of climate change by timescale (e.g., 1-10 years: large volcanic eruptions; 10-100s of years: changes in human activity; 10-100s of thousands of years: changes to Earth's orbit).

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High School	3. Earth and Space Science	5. Plate tectonics can be viewed as the surface expression of mantle convection, which is driven by heat from radioactive decay within the Earth's crust and mantle.	a. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. (HS-ESS2-1) *(Clarification Statement: Emphasis is on how the appearance of land features [such as mountains, valleys, and plateaus] and sea-floor features [such as trenches, ridges, and seamounts] are a result of both constructive forces [such as volcanism, tectonic uplift, and orogeny] and destructive mechanisms [such as weathering, mass wasting, and coastal erosion].) (Boundary Statement: Does not include memorization of the details of the formation of specific geographic features of Earth's surface.)*	a. Develop a model to illustrate the similarities of the features of the Earth' surface and the ocean floor and the forces that created them.
High School	3. Earth and Space Science	5. Plate tectonics can be viewed as the surface expression of mantle convection, which is driven by heat from radioactive decay within the Earth's crust and mantle.	b. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. (HS-ESS2-3) *(Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.)*	b. Use a model to illustrate the composition of Earth's layers.

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High School	3. Earth and Space Science	6. The planet's dynamics are greatly influenced by water's unique chemical and physical properties.	a. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. (HS-ESS2-5) *(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.)*	a. Identify the effects of water on the Earth's surface, including stream transportation, and erosion, and frost wedging.
High School	3. Earth and Space Science	7. The role of radiation from the sun and its interactions with the atmosphere, ocean, and land are the foundation for the global climate system. Global climate models are used to predict future changes, including changes influenced by human behavior and natural factors.	a. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. (HS-ESS2-2) *(Clarification Statement: Examples should include climate feedback, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.)*	a. Examine connections between Earth systems (causes and effects) using data (graph, table) to compare the changes in one aspect of the Earth's surface to another aspect of the Earth's surface (e.g., loss of ground vegetation causes increase in water runoff and soil erosion, increase in greenhouse gases causes a rise in global temperatures that melts ice).

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High School	3. Earth and Space Science	7. The role of radiation from the sun and its interactions with the atmosphere, ocean, and land are the foundation for the global climate system. Global climate models are used to predict future changes, including changes influenced by human behavior and natural factors.	b. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. (HS-ESS2-4) (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). (Boundary Statement: Results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution).	b. Use a model of Earth's rotation, orbit and tilt, describe how the amount of energy (i.e., the sun) in and out of Earth systems changes based on these factors and creates different climates. i. Describe the effect on surface temperature, precipitation patterns, sea levels and biosphere distribution of different amounts of energy (i.e., the Sun) going in and out of Earth systems.
High School	3. Earth and Space Science	7. The role of radiation from the sun and its interactions with the atmosphere, ocean, and land are the foundation for the global climate system. Global climate models are used to predict future changes, including changes influenced by human behavior and natural factors.	c. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. (HS-ESS2-6) (Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere [including humans], providing the foundation for living organisms).	c. Use a qualitative carbon cycle model, describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
High School	3. Earth and Space Science	7. The role of radiation from the sun and its interactions with the atmosphere, ocean, and land are the foundation for the global climate system. Global climate models are used to predict future changes, including changes	d. Construct an argument based on evidence about the simultaneous co-evolution of Earth's systems and life on Earth. (HS-ESS2-7) (Clarification Statement: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of	d. Explain the relationship between dynamic causes, effects, and feedback between the biosphere and Earth’s other systems and the simultaneous co-evolution of Earth’s systems and life on Earth.

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		influenced by human behavior and natural factors.	animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms). (Boundary Statement: Does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems).	
High School	3. Earth and Space Science	8. The biosphere and Earth's other systems have many interconnections that cause a continual co-evolution of Earth's surface and life on it.	a. Construct an argument based on evidence about the simultaneous co-evolution of Earth's systems and life on Earth. (HS-ESS2-7) (Clarification Statement: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms). (Boundary Statement: Does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems).	a. Create a timeline comparing the evolution of the Earth's biosphere (e.g., surface, atmosphere and hydrosphere) and the evolution of living organisms.

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High School	3. Earth and Space Science	9. Resource availability has guided the development of human society and use of natural resources has associated costs, risks, and benefits.	a. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. (HS-ESS3-1) (Clarification Statement: Examples of key natural resources include access to fresh water [such as rivers, lakes, and groundwater], regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes [such as volcanic eruptions and earthquakes], surface processes [such as tsunamis, mass wasting, and soil erosion], and severe weather [such as hurricanes, floods, and droughts]. Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised).	a. Using evidence (e.g., graphs, tables, anecdotal information) identify how the availability of natural resources and the occurrence of natural hazards (e.g., volcanos, earthquakes, tsunamis) impacts human activity.
High School	3. Earth and Space Science	9. Resource availability has guided the development of human society and use of natural resources has associated costs, risks, and benefits.	b. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. (HS-ESS3-2) (Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources [such as minerals and metals] where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining [for coal, tar sands, and oil shales] and pumping [for petroleum and natural gas]. Science knowledge indicates what can happen in natural systems — not what should happen).	b. Compare the most cost-effective solution for conserving, recycling, and reusing energy and mineral resources.

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High School	3. Earth and Space Science	10. Natural hazards and other geological events have shaped the course of human history at local, regional, and global scales.	a. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. (HS-ESS3-1) *(Clarification Statement: Examples of key natural resources include access to fresh water [such as rivers, lakes, and groundwater], regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes [such as volcanic eruptions and earthquakes], surface processes [such as tsunamis, mass wasting, and soil erosion], and severe weather [such as hurricanes, floods, and droughts]. Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.)*	a. Using evidence (e.g., graphs, tables, anecdotal information) identify how the availability of natural resources and the occurrence of natural hazards (e.g., volcanos, earthquakes, tsunamis) impacts human activity.
High School	3. Earth and Space Science	11. Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technologies.	a. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity. (HS-ESS3-3) (Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning). (Boundary Statement: Computational simulation is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations).	a. Create a representation (e.g., graphical, computational simulation, model) to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity).

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High School	3. Earth and Space Science	11. Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technologies.	b. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. (HS-ESS3-4) (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 areal 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]).	b. Evaluate a solution to reduce the impact of human activities on natural systems (e.g., conserving, reusing, recycling).
High School	3. Earth and Space Science	12. Global climate models used to predict future climate change continue to improve our understanding of the impact of human activities on the global climate system.	a. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems. (HS-ESS3-5) (Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes [such as precipitation and temperature] and their associated impacts [such as on sea level, glacial ice volumes, or atmosphere and ocean composition]). (Boundary Statement: Limited to one example of a climate change and its associated impacts).	a. Use geoscience data (e.g., graphs, tables) and climate change models (e.g., precipitation, temperature) to make predictions about climate change as it relates to their community (e.g., atmosphere, precipitation).

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High School	3. Earth and Space Science	12. Global climate models used to predict future climate change continue to improve our understanding of the impact of human activities on the global climate system.	b. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. (HS-ESS3-6) (Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations). (Boundary Statement: Does not include running computational representations but is limited to using the published results of scientific computational models).	b. Review models of changes in Earth systems (e.g., atmosphere, cryosphere, geosphere and/or biosphere) and identify human activities that affect these changes.