MSAA

MSAA Science Extended Performance Expectations (EPEs)

Core Ideas for Knowing Science*

Physical Science

P1: All matter in the Universe is made of exceedingly small particles.

P2: Object can affect other objects at a distance.

P3: Changing the movement of an object requires a net force to be acting on it.

P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.

Earth and Space Science

E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.

E2: The Earth and our solar system are an exceedingly small part of many galaxies within the Universe.

Life Science

L1: Organisms are organized with cellular basis and have a finite lifespan.

L2: Organisms require a supply of energy and materials for which they often depend on or compete with other organisms.

L3: Genetic information is passed down from one generation of organisms to another.

L4: The unity and diversity of organisms, living and extinct is the result of evolution.

Core Ideas for Using Science*

U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

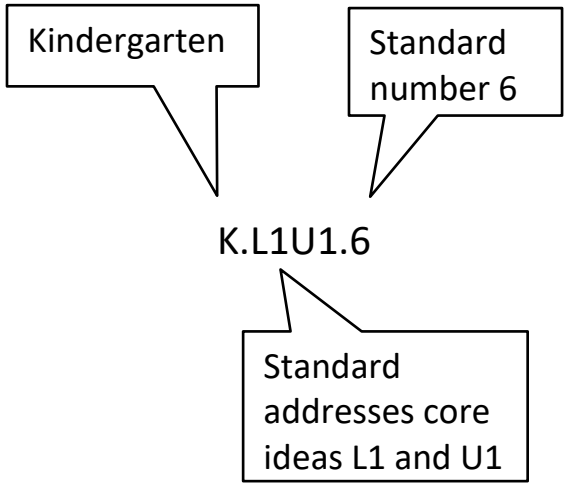
U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.

U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

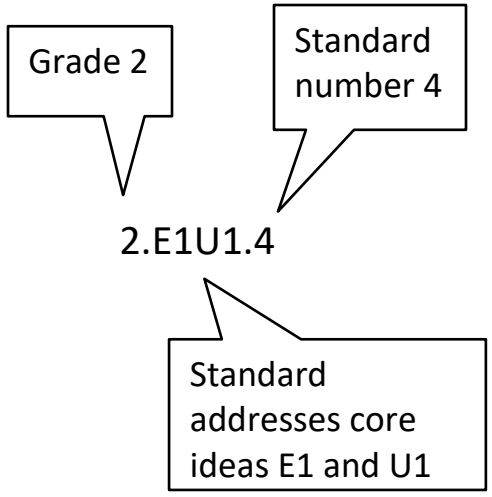
***Adapted from Working with Big Ideas in Science Education**

Coding of the K-8 Science Standards

Each K-8 standard represents the intersection of core ideas for knowing science and using science. This intersection stresses that content in physical science, earth and space science, and life science is not learned independently from ideas about the nature of science, applications of science, or the social implications of using science. The coding of the standard captures this interaction. Students engage in multiple practices as they gather information to solve problems, answer their questions, reason about how the data provide evidence to support their understanding, and then communicate their understanding of phenomena, applications, or social implications. They use the crosscutting concepts to support their understanding of patterns, cause and effect relationships, and systems thinking as they make sense of phenomena. The standard number at the end of the code is designed for recording purposes and does not imply instructional sequence or importance. **The figures below** are examples and descriptions of coding of the K-8 Standards.



K.L1U1.6 Obtain, evaluate, and communicate information about how organisms use different body parts for survival.



2.E1U1.4 Observe and Investigate how wind and water change the shape of the land resulting in a variety of landforms.

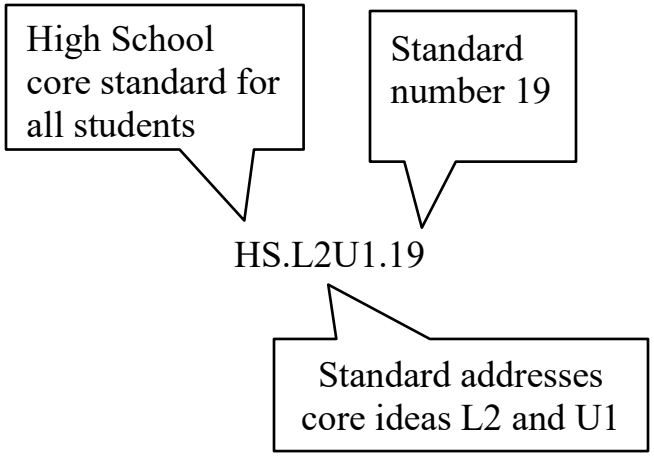
Coding of the High School Science Standards

In Arizona, students' requirements are 3 credits of high school science aligned to standards in physical, earth and space, and life sciences to meet graduation requirements, but there is no mandatory course sequence across the state. Because of this, the high school standards are written at two levels: essential and plus.

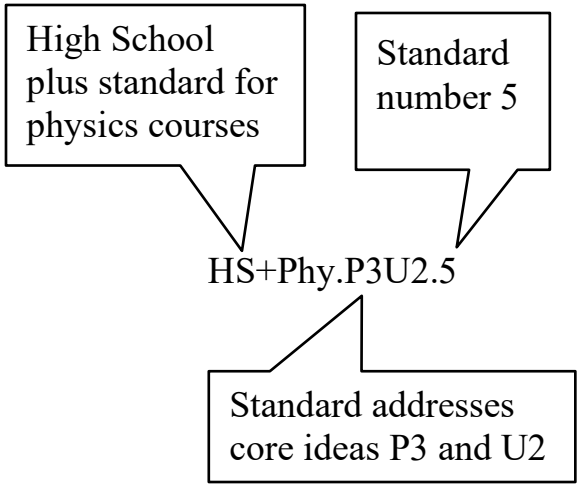
- Every high school student should learn all high school essential standards (HS) regardless of the 3-credit course sequence they take. The full set of essential high school (HS) standards is designed to be taught over a 3-year period.
- The high school plus (HS+) standards are designed to enhance the rigor of general science courses by extending the essential standards within general chemistry (HS+C), physics (HS+Phy), earth and space sciences (HS+E), or biology (HS+B) courses. These HS+ standards are intended to provide the additional rigor of these courses to prepare students for college courses for science majors.

Like K-8, each high school standard represents the intersection of core ideas for knowing science and using science. This intersection stresses that content in physical science, earth and space science, and life science is not learned independently from ideas about the nature of science, applications of science, or the social implications of using science. The coding of the standard captures this intersection. Students engage in multiple practices as they gather information to solve problems, answer their questions, reason about how the data provide evidence to support their understanding, and then communicate their understanding of phenomena, applications, or social implications. They use the crosscutting concepts to support their understanding of patterns, cause and effect

relationships, and systems thinking as they make sense of phenomena. The standard number at the end of the code is designed for recording purposes and does not imply instructional sequence or importance.



HS.L2U1.19 Develop and use models that show how changes in the transfer of matter and energy within an ecosystem and interactions between species may affect organisms and their environment.



HS+Phy.P3U2.5 Design, evaluate, and refine a device that minimizes or maximizes the force on a macroscopic object during a collision.

MSAA Science Extended Performance Expectations (EPE) are aligned to the Science Standards on the following pages. Disciplinary Core Ideas (DCI) are included in each standard. The standards may also align with Crosscutting Concepts (CCCs) and Science and Engineering Practices (SEPs).

Extended Performance Expectations (EPE) not developed for K-2.

Kindergarten Standards
K.P2U1.1 Investigate how senses can detect light, sound, and vibrations even when they come from far away; use the collected evidence to develop and support an explanation.
K.P2U2.2 Design and evaluate a tool that helps people extend their senses.
K.E1U1.3 Observe, record, and ask questions about temperature, precipitation, and other weather data to identify patterns or changes in local weather.
K.E1U1.4 Observe, describe, ask questions, and predict seasonal weather patterns; and how those patterns impact plants and animals (including humans).
K.E2U1.5 Observe and ask questions about patterns of the motion of the sun, moon, and stars in the sky.
K.L1U1.6 Obtain, evaluate, and communicate information about how organisms use different body parts for survival.
K.L1U1.7 Observe, ask questions, and explain how specialized structures found on a variety of plants and animals (including humans) help them sense and respond to their environment.
K.L2U1.8 Observe, ask questions, and explain the differences between the characteristics of living and non-living things.

First Grade Standards
1.P2U1.1 Plan and carry out investigations demonstrating the effect of placing objects made with different materials in the path of a beam of light and predict how objects with similar properties will affect the beam of light.
1.P2U1.2 Use models to provide evidence that vibrating matter creates sound and sound can make matter vibrate.
1.P3U1.3 Plan and carry out investigations which demonstrate how equal forces can balance objects and how unequal forces can push, pull, or twist objects, making them change their speed, direction, or shape.
1.P4U2.4 Design and evaluate ways to increase or reduce heat from friction between two objects.
1.E1U1.5 Obtain, evaluate, and communicate information about the properties of Earth materials and investigate how humans use natural resources in everyday life.
1.L1U1.6 Observe, describe, and predict life cycles of animals and plants.
1.L2U2.7 Develop and use models about how living things use resources to grow and survive; design and evaluate habitats for organisms using earth materials.
1.L2U1.8 Construct an explanation describing how organisms obtain resources from the environment including materials that are used again by other organisms.
1.L3U1.9 Obtain, evaluate, and communicate information to support an evidence-based explanation that plants and animals produce offspring of the same kind, but offspring are generally not identical to each other or their parents.
1.L4U1.10 Develop a model to describe how animals and plants are classified into groups and subgroups according to their similarities.
1.L4U3.11 Ask questions and explain how factors can cause species to go extinct.

Second Grade Standards
2.P1U1.1 Plan and carry out an investigation to determine that matter has mass, takes up space, and is recognized by its observable properties; use the collected evidence to develop and support an explanation.
2.P1U1.2 Plan and carry out an investigation to gather evidence to support an explanation on how heating or cooling can cause a phase change in matter.
2.P4U1.3 Obtain, evaluate, and communicate information about ways heat energy can cause change in objects or materials.
2.E1U1.4 Observe and investigate how wind and water change the shape of the land resulting in a variety of landforms.
2.E1U1.5 Develop and use models to represent that water can exist in different states and is found in oceans, glaciers, lakes, rivers, ponds, and the atmosphere.
2.E1U1.6 Analyze patterns in weather conditions of various regions of the world and design, test, and refine solutions to protect humans from severe weather conditions.
2.E1U3.7 Construct an argument from evidence regarding positive and negative changes in water and land systems that impact humans and the environment.
2.E2U1.8 Observe and explain the Sun's position at various times during a twenty-four-hour period and changes in the apparent shape of the Moon from one night to another.
2.L2U1.9 Obtain, analyze, and communicate evidence that organisms need a source of energy, air, water, and certain temperature conditions to survive.
2.L2U1.10 Develop a model representing how life on earth depends on energy from the sun and energy from other organisms.

Third Grade Standards	Extended Performance Expectations
3.P2U1.1 Ask questions and investigate the relationship between light, objects, and the human eye.	No EPE developed for this standard.
3.P2U1.2 Plan and investigate to explore how sound waves affect objects at varying distances.	No EPE developed for this standard.
3.P4U1.3 Develop and use models to describe how light and sound waves transfer energy.	No EPE developed for this standard.
3.E1U1.4 Construct an explanation describing how the sun is the primary source of energy impacting earth systems.	• 5-ESS2-1.1 Use a model (diagram) to identify parts of various Earth systems (e.g., geosphere, hydrosphere, atmosphere, biosphere). • 5-ESS2-1.2 Use a model to describe how any two Earth systems interact. • 5-ESS2-1.3 Develop a model to show ways in which any two Earth systems interact.

3.L1U1.5 Develop and use models to explain that plants and animals (including humans) have internal and external structures that serve various functions that aid in growth, survival, behavior, and reproduction.	• 4-LS1-1.1 Use a model to identify major internal or external structures of plants or animals that are used for specific functions (e.g. thorns, stems, roots, colored petals, heart, stomach, lung, brain, skin). • 4-LS1-1.2 Use data or observations to describe how internal or external structures help a plant or animal survive, grow, or reproduce.
3.L2U1.6 Plan and conduct investigations to demonstrate ways plants and animals react to stimuli.	• 4-LS1-1.1 Use a model to identify major internal or external structures of plants or animals that are used for specific functions (e.g. thorns, stems, roots, colored petals, heart, stomach, lung, brain, skin). • 4-LS1-1.2 Use data or observations to describe how internal or external structures help a plant or animal survive, grow, or reproduce.

3.L2U1.7 Develop and use system models to describe the flow of energy from the sun to and among living organisms.	• 5-PS3-1.1 Identify food chains or drawings of ecosystems that show the Sun as the common source of energy for ecosystems. • 5-PS3-1.2 Use a model to describe or show the direction of energy transfer between two organisms (e.g., plant-animal, animal-animal) or between the Sun and a plant. • 5-PS3-1.3 Use a model to describe or show how the energy animals obtain from food comes from the Sun.
3.L2U1.8 Construct an argument from evidence that organisms are interdependent.	No EPE developed for this standard.

Fourth Grade Standards	Extended Performance Expectations
4.P4U1.1 Develop and use a model to demonstrate how a system transfers energy from one object to another even when the objects are not touching.	No EPE developed for this standard.
4.P4U1.2 Develop and use a model that explains how energy is moved from place to place through electric currents.	No EPE developed for this standard.
4.P4U1.3 Develop and use a model to demonstrate magnetic forces.	No EPE developed for this standard.
4.P4U3.4 Engage in argument from evidence on the use and impact of renewable and nonrenewable resources to generate electricity.	No EPE developed for this standard.
4.E1U1.5 Use models to explain seismic waves and their effect on the earth.	No EPE developed for this standard.
4.E1U1.6 Plan and investigate to explore and explain the interactions between earth's major systems and the impact on earth's surface materials and processes.	• 5-ESS2-1.1 Use a model (diagram) to identify parts of various Earth systems (e.g., geosphere, hydrosphere, atmosphere, biosphere). • 5-ESS2-1.2 Use a model to describe how any two Earth systems interact.

4.E1U1.7 Develop and/or revise a model using various rock types, fossil location, and landforms to show evidence that earth's surface has changed over time.	No EPE developed for this standard.
4.E1U1.8 Collect, analyze, and interpret data to explain weather and climate patterns.	• 3-ESS2-1.1 Use observations to describe weather conditions. • 3-ESS2-1.2 Use tables or graphical displays of data to describe patterns of typical weather conditions in a particular season.
4.E1U3.9 Construct and support an evidence-based argument about the validity of water and its impact on life.	No EPE developed for this standard.
4.E1U2.10 Define problem(s) and design solution(s) to minimize the effects of natural hazards.	No EPE developed for this standard.
4.L4U1.11 Analyze and interpret environmental data to demonstrate that species either adapt and survive or go extinct over time.	No EPE developed for this standard.

Fifth Grade Standards	Expected Performance Expectations
5.P1U1.1 Analyze and interpret data to explain that matter of any type can be subdivided into particles too small to see and in a closed system if properties change or chemical reactions occur the amount of the matter stays the same.	• 5-PS1-2.1 Match the appropriate tools or standard units of measurement to physical quantities such as weight, time, temperature, or volume to complete a scientific task. • 5-PS1-2.2 Use data to compare the weight of substances before and after they are heated, cooled, or mixed.
5.P1U1.2 Plan and conduct investigations to demonstrate that some substances combine to form new substances with different properties and others can be mixed without taking on new properties.	No EPE developed for this standard.
5.P2U1.3 Construct an explanation using evidence to demonstrate that objects can affect other objects even when they are not touching.	No EPE developed for this standard.
5.P3U1.4 Obtain, analyze, and communicate evidence of the effects that balanced and unbalanced forces have on the motion of objects.	No EPE developed for this standard.

5.P3U2.5 Define problems and design solutions pertaining to force and motion.	No EPE developed for this standard.
5.P4U1.6 Analyze and interpret data to determine how and where energy is transferred when objects move.	• 4-PS3-4.2 Describe the energy transfer that occurs in an everyday object or device.
5.E2U1.7 Develop, revise, and use models based on evidence to construct explanations about the movement of the Earth and Moon within our solar system.	• 5-ESS1-2.1 Identify or label a model that shows the positions of the Sun, the Moon, and Earth in the solar system. • 5-ESS1-2.2 Use models or data to identify patterns of change related to the rotation of Earth, Earth's orbit around the Sun, and/or the Moon's orbit around Earth (e.g., length and direction of shadows, day and night, seasonal appearance of stars).

5.E2U1.8 Obtain, analyze, and communicate evidence to support an explanation that the gravitational force of Earth on objects is directed toward the planet's center.	• 5-PS2-1.1 Use observations to identify patterns in the motion of objects when they are released on Earth. • 5-PS2-1.2 Select or complete a model that shows the direction objects move when they are released on Earth (downward). • 5-PS2-1.3 Describe observations, data, or a model that supports the claim that Earth's gravity pulls objects down (toward Earth's center).
5.L3U1.9 Obtain, evaluate, and communicate information about patterns between the offspring of plants, and the offspring of animals (including humans); construct an explanation of how genetic information is passed from one generation to the next.	• 3-LS3-1.1 Use media (e.g., drawings, photographs) to identify or show pairs of parents and their offspring. • 3-LS3-1.2 Use observations to identify patterns of similarities and differences in traits of groups of organisms (e.g., parents and their offspring, siblings, populations of similar organisms). • 3-LS3-1.3 Use data to show that plants and animals inherit traits from their parents, and that there are differences in these traits in groups of similar organisms.

5.L3U1.10 Construct an explanation based on evidence that the changes in an environment can affect the development of the traits in a population of organisms.	No EPE developed for this standard.
5.L4U3.11 Obtain, evaluate, and communicate evidence about how natural and human-caused changes to habitats or climate can impact populations.	No EPE developed for this standard.
5.L4U3.12 Construct an argument based on evidence that inherited characteristics can be affected by behavior and/or environmental conditions.	No EPE developed for this standard.

Sixth Grade Standards	Expected Performance Expectations
6.P1U1.1 Analyze and interpret data to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases (Kinetic Theory).	No EPE developed for this standard.
6.P1U1.2 Plan and carry out an investigation to demonstrate that variations in temperature and/or pressure affect changes in state of matter.	No EPE developed for this standard.
6.P1U1.3 Develop and use models to represent that matter is made up of smaller particles called atoms.	No EPE developed for this standard.
6.P2U1.4 Develop and use a model to predict how forces act on objects at a distance.	No EPE developed for this standard.
6.P4U2.5 Analyze how humans use technology to store (potential) and/or use (kinetic) energy.	No EPE developed for this standard.
6.E1U1.6 Investigate and construct an explanation demonstrating that radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere.	No EPE developed for this standard.

6.E2U1.7 Use ratios and proportions to analyze and interpret data related to scale, properties, and relationships among objects in our solar system.	No EPE developed for this standard.
6.E2U1.8 Develop and use models to explain how constellations and other night sky patterns appear to move due to Earth's rotation and revolution.	No EPE developed for this standard.
6.E2U1.9 Develop and use models to construct an explanation of how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system.	• MS-ESS1-1.1 Identify a model that shows the positions of Earth (with its tilt), the Sun, and the Moon as Earth revolves around the Sun and the Moon orbits Earth in the solar system. • MS-ESS1-1.2 Use a model to describe or compare the positions of objects or amount or path of light in the cyclic patterns of seasons, lunar phases, or eclipses. • MS-ESS1-1.3 Develop or use a model of the Earth-Sun-Moon system to compare or show patterns in seasons, lunar phases, or eclipses.

6.E2U1.10 Use a model to show how the tilt of Earth's axis causes variations in the length of the day and gives rise to seasons.	• MS-ESS1-1.2 Use a model to describe or compare the positions of objects or amount or path of light in the cyclic patterns of seasons, lunar phases, or eclipses. • MS-ESS1-1.3 Develop or use a model of the Earth-Sun-Moon system to compare or show patterns in seasons, lunar phases, or eclipses.
6.L2U3.11 Use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems.	No EPE developed for this standard.
6.L2U3.12 Engage in argument from evidence to support a claim about the factors that cause species to change and how humans can impact those factors.	No EPE developed for this standard.

6.L2U1.13 Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.	• MS-LS2-1.1 Use data or observations to identify resources (e.g., food, water, nutrients, space) that are necessary for organisms and populations of organisms to grow and survive. • MS-LS2-1.2 Use data or observations to describe the effects of resource availability on organisms and/or populations of organisms. • MS-LS2-1.3 Analyze data to identify evidence for a cause-effect relationship between resource availability and growth of organisms and/or populations of organisms.
6.L2U1.14 Construct a model that shows the cycling of matter and flow of energy in ecosystems.	• MS-LS2-3.1 Use a model to identify the role of organisms (e.g., producer, consumer, decomposer) or nonliving things (e.g., the Sun, water, minerals, air) in cycling energy or matter in an ecosystem. • MS-LS2-3.2 Use a model to identify that energy is transferred or matter is cycled from one specific part of an ecosystem to another specific part. • MS-LS2-3.3 Develop a model to describe how energy is transferred or how matter is cycled among living and nonliving parts of ecosystems.

Seventh Grade Standards	Expected Performance Expectations
7.P2U1.1 Collect and analyze data demonstrating how electromagnetic forces can be attractive or repulsive and can vary in strength.	No EPE developed for this standard.
7.P2U1.2 Develop and use a model to predict how forces act on objects at a distance.	No EPE developed for this standard.
7.P3U1.3 Plan and carry out an investigation that can support an evidence-based explanation of how objects on Earth are affected by gravitational force.	No EPE developed for this standard.
7.P3U1.4 Use non-algebraic mathematics and computational thinking to explain Newton's laws of motion.	No EPE developed for this standard.

7.E1U1.5 Construct a model that shows the cycling of matter and flow of energy in the atmosphere, hydrosphere, and geosphere.	• MS-ESS2-4.1 Use a model to trace the path of water through Earth's systems. • MS-ESS2-4.2 Use a model to describe the state of water or state changes in various parts of the water cycle. • MS-ESS2-4.3 Develop a model to describe how the Sun's energy or the force of gravity moves water through the water cycle.
7.E1U1.6 Construct a model to explain how the distribution of fossils and rocks, continental shapes, and seafloor structures provides evidence of the past plate motions.	No EPE developed for this standard.
7.E1U2.7 Analyze and interpret data to construct an explanation for how advances in technology has improved weather prediction.	No EPE developed for this standard.
7.L1U1.8 Obtain, evaluate, and communicate information to provide evidence that all living things are made of cells, cells come from existing cells, and cells are the basic structural and functional unit of all living things.	No EPE developed for this standard.

7.L1U1.9 Construct an explanation to demonstrate the relationship between major cell structures and cell functions (plant and animal).	No EPE developed for this standard.
7.L1U1.10 Develop and use a model to explain how cells, tissues, and organ systems maintain life (animals).	No EPE developed for this standard.
7.L1U1.11 Construct an explanation for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.	No EPE developed for this standard.
7.L2U1.12 Construct an explanation for how some plant cells convert light energy into food energy.	No EPE developed for this standard.

Eighth Grade Standards	Expected Performance Expectations
8.P1U1.1 Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved.	No EPE developed for this standard.
8.P1U1.2 Obtain and evaluate information regarding how scientists identify substances based on unique physical and chemical properties.	No EPE developed for this standard.
8.P4U1.3 Construct an explanation on how energy can be transferred from one energy store to another.	No EPE developed for this standard.

8.P4U1.4 Develop and use mathematical models to explain wave characteristics and interactions.	• MS-PS4-2.1 Use observations to identify whether a wave is being reflected, absorbed, or transmitted through a material. • MS-PS4-2.2 Use a model to describe the path of a wave that is reflected, absorbed, or transmitted through different materials. • MS-PS4-2.3 Develop a model to represent what happens to waves when they are reflected, absorbed, or transmitted through different materials.
8.P4U2.5 Develop a solution to increase efficiency when transferring energy from one source to another.	No EPE developed for this standard.
8.E1U1.6 Analyze and interpret data about the Earth's geological column to communicate relative ages of rock layers and fossils.	No EPE developed for this standard.

8.E1U3.7 Obtain, evaluate, and communicate information about data and historical patterns to predict natural hazards and other geological events.	No EPE developed for this standard.
8.E1U3.8 Construct and support an argument about how human consumption of limited resources impacts the biosphere.	No EPE developed for this standard.
8.L3U1.9 Construct an explanation of how genetic variations occur in offspring through the inheritance of traits or through mutations.	No EPE developed for this standard.
8.L3U3.10 Communicate how advancements in technology have furthered the field of genetic research and use evidence to support an argument about the positive and negative effects of genetic research on human lives.	No EPE developed for this standard.
8.L4U1.11 Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time.	No EPE developed for this standard.
8.L4U1.12 Gather and communicate evidence on how the process of natural selection provides an explanation of how new species can evolve.	No EPE developed for this standard.

High School Physical Science Standards	Expected Performance Expectations
Essential HS.P1U1.1 Develop and use models to explain the relationship of the structure of atoms to patterns and properties observed within the Periodic Table and describe how these models are revised with new evidence.	• HS-PS1-2.1 Use provided information to complete a model of a chemical reaction. • HS-PS1-2.2 Use the periodic table as a model to identify or classify elements that will behave similarly in chemical reactions. • HS-PS1-2.3 Use the periodic table to construct an explanation for specific chemical reactions.
Essential HS.P1U1.2 Develop and use models for the transfer or sharing of electrons to predict the formation of ions, molecules, and compounds in both natural and synthetic processes.	• HS-PS1-2.1 Use provided information to complete a model of a chemical reaction. • HS-PS1-2.2 Use the periodic table as a model to identify or classify elements that will behave similarly in chemical reactions. • HS-PS1-2.3 Use the periodic table to construct an explanation for specific chemical reactions.

Essential HS.P1U1.3 Ask questions, plan, and conduct investigations to explore the cause-and-effect relationship between reaction rate factors.	No EPE developed for this standard.
Essential HS.P1U3.4 Obtain, evaluate, and communicate information about how the use of chemistry related technologies have had positive and negative ethical, social, economic, and/or political implications.	No EPE developed for this standard.
Essential HS.P2U1.5 Construct an explanation for a field's strength and influence on an object (electric, gravitational, magnetic).	No EPE developed for this standard.
Essential HS.P3U1.6 Collect, analyze, and interpret data regarding the change in motion of an object or system in one dimension, to construct an explanation using Newton's Laws.	No EPE developed for this standard.
Essential HS.P3U2.7 Use mathematics and computational thinking to explain how Newton's laws are used in engineering and technologies to create products to serve human ends.	No EPE developed for this standard.

Essential HS.P4U1.8 Engage in argument from evidence that the net change of energy in a system is always equal to the total energy exchanged between the system and the surroundings.	No EPE developed for this standard.
Essential HS.P4U3.9 Engage in argument from evidence regarding the ethical, social, economic, and/or political benefits and liabilities of energy usage and transfer.	No EPE developed for this standard.
Essential HS.P4U1.10 Construct an explanation about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology.	No EPE developed for this standard.

High School Earth and Space Standards	Extended Performance Expectations
Essential HS.E1U1.11 Analyze and interpret data to determine how energy from the Sun affects weather patterns and climate.	• HS-ESS2-4.1 Use a model to trace the flow of energy between two Earth systems. • HS-ESS2-4.2 Use a model to describe how energy from the Sun drives Earth's climate system. • HS-ESS2-4.3 Use models to predict and/or make conclusions about how various activities (e.g., large volcanic eruptions, human activity, solar output, changes to Earth's orbit and axis, changes to atmospheric composition, etc.) cause changes in climate (which can be measured as changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, biosphere distribution).

Essential HS.E1U1.12 Develop and use models of the Earth that explain the role of energy and matter in Earth's constantly changing internal and external systems (geosphere, hydrosphere, atmosphere, biosphere).	• HS-ESS2-4.1 Use a model to trace the flow of energy between two Earth systems. • HS-ESS2-4.2 Use a model to describe how energy from the Sun drives Earth's climate system.
Essential HS.E1U1.13 Evaluate explanations and theories about the role of energy and matter in geologic changes over time.	No EPE developed for this standard.
Essential HS.E1U3.14 Engage in argument from evidence about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.	No EPE developed for this standard.
Essential HS.E2U1.15 Construct an explanation based on evidence to illustrate the role of nuclear fusion in the life cycle of a star.	No EPE developed for this standard.

Essential HS.E2U1.16 Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings.	No EPE developed for this standard.
Essential HS.E2U1.17 Construct an explanation of the origin, expansion, and scale of the universe based on astronomical evidence.	No EPE developed for this standard.

High School Life Science Standards	Extended Performance Expectations
Essential HS.L2U3.18 Obtain, evaluate, and communicate about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.	• HS-LS2-2.1 Use the provided information to identify factors that affect population size and/or biodiversity. • HS-LS2-2.2 Interpret data to describe the effect of a factor in a specific ecosystem. • HS-LS2-2.3 Use mathematical representations (e.g., averages, trends, graphs) to explain how a specific factor affects the biodiversity or sizes of populations in ecosystems of different scales.
Essential HS.L2U1.19 Develop and use models that show how changes in the transfer of matter and energy within an ecosystem and interactions between species may affect organisms and their environment.	No EPE developed for this standard.

Essential HS.L1U1.20 Ask questions and/or make predictions based on observations and evidence to demonstrate how cellular organization, structure, and function allow organisms to maintain homeostasis.	No EPE developed for this standard.
Essential HS.L2U1.21 Obtain, evaluate, and communicate data showing the relationship of photosynthesis and cellular respiration; flow of energy and cycling of matter.	No EPE developed for this standard.
Essential HS.L1U1.22 Construct an explanation for how cellular division (mitosis) is the process by which organisms grow and maintain complex, interconnected systems.	No EPE developed for this standard.
Essential HS.L1U3.23 Obtain, evaluate, and communicate the ethical, social, economic and/or political implications of the detection and treatment of abnormal cell function.	No EPE developed for this standard.
Essential HS.L3U1.24 Construct an explanation of how the process of sexual reproduction contributes to genetic variation.	No EPE developed for this standard.

Essential HS.L3U1.25 Obtain, evaluate, and communicate information about the causes and implications of DNA mutation.	No EPE developed for this standard.
Essential HS.L3U3.26 Engage in argument from evidence regarding the ethical, social, economic, and/or political implications of a current genetic technology.	No EPE developed for this standard.
Essential HS.L4U1.27 Obtain, evaluate, and communicate evidence that describes how changes in frequency of inherited traits in a population can lead to biological diversity.	• HS-LS4-3.1 Use the provided information to identify traits that can vary for a given organism. • HS-LS4-3.2 Use graphs to describe changes in the distribution of traits in a population in a given environment. • HS-LS4-3.3 Use data comparing distributions of traits in a population as evidence that organisms with advantageous traits increase in proportion to organisms lacking the trait.

Essential HS.L4U1.28 Gather, evaluate, and communicate multiple lines of empirical evidence to explain the mechanisms of biological evolution.	• HS-LS4-1.1 Use the provided information to identify how organisms have changed over time. • HS-LS4-1.2 Use various types of data (DNA sequences, amino acid sequences, structures found in organisms, embryos, fossils) to draw conclusions about patterns of relatedness among organisms. • HS-LS4-1.3 Describe how patterns in data comparing DNA sequences, amino acid sequences, or structures found in organisms, embryos, and/or fossils are evidence for biological evolution and common ancestry of living things.