Colorado Academic Standards

Science

Preschool – Second Grade

COLORADO
Department of Education

ALL STUDENTS • ALL STANDARDS

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This document was updated in December 2019 to reflect typographic and other corrections made to Standards Online.

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Purpose of Science

"Science is facts; just as houses are made of stone, so is science made of facts; but a pile of stones is not a house, and a collection of facts is not necessarily science."
--Jules Henri Poincaré (1854-1912) French mathematician

High expectations in education are essential for the U.S. to continue as a world leader in the 21st century. In order to be successful in postsecondary education, the workforce, and in life, students need a rigorous, age-appropriate set of standards that include finding and gathering information, critical thinking, and reasoning skills to evaluate information, and use information in social and cultural contexts. Students must learn to comprehend and process information, analyze and draw conclusions, and apply the results to everyday life.

A quality science education embodies 21st century skills and postsecondary and workforce readiness by teaching students critical skills and thought processes to meet the challenges of today's world. Scientifically literate graduates will help to ensure Colorado's economic vitality by encouraging the development of research and technology, managing and preserving our environmental treasures, and caring for the health and well-being of our citizens.

Science is both a body of knowledge that represents the current understanding of natural systems, and the process whereby that body of knowledge has been established and is continually extended, refined, and revised. Because science is both the knowledge of the natural world and the processes that have established this knowledge, science education must address both of these aspects.

At a time when pseudo-scientific ideas and outright fraud are becoming more common place, developing the skepticism and critical thinking skills of science gives students vital skills needed to make informed decisions about their health, the environment, and other scientific issues facing society. A major aspect of science is the continual interpretation of evidence. All scientific ideas constantly are being challenged by new evidence and are evolving to fit the new evidence. Students must understand the collaborative social processes that guide these changes so they can reason through and think critically about popular scientific information, and draw valid conclusions based on evidence, which often is limited. Imbedded in the cognitive process, students learn and apply the social and cultural skills expected of all citizens in school and in the workplace. For example, during class activities, laboratory exercises, and projects, students learn and practice self-discipline, collaboration, and working in groups.

The Colorado Academic Standards in science represent what all Colorado students should know and be able to do in science as a result of their preschool through twelfth-grade science education. Specific expectations are given for students who complete each grade from preschool through eighth grade and for high school. These standards outline the essential level of science content knowledge and the application of the skills needed by all Colorado citizens to participate productively in our increasingly global, information-driven society.

Prepared Graduates in Science

1. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding structure, properties and interactions of matter.
2. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding interactions between objects and within systems of objects.
3. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how energy is transferred and conserved.
4. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how waves are used to transfer energy and information.
5. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.
6. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how living systems interact with the biotic and abiotic environment.
7. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how genetic and environmental factors influence variation of organisms across generations.
8. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.
9. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding the universe and Earth's place in it.
10. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.
11. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how human activities and the Earth's surface processes interact.

Standards in Science

Standards are the topical organization of an academic content area. The three standards of science, including the disciplinary core ideas, are:

1. Physical Science

Students know and understand common properties, forms, and changes in matter and energy.

- PS1 Matter and Its Interactions
- PS2 Motion and Stability: Forces and Interactions
- PS3 Energy
- PS4 Waves and Their Applications in Technologies for Information Transfer

2. Life Science

Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment.

- LS1 From Molecules to Organisms: Structures and Processes
- LS2 Ecosystems: Interactions, Energy, and Dynamics
- LS3 Heredity: Inheritance and Variation of Traits
- LS4 Biological Evolution: Unity and Diversity

3. Earth and Space Science

Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space.

- ESS1 Earth's Place in the Universe
- ESS2 Earth's Systems
- ESS3 Earth ad Human Activity

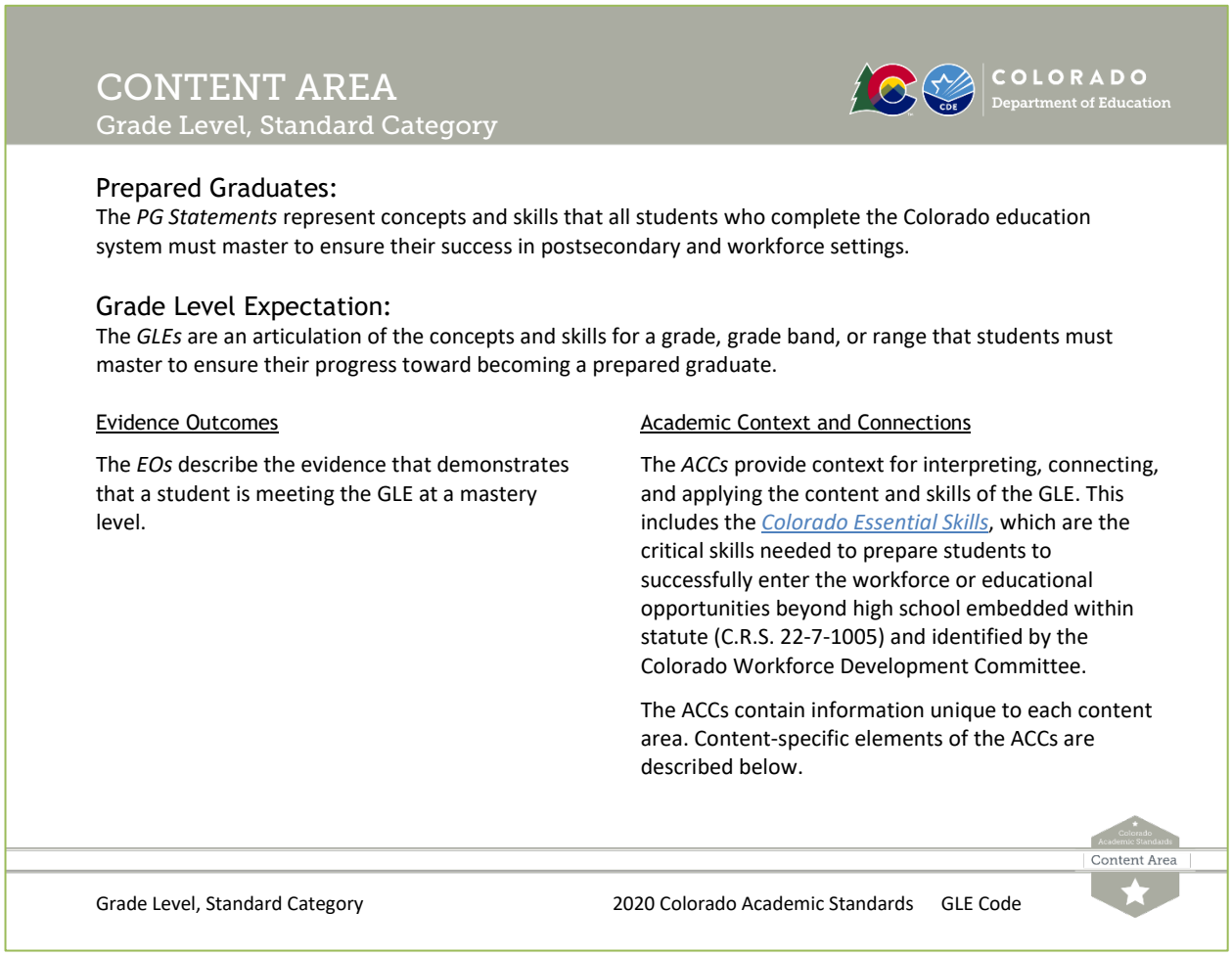
Science and Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Cross Cutting Concepts

1. *Patterns.* Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
2. *Cause and effect: Mechanism and explanation*. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
3. *Scale, proportion, and quantity.* In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
4. *Systems and system models.* Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.
5. *Energy and matter: Flows, cycles, and conservation.* Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
6. *Structure and function.* The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.
7. *Stability and change.* For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

How to Read the Colorado Academic Standards



Academic Context and Connections in Science:

Colorado Essential Skills and Science and Engineering Practices: These statements describe how the learning of the content and skills described by the GLE and EOs connects to and supports the development of the *Colorado Essential Skills* named in the parentheses. The science and engineering practices are things that scientists employ as they investigate and build models and theories about the world. These terms are used to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice.

Elaboration on the GLE: This section provides greater context for the GLE through a description of the understanding about the core ideas that should be developed by students.

Cross Cutting Concepts: The crosscutting concepts have application across all domains of science. As such, they provide one way of linking across the domains through core ideas.

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Prepared Graduates:

1. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding structure, properties and interactions of matter.

Preschool Learning and Development Expectation:

1. Recognize that physical properties of objects and/or materials help us understand the world.

Indicators of Progress

By the end of the preschool experience (approximately 60 months/5 years old), students may:

a. Use senses to explore the properties of objects and materials (e.g., solids, liquids).
b. Make simple observations, predictions, explanations, and generalizations based on real-life experiences.
c. Collect, describe, predict and record information using words, drawings, maps, graphs and charts.
d. Observe, describe, and discuss living things and natural processes.

Examples of High-Quality Teaching and Learning Experiences

Supportive Teaching Practices/Adults May:

1. Provide a variety of materials and objects (i.e., solids and liquids) to encourage children to observe, manipulate, sort, and describe physical properties (e.g., size, shape, color, texture, weight) using their five senses as well as simple tools (e.g., magnifiers, balance scales, funnels).
2. Provide opportunities for children to explore changes in matter (e.g., solids and liquids) when adding heat or cold, when mixing ingredients during cooking, when adding items to liquid (e.g., oil, pebbles).
3. Provide each child with materials for experiments.
4. Display child observations, predictions and projects.

Examples of Learning/Children May:

1. Investigate changes in liquids and solids when substances are heated, cooled, combined etc.
2. Predict outcomes when altering materials (liquids and solids) and record using journals, charts, graphs, technology or drawings.
3. Participate in experiments, ask how and why questions.
4. Draw connections between classroom experiments/investigation and real world experiences (e.g., “The water turned to ice like the lake next to my house because it was cold”).

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Prepared Graduates:

1. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding structure, properties and interactions of matter.

Preschool Learning and Development Expectation:

2. Recognize there are cause - and - effect relationships related to matter and energy.

Indicators of Progress

By the end of the preschool experience (approximately 60 months/5 years old), students may:

a. Recognize and investigate cause - and - effect relationships in everyday experiences (pushing, pulling, kicking, rolling or blowing objects).
b. Notice change in matter.
c. Observe, describe and discuss properties of materials and transformation of substances.
d. Seek answers to questions and test predictions using simple experiments.

Examples of High-Quality Teaching and Learning Experiences

Supportive Teaching Practices/Adults May:

1. Provide opportunities for children to explore motion (e.g., fans and scarves, ramps and toy cars).
2. Provide opportunities for children to investigate energy (e.g., heat, light, sound; investigate shadows, sort musical instruments and discuss different sounds made by particular movements; explore transparent properties on a light table).
3. Provide opportunities for children to record observations in the changes of matter (e.g., ice melting at the sensory table).
4. Facilitate inquiry by asking how and why questions to encourage children to make predictions and chart results.

Examples of Learning/Children May:

1. Discover the higher the incline in a ramp (in block area) makes the car go farther.
2. Explain that some magnets pull away and some come together.
3. Identify when a change in matter occurs (ice melting, icicles forming, etc.).
4. Identify how and why things move (e.g., using a balance, pushing structures over, how fast different objects move).
5. Ask questions related to why things happen.

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Prepared Graduates:

5. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Preschool Learning and Development Expectation:

1. Recognize that living things have unique characteristics and basic needs that can be observed and studied.

Indicators of Progress

By the end of the preschool experience (approximately 60 months/5 years old), students may:

a. Observe, describe and discuss living things.
b. Observe similarities and differences in the needs of living things.
c. Observe and describe how natural habitats provide for the basic needs of plants and animals with respect to shelter, food, water, air and light.
d. Ask and pursue questions through simple investigations and observations of living things.
e. Collect, describe, and record information about living things through discussion, drawings, graphs, technology and charts.
f. Identify differences between living and nonliving things.

Examples of High-Quality Teaching and Learning Experiences

Supportive Teaching Practices/Adults May:

1. Provide opportunities for children to engage with live animals and plants along with toy/stuffed animals and plans and photographs/pictures throughout the classroom.
2. Read books about living and nonliving things, inquire about how we know if something is living or not.
3. Display worm farms, bird feeders, caterpillar/butterfly habitat, fish tank for observation.
4. Watching the fish, observe and discuss the movement of the gills, explaining this is how fish breathe under water.
5. Provide opportunities for children to use different materials (technology, journals, drawings, etc.) to observe living things.

Examples of Learning/Children May:

1. Match photographs of different habitats to the things that occupy them (i.e., worms live in the ground; fish live in water).
2. Sequence a series of photographs/pictures of a plant's growth.
3. Sequence a series of photographs/pictures of the life cycle of a butterfly from caterpillar to chrysalis/cocoon to butterfly.
4. Document the life cycle of living thing.
5. Recognize that living things require water, air, food.

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Prepared Graduates:

6. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how living systems interact with the biotic and abiotic environment.

Preschool Learning and Development Expectation:

2. Recognize that living things develop in predictable patterns.

Indicators of Progress

By the end of the preschool experience (approximately 60 months/5 years old), students may:

a. Identify the common needs such as food, air and water of familiar living things.
b. Predict, explain and infer patterns based on observations and representations of living things, their needs and life cycles.
c. Observe and document changes in living things over time using different modalities such as drawing, dramatization, describing or using technology.
d. Recognize that plants and animals grow and change.

Examples of High-Quality Teaching and Learning Experiences

Supportive Teaching Practices/Adults May:

1. Provide opportunities for observation and investigation of the characteristics of animals and plants over time.
2. Take nature walks.
3. Encourage children to identify similarities and differences between living things and document what each need to survive.
4. Provide opportunities for children to explore available outdoor habitats.
5. Provide opportunities for children to help feed the classroom pet, water the plants, etc.

Examples of Learning/Children May:

1. Identify and describe through a variety of modalities the changes in living things overtime (e.g., bears hibernate when it is cold outside).
2. Investigate living things by caring for animals and plants in the classroom.
3. Document the human life cycle - babies grow into children, children grow to adults, adults get older.

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Prepared Graduates:

11. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how human activities and the Earth's surface processes interact.

Preschool Learning and Development Expectation:

1. The acquisition of concepts and facts related to the Earth materials and their uses.

Indicators of Progress

By the end of the preschool experience (approximately 60 months/5 years old), students may:

a. Use senses and tools, including technology, to investigate materials, and observe processes and relationships to gather information and explore the environment.
b. Inquire about the natural and physical environment.
c. Observe and discuss common properties, differences and comparisons among objects.
d. Participate in simple investigations to form hypothesis, gather observations, draw conclusions.
e. Record observations using words, drawings, maps, graphs and charts.

Examples of High-Quality Teaching and Learning Experiences

Supportive Teaching Practices/Adults May:

1. Engage children in exploring natural objects such as small rocks, soil, leaves, sand and other objects.
2. Provide soil and containers for planting.
3. Display rocks, stones and pebbles of different shapes and colors for sorting.
4. Ask questions and make comments that lead children to observe closely and think about how they could find out more.
5. Encourage children to compare and contrast types of earth materials.
6. Encourage children to ask question and seek answers through active exploration
7. Provide a variety of materials for children to document observations (e.g., tablets, computers, notebooks, poster paper).

Examples of Learning/Children May:

1. Ask and pursue questions through simple investigations and observations of natural objects.
2. Explore rocks, soil and sand using a magnifier.
3. Use sense and simple tools to explore earth materials.
4. Discuss evidence from investigations and observations.

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Prepared Graduates:

9. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding the universe and Earth's place in it.

Preschool Learning and Development Expectation:

2. The acquisition of concepts and facts related to the natural and physical world and the understanding of naturally occurring relationships.

Indicators of Progress

By the end of the preschool experience (approximately 60 months/5 years old), students may:

a. Predict, explain and infer patterns based on observations and evidence.
b. Articulate findings through a variety of modalities (e.g., drawings, words, dramatizations).
c. Recognizes familiar elements of the natural world and demonstrates an understanding that these may change over time (e.g., sun and moon, weather).
d. Observe and describe patterns observed over the course of a number of days and nights (e.g., differences in the activities or appearance of plants and animals).

Examples of High-Quality Teaching and Learning Experiences

Supportive Teaching Practices/Adults May:

1. Take nature walks to observe weather conditions.
2. Talk about weather conditions daily.
3. Provide opportunities to sort pictures of activities, clothing and toys according to the types of weather and seasons they correspond to (e.g., sled with snow, sunglasses in summer).
4. Talk about things that can be found in the day or night sky (e.g., sun, moon, clouds, stars).

Examples of Learning/Children May:

1. Match types of clothing or activities to seasonal weather conditions (e.g., we use an umbrella when it is raining; we wear boots when it snows; we wear hats and gloves when it is cold outside).
2. Discuss current weather events that affect the community.
3. Observe and describe different types of clouds and moon phases.
4. Describe differences in weather patterns and day vs. night via drawing, dramatization or words.

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Prepared Graduates:

2. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding interactions between objects and within systems of objects.

Grade Level Expectation:

1. Pushes and pulls can have different strengths and directions, and can change the speed or direction of an object's motion or start or stop it.

Evidence Outcomes

Students Can:

a. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. (K-PS2-1) *(Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball and two objects colliding and pushing on each other.) (Boundary: Limited to different relative strengths or different directions, but not both at the same time. Does not include non-contact pushes or pulls such as those produced by magnets.)*

b. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull. (K-PS2-2) *(Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.) (Boundary: Does not include friction as a mechanism for change in speed.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. With guidance, plan and conduct an investigation in collaboration with peers (Planning and Carrying Out Investigations) (Personal: Initiative/Self-direction).
2. Analyze data from tests of an object or tool to determine if it works as intended (Analyzing and Interpreting data) (Entrepreneurial: Critical thinking/Problem solving).
3. Connections to Nature of Science: Scientists use different ways to study the world.

Elaboration on the GLE:

1. Students can answer the question: How can one predict an object's continued motion, changes in motion or stability?
2. PS2:A Forces and Motion: Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
3. PS2:B Types of Interactions: When objects touch or collide, they push on one another and can change motion.
4. PS3:C Relationship Between Energy and Forces: A bigger push or pull makes things speed up or slow down more quickly.

Cross Cutting Concepts:

1. Cause and Effect: Simple tests can be designed to gather evidence to support or refute student ideas about causes.

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Prepared Graduates:

3. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how energy is transferred and conserved.

Grade Level Expectation:

2. Sunlight affects the Earth's surface.

Evidence Outcomes

Students Can:

a. Make observations to determine the effect of sunlight on Earth's surface. (K-PS3-1) *(Clarification Statement: Examples of Earth's surface could include sand, soil, rocks and water) (Boundary: Temperature is limited to relative measures such as warmer/cooler.)*
b. Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area. (K-PS3- 2) *(Clarification Statement: Examples of structures could include umbrellas, canopies and tents that minimize the warming effect of the sun.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Make observations (firsthand or from media) to collect data that can be used to make comparisons. (Planning and Carrying Out Investigations) (Personal: Personal responsibility)
2. Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem. (Constructing Explanations and Designing Solutions) (Civic/Interpersonal: Civic engagement)
3. Connections to Nature of Science: Scientists use different ways to study the world.

Elaboration on the GLE:

1. Students can answer the question: What is meant by conservation of energy? How is energy transferred between objects or systems?
2. PS3:B Conservation of Energy and Energy Transfer: Sunlight warms Earth's surface.

Cross Cutting Concepts:

1. Cause and Effect: Events have causes that generate observable patterns.

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Prepared Graduates:

5. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

1. To live and grow, animals obtain food they need from plants or other animals, and plants need water and light.

Evidence Outcomes

Students Can:

a. Use observations to describe patterns of what plants and animals (including humans) need to survive. (K-LS1-1) *(Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and that all living things need water.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (Analyzing and Interpreting data) (Entrepreneurial: Critical thinking/Problem solving)
2. Connections to Nature of Science: Scientists look for patterns and order when making observations about the world

Elaboration on the GLE:

1. Students can answer the question: How do the structures of organisms enable life's functions?
2. LS1:C Organization for Matter and Energy Flow in Organisms: All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

Cross Cutting Concepts:

1. Patterns: Patterns in the natural and human designed world can be observed and used as evidence.

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Prepared Graduates:

10. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.

Grade Level Expectation:

1. Patterns are observed when measuring the local weather, including how humans and other organisms impact their environment.

Evidence Outcomes

Students Can:

a. Use and share observations of local weather conditions to describe patterns over time. (K-ESS2-1) *(Clarification Statement: Examples of qualitative observations could include descriptions of the weather [such as sunny, cloudy, rainy, and warm]; examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.) (Boundary: Quantitative observations limited to whole numbers and relative measures such as warmer/cooler.)*

b. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. (K-ESS2-2) *(Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (Analyzing and Interpreting data) (Entrepreneurial: Critical thinking/Problem solving).
2. Construct an argument with evidence to support a claim. (Engaging in Argument from Evidence) (Personal: Personal responsibility).
3. Connections to Nature of Science: Scientists look for patterns and order when making observations about the world

Elaboration on the GLE:

1. Students can answer the question: What regulates weather and climate?
2. ESS2:D Weather and Climate: Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.
3. ESS2:E Biogeology: Plants and animals can change their environment.
4. ESS3:C Human Impacts on Earth Systems: Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air and other living things

Cross Cutting Concepts:

1. Pattern: Patterns in the natural world can be observed, used to describe phenomena and used as evidence.
2. Systems and System Models: Systems in the natural and designed world have parts that work together.

Prepared Graduates:

11. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how human activities and the Earth's surface processes interact.

Grade Level Expectation:

2. Plants and animals meet their needs in their habitats and impact one another; people can prepare for severe weather.

Evidence Outcomes

Students Can:

a. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live. (K-ESS3-1) *(Clarification Statement: Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system.)*
b. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather. (K-ESS3-2) *(Clarification Statement: Emphasis is on local forms of severe weather.)*
c. Communicate solutions that will reduce the impact of humans on the land, water, air and/or other living things in the local environment. (K-ESS3-3) *(Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Ask questions based on observations to find more information about the designed world. (Asking Questions and Defining Problems) (Entrepreneurial: Inquiry/Analysis).
2. Use a model to represent relationships in the natural world. (Developing and Using Models) (Personal: Initiative/Self-direction).
3. Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world. (Obtaining, Evaluating and Communicating Information) (Civic/Interpersonal: Communication).
4. Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas. (Obtaining, Evaluating and Communicating Information) (Civic/Interpersonal: Communication).

Elaboration on the GLE:

1. Students can answer the question: How do Earth's surface processes and human activities affect each other?
2. ESS3:A Natural Resources: Living things need water, air and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.
3. ESS3:B Natural Hazards: Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events.
4. ESS3:C Human Impacts on Earth Systems: Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air and other living things.

Cross Cutting Concepts:

1. Cause and Effect: Events have causes that generate observable patterns.
2. Systems and System Models: Systems in the natural and designed world have parts that work together.
3. Connections to Engineering, Technology, and Applications of Science: People encounter questions about the natural world every day. People depend on various technologies in their lives; human life would be very different without technology.

COLORADO
Department of Education

Prepared Graduates:

4. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how waves are used to transfer energy and information.

Grade Level Expectation:

1. Sound can make matter vibrate and vibrating matter can make sound.

Evidence Outcomes

Students Can:

a. Plan and conduct investigations to provide evidence that vibrating materials can make a sound and that sound can make materials vibrate. (1-PS4-1) *(Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.)*

b. Make observations to construct an evidence-based account that objects can be seen only when illuminated. (1-PS4-2) *(Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.)*

c. Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. (1-PS4-3) *(Clarification Statement: Examples of materials could include those that are transparent [such as clear plastic], translucent [such as wax paper], opaque [such as cardboard] and reflective [such as a mirror].)*

d. Use tools and materials to design and build a device that used light or sound to solve the problem of communicating over a distance. (1-PS4-4) *(Clarification Statement: This performance expectation integrates transitional science content with engineering through a practice or disciplinary core idea.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Plan and conduct investigations collaboratively to produce evidence to answer a question. (Planning and Carrying Out Investigations) (Personal: Initiative/Self-direction)
2. Make observations (firsthand or from media) to construct an evidence-based conclusion and use tools and materials provided to design and build devices. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Critical thinking/Problem solving)
3. Scientific Investigations Use a Variety of Methods: Scientists use different ways to study the world. Science investigations begin with a question.

Elaboration on the GLE:

1. Students can answer the question: What are the characteristic properties and behaviors of waves?
2. PS4:A Wave Properties: Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; it does not move in the direction of the wave - observe, for example, a bobbing cork or seabird - except when the water meets the beach. Sound can make matter vibrate and vibrating matter can make sound.
3. PS4:B Electromagnetic Radiation: Objects can be seen only when light is available to illuminate them. Very hot objects give off light (e.g., a fire, the sun).
4. PS4:C Information Technologies and Instrumentation: People use their senses to learn about the world around them. Their eyes detect light, their ears detect sound, and they can feel vibrations by touch.

Cross Cutting Concepts:

1. Cause and Effect: Simple tests can be designed to gather evidence to support or refute student ideas about causes.

COLORADO
Department of Education

Prepared Graduates:

5. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

1. All organisms have external parts that they use to perform daily functions.

Evidence Outcomes

Students Can:

a. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow and meet their needs. (1-LS1-1) *(Clarification Statement: Examples of human problems that can be solved could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and detecting intruders by mimicking eyes and ears.)*
b. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. (1-LS1-2) *(Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make [such as crying, cheeping and other vocalizations] and the responses of the parents [such as feeding, comforting and protecting the offspring].)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Use materials to design a device that solves a specific problem or a solution to a specific problem. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Creativity/Innovation)
2. Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world. (Obtaining, Evaluating, and Communicating Information) (Civic/Interpersonal: Communication)
3. Connections to Nature of Science: Science Knowledge is Based on Empirical Evidence. Scientists look for patterns and order when making observations about the world.

Elaboration on the GLE:

1. Students can answer the question: How do the structures of organisms enable life's functions?
2. LS1:A Structure and Function: All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place and seek, find and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive, grow and produce more plants.
3. LS1:B Growth and Development of Organisms: Plants and animals have predictable characteristics at different stages of development. Plants and animals grow and change. Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.
4. LS1:D Information Processing: Animals have body parts that capture and convey different kinds of information needed for growth and survival - for example, eyes for light, ears for sounds, and skin for temperature or touch. Animals respond to these inputs with behaviors that help them survive (e.g., find food, run from a predator). Plants also respond to some external inputs (e.g., turn leaves toward the sun).

Cross Cutting Concepts:

1. Structure and Function: The shape and stability of structures of natural and designed objects are related to their function(s).
2. Patterns: Patterns in the natural world can be observed, used to describe phenomena and used as evidence.

COLORADO
Department of Education

Prepared Graduates:

7. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how genetic and environmental factors influence variation of organisms across generations.

Grade Level Expectation:

2. Young organisms are very much, but not exactly, like their parents, and also resemble other organisms of the same kind.

Evidence Outcomes

Students Can:

a. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents. (1-LS3-1) *(Clarification Statement: Examples of patterns could include features that plants or animals share. Examples of observations could include leaves from the same kind of plant that are the same shape but can differ in size; and, a particular breed of dog looks like its parents but is not exactly the same. This performance expectation integrates traditional science content with engineering through a practice or disciplinary core idea.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (Constructing Explanations and Designing Solutions) (Civic/Interpersonal: Communication).

Elaboration on the GLE:

1. Students can answer the questions: How are the characteristics of one generation related to the previous generation? Why do individuals of the same species vary in how they look, function, and behave?
2. LS3:A Inheritance of Traits: Young animals are very much, but not exactly, like their parents. Plants also are very much, but not exactly, like their parents.
3. LS3:B Variation of Traits: Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.

Cross Cutting Concepts:

1. Patterns: Patterns in the natural and human designed world can be observed, used to describe phenomena and used as evidence.

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Prepared Graduates:

9. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding the universe and Earth's place in it.

Grade Level Expectation:

1. Patterns of movement of the sun, moon and stars as seen from Earth can be observed, described and predicted.

Evidence Outcomes

Students Can:

a. Use observations of the sun, moon, and stars to describe patterns that can be predicted. (1-ESS1-1) *(Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky and set; and stars other than our sun are visible at night but not during the day.)*
b. Make observations at different times of year to relate the amount of daylight to the time of year. (1-ESS1-2) *(Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.) (Boundary Statement: Limited to relative amounts of daylight, not quantifying the hours or time of daylight.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Plan and conduct investigations collaboratively to produce evidence to answer a question. (Planning and Carrying out Investigations) (Personal: Personal responsibility).
2. Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (Analyzing and Interpreting Data) (Entrepreneurial: Creativity/Innovation).

Elaboration on the GLE:

1. Students can answer the questions: What is the universe, and what goes on in stars? (ES1.A) What are the predictable patterns caused by Earth's movement in the solar system? (ES1.B)
2. ESS1:A The Universe and its Stars: Patterns of the motion of the sun, moon and stars in the sky can be observed, described and predicted. At night one can see the light coming from many stars with the naked eye, but telescopes make it possible to see many more and to observe them and the moon and planets in greater detail.
3. ESS1:B Earth and the Solar System: Seasonal patterns of sunrise and sunset can be observed, described and predicted.

Cross Cutting Concepts:

1. Patterns: Patterns in the natural world can be observed, used to describe phenomena and used as evidence.
2. Scientific Knowledge Assumes an Order and Consistency in Natural Systems: Science assumes natural events happen today as they happened in the past.

COLORADO
Department of Education

Prepared Graduates:

1. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding structure, properties and interactions of matter.

Grade Level Expectation:

1. Matter exists as different substances that have observable different properties.

Evidence Outcomes

Students Can:

a. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. (2-PS1-1) *(Clarification Statement: Observations could include color, texture, hardness and flexibility. Patterns could include the similar properties that different materials share.)*
b. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. (2-PS1-2) *(Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture and absorbency.) (Boundary Statement: Quantitative measurement is limited to length.)*
c. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. (2-PS1-3) *(Clarification Statement: Examples of pieces could include blocks, building bricks or other assorted small objects.)*
d. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. (2-PS1-4) *(Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf and heating paper.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question (Planning and Carrying Out Investigations) (Personal: Personal responsibility)
2. Analyze data from tests of an object or tool to determine if it works as intended (Analyzing and Interpreting Data) (Entrepreneurial: Critical thinking/Problem solving)
3. Make observations from several sources to construct an evidence-based account for natural phenomena (Constructing Explanations and Designing Solutions) (Entrepreneurial: Inquiry/Analysis)
4. Construct an argument with evidence to support a claim (Engaging in Argument from Evidence) (Personal: Initiative/Self-direction)
5. Connections to Nature of Science: Science Models, Laws, Mechanisms and Theories Explain Natural Phenomena: Science searches for cause - and - effect relationships to explain natural events.

Elaboration on the GLE:

1. Students can answer the question: How do particles combine to form the variety of matter one observes?
2. PS1:A Structure and Properties of Matter: Different kinds of matter exist (e.g., wood, metal, water), and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties (e.g., visual, aural, textural), by its uses and by whether it occurs naturally or is manufactured. Different properties are suited to different purposes. A great variety of objects can be built up from a small set of pieces (e.g., blocks, construction sets). Objects or samples of a substance can be weighed, and their size can be described and measured.
3. PS1:B Chemical Reactions: Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible (e.g., melting and freezing), and sometimes they are not (e.g., baking a cake, burning fuel).

Cross Cutting Concepts:

1. Patterns: Patterns in the natural and human - designed world can be observed.
2. Cause and Effect: Events have causes that generate observable patterns. Simple tests can be designed to gather evidence to support or refute student ideas about causes.
3. Energy and Matter: Objects may break into smaller pieces and be put together into larger pieces or may change shapes.
4. Connections to Engineering, Technology and Applications of Science: Influence of Science, Engineering and Technology on Society & the Natural World. Every human-made product is designed.

COLORADO
Department of Education

Prepared Graduates:

6. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how living systems interact with the biotic and abiotic environment.

Grade Level Expectation:

1. Plants depend on water and light to grow and on animals for pollination or to move their seeds around.

Evidence Outcomes

Students Can:

a. Plan and conduct an investigation to determine if plants need sunlight and water to grow. (2-LS2-1) *(Boundary Statement: Limited to using one variable at a time.)*
b. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. (2-LS2-2)

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Develop a simple model based on evidence to represent a proposed object or tool (Developing and Using Models) (Personal: Initiative/Self-direction)
2. Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question (Planning and Carrying Out Investigations) (Civic/Interpersonal: Collaboration/Teamwork)
3. Connections to Nature of Science: Science Knowledge is Based on Empirical Evidence

Elaboration on the GLE:

1. Students can answer the question: How do organisms interact with the living and nonliving environments to obtain matter and energy?
2. LS2:A Interdependent Relationships in Ecosystems: Animals depend on their surroundings to get what they need, including food, water, shelter and a favorable temperature. Animals depend on plants or other animals for food. They use their senses to find food and water, and they use their body parts to gather, catch, eat and chew the food. Plants depend on air, water, minerals (in the soil) and light to grow. Animals can move around, but plants cannot, and they often depend on animals for pollination or to move their seeds around. Different plants survive better in different settings because they have varied needs for water, minerals and sunlight.

Cross Cutting Concepts:

1. Cause and Effect: Events have causes that generate observable patterns.
2. Structure and Function: The shape and stability of structures of natural and designed objects are related to their function(s).

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Prepared Graduates:

8. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.

Grade Level Expectation:

2. A range of different organisms lives in different places.

Evidence Outcomes

Students Can:

a. Make observations of plants and animals to compare the diversity of life in different habitats. (2-LS4-1) *(Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Make observations to collect data that can be used to make comparisons. (Planning and Carrying Out Investigations) (Entrepreneurial: Creativity/Innovation)
2. Connections to Nature of Science: Science Knowledge is Based on Empirical Evidence

Elaboration on the GLE:

1. Students can answer the question: What evidence shows that different species are related?
2. LS4:D Biodiversity and Humans: There are many different kinds of living things in any area, and they exist in different places on land and in water.

Prepared Graduates:

9. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding the universe and Earth's place in it.

Grade Level Expectation:

1. Some events on Earth occur quickly; others can occur very slowly.

Evidence Outcomes

Students Can:

a. Use information from several sources to provide evidence that Earth events can occur quickly or slowly. (2-ESS1-1) *(Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly, and erosion of rocks, which occurs slowly.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Make observations from several sources to construct an evidence-based account for natural phenomena. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Critical thinking/Problem solving)

Elaboration on the GLE:

1. Students can answer the question: How do people reconstruct and date events in the Earth's planetary history?
2. ESS1:C The History of Planet Earth: Some events on Earth occur in cycles, like day and night, and others have a beginning and an end, like a volcanic eruption. Some events, like an earthquake, happen very quickly; others, such as the formation of the Grand Canyon, occur very slowly over a time period much longer than one can observe.

Cross Cutting Concepts:

1. Stability and Change: Things may change rapidly or slowly.

Prepared Graduates:

10. Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.

Grade Level Expectation:

2. Wind and water can change the shape of the land; models can show the shape and these changes to the land.

Evidence Outcomes

Students Can:

a. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. (2-ESS2-1) *(Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.)*
b. Develop a model to represent the shapes and kinds of land and bodies of water in an area. (2-ESS2-2) *(Boundary Statement: Does not include quantitative scaling in models.)*
c. Obtain information to identify where water is found on Earth and that it can be solid or liquid. (ESS2-3)

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Compare multiple solutions to a problem. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Inquiry/Analysis)
2. Develop a model to represent patterns in the natural world. (Developing and Using Models) (Personal: Initiative/Self-direction)
3. 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. (Obtaining, Evaluating, and Communicating Information) (Civic/Interpersonal: Communication)

Elaboration on the GLE:

1. Students can answer the question: How and why is Earth constantly changing?
2. ESS2:A Earth Materials and Systems: Wind and water can change the shape of the land. The resulting landforms, together with the materials on the land, provide homes for living things.
3. ESS2:B Plate Tectonics and Large-Scale System Interactions: Rocks, soils, and sand are present in most areas where plants and animals live. There may also be rivers, streams, lakes and ponds. Maps show where things are located. One can map the shapes and kinds of land and water in any area.
4. ESS2:C The Roles of Water in Earth's Surface Processes: Water is found in the ocean, rivers, lakes and ponds. Water exists as solid ice and in liquid form. It carries soil and rocks from one place to another and determines the variety of life forms that can live in a particular location.

Cross Cutting Concepts:

1. Patterns: Patterns in the natural world can be observed.
2. Stability and Change: Things may change slowly or rapidly.
3. Influence of Science, Engineering and Technology on Society and the Natural World: Developing and using technology has impacts on the natural world.
4. Connections to Nature of Science: Science Addresses Questions About the Natural and Material World. Scientists study the natural and material world.