# K-12 Science Curriculum

## Lincoln County School District #1

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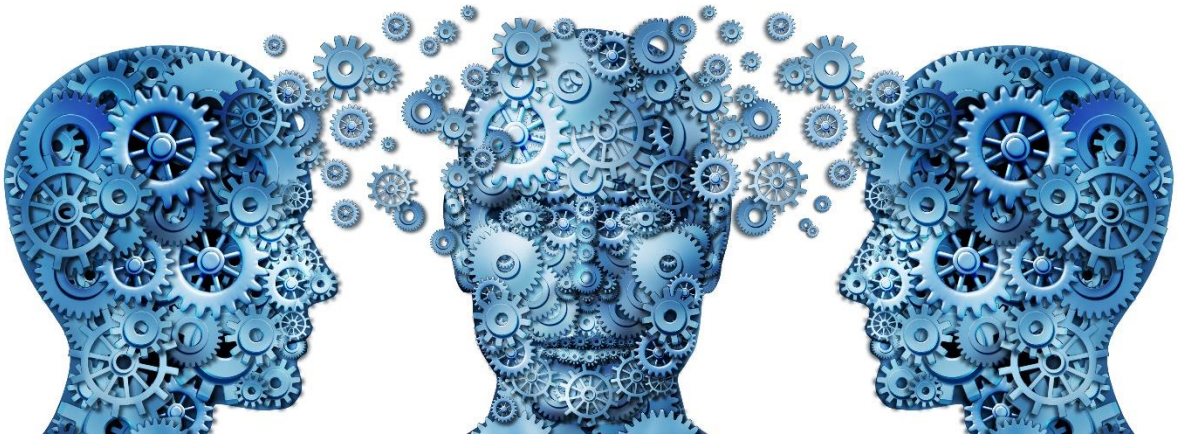

## District Mission Statement

Empower achievement today, inspire learning for life.

## Subject Mission Statement

Students in LCSD#1 will apply 21st Century skills and scientific knowledge to analyze and propose solutions to real-world problems. Students will acquire knowledge through content-rich informational text and scientific inquiry, and clearly express scientific ideas.

# Introduction

## Curriculum Development

The purpose of this document is to make sure the essential curriculum for all levels is implemented in each of the district's classrooms. The document has been aligned with the Wyoming Science Content and Performance Standards.

This document is designed to be used as a guide for: (1) developing and implementing aligned instructional plans in each science classroom and (2) creating and using valid and reliable common assessments.

It has been validated in terms of:

- **scope** - content coverage and student mastery in the class time available;
- **sequence** - grade-to-grade articulation and the building of skills and knowledge areas;
- its appropriateness with regard to **student readiness**;
- **resources** available to support the skills and knowledge areas being taught.

## Key Features of the Curriculum

Each grade level/course is organized in the following manner:

**Purpose Statement** describes the focus of the subject at this grade level or in this course; it points out what is new or different in terms of student learning at this level.

**High Achievement Outcomes** describe the essential things all students in the grade level or course must know or be able to do in this subject. They are units of instruction that make connections among separate concepts and skills. They require high cognitive levels and dynamic student involvement, and they direct assessment.

**Components** are statements of simple and complex concepts or skills that describe what students must know or do in order to perform each outcome. They are the elements of the curriculum that drive day-to-day instructional activities.

**Standard References** are the codes for the specific standards that align to a component of the curriculum. If no standard code is present in the standard reference column, the curriculum writers exercised local control and kept this item in the curriculum although it may not align with the grade level standards. In many instances, the items without standards either fill a gap or go above and beyond the standards being used.

# How to Read the Curriculum Map

**Purpose Statement** *identifies the purpose of a class and what is new or different at this level.*

| | |
|---|---|
| Purpose Statement | Students will compare and contrast different types of rock formation and identify changes in a landscape over time. Students will classify an organism and identify adaptations made through internal and external structures. Students will provide evidence that energy is transferred from place to place by sound, light, heat, and electric currents. |

**Outcome** *overall objective for a unit*

High Achievement Unit Outcomes:

| | | | |
|---|---|---|---|
| SCI.5.1 | | Students will classify materials based on properties; demonstrate conservation of matter; verify matter is made of particles too small to be seen; and explain how new substances can be formed. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.5.1.1 | classify materials based on their properties using observations and measurements. | 5-PS1-3 |
| | SCI.5.1.2 | demonstrate through measurement and graphing that the total weight of matter is conserved. | 5-PS1-2 |
| | SCI.5.1.3 | verify that matter is made up of particles too small to be seen. | 5-PS1-3 |
| | SCI.5.1.4 | explain how when two or more substances are mixed, a new substance with different properties may be formed. | 5-PS1-4 |

**Component Code**
***SCI.****5.1.3 = Subject area (Science)*
*SCI.****5****.1.3 = Grade/course level*
*SCI.5.****1****.3 = Outcome*
*SCI.5.1.****3*** *= Component*

**Components** *are individual skills that lead up to achieving the outcome.*

**WY State Science Standard Reference**
***5****-PS1-3 = Grade*
*5-****PS****1-3 = Core Discipline (physical science)*
*5-PS****1****-3 = Standard*
*5-PS1-****3*** *= Benchmark*

# Curriculum at a Glance

| Grade Level or Course | Purpose Statement |
|---|---|
| **Kindergarten Science** | Students will compare the effects of different strengths and different directions of pushes and pulls on the motion of an object and analyze data; use observations to explain what plants and animals, including humans, need to survive using tools to design and build structures that reduce warming effects of sunlight, communicate solutions of human impact on the environment; and record observations of local weather conditions to determine appropriate dress or activities based on the weather. |
| **1st Grade Science** | Students will describe observable properties of light and sound; explain, describe, and compare characteristics and behaviors of plants and animals; use observation data to describe changes in daylight and movement of the sun, moon, and stars; and define a current problem, describe and draw a new tool or object that can be used to help solve the problem, draw a simple sketch, to show how the shapes of objects help them function, and compare two different student object ideas (SCI.1.4.1) to determine similarities, differences, and possible problem-solving success. |
| **2nd Grade Science** | Students will explain the structure and properties of matter; conduct an investigation to determine the needs of plants, how they are pollinated and how seeds are dispersed; and synthesize evidence to categorize changes of the Earth. |
| **3rd Grade Science** | Students will investigate interactions to determine the effects of forces on objects; differentiate between traits that are inherited and traits that are caused by the environment; represent weather data in tables and graphs; and use evidence to make claims about environmental changes and weather-related hazards. |
| **4th Grade Science** | Students will compare and contrast different types of rock formation and identify changes in a landscape over time. Students will classify an organism and identify adaptations made through internal and external structures. Students will provide evidence that energy is transferred from place to place by sound, light, heat, and electric currents. |
| **5th Grade Science** | Students will compare and contrast the structure and properties if matter. Students will investigate and model the transfer of energy and matter in organisms and ecosystems. Students will describe Earth's systems, stars, and the solar system. |
| **6th Grade Science** | Students will compare the states of matter and demonstrate Newton's Laws showing the interaction of forces; develop models showing characteristics of waves, transmission of waves, and wave interaction; and construct a model of a human body system. |

| | |
|---|---|
| **7th Grade Science** | Students will develop models to describe the basic structures and functions of living organisms, use models to show the patterns of Mendelian Genetics, and analyze the interactions between organisms and their environment to determine the flow of energy and matter through an ecosystem and the impact of human activity on the biosphere. |
| **8th Grade Science** | Students will apply the steps of the scientific method to create, conduct, and share the results of a scientific experiment; model geoscientific processes to determine their effect on the Earth's surface. |
| **General Physical Science** | Students will examine matter to explain the changes and reactions that occur, and analyze the forces that they interact with in everyday life. |
| **Biology** | Students will distinguish between the physiological processes occurring within the cell, apply the mechanisms of evolution to explain how and why species change, and explain how and why organisms interact with their environment and what the effects of these interactions are. |
| **Chemistry** | Students will analyze matter in chemical systems to determine the name, formula, and nature of various compounds, and compare and contrast the types of energy associated with these compounds. |
| **Physics** | Students will solve problems of motion mathematically and through experimentation, and compare the different types of energy and relate these concepts of energy to wave interaction. |
| **Geology** | Students will analyze earth systems and explain how these systems interact with one another, how humans interact with these systems, and Earth's place in the universe. |
| **Anatomy and Physiology** | Students will distinguish between the human body systems and explain the relationships between each. |
| **Science Exploration** | Students will compare and contrast the characteristics of plants and distinguish between the major plant groups. Students will apply concepts of the atmosphere and climate to global weather. |
| **Earth Science** | Students will develop models, analyze data, plan and conduct investigations, and construct argument that will describe the development of the various Earth systems and how humans have interacted with those systems in the past through to the present. |

# Kindergarten Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will compare the effects of different strengths and different directions of pushes and pulls on the motion of an object and analyze data; use observations to explain what plants and animals, including humans, need to survive using tools to design and build structures that reduce warming effects of sunlight, communicate solutions of human impact on the environment; and record observations of local weather conditions to determine appropriate dress or activities based on the weather. |

High Achieving Unit Outcomes:

| SCI.K.1 | | Students will compare the effects of different strengths or directions of pushes and pulls on the motion of an object and analyze data to determine if the solution works as intended. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.K.1.1 | Compare the effects of different strengths of pushes and pulls on the motion of an object. | K-PS2-1 |
| | SCI.K.1.2 | Compare the effects of different directions of pushes and pulls on the motion of an object. | K-PS2-1 |
| | SCI.K.1.3 | 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<br>K-2-ETS1-1<br>K-2- ETS1-3 |

| SCI.K.2 | | Students will explain what plants and animals, including humans, need to survive; use tools to design and build a structure that will reduce the warming effect of sunlight on an area; and communicate solutions that will manage the impact of humans on the environment. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.K.2.1 | Explain that plants need water, soil, air, and sunlight to survive. | K-LS1-1<br>K-PS3-1<br>K-2-ETS1-1<br>K-2 ETS1-2 |
| | SCI.K.2.2 | Explain and use models to show that animals, including humans, need food, water, and shelter to survive. | K-LS1-1<br>K-2-ETS1-1<br>K-2 ETS1-2 |

| | | | |
|---|---|---|---|
| | | | K-ESS3-1 |
| | SCI.K.2.3 | Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area (*e.g. plants that need shade to survive*). | K-PS3-2<br>K-2-ETS1-1<br>K-2-ETS1-2<br>K-ESS2-2 |
| | SCI.K.2.4 | Communicate solutions that will manage the impact of humans on the land, water, air, or other living things in the local environment. | K-ESS3-3<br>K-2-ETS1-2 |

| SCI.K.3 | | Students will record, describe, and respond to weather conditions. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Comp | SCI.K.3.1 | Record weather conditions and describe patterns. | K-ESS3-2<br>K-ESS2-1 |
| | SCI.K.3.2 | Respond to a weather forecast by determining appropriate dress or activities for the day. | K-ESS3-2 |

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# 1st Grade Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will describe observable properties of light and sound; explain, describe, and compare characteristics and behaviors of plants and animals; use observation data to describe changes in daylight and movement of the sun, moon, and stars; and define a current problem, describe and draw a new tool or object that can be used to help solve the problem, draw a simple sketch, to show how the shapes of objects help them function, and compare two different student object ideas (SCI.1.4.1) to determine similarities, differences, and possible problem-solving success. |

High Achieving Unit Outcomes:

| SCI.1.1 | | Students will explain, describe, and compare characteristics and behaviors of plants and animals that help them survive and grow. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.1.1.1 | explain how plants use their external parts to help them survive and grow. | 1-LS1-1 |
| | SCI.1.1.2 | explain how animals use their external parts to help them survive and grow. | 1-LS1-1 |
| | SCI.1.1.3 | describe parent behaviors that help offspring survive. | 1-LS1-2 |
| | SCI.1.1.4 | compare young plants and animals to determine how they are alike and different from their parents. | 1-LS3-1 |

| SCI.1.2 | | Students will describe observable properties of light and sound. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.1.2.1 | use results of an experiment to describe how sound can make materials vibrate. | 1-PS4-1 |
| | SCI.1.2.2 | describe how some objects can only be seen when illuminated. | 1-PS4-2 |
| | SCI.1.2.3 | explain the effect of placing objects made with different materials in the path of a beam of light. | 1-PS4-3 |

| SCI.1.3 | | Students will use observation data to describe the changes of daylight throughout the year and the movement of the sun, moon, and stars. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Comp | SCI.1.3.1 | use observations of movement of the sun, moon, and stars to describe patterns that can be predicted. | 1-ESS1-1 |
| | SCI.1.3.2 | use observation data to describe the changes of daylight throughout the year. | 1-ESS1-2 |

| SCI.1.4 | | Students will draw a simple sketch to show how the shapes of objects help them function, define a current problem, describe and draw a new tool or object that can be used to help solve the problem, and compare two different student object ideas (SCI.1.4.1) to determine similarities, differences, and possible problem-solving success. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.1.4.1 | draw a simple sketch, to show how the shapes of objects help them function. | ETS1-2 |
| | SCI.1.4.2 | define a current problem, describe and draw a new tool or object that can be used to help solve the problem. | ETS1-1 |
| | SCI.1.4.3 | compare two different student object ideas (SCI.1.4.1) to determine similarities, differences, and possible problem-solving success. | ETS1-3 |

*****

# 2nd Grade Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will explain the structure and properties of matter; conduct an investigation to determine the needs of plants, how they are pollinated and how seeds are dispersed; and synthesize evidence to categorize changes of the Earth. |

High Achieving Unit Outcomes:

| SCI.2.1 | | Students will use properties of matter to describe and classify materials; disassemble and assemble objects, analyze data obtained from testing different materials; and explain changes caused by heating and cooling. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.2.1.1 | describe and classify different kinds of materials by their observable properties, justifying your reasoning. | 2-PS1-1 |
| | SCI.2.1.2 | disassemble an object and create a new object using the same pieces. | 2-PS1-3 |
| | SCI.2.1.3 | analyze data obtained from testing different materials to determine which have the properties that are best suited for an intended purpose (*e.g. paper versus plastic*). | 2-PS1-2 |
| | SCI.2.1.4 | explain the changes caused by heating and cooling objects, identifying reversible and irreversible changes. | 2-PS1-4 |

| SCI.2.2 | | Students will plan and conduct an investigation to explain the needs of plants; give examples of how seeds are dispersed and plants are pollinated; and compare the diversity of life in different habitats. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.2.2.1 | plan and conduct an investigation to explain what plants need to grow. | 2-LS2-1 |
| | SCI.2.2.2 | give examples of how seeds are dispersed and plants are pollinated. | 2-LS2-2 |
| | SCI.2.2.3 | compare the diversity of life in different habitats. | 2-LS4-1 |

| | | | |
|---|---|---|---|
| SCI.2.3 | | Students will use information from several sources to provide evidence on Earth events; compare solutions to prevent or slow changes in the shape of land; and identify where water is found and can be solid, liquid, or gas; and create a model to represent the shapes and kinds of land and bodies of water. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.2.3.1 | use information from several sources to provide evidence that Earth events can change the shape of land quickly or slowly. | 2-ESS1-1 |
| | SCI.2.3.2 | compare plausible solutions designed to prevent or slow the changes in the shape of land caused by wind or water (*e.g. snow fences*). | 2-ESS2-1 |
| | SCI.2.3.3 | identify where water is found on Earth and can be solid, liquid, or gas. | 2-ESS2-3 |
| | SCI.2.3.4 | create a model to represent the shapes and kinds of land and bodies of water in an area. | 2-ESS2-2 |

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# 3rd Grade Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will investigate interactions to determine the effects of forces on objects; differentiate between traits that are inherited and traits that are caused by the environment; represent weather data in tables and graphs; and use evidence to make claims about environmental changes and weather-related hazards. |

High Achieving Unit Outcomes:

| | | | |
|---|---|---|---|
| SCI.3.1 | | Students will plan and conduct an investigation to provide evidence of forces on the motion of an object; provide evidence through observations and measurements that a pattern can be used to predict future motion; investigate cause-and-effect relationships of electric or magnetic interactions; and define and construct a design pattern that can be solved by applying scientific ideas. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.3.1.1 | through investigations, explain the effects of balanced and unbalanced forces on the motion of an object. | 3-PS2-1 |
| | SCI.3.1.2 | predict the future motion of an object, using evidence gathered through observations and/or measurements. | 3-PS2-2 |
| | SCI.3.1.3 | explain the cause-and-effect relationships of electric or magnetic interactions between two objects not in contact with each other. | 3-PS2-3 |
| | SCI.3.1.4 | construct a simple design problem that can be solved by applying scientific ideas about magnets. | 3-PS2-4 |

| | | | |
|---|---|---|---|
| SCI.3.2 | | Students will develop models of the life cycles of organisms and explain commonalities (i.e., birth, growth, reproduction, and death); construct an argument that some animals form groups for survival; provide evidence that animals and plants inherit traits from parents; and explain how traits can be influenced by the environment. | Standard Reference |
| *Students will…* | | | |
| Comp | SCI.3.2.1 | develop models showing unique life cycles of at least two organisms and explain the commonalities of birth, growth, | 3-LS1-1 |

| | | | |
|---|---|---|---|
| | | reproduction, and death (i.e. caterpillar to butterfly, seed to plant). | |
| | SCI.3.2.2 | explain how some animals form groups to help the members survive. | 3-LS2-1 |
| | SCI.3.2.3 | explain traits that plants and animals inherit from parents. | 3-LS3-1 |
| | SCI.3.2.4 | explain how the variation of their traits can be influenced by the environment (i.e. diet, changes in habitat). | 3-LS3-2 |

| SCI.3.3 | | Students will analyze fossils to describe evidence of the past; explain how variations in characteristics may provide advantages in survival; construct an argument regarding the survival of organisms in a given habitat; and use evidence to make a claim about the merit of a solution to a problem caused when the environment changes. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.3.3.1 | use fossils to describe the environment and the organisms that lived in the area long ago. | 3-LS4-1 |
| | SCI.3.3.2 | explain how variations in characteristics among individuals of the same species may provide advantages in survival, selecting a mate, and reproduction. | 3-LS4-2 |
| | SCI.3.3.3 | use characteristics of organisms to describe how well they will survive in a specific habitat. | 3-LS4-3 |
| | SCI.3.3.4 | explain the effectiveness of solutions to problems caused to plants or animals by environmental changes (*e.g., a town is growing and taking over the habitat, so animals no longer have winter feed. The solution is to extend the hunting season. Is this a good solution? Why or why not?*) | 3-LS4-4 |

| SCI.3.4 | | Student will represent typical weather conditions in tables and graphical displays; synthesize research to describe climates in different regions of the world; and make a claim about a design solution that reduces impacts of a weather-related hazard. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.3.4.1 | represent data in tables and graphical displays to distinguish typical weather conditions expected during a particular season. | 3-ESS2-1 |
| | SCI.3.4.2 | synthesize research to describe climates in different regions of the world. | 3-ESS2-2 |
| | SCI.3.4.3 | use evidence to explain the merit of a solution that reduces the impact of a weather-related hazard. | 3-ESS3-3 |

| | | | |
|---|---|---|---|
| SCI.3.5 | | Students will recognize that the Earth is part of a system called the solar system that includes the sun, planets, and many moons; explain the differences between rock planets and gas planets; define two components and patterns in the constellations; recognize that the Earth's rotation effects day and night, cycles of the moon, and weather patterns. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.3.5.1 | define the parts of the solar system, including the sun, planets (in order), and moons. | |
| | SCI.3.5.2 | explain the differences between the rock and gas planets. | |
| | SCI.3.5.3 | explain the relationship between the rotation of the Earth on its axis and the day/night cycle and how it effects the Earth's patterns. | |
| | SCI.3.5.4 | explain the changes in the appearance of the moon and how it does not change shape, but at times may appear to be a different shape. | |
| | SCI.3.5.5 | define patterns that are associated with constellations. | |

*****

# 4th Grade Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will compare and contrast different types of rock formation and identify changes in a landscape over time. Students will classify an organism and identify adaptations made through internal and external structures. Students will provide evidence that energy is transferred from place to place by sound, light, heat, and electric currents. |

High Achieving Unit Outcomes:

| SCI.4.1 | | Students will distinguish patterns in rock formations; describe forces of change on development of landscape; and analyze data from maps to describe patterns of Earth's features. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.4.1.1 | distinguish patterns in rock formations that classify metamorphic, igneous, and sedimentary rocks. | 4-ESS1 |
| | SCI.4.1.2 | examine rock formations and landscapes to describe the forces of change behind their development *(*i.e. canyon being formed by glacier or river). | 4-ESS1<br>4-ESS2 |
| | SCI.4.1.3 | analyze and interpret data from topographical maps to describe patterns of Earth's features. | 4-ESS2 |

| SCI.4.2 | | Students will relate animal senses and body construction to behaviors used for survival; categorize trees using internal properties and unique adaptations; and construct a model of a new species. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.4.2.1 | identify and relate animal senses and body construction to adaptions for survival in their habitat (i.e. skulls – teeth, eye placement, eye socket size, and nose opening size). | 4-LS1 |
| | SCI.4.2.2 | categorize trees using internal properties and unique adaptions. | 4-LS1 |
| | SCI.4.2.3 | construct a model of a new species of animal based on specific habitat and body structures. | 4-LS1 |

| SCI.4.3 | | Students will explain the reason an object is displaying potential or kinetic energy; identify transfer of energy; provide evidence that energy is being transferred from one place to another; create a diagram of waves to describe patterns in terms of amplitude and wavelength related to an objects movement; and test then refine a device that converts energy from one form to another. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.4.3.1 | explain the reason an object is displaying potential or kinetic energy. | 4-PS3 |
| | SCI.4.3.2 | identify forms of energy (i.e. sound, light, heat, or electric currents). | 4-PS3 |
| | SCI.4.3.3 | create a diagram of waves to describe patterns in terms of amplitude and wavelength related to an objects movement. | 4-PS4 |
| | SCI.4.3.4 | test and refine a device that converts energy from one form to another. | 4-PS3<br>4-PS4 |

| SCI.4.4 | | Students will identify and define renewable and nonrenewable fuel sources; compare renewable and nonrenewable fuel sources; and compare multiple solutions to reduce impacts on fuel sources on the Earth. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.4.4.1 | identify and define renewable and nonrenewable fuel sources. | 4-ESS3 |
| | SCI.4.4.2 | compare renewable and nonrenewable fuel sources to determine their effects on the environment. | 4-ESS3 |
| | SCI.4.4.3 | compare multiple solutions to reduce impacts of fuel sources on the Earth. | 4-ESS3 |

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# 5th Grade Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will compare and contrast the structure and properties of matter. Students will investigate and model the transfer of energy and matter in organisms and ecosystems. Students will describe Earth's systems, stars, and the solar system. |

High Achieving Unit Outcomes:

| SCI.5.1 | | Students will classify materials based on properties; demonstrate conservation of matter; verify matter is made of particles too small to be seen; and explain how new substances can be formed. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.5.1.1 | classify materials based on their properties using observations and measurements. | 5-PS1-3 |
| | SCI.5.1.2 | demonstrate through measurement and graphing that the total weight of matter is conserved. | 5-PS1-2 |
| | SCI.5.1.3 | verify that matter is made up of particles too small to be seen. | 5-PS1-3 |
| | SCI.5.1.4 | explain how when two or more substances are mixed, a new substance with different properties may be formed. | 5-PS1-4 |

| SCI.5.2 | | Students will distinguish between different Earth spheres and explain how they interact; compare and contrast the amount of water and their locations; justify how communities use science to protect resources and the environment. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.5.2.1 | distinguish between the geosphere, biosphere, hydrosphere, and the atmosphere; explain how they will interact. | 5-ESS2-1 |
| | SCI.5.2.2 | compare and Contrast the amounts of water (salt and fresh) and where they are located on Earth. | 5-ESS2-2 |
| | SCI.5.2.3 | justify how communities use science to protect resources and the environment. | 5-ESS3-1 |

| SCI.5.3 | | Students will explain the process of plant growth,; illustrate energy transfer in food; and illustrate and explain the movement of matter in an ecosystem. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.5.3.1 | explain the process of plant growth through the consumption of air and water (photosynthesis). | 5-LS1-1 |
| | SCI.5.3.2 | illustrate that energy in animal's food was once energy from the sun. | 5-PS3-1 |
| | SCI.5.3.3 | illustrate and explain the movement of matter among plants, animals, decomposers, and the environment. | 5-LS2-1 |

| SCI.5.4 | | Students will catalogue patterns of daily changes in shadows, day and night, and seasonal appearances of some stars in the night sky; illustrate and explain that the apparent brightness of the sun compared to other stars is due to their distance from Earth; and verify that the gravitational force exerted by Earth on objects is directed down. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.5.4.1 | catalogue patterns of daily changes in length and direction of shadows, day and night, and seasonal appearances of some stars in the night sky. | 5-ESS1-2 |
| | SCI.5.4.2 | illustrate and explain that the apparent brightness of the sun compared to other stars is due to their relative distance from Earth. | 5-ESS1-1 |
| | SCI.5.4.3 | verify that the gravitational force exerted by Earth on objects is directed down. | 5-PS2-1 |

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# 6th Grade Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will compare the states of matter and demonstrate Newton's Laws showing the interaction of forces; develop models showing characteristics of waves, transmission of waves, and wave interaction; and construct a model of a human body system. |

High Achieving Unit Outcomes:

| | | | |
|---|---|---|---|
| SCI.6.1 | | Students will explain the relationship between atoms, elements, and compounds; draw and label the subatomic parts of an atom; identify the components of a simple chemical formula and write simple chemical formulas; explain that elements and pure substances have physical and chemical properties; compare the characteristics and arrangement of atoms in each of the three states of matter: solid, liquid, and gas; and explain how thermal energy affects state of matter. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.6.1.1 | draw or create and label the subatomic parts of an atom. | MS-PS1-1 |
| | SCI.6.1.2 | define atom, element, compound and express how they are related. | MS-PS1-1 |
| | SCI.6.1.3 | identify the components of a simple chemical formula and write simple chemical formulas. | MS-PS1-5 |
| | SCI.6.1.4 | use textual evidence to explain how elements and pure substances each have both physical and chemical properties. | MS-PS1-2<br>RST.6-8.1 |
| | SCI.6.1.5 | compare three states of matter (i.e., solid, liquid, and gas) and explain the characteristics and properties that make them different at the molecular level. | MS-PS1-4 |
| | SCI.6.1.6 | explain how adding or taking away thermal energy will affect the states of matter. | MS-PS1-6 |

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| SCI.6.2 | | Students will design, construct, and test a device demonstrating thermal energy transfer; interpret graphical data to explain and model the kinetic and potential energy of an object. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.6.2.1 | explain temperature as a measure of the average kinetic energy of atoms in matter. | MS-PS3-4 |
| | SCI.6.2.2 | differentiate between conduction and convection. | MS-PS3-3 |
| | SCI.6.2.3 | explain what insulation is and which state of matter makes the best insulator. | MS-PS3-3 |
| | SCI.6.2.4 | design, construct, and test a device that increases or decreases thermal energy transfer. | MS-PS3-3 |
| | SCI.6.2.5 | interpret graphical data to explain the relationship between mass and kinetic energy and the relationship between velocity and kinetic energy of an object to the proportional amount of kinetic energy. | MS-PS3-1 |
| | SCI.6.2.6 | define potential energy and use a model to explain how objects at different locations and positions can have different potential energy. | MS-PS3-2 |

| SCI.6.3 | | Students will apply Newton's Laws to plan an investigation demonstrating the qualitative effects of forces on objects; conduct investigations using observations to explain force interaction; and analyze data to determine the existence of electric or magnetic fields. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.6.3.1 | define and give examples of Newton's First, Second, and Third Laws of Motion. | MS-PS2-1<br>MS-PS2-2 |
| | SCI.6.3.2 | plan an investigation using Newton's First and Second Laws of Motion that demonstrates the qualitative effect of forces on objects (*e.g., drop a ball from a certain height*). | MS-PS2-2 |
| | SCI.6.3.3 | apply Newton's Third Law to predict the motion of colliding objects. | MS-PS2-1 |
| | SCI.6.3.4 | explain how electric and magnetic forces can be attractive or repulsive, and that the size of the force depends on the magnitude of the charges, currents, strengths, or distances between objects. | MS-PS2-3<br>MS-PS2-5 |
| | SCI.6.3.5 | analyze experimental data to determine that electric or magnetic fields exist between objects. | MS-PS2-3<br>MS-PS2-5 |

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| SCI.6.4 | | Students will draw and label waves and explain the relationship between amplitude and energy of a wave; differentiate between reflection, refraction, and absorption; and develop models to show wave transmission. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.6.4.1 | draw and label a wave (i.e., crest, trough, amplitude, wavelength, frequency) and explain how the amplitude of a wave is related to the amount of energy the wave carries. | MS-PS4-1 |
| | SCI.6.4.2 | differentiate between reflection, refraction, and absorption of waves. | MS-PS4-2 |
| | SCI.6.4.3 | develop models to show how different types waves are transmitted in different mediums (*e.g., light wave through space, sound wave through matter*). | MS-PS4-2 |

| SCI.6.5 | | Students will construct a model of a body system showing how cells contribute to the function of that system. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.6.5.1 | identify the levels of structural organization of multicellular organisms. | MS-LS1-1 |
| | SCI.6.5.2 | identify the major body systems and their functions (i.e., skeletal, muscular, circulatory, excretory, digestive, respiratory, and nervous). | MS-LS1-3 |
| | SCI.6.5.3 | describe the relationship between tissue functions, cell type, and organs (*e.g., the brain is composed of nervous tissue that contains neurons*). | MS-LS1-1<br>MS-LS1-2 |
| | SCI.6.5.4 | construct a model of a specific human body system showing how cells contribute to the function of that system. | MS-LS1-2 |

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# 7th Grade Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will develop models to describe the basic structures and functions of living organisms, use models to show the patterns of Mendelian Genetics, and analyze the interactions between organisms and their environment to determine the flow of energy and matter through an ecosystem and the impact of human activity on the biosphere. |

High Achieving Unit Outcomes:

| | | | |
|---|---|---|---|
| SCI.7.1 | | Students will compare the location and charge of the subatomic particles and explain the role that electrons play in the reactivity of an element; develop and use models to describe the atomic composition of molecules; explain that the physical and chemical properties of reactants differs from reactants and can be used to determine if a chemical reaction has occurred; and use a model to illustrate the changes in average kinetic energy of particles, temperature, and state of a pure substance when thermal energy is added or removed. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.7.1.1 | compare the location and charge of the subatomic particles of an atom. | MS-PS1-1 |
| | SCI.7.1.2 | explain how electrons are arranged around an atom (i.e., first three orbitals) and the role they play in the reactivity of an element. | MS-PS1-1 |
| | SCI.7.1.3 | develop models to describe the atomic composition of simple molecules and extended structures. | MS-PS1-1 |
| | SCI.7.1.4 | analyze and interpret data on chemical and physical properties of reactants to determine if a chemical reaction has occurred (i.e., properties include density, melting point, boiling point, solubility, flammability, odor). | MS-PS1-2 |
| | SCI.7.1.5 | use a model to illustrate the changes in average kinetic energy of particles, temperature, and state of a pure substance when thermal energy is added or removed. | MS-PS1-4 |

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| SCI.7.2 | | Students will observe to categorize objects as living and non-living; apply the Cell Theory to living things; compare prokaryotic and eukaryotic, animal and plant cells; use a model to describe the role of the nucleus, DNA, and organelles in a eukaryotic cell. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.7.2.1 | categorize objects as living or not-living using the seven characteristics of living things *(i.e., cellular organization, homeostasis, metabolism, responsiveness, reproduction, heredity, and growth*). | MS-LS1-1 |
| | SCI.7.2.2 | identify the three parts of the Cell Theory and apply to living things. | MS-LS1-1 |
| | SCI.7.2.3 | compare prokaryotic and eukaryotic cells (i.e., presence or absence of nucleus and other organelles). | MS-LS1-1 |
| | SCI.7.2.4 | describe the role of the nucleus, DNA, cellular organelles, cell membrane, and cell wall in general functioning and maintenance of homeostasis of plant and animal cells. | MS-LS1-2 |

| SCI.7.3 | | Students will explain why cells divide and compare methods of division; develop and use models to describe how asexual and sexual reproduction are different; and construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.7.3.1 | explain why a cell divides (i.e. growth, reproduction, repair, replacement). | |
| | SCI.7.3.2 | compare the function and end-products of binary fission, mitosis and meiosis. | |
| | SCI.7.3.3 | analyze why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. | MS-LS3-2 |
| | SCI.7.3.4 | differentiate between environmental and genetic factors and how they influence the growth of organisms. | MS-LS1-5 |

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| | | | |
|---|---|---|---|
| SCI.7.4 | | Students will explain how DNA is organized in a cell and that the information coded for in DNA guides all cellular activities; interpret sample karyotypes to determine characteristics of an organism or individual (*e.g., number of chromosomes, gender, genetic disorders*); develop and use a model to illustrate that nucleotides are the building blocks of DNA and are composed of a sugar, phosphate group, and nitrogenous base; use evidence to support explanations that specific nitrogenous bases bond with each other and hold the strands of DNA together; develop a model to illustrate the process of DNA replication to show that DNA replication occurs prior to cell division and results in an identical copy of the DNA molecule. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.7.4.1 | use a model to illustrate that nucleotides are the building blocks of DNA and are composed of a sugar, phosphate group, and nitrogenous base. | MS-LS1-2 |
| | SCI.7.4.2 | use evidence to support explanations that specific nitrogenous bases bond with each other and hold the strands of DNA together. | MS-LS1-2 |
| | SCI.7.4.3 | explain how DNA is organized in a cell (i.e., genes, chromatin, and chromosomes) and that the information coded for in DNA guides all cellular activities. | MS-LS1-2 |
| | SCI.7.4.4 | interpret sample karyotypes to determine characteristics of an organism or individual (*e.g., number of chromosomes, gender, genetic disorders*). | |
| | SCI.7.4.5 | use models to explain that DNA replication occurs prior to division and results in an identical copy of the DNA molecule. | MS-LS1-2 |

| | | | |
|---|---|---|---|
| SCI.7.5 | | Students will explain that genes are located in the chromosomes of cells and consist of dominant and recessive variants; describe the role that genes play in production of proteins; use models to illustrate that changes to genes (mutations) can result in changes to proteins and the structure and function of traits of an organism; compare phenotype and genotype, dominant and recessive, and homozygous and heterozygous; use Punnett squares to model the genetic crosses performed in Gregor Mendel's experiments with pea plants and describe basic inheritance (monohybrid) patterns; and identify the components of a pedigree and explain how it represents inheritance patterns from one generation to the next. | Standard Reference |
| *Students will…* | | | |

| | | | |
|---|---|---|---|
| Components | SCI.7.5.1 | explain that genes are located in the chromosomes of cells and consist of dominant and recessive variants. | MS-LS3-1 (LS3.A) |
| | SCI.7.5.2 | compare phenotype and genotype and homozygous and heterozygous. | MS-LS3-1 (LS3.A) |
| | SCI.7.5.3 | use Punnett squares to model the genetic crosses performed in Gregor Mendel's experiments with pea plants and describe basic inheritance patterns (i.e. monohybrid crosses). | MS-LS3-2 |
| | SCI.7.5.4 | describe the role of genes in production of proteins. | MS-LS3-1 (LS3.A) |
| | SCI.7.5.5 | use models to illustrate that changes to genes (mutations) can result in changes to proteins and the structure and function of traits of an organism. | MS-LS3-1 (LS3.A,B) |
| | SCI.7.5.6 | identify the components of a pedigree and explain how it represents inheritance patterns from one generation to the next. | MS-LS3-2 |

| | | | |
|---|---|---|---|
| SCI.7.6 | | Students will analyze scientific observations to determine their contributions to the development of the Theory of Evolution by Natural Selection; use various evidences to support explanations of evolution and common ancestry between current and past organisms; apply the concept of evolution by natural selection to explain changes observed in natural populations and explain how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. Students will use evidence to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of reproductive success. Students will explain how relative and absolute dating are used to support the change of organisms over time; and use empirical evidence to support reasoning that technology has changed the way humans influence the inheritance of desired traits in organisms. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.7.6.1 | use various evidences to support explanations of evolution and common ancestry between current and past organisms (i.e., fossil record, anatomical similarities, and embryological evidence). | MS-LS4-1 MS-LS4-2 MS-LS4-3 |
| | SCI.7.6.2 | explain how relative and absolute dating techniques of fossils are used to support evidence of the evolution of organisms over time. | MS-LS4-1 |
| | SCI.7.6.3 | analyze Charles Darwin's observations that lead to the development of the Theory of Evolution by Natural Selection. | MS-LS4-1 |

| | | | |
|---|---|---|---|
| | SCI.7.6.4 | apply the concept of evolution by natural selection to explain changes observed in natural populations and explain how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment (*e.g., peppered moth*). | MS-LS4-4 |
| | SCI.7.6.5 | use evidence to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of reproductive success. | MS-LS1-4 |
| | SCI.7.6.6 | evaluate the claim that technology has changed the way humans influence the inheritance of desired traits in organisms (*e.g., cloning, gene therapy, selective breeding*). | MS-LS4-5 |

| SCI.7.7 | | Students will compare the organs of the skeletal, muscular, and nervous systems and develop an argument using evidence to explain how systems interact to produce movement. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.7.7.1 | compare the structure of various bone types (*e.g., spongy, compact*) and identify major bones of the skull, vertebrae, and limbs. | MS-LS1-3 |
| | SCI.7.7.2 | compare the structure and function of cardiac, smooth and skeletal muscle tissues and identify the functions of the muscular system. | MS-LS1-3 |
| | SCI.7.7.3 | identify the organs of the nervous system (i.e., brain, spinal cord, nerves. | MS-LS1-3 |
| | SCI.7.7.4 | develop an argument using evidence to explain how the skeletal, muscular and nervous systems interact to produce movement. | MS-LS1-3 |

| SCI.7.8 | | Students will describe the function of various circulatory, respiratory, and digestive organs and use a model to describe how nutrients and gasses are transported throughout the body. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.7.8.1 | describe the function of various circulatory and respiratory organs (i.e., heart, vessels, lungs, trachea). | MS-LS1-3 |
| | SCI.7.8.2 | identify the components of the digestive system and explain their role in digestion. | MS-LS1-3 |
| | SCI.7.8.3 | use a model to describe how nutrients and respiratory gasses are transported to various parts of the body. | MS-LS1-3 |

| SCI.7.9 | | Students will develop a model to describe the cycling of matter and flow of energy among organisms through photosynthesis, cellular respiration, and interaction between organisms in an ecosystem. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.7.9.1 | describe the cycling of matter and flow of energy among biotic and abiotic parts of an ecosystem. | MS-LS2-3 |
| | SCI.7.9.2 | compare the processes of photosynthesis and cellular respiration and the role they play in the cycling of matter in an ecosystem (i.e. basic reactants and products of each, organisms that perform each). | MS-LS1-6<br>MS-LS1-7 |
| | SCI.7.9.3 | illustrate how energy is transferred in an ecosystem between producers (autotrophs), consumers (heterotrophs), and decomposers. | MS-LS2-3 |

| SCI.7.10 | | Students will analyze and interpret data to provide evidence for the effects of various factors on populations; and use empirical evidence to support arguments that changes to ecosystems affect the populations within them. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.7.10.1 | list the factors (*e.g., birth rate, death rate, immigration, emigration*) which affect the growth rate of populations. | MS-LS2-1 |
| | SCI.710.2 | analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms within an ecosystem (i.e., carrying capacity, density-dependent, and density-independent factors). | MS-LS2-1 |
| | SCI.7.10.3 | describe interactions between organisms within a community and predict how each influences populations of organisms (i.e., predation, mutualistic relationships, and competition). | MS-LS2-2 |
| | SCI.7.10.4 | explain that changes to physical or biological components of an ecosystem affects populations in the ecosystem (*e.g., construction of wetlands or related habitats, destruction of habitat*). | MS-LS2-4 |

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| SCI.7.11 | | Students will use a model to explain factors that influence the climate and biomes of Earth; compare the Earth's major biomes; and support the argument that abiotic and biotic factors influence biodiversity. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.7.11.1 | explain how average temperature and precipitation influence the climate of a region. | MS-ESS2-6 |
| | SCI.7.11.2 | compare the Earth's major biomes (i.e., terrestrial and aquatic ecosystems) and identify biome locations on Earth. | |
| | SCI.7.11.3 | explain how abiotic and biotic factors influence the biodiversity of an environment. | MS-LS2-4 |

| SCI.7.12 | | Students will design a method for monitoring and minimizing the impacts of human activities on the environment. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.7.12.1 | design a method for monitoring and minimizing a human impact on the environment. | MS-ESS3-3 |
| | SCI.7.12.2 | identify different types of conservation efforts being practiced in regard to land usage biodiversity and the prevention of soil degradation. | MS-ESS3-3 |
| | SCI.7.12.3 | describe different types of pollution (i.e., air, land, or water) and their effects, and compare the efforts made to reduce the effects of pollution. | MS-ESS3-3 |

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# 8th Grade Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will apply the steps of the scientific method to create, conduct, and share the results of a scientific experiment; model geoscientific processes to determine their effect on the Earth's surface. |

High Achieving Unit Outcomes:

| SCI.8.1 | | Students will design and conduct a scientific experiment and communicate the process and results to others. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.8.1.1 | make observations and develop testable questions. | |
| | SCI.8.1.2 | formulate a hypothesis that identifies independent and dependent variables. | |
| | SCI.8.1.3 | design a controlled experiment, including both experimental and control groups, to gather data relating to the question and hypothesis. | |
| | SCI.8.1.4 | collect and analyze quantitative or qualitative data (*e.g., graphs, tables, charts*) to determine the relationships between the variables. | |
| | SCI.8.1.5 | interpret experimental results from data collection to support or refute the hypothesis, identify sources of experimental error and potential for future experimentation. | |
| | SCI.8.1.6 | communicate results of experiment in lab report format. | |

| SCI.8.2 | | Students will examine the role gravity plays in the formation of heavenly bodies; analyze research about the planets in our solar system and create a scaled model of the solar system; explain the origin and characteristics of the moon; use models to describe the interaction between the Sun, Moon, and Earth, their effect on the cyclical patterns of lunar phases, eclipses, and ocean tides. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Comp | SCI.8.2.1 | use evidence to support the role gravity plays in the formation of planets, comets, asteroids, and meteors, and their current orbits in our solar system. | MS-PS2-4 |

| | | | |
|---|---|---|---|
| | SCI.8.2.2 | describe how gravity initiates the creation of a star and influences progressive stages of a star's life cycle. | MS-ESS1-2 |
| | SCI.8.2.3 | compare placement, composition, and characteristics of the planets (i.e. crust, atmosphere, surface features, and orbital radius). | MS-ESS1-3 |
| | SCI.8.2.4 | display the placement of the planets and explain various ways to measure distances in space *(e.g., construct a scaled model of the solar system)*. | MS-ESS1-3 |
| | SCI.8.2.5 | explain the origin of the moon and its characteristics. Use a model to show how the orbits of the moon and Earth result in the moon's monthly phases and both solar and lunar eclipses. | MS-ESS1-1 |
| | SCI.8.2.6 | use a model to explain how the revolutions and rotations of both the earth and moon around the sun affects the tides of the oceans. | MS-ESS1-1 |

| SCI.8.3 | | Students will explain how the Earth was formed and how geoscience processes have changed the Earth's surface; compare evidence supporting the theories of the origins of life on Earth; explain how relative and absolute dating of fossils or rock strata have helped build a timeline of the Earth's history. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.8.3.1 | explain how the Earth was formed and describe the conditions of the Earth early in its history. | |
| | SCI.8.3.2 | compare theories on the origin of life on Earth and the evidence supporting them. | |
| | SCI.8.3.3 | construct an explanation based on evidence for how geoscience processes have changed the Earth's surface at varying time and spatial scales (i.e., Uniformitarianism led to the belief that the Earth was older than previously thought). | MS-ESS2-2 |
| | SCI.8.3.4 | relate how the discovery of fossils, as well as the mummified remains and other signs of organisms, have helped build a timeline of the Earth's history. | MS-ESS1-4 |
| | SCI.8.3.5 | use the principals of Original Horizontality, Superposition, and cross-cutting to determine relative dates of fossils or rock strata. | MS-ESS1-4 |
| | SCI.8.3.6 | explain how radioactive half-lives are used to determine the absolute age of a fossil or rock strata. | MS-ESS1-4 |

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| SCI.8.4 | | Students will analyze the evidence to support the Theories of Continental Drift and Plate Tectonics; diagram convection currents; compare plate boundaries to predict geological features; and describe the structural zones of the Earth. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.8.4.1 | label and describe compositional and structural zones of the Earth. | MS-ESS2-3 |
| | SCI.8.4.2 | examine and reconstruct the evidence to support the reasoning of Alfred Wegener's Theory of Continental Drift. (i.e., continental coast lines, fossil evidence, rock formations, and climatic evidence). | MS-ESS2-2<br>MS-ESS2-3 |
| | SCI.8.4.3 | analyze the evidence of sea floor spreading to explain how the Theory of Plate Tectonics was developed (i.e., differing ages of the sea floor crust, paleomagnetism, and thickness of the crust in relation to the mid-ocean ridges and subduction zones). | MS-ESS2-2<br>MS-ESS2-3 |
| | SCI.8.4.4 | use a diagram to explain how convection currents move tectonic plates. | MS-ESS2-1<br>MS-ESS2-2 |
| | SCI.8.4.5 | compare the types of plate boundaries and predict what kind of geological features (*e.g., ridges, mountains, trenches*) would be found at each type of plate boundary. | MS-ESS2-2<br>MS-ESS2-3 |

| SCI.8.5 | | Students will use diagrams to explain the relationship between fault type and plate boundary movement; explain causes of earthquakes; distinguish between seismic to determine Earth's composition and triangulate an earthquake's epicenter; compare earthquake scales; describe hazards and methods to mitigate earthquake effects; and evaluate earthquake resistant building designs. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.8.5.1 | use diagrams to explain the relationship between fault type and plate boundary movement. | MS-ESS2-2 |
| | SCI.8.5.2 | distinguish between the epicenter and focus of an earthquake. | MS-ESS2-2 |
| | SCI.8.5.3 | distinguish between the different seismic waves (i.e., body waves and surface waves) and explain how they are used to determine the composition of inner Earth. | MS-ESS2-2 |
| | SCI.8.5.4 | analyze data from a seismograph. Explain how the data from a seismograph can be utilized to identify the location *(e.g. epicenter triangulation)* and the magnitude of an earthquake. | MS-ESS2-2 |

| | | | |
|---|---|---|---|
| | SCI.8.5.5 | compare scales used to measure earthquakes (i.e., Richter Scale, Mercalli Scale, moment magnitude scale). | MS-ESS2-2 |
| | SCI.8.5.6 | describe hazards associated with earthquakes and methods used to mitigate their effects. | MS-ESS2-2<br>MS-ESS3-2 |
| | SCI.8.5.7 | evaluate competing earthquake resistant building designs to determine the best characteristics of each and which would be more likely to withstand damage. | MS-ESS3-2<br>MS-ETS1-2 |

| SCI.8.6 | | Students will differentiate between types of lava or rock; compare volcano types, eruptions, and lava; diagram volcanic features; and summarize the hazards of eruptions and how to prepare for them. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.8.6.1 | define volcano, magma, lava, and viscosity and differentiate between felsic and mafic lava or rock in terms of its volatile behavior. | MS-ESS2-2 |
| | SCI.8.6.2 | compare the three different types of volcanoes (i.e., Shield, Cinder Cone, and Composite/Strato Volcanoes). | MS-ESS2-2 |
| | SCI.8.6.3 | identify and describe the three types of lava (i.e., Pahoehoe, A'a, and Pillow lava). | MS-ESS2-2 |
| | SCI.8.6.4 | label a diagram showing volcanic features (*e.g., such as dikes, sills, batholithes, stocks, volcanic necks, magma chambers*). | MS-ESS2-2 |
| | SCI.8.6.5 | summarize the hazards associated with volcanic eruptions, the effects they have on the environment, and how predicting eruptions can be used to prepare. | MS-ESS2-2<br>MS-ESS3-2 |

| SCI.8.7 | | Students will distinguish between weather and climate; use models to describe factors affecting regional climates, including El Niño; use data to describe weather patterns associated with high and low pressure systems; and research the causes of various weather phenomena. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.8.7.1 | distinguish between weather and climate and use a model to describe the factors affecting the climate of an area (i.e., the tilt of the earth, angle of the sun's rays, the greenhouse effect, wind and ocean currents, land masses, and elevation). | MS-ESS2-6 |
| | SCI.8.7.2 | use data to describe the characteristics and weather patterns associated with high and low pressure systems and research the causes and characteristics of various storms | MS-ESS2-5 |

| | | | |
|---|---|---|---|
| | | (*e.g., hurricanes, tornadoes, blizzards, and lightning storms*). | |
| | SCI.8.7.3 | use a model to explain the changes in weather patterns that El Niño causes and identify the effects it has on the weather and economy in various regions. | MS-ESS2-6 |

| SCI.8.8 | | Students will analyze geological features to determine the effects of the water cycle, weathering, and erosion. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.8.8.1 | use a diagram to explain the steps in the water cycle. | MS-ESS2-4 |
| | SCI.8.8.2 | examine geological features (*e.g., stalagmites, stalactites, sink holes*) to determine the role water plays in physical or mechanical weathering. | MS-ESS2-2 |
| | SCI.8.8.3 | analyze examples to determine the role humans and natural processes play in chemical weathering and design a method to minimize human impact. | MS-ESS3-3 |
| | SCI.8.8.4 | explain how erosion and deposition shape geological features and design a method to minimize the effects of erosion in the environment. | MS-ESS2-2 |

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# General Physical Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will examine matter to explain the changes and reactions that occur, and analyze the forces that they interact with in everyday life. |

High Achieving Unit Outcomes:

| | | | |
|---|---|---|---|
| SCI.GPS.1 | | Students will compare pure substances and mixtures, homogeneous and heterogeneous mixtures, and explain how parts of a mixture can be separated using physical properties (*e.g. distillation, filtration, separation*); support explanations for whether a property of matter is physical or chemical; differentiate between chemical (*e.g., oxidation, combustion*) and physical changes (*e.g., melting, freezing, evaporation, condensation, sublimation*); and use deductive reasoning to describe the relationship between macroscopic and microscopic particle activity. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GPS.1.1 | compare pure substances and mixtures, homogeneous and heterogeneous mixtures, and explain how parts of a mixture can be separated using physical properties (*e.g. distillation, filtration, separation*). | |
| | SCI.GPS.1.2 | support explanations for whether a property of matter is physical or chemical. | HS-PS1-1 |
| | SCI.GPS.1.3 | differentiate between chemical (*e.g., oxidation, combustion*) and physical changes (i.e., melting, freezing, evaporation, condensation, sublimation). | |
| | SCI.GPS.1.4 | using macroscopic observations of states of matter, deduce microscopic particle activity based on the kinetic molecular theory. | HS-PS3-2 |

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|---|---|---|---|
| SCI.GPS.2 | | Students will compare different atomic theories; use the periodic table to compare families of elements and determine protons, neutrons, and electrons an atom has when given its symbol, atomic number, and mass number; explain why atoms gain or lose electrons to form ions; use models to compare nuclear processes; and determine half-lives using graphs and mathematical calculations. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GPS.2.1 | compare historical atomic theories (i.e., Democritus, Dalton, Thompson, Rutherford, Bohr, Mendeleev). | |
| | SCI.GPS.2.2 | use the periodic table to describe properties of elements (i.e. subatomic particles, electron configuration, ion formation, isotopes, families of elements). | HS-PS1-1<br>HS-PS1-2 |
| | SCI.GPS.2.3 | use models to compare nuclear processes and the energy they release. (i.e. radioactivity, nuclear fusion, and nuclear fission). | HS-PS1-8 |
| | SCI.GPS.2.4 | interpret a graph simulating a decaying element to determine its half-life and use mathematical calculations to determine the age of a radioactive sample given it's half-life. | HS-PS1-8 |

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| SCI.GPS.3 | | Students will differentiate between ionic, covalent and metallic bonds and explain why they form; translate between compound names and chemical formulas; and compare properties of molecules with different types of bonds using Lewis dot structures. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GPS.3.1 | describe how the number of valence electrons affects an atoms reactivity and compare the ways in which atoms bond (i.e. ionic, covalent, and metallic bonds); write the lewis dot structures of ionic and covalent bonds. | HS-PS1-2 |
| | SCI.GPS.3.2 | explain how electronegativity affects the bond type formed between atoms. | HS-PS1-2 |
| | SCI.GPS.3.3 | translate between the chemical formula and the compound name of simple covalent and ionic compounds (i.e., binary type 1). | HS-PS1-2 |
| | SCI.GPS.3.4 | use observations to compare the bulk properties of substances with different types of bonds and infer the strength of electrical forces between particles. | HS-PS1-3 |

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| SCI.GPS.4 | | Students will use a model to explain that energy is required to form or break chemical bonds; distinguish between endo- and exothermic reactions; use evidence to support whether a chemical reaction has occurred and how factors affect reaction rates; write and balance simple equations showing that a chemical reaction follows the law of conservation of matter and mass; predict the results of reactions. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GPS.4.1 | use evidence from observations to determine whether a chemical reaction has occurred. | HS-PS1-2 |
| | SCI.GPS.4.2 | explain that energy is exchanged during a chemical reaction when bonds are broken and or formed and that the amount of energy required is the activation energy. Compare the energy of reactants and products in endothermic and exothermic reactions. | HS-PS1-4 |
| | SCI.GPS.4.3 | use evidence to support explanations of the effects of various factors (i.e., temperature, concentration, surface area, catalyst, pressure) on reaction rates. | HS-PS1-5 |
| | SCI.GPS.4.4 | write and balance simple equations to show that mass is conserved during a reaction and determine the molar mass of various compounds. | HS-PS1-7 |
| | SCI.GPS.4.5 | predict the results of reactions when adding or removing reactants or products to reach equilibrium. | HS-PS1-6 |
| | SCI.GPS.4.6 | distinguish between chemical reaction types (i.e., synthesis, decomposition, single and double replacement, combustion). | |

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| SCI.GPS.5 | | Students will distinguish between the solute and solvent of a solution and explain the role of forces between particles in dissolving compare solutions of weak acids or bases and solutions of strong acids or bases; explain that pH the concentration of hydronium ions or hydroxide ions in a solution; explain what happens during neutralization reactions and identify the products of the reaction; and describe changes in acidity (pH) following neutralization reactions. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GPS.5.1 | distinguish between the solute and solvent of a solution and explain the role of forces between particles in dissolving. | |
| | SCI.GPS.5.2 | compare solutions of weak acids or bases and solutions of strong acids or bases. | |
| | SCI.GPS.5.3 | explain that pH represents the concentration of hydronium ions or hydroxide ions in a solution. | |

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|---|---|---|---|
| | SCI.GPS.5.4 | explain what happens during neutralization reactions, identify the products of the reaction, and describe changes in acidity (pH) following neutralization reactions. | |

| SCI.GPS.6 | | Students will explain an object's motion relative to a frame of reference; contrast distance and displacement; describe the relationship between speed, distance, and time; interpret graphs to draw conclusions about an object's motion; illustrate and interpret an object's motion with vectors; and use kinematic equations to solve for position, time, speed, or velocity. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.GPS.6.1 | explain an object's motion relative to a frame of reference. | HS-PS2-1 |
| | SCI.GPS.6.2 | contrast distance and displacement. | HS-PS2-1 |
| | SCI.GPS.6.3 | describe the relationship between speed, distance, and time and solve problems to determine position, time, speed or velocity, and acceleration. | HS-PS2-1 |
| | SCI.GPS.6.4 | interpret a position vs. time graph to draw conclusions about an object's motion (i.e. position, speed/velocity, acceleration). | HS-PS2-1 |
| | SCI.GPS.6.5 | illustrate and interpret an object's motion with vectors. | HS-PS2-1 |

| SCI.GPS.7 | | Students will distinguish between static and kinetic friction; use evidence to support Newton's second and third laws; predict the resultant force when given an action force; describe and predict forces through Newton's laws and use free body diagrams to predict motion; use mathematical representations to explain how momentum is conserved in a system during a collision. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.GPS.7.1 | use evidence to support the relationship between force, mass and acceleration and solve problems involving force, mass, and acceleration. | HS-PS2-1 |
| | SCI.GPS.7.2 | distinguish between static and kinetic friction and their effects on an object. | |
| | SCI.GPS.7.3 | use Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. | HS-PS2-2 |
| | SCI.GPS.7.4 | use free-body diagrams to illustrate the net force and component forces acting upon an object and use evidence to support claims that the total momentum of a | HS-PS2-4<br>HS-PS2-3<br>HS-PS2-2 |

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| | | system is conserved when there is no net force on the system. | |

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| SCI.GPS.8 | | Students will evaluate the work performed on an object using force and distance; explain the relationship between work and time in determining power; list the types of simple machines and provide examples of each; use evidence to support claims that simple machines have mechanical advantage and improve efficiency; solve for work, power, mechanical advantage and efficiency. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GPS.8.1 | evaluate the work performed on an object using force and distance. | |
| | SCI.GPS.8.2 | explain the relationship between work and time in determining power and solve for power when given work performed and time. | |
| | SCI.GPS.8.3 | list the types of simple machines and provide examples of each. | |
| | SCI.GPS.8.4 | determine mechanical advantage and efficiency of simple machines. | |

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| SCI.GPS.9 | | Students will use models to explain that energy is dependent on the motion and interactions of matter and radiation within a system; distinguish between the different types of and transformations of energy; use data to support the conservation of energy; solve problems involving potential and kinetic energy; and explain what specific heat represents in terms of heating and cooling of materials and describe the relationship between energy gain/loss, mass, specific heat and temperature change | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GPS.9.1 | use models to explain that energy is dependent on the motion and interactions of matter and radiation within a system. | HS-PS3-2 |
| | SCI.GPS.9.2 | distinguish between the different types of energy (i.e. potential, kinetic, chemical, mechanical, and radiation) and solve problems of potential and kinetic energy. | |
| | SCI.GPS.9.3 | use data to support the conservation of energy during energy transformations. | HS-PS3-1<br>HS-PS3-4 |
| | SCI.GPS.9.4 | distinguish between the types of energy transformations (i.e. convection, conduction, radiation). | HS-PS3-2 |
| | SCI.GPS.9.5 | explain what specific heat represents in terms of heating and cooling of materials and describe the relationship | |

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| | | between energy gain/loss, mass, specific heat and temperature change. | |

| SCI.GPS.10 | | Students will distinguish between wave types and identify characteristics of waves; use mathematical representations to describe waves; explain how the Doppler effect influences wavelength and frequency; predict wave behavior through wave interactions. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.GPS.10.1 | distinguish between wave types (electromagnetic and mechanical: Transverse and longitudinal), and explain how they represent a transfer energy. | HS-PS4-3 |
| | SCI.GPS.10.2 | explain that electromagnetic radiation can be described by a wave or particle model. | |
| | SCI.GPS.10.3 | identify wave characteristics such as wavelength, amplitude, frequency, and period and use mathematical representations to determine wave frequency, period and wave speed. | HS-PS4-1 |
| | SCI.GPS.10.4 | explain how the Doppler effect influences wavelength and frequency of waves. | PS4.A |
| | SCI.GPS.10.5 | predict wave behavior through reflection, refraction, interference, and diffraction. | PS4.A<br>HS-PS4-3 |
| | SCI.GPS.10.6 | explain how wave behavior can be used to transmit or store information and energy and describe the advantages of digital transmission in media and storage of information. | HS-PS4-2<br>HS-PS4-5 |

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# Biology

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

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|---|---|
| Purpose Statement | Students will distinguish between the physiological processes occurring within the cell, apply the mechanisms of evolution to explain how and why species change, and explain how and why organisms interact with their environment and what the effects of these interactions are. |

High Achieving Unit Outcomes:

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|---|---|---|---|
| SCI.BIO.1 | | Students will use representations to develop and support explanations of factors affecting the biodiversity, resiliency and stability of ecosystems; distinguish between the interactions between organisms in an ecosystem; construct explanations based on evidence supporting the flow of energy and cycling of matter in an ecosystem; develop explanations based on evidence about factors affecting populations in ecosystems; evaluate the claims and evidence that the types and numbers of organisms will remain relatively constant in stable conditions; use evidence to support the claim that ecosystems will return to its original state following a period of change through primary or secondary succession; evaluate the influences that environmental changes and human activities have on ecosystem biodiversity. | Standard Reference |
| Students will… | | | |
| Components | SCI.BIO.1.1 | use evidence to support explanations of factors, both biotic and abiotic, that affect the biodiversity, resiliency and stability of an ecosystem. | HS-LS2-1<br>HS-LS2-2 |
| | SCI.BIO.1.2 | distinguish between the ways organisms within an ecosystem interact (*e.g. symbiosis, predator-prey*) and explain how this interaction influences communities of organisms in an ecosystem. Relate the interaction between organisms to the flow of energy between trophic levels in an ecosystem. | HS-LS2-2 |
| | SCI.BIO.1.3 | construct explanations to support claims for the cycling of matter among organisms in an ecosystem. | HS-LS2-4 |
| | SCI.BIO.1.4 | develop explanations based on evidence about factors affecting populations in ecosystems. | HS-LS2-2 |
| | SCI.BIO.1.5 | use evidence to support the claim that in stable conditions the types and number of organisms in an ecosystem | HS-LS2-6 |

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| | | remains relatively constant and that an ecosystem will return to its original state following disturbance through primary or secondary succession. | |
| | SCI.BIO.1.6 | evaluate the influences, including both positive and negative, that environmental changes and human activities have on ecosystem biodiversity. | HS-LS1-7 |

| SCI.BIO.2 | | Students will list the hierarchical organization of interacting systems and explain the relationship between tissues and cell structure in multicellular organisms; differentiate between cell structure of prokaryotes and eukaryotes, plants and animals; compare the locations and processes of photosynthesis and cellular respiration. | Standard Reference |
|---|---|---|---|
| Students will… | | | |
| Components | SCI.BIO.2.1 | list the levels of structural organization in multicellular organisms and explain the relationship between structure and function at the cellular and tissue levels | HS-LS1-2 |
| | SCI.BIO.2.2 | describe the structure of the cell membrane and explain its role in cell transport and communication. | HS-LS1-2 |
| | SCI.BIO.2.3 | compare properties of all cells (i.e. Prokaryotic, Eukaryotic, Plant and Animal | HS-LS1-2 |
| | SCI.BIO.2.4 | compare the role of organelles in energy production (mitochondria and chloroplast) | HS-LS1-2 |
| | SCI.BIO.2.5 | construct an explanation for the cycling of matter and flow of energy in photosynthesis and cellular respiration and explain how energy is stored and released in the ATP molecule and used by cells. | HS-LS1-2 |

| SCI.BIO.3 | | Students will compare cell division in prokaryotes and eukaryotes; use a model to explain changes occurring in the cell during the eukaryotic cell cycle; use a model to explain the role of cellular division (i.e. mitosis) and differentiation in producing and maintaining complex organisms; and compare the ways in which cell division is regulated; distinguish between asexual and sexual reproduction; and use a model to explain the role of meiosis in creating genetic variation and producing cells used in sexual reproduction | Standard Reference |
|---|---|---|---|
| Students will… | | | |
| Components | SCI.BIO.3.1 | compare cell division in prokaryotes and eukaryotes. | HS-LS1-4 |
| | SCI.BIO.3.2 | use a model to explain changes occurring in the cell during the eukaryotic cell cycle (i.e. interphase, cell division – mitosis and cytokinesis). and explain the role of mitosis and | HS-LS1-4 |

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|---|---|---|---|
| | | differentiation in producing and maintaining complex organisms. | |
| | SCI.BIO.3.3 | identify internal and external factors that influence cell growth and division, compare the checkpoints of the cell cycle, and explain potential hazards when cell division is not properly regulated. | |
| | SCI.BIO.3.4 | distinguish between asexual and sexual reproduction. | HS-LS3-2 |
| | SCI.BIO.3.5 | use a model to explain the role of meiosis in creating genetic variation and producing haploid cells used in sexual reproduction. | HS-LS3-2 |

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| SCI.BIO.4 | | Students will explain the role of DNA and chromosomes in coding for characteristic traits passed from parents to offspring; use models to explain patterns of inheritance; apply concepts of statistics and probability to predict outcomes of genetic crosses; analyze pedigrees to determine the mode of inheritance represented, the phenotype or genotype of individuals, and predict probability of future offspring. | Standard Reference |
| Students will… | | | |
| Components | SCI.BIO.4.1 | explain the role of genes, alleles, and chromosomes in coding for characteristic traits passed from parents to offspring and explain patterns of Mendelian inheritance (i.e. segregation, independent assortment, and dominance). | HS-LS3-3 |
| | SCI.BIO.4.2 | compare complex patterns of inheritance (i.e. polygenic inheritance, multiple alleles, codominance, incomplete dominance, sex-linked, and autosomal inheritance) and explain how environmental factors can influence inheritance and expression of traits. | HS-LS3-3 |
| | SCI.BIO.4.3 | apply concepts of statistics and probability to predict outcomes of genetic crosses. | HS-LS3-3 |
| | SCI.BIO.4.4 | analyze pedigrees to determine the mode of inheritance represented, the phenotype or genotype of individuals, and predict probability of future offspring. | HS-LS3-3 |

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|---|---|---|
| SCI.BIO.5 | Students will construct an explanation for the role that DNA plays in coding for the structure of proteins which carry out the essential functions of life; compare RNA and DNA both structurally and functionally; use models to compare the functions and events occurring during DNA replication and gene expression; and evaluate the impact of gene regulation and mutations on gene expression. | Standard Reference |

| Students will… | | | |
|---|---|---|---|
| Components | SCI.BIO.5.1 | construct an explanation for the role that DNA plays in coding for the structure of proteins which carry out the essential functions of life. | HS-LS1-1 |
| | SCI.BIO.5.2 | describe the role of DNA replication in cell division and summarize the stages occurring during replication. | HS-LS1-4 |
| | SCI.BIO.5.3 | summarize the stages of Gene Expression (i.e. Transcription and Translation) and explain the role of both DNA and RNA in these processes. | HS-LS1-1 HS-LS3-1 |
| | SCI.BIO.5.4 | describe how feedback mechanisms influence gene expression and summarize the role of gene splicing in gene regulation (i.e. introns, exons, TATA box). | HS-LS3-1 |
| | SCI.BIO.5.5 | explain how errors in replication and environmental factors can influence the coding in DNA and can lead to errors in expression of genes (i.e. frameshift and point mutations). | HS-LS3-2 |

| SCI.BIO.6 | | Students will use evidence to support common ancestry and biological evolution; construct an explanation based on evidence that adaptation in populations primarily results from the processes of natural selection and is influenced by changes in environmental conditions. | Standard Reference |
|---|---|---|---|
| Students will… | | | |
| Components | SCI.BIO.6.1 | use evidence to explain common ancestry and biological evolution (i.e. similarities in DNA sequences, anatomical structures, embryological development, and the fossil record). | HS-LS4-1 |
| | SCI.BIO.6.2 | construct an explanation that the process of evolution primarily results from four factors: 1)potential for 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 organisms that are better suited to survive and reproduce in the environment. | HS-LS4-2 HS-LS4-3 |
| | SCI.BIO.6.3 | construct an explanation based on evidence for how natural selection leads to adaptation of populations and formation of new species. | HS-LS4-4 |
| | SCI.BIO.6.4 | 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 |

| SCI.BIO.7 | | Students will identify the levels of classification in the Linnaean Classification System; compare the Domain and Kingdom levels of classification; use observations to support explanations of evolutionary characteristics in animals. | Standard Reference |
|---|---|---|---|
| Students will… | | | |
| Components | SCI.BIO.7.1 | use evidence from classification systems to support common ancestry among organisms. | HS-LS4-1 |
| | SCI.BIO.7.2 | identify the levels of classification in the Linnaean Classification System. | HS-LS4-1 |
| | SCI.BIO.7.3 | compare the three domains of life (i.e. Bacteria, Archaea, and Eukarya). | HS-LS4-1 |
| | SCI.BIO.7.4 | compare the 4 kingdoms of domain Eukarya (i.e. Plantae, Animalia, Fungi, Protista). | HS-LS4-1 |
| | SCI.BIO.7.5 | distinguish between invertebrates and vertebrates. Compare animal body systems (i.e. skeletal systems, digestive and excretory systems, nervous system, respiratory and circulatory systems, and reproduction). | HS-LS1-2 HS-LS1-3 |
| | SCI.BIO.7.6 | compare the major evolutionary characteristics of chordates. | HS-LS1-2 |

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# Chemistry

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

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|---|---|
| Purpose Statement | Students will analyze matter in chemical systems to determine the name, formula, and nature of various compounds, and compare and contrast the types of energy associated with these compounds. |

High Achieving Unit Outcomes:

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| SCI.CHEM.1 | | Students will use the Quantum Model of the Atom to describe the arrangement of electrons in an atom; distinguish between the orbitals that predict the probable location of electrons; compare the four quantum numbers and the general information provided by each; write orbital- and electron configurations for a given element. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.CHEM.1.1 | use the Quantum model of the atom to describe the arrangement of electrons in an atom. | HS-PS1-1 |
| | SCI.CHEM.1.2 | distinguish between the orbitals that predict the probable location of electrons. | HS-PS1-1 |
| | SCI.CHEM.1.3 | compare the four quantum numbers and the general information provided by each. | HS-PS1-1 |
| | SCI.CHEM.1.4 | write orbital- and electron configurations for various elements. | HS-PS1-1 |

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| SCI.CHEM.2 | | Students will use the periodic table to describe patterns of electrons and protons of an element use patterns in the periodic table to support explanations of characteristic properties of elements; and explain how period and group trends are used to describe characteristics of the atom. | Standard Reference |
| *Students will…* | | | |
| Comp | SCI.CHEM.2.1 | explain how patterns of electrons and protons are reflected in the periodic table. | HS-PS1-1 |
| | SCI.CHEM.3.2 | use patterns in the periodic table to support explanations of characteristic properties of elements in blocks s, p, d, p and f. | HS-PS1-1 |

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| | SCI.CHEM.2.3 | use period and group trends to describe properties of main-group elements (i.e., atomic radii, first ionization energy, electron affinity, ionic radii, and electronegativity). | HS-PS1-1 |

| SCI.CHEM.3 | | Students will name and write formulas of Covalent, Organic, and Ionic compounds binary type 1, 2, and 3. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.CHEM.3.1 | interpret and write the names and formulas for ionic and covalent compounds. | |
| | SCI.CHEM.3.2 | name and write formulas for common acids and bases. | |
| | SCI.CHEM.3.3 | predict the type of bonding (*e.g. ionic or covalent*) and the shape of simple compounds using Lewis dot structures. | |
| | SCI.CHEM.3.4 | name and label common polyatomic ions. | |
| | SCI.CHEM.3.5 | compare properties Ionic, Covalent, and Organic molecules(*e.g. bond strength, bulk properties*). | |
| | SCI.CHEM.3.6 | name and write formulas for organic compounds. | |

| SCI.CHEM.4 | | Students will write and balance chemical equations; define the collision model; identify chemical equations as synthesis, decomposition, single replacement, double replacement, and combustion reactions; interpret the products of a reaction based on the reactants. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.CHEM.4.1 | write chemical equations. | HS-PS1-1 |
| | SCI.CHEM.4.2 | balance chemical equations. | HS-PS1-7 |
| | SCI.CHEM.4.3 | identify chemical equations as synthesis, decomposition, single replacement, double replacement, and combustion reactions. | HS-PS1-2 |
| | SCI.CHEM.4.4 | interpret the products of a reaction based on the reactants. | |

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| SCI.CHEM.5 | | Students will use molar mass to determine the number of moles and atoms of a given compound; use mole ratios to determine the mass of a given compound; apply mole ratios in determining empirical and molecular formulas; and predict percent yield, mass of excess, theoretical yield, and limiting reagent in chemical reactions. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.CHEM.5.1 | use molar mass to determine the number of moles and atoms of a given compound. | HS-PS1-7 |
| | SCI.CHEM.5.2 | use mole ratios to determine the mass of a given compound. | HS-PS1-7 |
| | SCI.CHEM.5.3 | apply mole ratios in determining empirical, and molecular formulas. | HS-PS1-7 |
| | SCI.CHEM.5.4 | predict the percent yield, the mass of excess, theoretical yield, and the limiting reagent in chemical reactions. | HS-PS1-7 |

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| SCI.CHEM.6 | | Students will use the kinetic-molecular theory to describe the behavior of ideal and real gases; Explain how collisions of air molecules generate pressure and use Dalton's Law of Partial Pressures to solve for the total pressure exerted by a mixture of gases; Describe the relationship between pressure, volume, and temperature of gases using Boyle's, Charles's, Gay-Lussac's and Combined gas laws; use the ideal gas equation to demonstrate relationships between volume,pressure, temperature, and moles of a gas under ideal conditions. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.CHEM.6.1 | use the kinetic-molecular theory to describe the behavior of ideal and real gases | HS-PS1-4 |
| | SCI.CHEM.6.2 | explain how collisions of air molecules generate pressure and use Dalton's Law of Partial Pressures to solve for the total pressure exerted by a mixture of gases | |
| | SCI.CHEM.6.3 | describe the relationship between pressure, volume, and temperature of gases using Boyle's, Charles's, Gay-Lussac's and Combined gas laws | |
| | SCI.CHEM.6.4 | use the ideal gas equation to demonstrate relationships between volume, pressure, temperature, and moles of a gas under ideal conditions. | |

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| SCI.CHEM.7 | | Students will compare the effects of varying pressure and temperature on solubility; perform calculations to find the concentration of solutions in terms of molarity and molality; describe the dissociation of ionic and some molecular compounds and write ionic equations for precipitation reactions; support explanations of characteristics of varying solutions using colligative properties; and apply the concept of chemical equilibrium and Le Châtelier's principle to predict the effect of change in conditions on a chemical equilibrium. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.CHEM.7.1 | compare the effects of varying pressure and temperature on solubility. | |
| | SCI.CHEM.7.2 | perform calculations to find the concentration of solutions in terms of molarity and molality. | |
| | SCI.CHEM.7.3 | describe the dissociation of ionic and some molecular compounds and write ionic equations for precipitation reactions. | |
| | SCI.CHEM.7.4 | perform calculations to find the concentration of solutions in terms of molar concentration and percent concentration. | |
| | SCI.CHEM.7.5 | apply the concept of chemical equilibrium and Le Châtelier's principle to predict the effect of change in conditions on a chemical equilibrium. | HS-PS1-6 |

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| SCI.CHEM.8 | | Students will distinguish between acids an bases; evaluate chemical formulas to identify common strong and weak acids and bases; use the hydronium or hydroxide ion concentration to determine the pH and pOH of aqueous solutions; and use evidence from a titration to support claims regarding the concentration of acid and base solutions. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.CHEM.8.1 | distinguish between acids and bases and evaluate chemical formulas to identify common strong and weak acids and bases. | |
| | SCI.CHEM.8.2 | use the hydronium or hydroxide ion concentration to determine the pH and pOH of aqueous solutions. | |

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| | SCI.CHEM.8.3 | use evidence from a titration to support claims regarding the concentration of acid and base solutions. | |

| SCI.CHEM.9 | | Students will analyze enthalpy changes in chemical reactions; use enthalpy, entropy and free energy to predict whether a reaction will occur spontaneously; use the collision theory and activation energy to describe how chemical reactions take place; and explain how various factors influence the rate of a chemical reaction. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.CHEM.9.1 | analyze chemical reactions to determine enthalpy changes. | HS-PS1-4 |
| | SCI.CHEM.9.2 | use enthalpy, entropy and free energy to predict whether a reaction will occur spontaneously. | HS-PS1-4 |
| | SCI.CHEM.9.3 | use the collision theory and activation energy to describe how chemical reactions take place. | |
| | SCI.CHEM.9.4 | explain how various factors influence the rate of a chemical reaction and use the general rate law equation to describe the relationship between the reaction rate and concentration of reactants. | |

| SCI.CHEM.10 | | Students will compare oxidation and reduction reactions and assign oxidation numbers to elements/compounds within a reaction; balance equations for oxidation-reduction reaction using the half-reaction method; and describe the role of the oxidizing and reducing agent in an oxidation-reduction reaction. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.CHEM.10.1 | compare oxidation and reduction reactions and assign oxidation numbers to elements/compounds within a reaction. | |
| | SCI.CHEM.10.2 | balance equations for oxidation-reduction reaction using the half-reaction method. | |
| | SCI.CHEM.10.3 | describe the role of the oxidizing and reducing agent in an oxidation-reduction reaction. | |

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# Physics

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

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|---|---|
| Purpose Statement | Students will solve problems of motion mathematically and through experimentation, and compare the different types of energy and relate these concepts of energy to wave interaction. |

High Achieving Unit Outcomes:

| SCI.PHY.1 | | Students will construct, interpret, and compare graphical representations of motion in one dimension, and apply kinematic equations to solve problems involving one dimensional motion. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.PHY.1.1 | apply kinematic equations to calculate distance, time, or velocity under conditions of constant acceleration. | HS-PS2-1 |
| | SCI.PHY.1.2 | construct and interpret graphs of position vs time. | HS-PS2-1 |
| | SCI.PHY.1.3 | compare graphical representations of accelerated and non-accelerated motions. | HS-PS2-1 |
| | SCI.PHY.1.4 | use evidence to support explanations about the influence of mass on objects in free fall. | HS-PS2-1 |
| | SCI.PHY.1.5 | calculate displacement, velocity, and time at various points in the motion of a freely falling object. | HS-PS2-1 |

| SCI.PHY.2 | | The student will distinguish between scalar and vector quantities; and apply kinematics and vectors to calculate and describe complex motion. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.PHY.2.1 | distinguish between scalar and vector quantities and add and subtract vectors. | |
| | SCI.PHY.2.2 | multiply and divide vector quantities by scalar quantities. | |
| | SCI.PHY.2.3 | apply the Pythagorean theorem and tangent function to calculate the magnitude and direction of a resultant vector. | |
| | SCI.PHY.2.4 | use sine and cosign functions to convert vectors into components. | |

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| | SCI.PHY.2.5 | add vectors that are not perpendicular. | |
| | SCI.PHY.2.6 | apply kinematic equations to solve problems involving projectile motion | |

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| SCI.PHY.3 | | Students will explain the relationship between the motion of an object and the net external force acting on the object; calculate the force required to bring an object into equilibrium; describe an objects acceleration in terms of mass and the net force acting on it; use action and reaction forces to determine direction and velocity of an object; describe air resistance as a form of friction and how it relates to terminal velocity; and use coefficients of friction to calculate the force of friction. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.PHY.3.1 | explain the relationship between the motion of an object and the net external force acting on the object and calculate the force required to bring an object into equilibrium. | HS-PS2-1 |
| | SCI.PHY.3.2 | describe an objects acceleration in terms of mass and the net force acting on it. | HS-PS2-1 |
| | SCI.PHY.3.3 | use action and reaction forces to determine direction and velocity of an object. | HS-PS2-1 |
| | SCI.PHY.3.4 | describe air resistance as a form of friction and how it relates to terminal velocity. | HS-PS2-1 |
| | SCI.PHY.3.5 | use coefficients of friction to calculate the force of friction. | HS-PS2-1 |

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|---|---|---|---|
| SCI.PHY.4 | | Students will explain the relationship between work, net force, and distance and solve for work performed by an object; solve for efficiency of simple machines; use concepts of kinetic and potential energy to solve for an object's position, mass, velocity, and energy; apply the work-kinetic energy theorem to solve for net work and change in kinetic energy of an object; and explain the relationship between power and the amount of time required to perform work and calculate the power of an object. | Standard Reference |
| *Students will…* | | | |
| Comp | SCI.PHY.4.1 | explain the relationship between work, net force, and distance and use this relationship to solve for work, net force, and distance. | |
| | SCI.PHY.4.2 | solve for the mechanical advantage and efficiency of a simple machine. | HS-PS3-1 |

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| | SCI.PHY.4.3 | use mathematical representations of kinetic and potential energy to ~~calculate and~~ determine an objects position, mass, velocity, and energy. | HS-PS3-2 |
| | SCI.PHY.4.4 | Apply the work-kinetic energy theorem to solve for net work or change in kinetic energy | HS-PS3-2 |
| | SCI.PHY.4.5 | Explain the relationship between power and the amount of time required to perform work and calculate the power performed by an object | |

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|---|---|---|---|
| SCI.PHY.5 | | Student will compare the momentum of moving objects; describe changes in momentum in terms of force and time; apply the law of conservation of momentum to predict the final velocities of objects after a collision given the initial velocities; compare the momentum and the kinetic energy of the types of collisions (*e.g. inelastic, elastic, perfectly inelastic*); and predict the movements of objects following a collision (*e.g. inelastic, elastic, perfectly inelastic*). | Standard Reference |
| *Students will…* | | | |
| Components | SCI.PHY.5.1 | compare the momentum of moving objects and describe changes in momentum in terms of force and time. | SCI.PHY.5.1 |
| | SCI.PHY.5.2 | apply the law of conservation of momentum to predict the final velocities of objects after a collision given the initial velocities. | SCI.PHY.5.2 |
| | SCI.PHY.5.3 | compare the momentum and the kinetic energy of the types of collisions (*e.g. inelastic, elastic, perfectly inelastic*). | SCI.PHY.5.3 |

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| SCI.PHY.6 | | Students will solve problems involving centripetal acceleration and force; explain how Newton's Law can account for various phenomena (*e.g. satellite orbits, falling objects, tides, etc.*); use mathematical representations of Newton's law of gravitation to describe and predict the gravitational force between two objects; use calculations to support explanations of how torque can affect the efficiency of different types of simple machines; calculate the magnitude of a torque on an object; and solve how torque can affect the efficiency of different types of simple machines. | Standard Reference |
| *Students will…* | | | |
| Comp | SCI.PHY.6.1 | solve problems involving centripetal acceleration and force. | HS-PS2-4 |
| | SCI.PHY.6.2 | use mathematical representations of Newton's Third Law of gravitation to describe and predict the gravitational force | HS-PS2-4 |

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|---|---|---|---|
| | | between two objects and explain how it can account for various phenomena (*e.g. satellite orbits, falling objects, tides, etc.*). | |
| | SCI.PHY.6.3 | solve problems involving orbital speed and period. | HS-PS2-4 |
| | SCI.PHY.6.4 | distinguish between force and torque and calculate the magnitude of torque on an object and how torque can affect the efficiency of simple machines. | HS-PS2-4 |

| SCI.PHY.7 | | Students will explain how force, velocity, acceleration, and period change as an object vibrates with simple harmonic motion; Calculate the period and frequency of an object vibrating with simple harmonic motion; determine wave speed, frequency, and wavelength; and apply the superposition principle to constructive and destructive interference and predict the result of wave interference. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.PHY.7.1 | explain how force, velocity, acceleration, and period change as an object vibrates with simple harmonic motion and calculate the spring force used in Hooke's law. | |
| | SCI.PHY.7.2 | calculate the period and frequency of an object vibrating with simple harmonic motion. | |
| | SCI.PHY.7.3 | apply mathematical relationships to determine wave speed, frequency, and wavelength. | HS-PS4-1 |
| | SCI.PHY.7.4 | apply the superposition principle to constructive and destructive interference and predict the result of wave interference | |

| SCI.PHY.8 | | Students will determine the magnitude of the buoyant force exerted on a floating and submerged object; use a model to explain why objects float or sink; calculate the pressure that a fluid exerts; and apply Bernoulli's principle to determine values of unknown pressure or volume. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.PHY.8.1 | determine the magnitude of the buoyant force exerted on a floating object or a submerged object and use a model to explain why some objects float and some objects sink. | |
| | SCI.PHY.8.2 | calculate the pressure exerted by a fluid at varying depths. | |
| | SCI.PHY.8.3 | apply Bernoulli's principle to determine values of unknown pressure or volume. | |

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|---|---|---|---|
| SCI.PHY.9 | | Students will differentiate between conductors and insulators; distinguish charges (induction, polarization); calculate electric force using Coulomb's Law; Compare the electrical force with gravitational force; use a model to describe the magnetic fields around a magnet; describe the magnetic field produced by a current; and given the force of a charge in a magnetic field determine the strength of the magnetic field through calculation. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.PHY.9.1 | differentiate between electrical conductors and insulators and compare methods of charging objects (*e.g. induction, polarization*). | HS-PS2-6 |
| | SCI.PHY.9.2 | use mathematical representations to describe and predict the electrostatic forces between objects and calculate electric force using Coulomb's Law. | HS-PS2-4 |
| | SCI.PHY.9.3 | use a model to illustrate the magnetic fields around a magnet and describe the relationship between magnetic fields and electrical currents. | HS-PS3-5<br>HS-PS2-5 |
| | SCI.PHY.9.4 | given the force of a charge in a magnetic field determine the strength of the magnetic field through calculation. | |

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# Science Exploration

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

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|---|---|
| Purpose Statement | Students will compare and contrast the characteristics of plants and distinguish between the major plant groups. Students will apply concepts of the atmosphere and climate to global weather. |

High Achieving Unit Outcomes:

| SCI.SE.1 | | Students will compare and contrast the characteristics of plant groups. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.SE.1.1 | identify the key characteristics that all plants share. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.1.2 | summarize the evolutionary history of plants from water to land. | HS-LS4 |
| | SCI.SE.1.3 | explain how adaptations made by plants through evolutionary history allowed plants to move from water to land. | HS-LS4.C |
| | SCI.SE.1.4 | distinguish between nonvascular, seedless vascular and seed vascular plants. | HS-LS4.A |
| | SCI.SE.1.5 | identify and describe the characteristics of all gymnosperms. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.1.6 | compare/Contrast the types of gymnosperms (i.e. conifers, gnetophytes, cycads, and ginkgos). | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.1.7 | compare and contrast various conifer types. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.1.8 | identify and describe the major characteristics of Angiosperms. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.1.9 | distinguish between monocots and dicots. | HS-LS1.A<br>HS-LS1.B |

| SCI.SE.2 | | Students will compare and contrast characteristics, life cycle, and types of gymnosperms and angiosperms. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| | SCI.SE.2.1 | explain why a plants life cycle is referred to as "alternation of generations". | HS-LS1.B |

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| | SCI.SE.2.2 | trace the life cycle of a plant and identify the diploid and haploid stages. | HS-LS1.B |
| | SCI.SE.2.3 | summarize the life cycle of a gymnosperm and identify the dominate stage of its life cycle. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.2.4 | identify and describe gymnosperm reproductive structures. Explain the role that cones and seeds play in the life cycle of a gymnosperm. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.2.5 | summarize the life cycle of angiosperms. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.2.6 | identify the parts of a flowering plant and explain how the structure of a flower relates to the method of reproduction. | HS-LS1.A<br>HS-LS1.B |

| SCI.SE.3 | | Students will explain how the plant body is organized and the role that meristems play in plant growth following germination. Students will distinguish between apical and lateral meristems and the tissues that are derived from them. Students will compare and contrast the structure and function of roots, stems and leaves in plants. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.SE.3.1 | explain how the plant body is organized following germination. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.3.2 | explain the role that meristems play in plant growth. Distinguish between apical and lateral meristems. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.3.3 | identify the three types of tissue that are found in vascular plants. Compare and contrast the structure, function, and location of dermal, vascular and ground tissue in plants. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.3.4 | describe the role that roots, stems, and leaves play in maintaining homeostasis. Identify and explain the functioning of the major external features of roots, stems and leaves. Describe the organization of internal structures/tissues within roots, stems, and leaves. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.3.5 | describe the formation of primary and secondary tissues in roots, stems and leaves. Distinguish between primary and secondary growth. Distinguish between the role of primary and secondary tissues in roots, stems and leaves. | HS-LS1.A<br>HS-LS1.B |

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| SCI.SE.4 | | Students will describe the conditions leading to and events of germination. Students will explain how various factors influence plant germination and plant growth. Students will distinguish between the macro- and micro-nutrients and the role they play in plants. Students will compare and contrast transport of materials through the xylem and phloem. Students will explain how environmental factors lead to changes in plant growth and response to stimulus and the role that hormones and nutrients play in plant functioning. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.SE.4.1 | compare and contrast the anatomy of monocot and dicot seeds. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.4.2 | describe the events and conditions leading to germination of seeds. Distinguish between the germination and growth of monocot and dicot embryos. Explain how various factors influence seed germination and plant growth. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.4.3 | describe nutritional adaptations plants possess to aid in obtaining required nutrients. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.4.4 | describe the role that soil plays in plant functioning. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.4.5 | explain how water and organic compounds are transported through a vascular plant. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.4.6 | compare the transport of substances through xylem and phloem. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.4.7 | define tropism and distinguish between phototropism, gravitropism, and thigmotropism. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.4.8 | explain how dormancy provides survival advantage in plants. Identify environmental conditions that influences the dormancy of plants. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.4.9 | explain what hormones are and the role they play in plants. | HS-LS1.A<br>HS-LS1.B |
| | SCI.SE.4.10 | distinguish between the macro- and micro-nutrients required by plants and the role that each plays. Describe the effects of the macro- and micro-nutrients in plants. | HS-LS1.A<br>HS-LS1.B |

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| SCI.SE.5 | | Students will identify the composition of the atmosphere and distinguish between the layers of the atmosphere. Students will use observations/evidence to explain how pressure and temperature changes as altitude in the atmosphere changes. Students will use models to explain the formation and breakdown of ozone in the atmosphere and the role it plays in Earth's atmosphere. Students will use observations/evidence to support reasoning for how energy is exchanged between the Sun, Earth, and Atmosphere. Students will summarize the cycling of water in the atmosphere and compare the distribution of water in the Earth/Atmosphere system. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.SE.5.1 | identify the components of the atmosphere and compare the relative percentage of components. | HS-ESS2.D |
| | SCI.SE.5.2 | distinguish between the five layers of the atmosphere. | HS-ESS2.D |
| | SCI.SE.5.3 | explain how pressure and temperature change as altitude in the atmosphere increases. | HS-ESS2.D |
| | SCI.SE.5.4 | describe how air exerts pressure, how that pressure is measured, and how the air pressure can vary. | HS-ESS2.D |
| | SCI.SE.5.5 | describe the formation and breakdown of ozone in the atmosphere and the role that it plays in Earth's atmosphere. | HS-ESS2.D |
| | SCI.SE.5.6 | distinguish between the modes of energy transfer and relate to exchanges of energy between the Sun, Earth, and Atmosphere. | HS-ESS2.D |
| | SCI.SE.5.7 | summarize the circulation of water in the Earth-Atmosphere System. | HS-ESS2.C |
| | SCI.SE.5.8 | compare the distribution of water in the Earth-Atmosphere system. | HS-ESS2.C |

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| SCI.SE.6 | | Students will use evidence to support reasoning that the amount of solar radiation striking any one point on Earth's surface varies throughout the year. Students will use models to support reasoning for how air circulates through major circulations and the Jet stream. Students will distinguish between the Koppen climate classifications and sub-classifications. Students will use evidence to support an explanation supporting or refuting the statement "climate change" is primarily anthropogenic. | Standard Reference |
| *Students will…* | | | |
| | SCI.SE.6.1 | describe how the amount of solar radiation striking a particular part of Earth's surface is dependent upon the time of year and position of Earth's orbit | HS-ESS2.D |

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| | SCI.SE.6.2 | explain how position of sun changes throughout the day/year and relate to Earth's rotation and orbit around sun | HS-ESS2.D |
| | SCI.SE.6.3 | distinguish between the major air circulations and describe the factors that contribute to their formation | HS-ESS2.D |
| | SCI.SE.6.4 | explain how the movement of air in the Jet Stream varies from regular air circulations. | HS-ESS2.D |
| | SCI.SE.6.5 | explain the relationship between climate and weather | HS-ESS2.D |
| | SCI.SE.6.6 | distinguish between the Koppen climate classifications and sub-classifications | HS-ESS2.D |
| | SCI.SE.6.7 | use evidence to support an explanation supporting or refuting the statement "climate change" is primarily anthropogenic | HS-ESS2.D<br>HS-ESS2-4<br>HS-ESS3-5 |
| | SCI.SE.6.8 | distinguish between precipitation, obscuration and other weather types | HS-ESS2.D |
| | SCI.SE.6.9 | explain how humidity and wind speed influence the experienced temperature | HS-ESS2.D |

| SCI.SE.7 | | Students will explain the importance of oceans in understanding weather. Student will describe characteristics of the oceans including layers, temperature and pressure changes, salinity and currents. Students will use evidence to distinguish between El Nino and La Nina weather events. Students will distinguish between sweel, rogue, and tsunami waves. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.SE.7.1 | explain the importance of the oceans in understanding weather. Compare the surface area and percentage of earth's surface covered by Earth's Oceans (Pacific, Atlantic, Indian, Southern, and Arctic). | HS-ESS2.C |
| | SCI.SE.7.2 | distinguish between the layers of the ocean. | HS-ESS2.C |
| | SCI.SE.7.3 | describe the composition of sea water and compare the salinity of various oceans. | HS-ESS2.C |
| | SCI.SE.7.4 | identify the factors that influence the world's surface ocean currents. | HS-ESS2.C |
| | SCI.SE.7.5 | distinguish between warm and cool surface and deep ocean currents. | HS-ESS2.C |
| | SCI.SE.7.6 | use evidence to distinguish between El Nino and La Nina. | HS-ESS2.C |
| | SCI.SE.7.7 | distinguish between swell, rogue and tsunami waves. | HS-ESS2.C |

| SCI.SE.8 | | Students will summarize the process of cloud formation and distinguish between types of clouds. Students will explain the relationship between the surface weather and patterns in the upper atmosphere. Students will use provided data to describe the condition of the upper atmosphere. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.SE.8.1 | Summarize the process of cloud formation. | HS-ESS2.C, D |
| | SCI.SE.8.2 | Distinguish between the types of clouds. | HS-ESS2.C, D |
| | SCI.SE.8.3 | Explain the relationship between surface weather and patterns in the upper air. | HS-ESS2.C, D |
| | SCI.SE.8.4 | Describe the "Parcel Theory" and explain the relationship between parcel movement and stability of the atmosphere. | HS-ESS2.C, D |
| | SCI.SE.8.5 | Distinguish between absolute stability, absolute instability, neutral stability, and conditional stability. | HS-ESS2.C, D |
| | SCI.SE.8.6 | Explain how radiosondes are used to measure the characteristics of the atmosphere. | HS-ESS2.C, D |
| | SCI.SE.8.7 | Analyze sample Skew-T Log-P Diagrams for Temperature, Pressure, Dry Adiabats, and Moist (Saturated) Adiabats, Mixing Ratio and Wind Speed and Direction. | HS-ESS2.C, D |

| SCI.SE.9 | | Students will analyze surface weather maps to determine large-scale weather patterns to include surface plots, location of fronts, high and low pressure systems, and predictions of associated weather. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.SE.9.1 | explain that synoptic meteorology represents weather conditions at a given time. | HS-ESS2.C, D |
| | SCI.SE.9.2 | distinguish between Coordinated Universal Time (Z-time) and standard time. | HS-ESS2.C, D |
| | SCI.SE.9.3 | compare the movement of air around high and low pressure systems. | HS-ESS2.C, D |
| | SCI.SE.9.4 | explain how pressure gradient force, Coriolis force and friction influence wind speed and direction. | HS-ESS2.C, D |
| | SCI.SE.9.5 | describe how the classifications of air masses differ in terms of temperature and moisture. | HS-ESS2.C, D |
| | SCI.SE.9.6 | distinguish between warm, cold, stationary, and occluded fronts. | HS-ESS2.C, D |
| | SCI.SE.9.7 | summarize the stages of the Norwegian Cyclone Model. | HS-ESS2.C, D |

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|---|---|---|---|
| | SCI.SE.9.8 | analyze station weather plots to describe weather conditions in given locations, location of fronts, precipitation, and high and low pressure systems. | HS-ESS2.C, D |

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# Earth Science

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will develop models, analyze data, plan and conduct investigations, and construct argument that will describe the development of the various Earth systems and how humans have interacted with those systems in the past through to the present. |

High Achieving Unit Outcomes:

| SCI. ES.1 | | Students will describe the universe through researching telescopic observations, Electro-Magnetic Radiation (EMR), scientific models, scientific laws, and using the speed of light. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.ES.1.1 | research and compare the two ways in which the universe is studied: telescopic observation and through measuring EMR using physics and chemistry. | HS-PS4-5 |
| | SCI.ES.1.2 | construct an explanation of the Big Bang theory based on red shift of galaxies, and cosmic waves. | HS-ESS1-2 |
| | SCI.ES.1.3 | use Newton's and Kepler's laws of motion to predict and describe the motion of the earth, its moon and other planetary bodies in our solar system. | HS-ESS1-4 |
| | SCI.ES.1.4 | explain how all earth's minerals came from the life cycle of stars in our universe. | HS-ESS1-3 |
| | SCI.ES.1.5 | describe how changes in technology have affected the view of the universe *(e.g., Hubble Space Telescope*). | HS-PS4-5 |

| SCI.ES.2 | | Students will construct models to illustrate earth's systems: the four spheres, two sources of energy, matter and the composition of the earth. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Comp | SCI.ES.2.1 | model the earth as a system composed of four interacting spheres, two sources of energy, and a finite supply of matter, that is "open" with regards to energy and "closed" with regards to matter. | HS-ESS2-4 |

| | | | |
|---|---|---|---|
| | SCI.ES.2.2 | model the six layers of the Geosphere and describing each layer in terms of its position, temperature, density, and chemical composition. | HS-ESS2-3 |
| | SCI.ES.2.3 | explain why Earth has a magnetic field, list consequences of this magnetic field, and describe the process of magnetic field reversal. | HS-ESS2-3 |
| | SCI.ES.2.4 | develop a model to describe the chemical composition of the Earth's mantle, differentiate between mafic and felsic magma and lava, and explain how mantle convection happens. | HS-ESS2-1 |
| | SCI.ES.2.5 | develop a model that describes how the creation of land and sea-floor features are a result of both constructive and destructive mechanisms. | HS-ESS2-1 |

| SCI.ES.3 | | Students will describe divisions and explorations of the global oceans; the features of the ocean floor including classification of sediments; the properties of ocean water, ocean life and resources; and ocean currents, tides, and energy. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.ES.3.1 | name the major divisions of the global ocean and the goals of oceanography. | HS-ESS2-2 |
| | SCI.ES.3.2 | describe the main features of the continental margins and deep ocean basin. | HS-ESS2-2 |
| | SCI.ES.3.3 | describe the formation of ocean-floor sediments and how they are classified according to physical composition. | HS-ESS2-2 |
| | SCI.ES.3.4 | describe the chemical and physical properties of ocean water, and how marine life alters the chemistry of ocean water. | HS-LS2-4 |
| | SCI.ES.3.5 | explain why plankton can be called the foundation of ocean life, and describe the major zones of life in the ocean. | HS- LS2-5 |
| | SCI.ES.3.6 | describe how wind patterns and density of ocean water affect ocean currents. | HS-ESS2-5 |
| | SCI.ES.3.7 | describe the formation of waves and the factors that affect wave size and interaction with the shore. | HS-ESS2-5 |
| | SCI.ES.3.8 | describe tidal forces, patterns, and tidal power variables. | HS-ESS2-5 |

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| SCI.ES.4 | | Students will analyze characteristics of the atmosphere and energy sources originating in the atmosphere; atmospheric moisture and precipitation; air masses, weather, weather instruments and forecasting; and factors that affect climate and climate zones. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.ES.4.1 | describe the composition and layers of the earth's atmosphere, explain how two types of barometers work, and identify the weather conditions that increase the effects of air pollution. | |
| | SCI.ES.4.2 | explain how radiant energy reaches the earth including the processes of radiation, conduction, and convection, and how light and infrared energy warms the earth. | HS-ESS1-1 |
| | SCI.ES.4.3 | describe global and local wind patterns. | HS-ESS2-4 |
| | SCI.ES.4.4 | explain how water vapor enters the air, the meaning of humidity and how it is measured, and what happens when the temperature of air decreases at or below the dew point. | HS-ESS2-5 |
| | SCI.ES.4.5 | list the conditions that must exist for a cloud or fog to form, identifying the types of clouds. | HS-ESS2-5 |
| | SCI.ES.4.6 | compare processes that cause precipitation, the various types of precipitation, and how it is measured. | HS-ESS2-5 |
| | SCI.ES.4.7 | explain how an air mass forms and describe the air masses that affect the weather of North America. | HS-ESS2-4 |
| | SCI.ES.4.8 | compare the weather characteristics of cold and warm fronts and the stages in the development of severe weather. | HS-ESS2-4 |

| SCI.ES.5 | | Students will compare methods for determining the earth's age using rock and fossil records, and identify the characteristics of the geologic eras. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.ES.5.1 | explain and apply the principle of uniformitarianism, explain how the law of superposition can be used to determine the relative age of rocks, compare three types of unconformity, and apply the law of crosscutting relationships to determine the age of rocks. | HS-ESS1-5 |
| | SCI.ES.5.2 | summarize the limitations of using the rates of erosion and deposition to determine the absolute age of rocks, describe the formation of varves, and explain how the process of radioactive decay can be used to determine the absolute age of rocks. | HS-ESS2-5 |
| | SCI.ES.5.3 | summarize the development of the geologic column and list the major units of geologic time. | HS-ESS1-5 |

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| | SCI.ES.5.4 | identify the characteristics of Precambrian rock, explain what scientists have learned from the geologic record about life during the Paleozoic, Mesozoic, and Cenozoic eras. | HS-ESS1-5 |
| | SCI.ES.5.5 | identify the landmasses that made up Pangaea, and its breakup. | HS-ESS1-6 |
| | SCI.ES.5.6 | summarize the changes in the North American continent that occurred during the Precambrian, Paleozoic, Mesozoic, and Cenozoic eras. | HS-ESS1-6 |

| SCI.ES.7 | | Students will explain, evaluate and conduct simulations of the interactions of the Earth's systems and human activity | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.ES.6.1 | 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 |
| | SCI.ES.6.2 | evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. | HS-ESS3-2 |
| | SCI.ES.6.3 | evaluate or refine a technological solution that reduces impacts of human activities on natural systems. | HS-ESS3-4 |
| | SCI.ES.6.4 | analyze geoscience data and the results from global climate models to make an evidence-based prediction of the current rate of global or regional climate change and associated future impacts to Earth systems. | HS-ESS3-5 |
| | SCI.ES.6.5 | use a computational representation to illustrate the relationship among Earth systems and how those relationships are being modified due to human activity. | HS-ESS3-6 |
| | SCI.ES.6.6 | create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. | HS-ESS3-3 |

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# Geology

*Note: This course is currently in draft form and still needs to be tried out and validated. Possible revisions may still be made.*

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

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|---|---|
| Purpose Statement | Students will analyze earth systems and explain how these systems interact with one another, how humans interact with these systems, and Earth's place in the universe. |

High Achieving Unit Outcomes:

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| SCI.GEO.1 | | Students will construct an explanation to support the relationship between the branches of earth science four main branches of earth science; analyze the suns life cycle; cite evidence supporting the Big Bang theory and summarize the major events; and describe the meteorite impact hypothesis. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GEO.1.1 | construct an explanation to support the relationship between the branches of earth science four main branches of earth science (i.e. astronomy, meteorology, oceanography, geology). | |
| | SCI.GEO.1.2 | analyze the sun's life span and the role of nuclear fusion in the sun's core. | HS-ESS1-1<br>HS-ESS1-3 |
| | SCI.GEO.1.3 | cite evidence supporting the Big Bang theory and summarize the major events. | HS-ESS1-2 |
| | SCI.GEO.1.4 | describe the giant impact hypothesis. | |

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| SCI.GEO.2 | Students will compare the three major zones of Earth's interior; trace the cycling of matter through the hydrosphere, atmosphere, geosphere, and biosphere; use seismic evidence to support claims regarding the composition of Earth's interior; describe the source of the earth's magnetism; use Newton's law of gravitation to support explanations of the cycling of matter in Earth's interior; use a model to illustrate Earth's revolution and rotation and describe the relationship to Earth's seasons; | Standard Reference |

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| | | and compare two types of satellites orbits and how they are used to study the earth. | |
| *Students will…* | | | |
| | SCI.GEO.2.1 | compare the three major zones of Earth's interior. | HS-ESS2-1 |
| | SCI.GEO.2.2 | trace cycling of the matter through the hydrosphere, atmosphere, geosphere, and biosphere. | HS-ESS2-6 |
| | SCI.GEO.2.3 | use seismic evidence to support claims regarding the composition of Earth's interior. | HS-ESS2-3 |
| | SCI.GEO.2.4 | describe the source of the earth's magnetism. | HS-ESS2-3 |
| | SCI.GEO.2.5 | use a model to illustrate Earth's revolution and rotation and describe the relationship to Earth's seasons. | HS-ESS2-4 |

| SCI.GEO.3 | | Students will be able to explain how a magnetic compasses can be used to find directions on Earth; use latitude and longitude; describe the characteristics and uses of three types of maps (Mercator, Gnomonic, Conic); use scale to determine distance on a map; and evaluate and interpret topographic maps. | Standard Reference |
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| *Students will…* | | | |
| Components | SCI.GEO.3.1 | use latitude and longitude coordinates to describe specific locations and use scale to determine distance on a map. | |
| | SCI.GEO.3.2 | explain how a magnetic compasses can be used to find directions on Earth. | |
| | SCI.GEO.3.3 | describe the characteristics and uses of three types of maps (Mercator, Gnomonic, Conic). | |
| | SCI.GEO.3.4 | interpret a topographic map to determine geographic features (*e.g. peaks, slopes, rivers, ridges, etc.*). | |

| SCI.GEO.4 | | Students will explain Wegner's hypothesis of continental drift through evidence and compare and contrast how this hypothesis supports sea floor spreading and plate tectonics. | Standard Reference |
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| *Students will…* | | | |
| Components | SCI.GEO.4.1 | use evidence to support the reasoning of Alfred Wegener's Theory of Continental Drift. (i.e., continental coast lines, fossil evidence, rock formations, and climatic evidence). | HS-ESS1-5<br>HS-ESS2-1 |
| | SCI.GEO.4.2 | analyze the evidence of sea floor spreading to explain how the Theory of Plate Tectonics was developed (i.e., differing ages of the sea floor crust, paleomagnetism, and thickness of the crust in relation to the mid-ocean ridges and subduction zones). | HS-ESS1-5<br>HS-ESS2-1 |

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| | SCI.GEO.4.3 | compare the types of plate boundaries and predict what kind of geological features (*e.g., ridges, mountains, trenches*) would be found at each type of plate boundary. | HS-ESS1-5 |
| | SCI.GEO.4.4 | use a model to illustrate the role of convection currents in plate movements and summarize the theory of micro plate terrains. | HS-ESS2-3 |

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| SCI.GEO.5 | | Students will evaluate sources of stress in crustal rock and predict what adjustments will occur from this stress; compare folding and faulting as responses from stress and identify example of each; differentiate between the types of plate collisions that form mountains; and compare these types of mountains. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GEO.5.1 | predict isostatic adjustments that will result from changes in the thickness of the earth's crust. | HS-ESS2-1 |
| | SCI.GEO.5.2 | evaluate a diagram to determine the source of stress in crustal rocks and compare folding and faulting as responses from stress and identify an example of each. | HS-ESS2-1 |
| | SCI.GEO.5.3 | differentiate between the types of plate collisions that form mountains and compare the four types of mountains. | HS-ESS2-1 |

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| SCI.GEO.6 | | Students will explain why earthquakes generally occur along plate boundaries and compare the types of seismic waves that earthquakes cause, and describe the relationship between tsunamis and earthquakes. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GEO.6.1 | compare the types of seismic waves (i.e. Primary, Secondary, Love, Raleigh) and explain why earthquakes generally happen along plate boundaries and summarize the Elastic Rebound theory. | |
| | SCI.GEO.6.2 | use triangulation to determine the epicenter of an earthquake. | |
| | SCI.GEO.6.3 | distinguish between the two types of scales to measure an earthquake (i.e. Richter, Mercalli). | |
| | SCI.GEO.6.4 | describe the effects of a major earthquake on buildings and discuss the relationship between tsunami's and earthquakes while identifying the changes in the earth's crust that may signal an earthquake. | |

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| SCI.GEO.7 | | Students will describe the formation and movement of magma; use evidence to support reasoning for the locations that volcanism is most likely to occur; summarize the composition of felsic and mafic lava and compare the force of volcanic eruption associated with each; compare the major types of pyroclastic materials; summarize the events that may signal a volcanic eruption; and compare differences between volcanism on earth and on other celestial bodies. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GEO.7.1 | describe the formation and movement of magma and use evidence to support reasoning for the locations that volcanism is most likely to occur. | |
| | SCI.GEO.7.2 | summarize the composition of felsic and mafic lava and compare the force of volcanic eruption associated with each. | |
| | SCI.GEO.7.3 | compare the major types of pyroclastic materials and summarize the events that may signal a volcanic eruption. | |
| | SCI.GEO.7.4 | compare differences between volcanism on earth and on other celestial bodies. | |

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| SCI.GEO.8 | | Students will distinguish between the two main types of mineral groups and describe the characteristics that distinguish one mineral from another. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.GEO.8.1 | distinguish between the two main mineral groups and identify the elements most commonly found in minerals. | |
| | SCI.GEO.8.2 | name six types of non-silicate minerals and distinguish between six main types of arrangements in silicate minerals. | |
| | SCI.GEO.8.3 | use characteristic properties of minerals to identify unknown samples (*e.g. hardness, color, luster, streak, etc.*). | |
| | SCI.GEO.8.4 | describe four special properties that may help identify certain minerals (magnetism, fluorescence, double refraction, radioactivity). | |

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| SCI.GEO.9 | | Students will classify rocks according to their mineral composition and identify samples of igneous, sedimentary, and metamorphic rock. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Comp | SCI.GEO.9.1 | trace the path of rocks in the rock cycle and describe how the cooling rate of rock affects the texture of the rock formed. | |
| | SCI.GEO.9.2 | classify igneous rocks according to their mineral composition. | |
| | SCI.GEO.9.3 | describe sedimentary rock features that help identify them. | |
| | SCI.GEO.9.4 | distinguish between regional and contact metamorphism and distinguish between foliated and non-foliated metamorphic rock. | |

| SCI.GEO.10 | | Students will examine the earth's mineral resources and explain the various ways we obtain energy, while analyzing data about these mineral resources and how they affect our environment. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.GEO.10.1 | explain why coal, petroleum, and natural gas are fossil fuels, and how they are removed from the earth and discuss the importance of fossil fuels as a source of energy and the petrochemical products that are formed from them. | HS-ESS3-2 |
| | SCI.GEO.10.2 | compare the processes of nuclear fusion and fission and how they relate to energy production. | HS-ESS3-1<br>HS-ESS3-2 |
| | SCI.GEO.10.3 | evaluate the efficiency of alternative (i.e. hydroelectric, wind, geothermal, solar, and biofuels) forms of energy that are used as a substitute for fossil fuels. | HS-ESS3-3<br>HS-ESS3-4 |
| | SCI.GEO.10.4 | analyze geoscience data and the results of global climate models to formulate an argument, for or against, that global warming is primarily the result of fossil fuels. | HS-ESS3-5<br>HS-ESS3-6 |

| SCI.GEO.11 | | Students will compare and contrast the agents of mechanical and chemical weathering, and identify how these agents affect soil and water. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Comp | SCI.GEO.11.1 | Compare the agents of mechanical and chemical weathering and factors that affect the rate of weathering. | HS-ESS2-2 |
| | SCI.GEO.11.2 | Compare the four agents of erosion and its effects on earth materials and surface processes. | HS-ESS2-2<br>HS-ESS2-4<br>HS-ESS2-5 |

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| | SCI.GEO.11.3 | Identify farming techniques that result in accelerated erosion and explain four methods of soil conservation (*e.g. no till, covercrop, terracing, windbreaks, irrigation*) and discuss how mass movements contribute to erosion. | HS-ESS2-1<br>HS-ESS2-2<br>HS-ESS2-5 |
| | SCI.GEO.11.4 | Explain the components of the water budget and evaluate the effectiveness of two major approaches to water conservation. | HS-ESS2-5<br>HS-ESS2-6 |

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# Anatomy and Physiology

*Note: This course is currently in draft form and still needs to be tried out and validated. Possible revisions may still be made.*

| Science Standard Reference Code | |
|---|---|
| PS | Physical Science |
| LS | Life Science |
| ESS | Earth & Space Science |
| ETS | Engineering, Technology, and Applications of Science |

| | |
|---|---|
| Purpose Statement | Students will distinguish between the human body systems and explain the relationships between each. |

High Achieving Unit Outcomes:

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| SCI.AP.1 | | Students will describe the human body, regional terms, directional terms, body planes and sections, and body cavities using proper anatomical terminology; and describe necessary life functions, survival needs and homeostasis as it applies to maintaining life. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.AP.1.1 | explain the relationship between the terms "anatomy" and "physiology." | HS-LS1-2 |
| | SCI.AP.1.2 | list the levels of structural organization in humans. | HS-LS1-2 |
| | SCI.AP.1.3 | identify the basic functions and major organs associated with each organ system. | HS-LS1-2 |
| | SCI.AP.1.4 | describe the necessary life functions and survival needs. | HS-LS1-2 |
| | SCI.AP.1.5 | explain the importance of homeostasis in humans. | HS-LS1-2 |
| | SCI.AP.1.6 | distinguish between positive and negative feedback mechanisms. | HS-LS1-2 |
| | SCI.AP.1.7 | describe and/or model anatomical position.. | HS-LS1-2 |
| | SCI.AP.1.8 | use proper anatomical terminology to describe body regions, directional terms, body planes and sections, and body cavities. | HS-LS1-2 |

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| SCI.AP.2 | | Students will describe the functions performed by the integumentary system; compare the structure, function, and location of the body membranes (i.e. cutaneous, mucous, serous, and synovial); distinguish between the anatomical regions of the epidermis, dermis, and accessory organs; and explain how the skin can be affected by burns and cancer. | Standard Reference |
| *Students will…* | | | |
| | SCI.AP.2.1 | compare the structure, function, and location of the body membranes (i.e. cutaneous, mucous, serous, and synovial). | HS-LS1-2 |
| | SCI.AP.2.2 | describe the functions of the integumentary system. | HS-LS1-2 |
| | SCI. AP.2.3 | distinguish between the layers of the epidermis (i.e. stratum corneum, stratumlucidum, stratum granulosum, stratum spinosum, and stratum basale). | HS-LS1-2 |
| | SCI. AP.2.4 | distinguish between the layers of the dermis (i.e. papillary layer, reticular layer). | HS-LS1-2 |
| | SCI.AP.2.5 | compare the structure and function of the appendages of the skin (i.e. cutaneous glands, hair and hair follicles, and nails). | |
| | SCI.AP.2.6 | compare homeostatic imbalances of the skin (i.e. infections, allergies, burns, cancer). | |

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| SCI.AP.3 | | Students will classify bones based on structure/shape, and location; distinguish between the anatomical regions of bones, both at the macroscopic and microscopic levels; describe the formation and remodeling of bone; identify the bones of the axial and appendicular skeleton and describe the major processes and/or markings, structure, and function of each; distinguish between the types of joints and the movements that each allows; and compare the effects of arthritis. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.AP.3.1 | describe the methods of sub-classifying the skeletal system (i.e. appendicular, axial, long, short, flat, irregular). | HS-LS1-2 |
| | SCI.AP.3.2 | identify and locate on a model or diagram the anatomical areas of a long bone, the microscopic and the markings/processes of bones. | HS-LS1-2 |
| | SCI.AP.3.3 | describe the microscopic organization of bone, summarize the process of long bone growth and remodeling and explain the role of osteoblasts and osteoclasts. | HS-LS1-2 |
| | SCI.AP.3.4 | identify the bones of the axial and appendicular skeleton and describe the major processes and/or markings, structure, and function of each. | HS-LS1-2 |

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| | SCI.AP.3.5 | distinguish between the types of joints and the movements allowed by each. | HS-LS1-2 |
| | SCI.AP.3.6 | compare Osteoarthritis, Rheumatoid Arthritis, and Gouty Arthritis. | HS-LS1-2 |

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| SCI.AP.4 | | Students will list the levels of structural organization in muscle tissue; compare types of muscle tissue; describe the events of skeletal muscle contraction; compare the methods of providing energy for contraction; define oxygen debt and explain how it leads to muscle fatigue; apply the 5 rules of skeletal muscle activity to body movements; identify and/or model body movements and identify the muscles responsible for the specific movement. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.AP.4.1 | list the levels of structural organization of muscles including connective tissue coverings. | HS-LS1-2 |
| | SCI.AP.4.2 | compare skeletal, smooth, and cardiac muscle tissue. | HS-LS1-2 |
| | SCI.AP.4.3 | describe the events of skeletal muscle cell contraction and explain the role of actin and myosin filaments. | HS-LS1-2 |
| | SCI.AP.4.4 | compare the 3 ways ATP is regenerated during muscle contraction and explain the role of oxygen in muscle fatigue. | HS-LS1-2 |
| | SCI.AP.4.5 | apply the 5 rules of skeletal muscle activity to body movements and explain how origin, insertion, prime mover, antagonist, synergist, and fixator relate to muscle movements. | HS-LS1-2 |
| | SCI.AP.4.8 | identify and/or model body movements (*e.g. flexion, extension, rotation, abduction, etc.*). | HS-LS1-2 |
| | SCI.AP.4.9 | identify the major skeletal muscles of the body, locate on a diagram/model, and describe the body movement they are associated with. | HS-LS1-2 |

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| SCI.AP.5 | | Students will distinguish between the classifications of the nervous nystem; describe the general structure of a neuron and explain how it allows for the propogation of a nerve impulse; Compare the support cells of the CNS and PNS; describe the major regions of the brain, including major sub-areas within each; explain how the brain and spinal cord are protected; and compare the sensory and motor functions that the cranial nerves and spinal nerve plexuses serve. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.AP.5.1 | distinguish between the structural (i.e. CNS, PNS) and functional (i.e. afferent, efferent, integration) classifications of the nervous system. | HS-LS1-2 |
| | SCI.AP.5.2 | describe the general structure of a neuron, and identify the important anatomical regions. | HS-LS1.A<br>HS-LS1-2 |
| | SCI.AP.5.3 | classify neurons according to structure and function. | HS-LS1.A<br>HS-LS1-2 |
| | SCI.AP.5.4 | compare the role of nervous system supporting cells. | HS-LS1-2 |
| | SCI.AP.5.5 | describe the events that lead to the generation of a nerve impulse and its conduction from one neuron to another. | HS-LS1-2 |
| | SCI.AP.5.6 | identify and describe the location and function of the major regions of the brain (i.e. cerebrum, dienchephalon, brain stem and cerebellum) and spinal cord. | HS-LS1-2 |
| | SCI.AP.5.7 | explain how the brain and spinal cord are protected. | HS-LS1-2 |
| | SCI.AP.5.8 | describe the levels of structural organization of nerves. | HS-LS1-2 |
| | SCI.AP.5.9 | identify the cranial nerves and spinal nerve plexuses and the body areas served by each. | HS-LS1-2 |
| | SCI.AP.5.10 | compare the divisions of the peripheral nervous system (i.e. autonomic, somatic, sympathetic and parasympathetic). | HS-LS1-2 |

| SCI.AP.6 | | Students will explain how glands and their associated hormones bring about changes in the body; Compare endocrine and exocrine glands; identify the major endocrine glands and their tissues on a model or diagram; compare the major organs of the endocrine system and the hormones produced by each; describe the effect of age on the endocrine system and body homeostasis. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.AP.6.1 | explain how glands and their associated hormones bring about changes in the body. | HS-LS1-2 |
| | SCI.AP.6.2 | compare endocrine and exocrine glands. | HS-LS1-2 |

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| | SCI.AP.6.3 | identify the major endocrine glands and their tissues on a model or diagram. | HS-LS1-2 |
| | SCI.AP.6.4 | compare the major organs of the endocrine system and the hormones produced by each. | HS-LS1-2 |
| | SCI.AP.6.5 | describe the effect of aging on the endocrine system and body homeostasis. | HS-LS1-2 |

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| SCI.AP.7 | | Students will compare the compositional elements of blood and the ABO and rH blood groups; identify the major organs of the cardiovascular system and their associated anatomical areas; trace the path of blood as it flows through the heart, pulmonary and systemic circuits, and special circulations; explain the events that lead to beating of the heart and circulation of blood through the heart; compare the factors that affect blood pressure, heart rate, and cardiac output; distinguish between the structure and function of the blood vessel types (i.e. arteries, arterioles, veins, venules, and capillaries); identify the major blood vessels on a diagram or model; and predict how changes in cardiac output and peripheral resistance affect blood pressure. | Standard Reference |
| *Students will…* | | | |
| Components | SCI.AP.7.1 | compare the compositional elements found in blood (i.e. Formed Elements, Plasma). | HS-LS1-2 |
| | SCI.AP.7.2 | compare the ABO and rH blood groups. | HS-LS1-2 |
| | SCI.AP.7.3 | identify the major organs of the cardiovascular system and their associated anatomical regions and locate on a diagram/model. | HS-LS1-2 |
| | SCI.AP.7.4 | trace the path of blood as it flows through the heart, pulmonary and systemic circuits, and special circulations (i.e., arterial supply of brain, hepatic portal circulation, and fetal circulation). | HS-LS1-2 |
| | SCI.AP.7.5 | name the elements of the intrinsic conduction system of the heart, and describe the pathway of impulses through this system. | HS-LS1-2 |
| | SCI.AP.7.6 | describe how the events of the cardiac cycle work to pump blood through the heart. | HS-LS1-2 |
| | SCI.AP.7.7 | explain the relationship between stroke volume, heart rate and cardiac output. | HS-LS1-2 |
| | SCI.AP.7.8 | describe how physical and neural factors affect cardiac output. | HS-LS1-2 |

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| | SCI.AP.7.9 | distinguish between the structure and function of the major blood vessel types (i.e. arteries, veins, , and capillaries). | HS-LS1-2 |
| | SCI.AP.7.10 | predict how changes in cardiac output and peripheral resistance affect blood pressure. | HS-LS1-2 |

| SCI.AP.8 | | Students will identify the organs forming the respiratory passageways and their associated anatomical regions; describe the protective mechanisms of the respiratory system; describe the events of respiration and explain the role that muscles play in this process; describe the mechanisms that allow for transport of respiratory gases through the respiratory system; and explain how various factors influence respiration. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.AP.8.1 | identify the organs forming the respiratory passageways and their associated anatomical regions on a model/diagram and compare the characteristics of each. | HS-LS1-2 |
| | SCI.AP.8.2 | describe the four events of respiration (i.e. pulmonary ventilation, external respiration, respiratory gas transport, and internal respiration). | HS-LS1-2 |
| | SCI.AP.8.3 | explain how respiratory muscles cause volume changes that lead to air flow into and out of the lungs. | HS-LS1-2 |
| | SCI.AP.8.4 | predict how changes to tidal volume, inspiratory reserve volume, expiratory reserve volume and residual volume affect vital capacity. | HS-LS1-2 |
| | SCI.AP.8.5 | describe how oxygen and carbon dioxide are transported in the blood and exchanged in the lungs and tissues. | HS-LS1-2 |
| | SCI.AP.8.6 | explain how physical, emotional, and chemical factors influence respiratory rate and depth. | HS-LS1-2 |

| SCI.AP.9 | | Students will identify the major organs of the digestive system and describe the anatomical regions of each; compare the role each organ plays in the digestive process; explain how foodstuffs are digested and/or absorbed along the alimentary canal. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Component | SCI.AP.9.1 | name the organs of the alimentary canal accessory digestive organ and the associated anatomical regions of each and identify on a diagram or model. | HS-LS1-2 |

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| | SCI.AP.9.2 | list and describe the six processes of the gastrointestinal tract (i.e. ingestion, propulsion, mechanical digestion, chemical digestion, absorption, and defecation. | HS-LS1-2 |
| | SCI.AP.9.3 | compare the general activities of each digestive system organ. | HS-LS1-2 |
| | SCI.AP.9.4 | list the major enzymes or enzyme groups produced by the digestive organs or accessory glands and identify the foodstuff they work to digest. | HS-LS1-2 |
| | SCI.AP.9.5 | explain how and where the breakdown products of proteins, carbohydrates, and fats are absorbed. | HS-LS1-2 |

| SCI.AP.10 | | Students will identify the major organs of the urinary system, the anatomical regions of each organ; compare the role of each identified urinary system organ; describe the process of urine formation; explain how the urinary system regulates water balance, electrolyte balance, and acid-base balance of the blood. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Components | SCI.AP.10.1 | identify the position of the kidneys in the body and the major anatomical regions of the kidneys. | HS-LS1-2 |
| | SCI.AP.10.2 | describe the role the kidneys play in the urinary system. | HS-LS1-2 |
| | SCI.AP.10.3 | identify the ureters, urinary bladder, and urethra as organs of the urinary system and major anatomical regions of each. | HS-LS1-2 |
| | SCI.AP.10.4 | describe the role that the ureters, urinary bladder, and urethra serve in the urinary system. | HS-LS1-2 |
| | SCI.AP.10.5 | describe the process of urine formation, identifying the areas of the nephron that are responsible for filtration, reabsorption, and secretion. | HS-LS1-2 |
| | SCI.AP.10.6 | compare the male and female urinary system organs. | HS-LS1-2 |
| | SCI.AP.10.7 | explain how the urinary system regulates water balance, electrolyte balance, and acid-base balance of the blood. | HS-LS1-2 |

| SCI.AP.11 | | Students will identify the organs of the reproductive system and their major anatomical regions; compare male and female reproductive organs and the role they play in reproduction; describe the events of embryonic and fetal development and the stages of child birth. | Standard Reference |
|---|---|---|---|
| *Students will…* | | | |
| Comp | SCI.AP.11.1 | identify the organs of the reproductive system and their major anatomical regions. | HS-LS1-2 |

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|---|---|---|---|
| | SCI.AP.11.2 | describe the general activities of the organs associated with the reproductive system. | HS-LS1-2 |
| | SCI.AP.11.3 | distinguish between organs of the male and female reproductive systems. | HS-LS1-2 |
| | SCI.AP.11.4 | compare and contrast spermatogenesis and oogenesis. | HS-LS1-2 |
| | SCI.AP.11.5 | describe the influence of hormones on reproductive functioning in both male and female reproductive systems. | HS-LS1-2 |
| | SCI.AP.11.6 | summarize the stages of the ovarian and uterine cycles. | HS-LS1-2 |
| | SCI.AP.11.7 | define fertilization and summarize the events of embryonic and fetal development. | HS-LS1-2 |
| | SCI.AP.11.8 | describe the effects of pregnancy on the mother. | HS-LS1-2 |
| | SCI.AP.11.9 | outline the stages of child birth (i.e. Initiation of labor, Stages of Labor). | HS-LS1-2 |

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# Appendix A

## LCSD#1 Instructional Planning Resource

| **Teacher:** | | **Subject/Course:** | |
|---|---|---|---|

| **Outcome:** | |
|---|---|
| **Component:** | **Standard Reference:** |
| **Component Assessment:** ☐ **Oral** ☐ **Written** ☐ **Product** ☐ **Performance** | |
| **Criterion:** | |

**Context (Relevancy) :**

| Teacher Methods | Student Activities | Resources |
|---|---|---|
| 1. | 1. | 1. |
| 2. | 2. | 2. |
| 3. | 3. | 3. |
| 4. | 4. | 4. |
| 5. | 5. | 5. |
| 6. | 6. | 6. |
| 7. | 7. | 7. |
| 8. | 8. | 8. |

| Remediation | Enrichment |
|---|---|
| | |

# Appendix B

## LCSD#1 Pacing Guide

_____ Grade/Course Outcomes

| Outcome Code | Outcome Wording | Month(s) Taught | Quarter Assessed | | | |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
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# Wyoming Science and Engineering Practices

| 2. Developing and Using Models | | | | |
|---|---|---|---|---|
| A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations.<br><br>Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs. | | | | |
| Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. | **K-2** | • Distinguish between a model and the actual object, process, and/or events the model represents.<br>• Compare models to identify common features and differences. | • Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s). | • Develop a simple model based on evidence to represent a proposed object or tool. |
| Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. | **3-5** | • Identify limitations of models. | • Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.<br>• Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.<br>• Develop and/or use models to describe and/or predict phenomena. | • Develop a diagram or simple physical prototype to convey a proposed object, tool, or process.<br>• Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system. |
| Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. | **6-8** | • Evaluate limitations of a model for a proposed object or tool. | • Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.<br>• Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.<br>• Develop and/or use models to describe and/or predict phenomena. | • Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. |
| Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). | **9-12** | • Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism, or system in order to select or revise a model that best fits the evidence or design criteria.<br>• Design a test of a model to ascertain its reliability. | • Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.<br>• Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations. | • Develop a complex model that allows for manipulation and testing of a proposed process or system.<br>• Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems. |

# Wyoming Science and Engineering Practices

| 3. Planning and Carrying Out Investigations | | | | |
|---|---|---|---|---|
| Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters.<br><br>Engineering investigations identify the effectiveness, efficiency, and durability of designs under different conditions. | | | | |
| Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. | **K-2** | • With guidance, plan and conduct an investigation in collaboration with peers (for K).<br>• Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. | • Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question. | • Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.<br>• Make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal.<br>• Make predictions based on prior experiences. |
| Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. | **3-5** | • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. | • Evaluate appropriate methods and/or tools for collecting data. | • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.<br>• Make predictions about what would happen if a variable changes.<br>• Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success. |
| Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. | **6-8** | • Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.<br>• Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation. | • Evaluate the accuracy of various methods for collecting data. | • Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.<br>• Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. |

# Wyoming Science and Engineering Practices

## 4. Analyzing and Interpreting Data

Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis.

Engineering investigations include analysis of data collected in the tests of designs. This allows comparison of different solutions and determines how well each meets specific design criteria—that is, which design best solves the problem within given constraints. Like scientists, engineers require a range of tools to identify patterns within data and interpret the results. Advances in science make analysis of proposed solutions more efficient and effective.

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| Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. | **K-2** | • Record information (observations, thoughts, and ideas).<br>• Use and share pictures, drawings, and/or writings of observations.<br>• Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.<br>• Compare predictions (based on prior experiences) to what occurred (observable events). | | | • Analyze data from tests of an object or tool to determine if it works as intended. |
| Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. | **3-5** | • Represent data in tables and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships. | • Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation. | • Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. | • Analyze data to refine a problem statement or the design of a proposed object, tool, or process.<br>• Use data to evaluate and refine design solutions. |
| Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. | **6-8** | • Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.<br>• Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships.<br>• Distinguish between causal and correlational relationships in data.<br>• Analyze and interpret data to provide evidence for phenomena. | • Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible. | • Consider limitations of data analysis (e.g., measurement error), and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials).<br>• Analyze and interpret data to determine similarities and differences in findings. | • Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success. |

# Wyoming Science and Engineering Practices

| 4. Analyzing and Interpreting Data | | | | | |
|---|---|---|---|---|---|
| Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis.<br><br>Engineering investigations include analysis of data collected in the tests of designs. This allows comparison of different solutions and determines how well each meets specific design criteria—that is, which design best solves the problem within given constraints. Like scientists, engineers require a range of tools to identify patterns within data and interpret the results. Advances in science make analysis of proposed solutions more efficient and effective. | | | | | |
| Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. | **9-12** | • Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. | • Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. | • Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.<br>• Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations | • Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.<br>• Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success. |

# Wyoming Science and Engineering Practices

| 5. Using Mathematical and Computational Thinking | | | | | |
|---|---|---|---|---|---|
| In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; solving equations exactly or approximately; and recognizing, expressing, and applying quantitative relationships.<br><br>Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of such predictions. | | | | | |
| Mathematical and computational thinking in K–2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s). | **K-2** | • Decide when to use qualitative vs. quantitative data. | • Use counting and numbers to identify and describe patterns in the natural and designed world(s). | • Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. | • Use quantitative data to compare two alternative solutions to a problem. |
| Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. | **3-5** | • Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. | • Organize simple data sets to reveal patterns that suggest relationships. | • Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems. | • Create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem. |
| Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments. | **6-8** | • Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends. | • Use mathematical representations to describe and/or support scientific conclusions and design solutions. | • Create algorithms (a series of ordered steps) to solve a problem.<br>• Apply mathematical concepts and/or processes (such as ratio, rate, percent, basic operations, and simple algebra) to scientific and engineering questions and problems.<br>• Use digital tools and/or mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem. | |
| Mathematical and computational thinking in 9-12 builds on K-8 and experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. | **9-12** | • Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. | • Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. | • Apply techniques of algebra and functions to represent and solve scientific and engineering problems.<br>• Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world.<br>• Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.). | |

# Wyoming Science and Engineering Practices

## 6. Constructing Explanations and Designing Solutions

The end-products of science are explanations and the end-products of engineering are solutions.

The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories.

The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Each proposed solution results from a process of balancing competing criteria of desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints.

| | | | | | |
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| Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. | **K-2** | • Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena. | | • Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.<br>• Generate and/or compare multiple solutions to a problem. | |
| Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. | **3-5** | • Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard). | • Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. | • Identify the evidence that supports particular points in an explanation. | • Apply scientific ideas to solve design problems.<br>• Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. |
| Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. | **6-8** | • Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.<br>• Construct an explanation using models or representations. | • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.<br>• Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events. | • Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion. | • Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.<br>• Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.<br>• Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and re-testing. |

# Wyoming Science and Engineering Practices

| 6. Constructing Explanations and Designing Solutions | | | | | |
|---|---|---|---|---|---|
| The end-products of science are explanations and the end-products of engineering are solutions.<br><br>The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories.<br><br>The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Each proposed solution results from a process of balancing competing criteria of desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints. | | | | | |
| Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. | **9-12** | • Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables. | • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.<br>• Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. | • Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. | • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. |

# Wyoming Science and Engineering Practices

## 7. Engaging in Argument from Evidence

Argumentation is the process by which evidence-based conclusions and solutions are reached.

In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem.

Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods based on merits.

Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims.

| | | | | | |
|---|---|---|---|---|---|
| Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). | **K-2** | • Identify arguments that are supported by evidence.<br>• Distinguish between explanations that account for all gathered evidence and those that do not.<br>• Analyze why some evidence is relevant to a scientific question and some is not.<br>• Distinguish between opinions and evidence in one's own explanations. | • Compare and refine arguments based on an evaluation of the evidence presented.<br>• Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation. | • Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts. | • Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.<br>• Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments. |
| Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). | **3-5** | • Compare and refine arguments based on an evaluation of the evidence presented.<br>• Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation. | • Respectfully provide and receive critiques from peers about a proposed procedure, explanation or model.by citing relevant evidence and posing specific questions. | • Construct and/or support an argument with evidence, data, and/or a model.<br>• Use data to evaluate claims about cause and effect. | • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. |
| Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). | **6-8** | • Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts. | • Respectfully provide and receive critiques about one's explanations, procedures, models and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail. | • Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. | • Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system, based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.<br>• Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. |

# Wyoming Science and Engineering Practices

| 7. Engaging in Argument from Evidence | | | | | |
|---|---|---|---|---|---|
| Argumentation is the process by which evidence-based conclusions and solutions are reached.<br><br>In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem.<br><br>Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods based on merits.<br><br>Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims. | | | | | |
| Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. | **9-12** | • Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.<br>• Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments. | • Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence and challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining what additional information is required to resolve contradictions. | • Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence. | • Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge, and student-generated evidence.<br>• Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). |

# Wyoming Science and Engineering Practices

| 8. Obtaining, Evaluating, and Communicating Information | | | | | |
|---|---|---|---|---|---|
| Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.<br><br>Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs. | | | | | |
| Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. | **K-2** | • Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural and designed world(s). | • Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea. | • Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim. | • Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas. |
| Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. | **3-5** | • Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence.<br>• Compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices. | • Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices. | • Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. | • Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts. |
| Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods. | **6-8** | • Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s). | • Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings. | • Gather, read, synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.<br>• Evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts. | • Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations. |

# Wyoming Science and Engineering Practices

| 8. Obtaining, Evaluating, and Communicating Information | | | | | |
|---|---|---|---|---|---|
| Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.<br><br>Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs. | | | | | |
| Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. | **9-12** | • Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. | • Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem. | • Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.<br>• Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. | • Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). |

References

Lee, O., Quinn, H., & Valdés, G. (2013). Science and language for English language learners in relation to Next Generation Science Standards and with implications for Common Core State Standards for English language arts and mathematics. *Educational Researcher.*