Colorado Academic Standards

Science

Third Grade – Fifth Grade

COLORADO
Department of Education

ALL STUDENTS • ALL STANDARDS

Science Standards Review and Revision Committee

Chairpersons

John Eyolfson
Assistant to the Principal
Presidential Awardee for Excellence in Mathematics and Science Teaching
Cherry Creek Schools

Charles R. Warren
University Licensure Officer
University of Northern Colorado

Members

Sherri K. Dennstedt
Science Technology Engineering Mathematics (STEM) Coordinator
National Board Certified Teacher (NBCT)
Cherry Creek Schools

Beverly DeVore-Wedding
Ph.D. Student/Former High School Teacher
Meeker School District

Scott Graham
Executive Director of Academic Support Services
Weld County School District Re-8

Amy Jo Hanson
Teacher
Presidential Awardee for Excellence in Mathematics or Science Teaching
Denver Public Schools

Steven Iona
Associate Professor
University of Denver

Tabbi Kinion
Statewide Education Coordinator
Colorado Parks and Wildlife

Catherine Kolbet
Middle School Science Teacher
Norwood School District

Kevin L. Lindauer
High School Science Teacher
National Board Certified Teacher (NBCT)
Denver Public Schools

Cheryl Mosier
High School Science Teacher
Presidential Awardee for Excellence in Mathematics or Science Teaching
Jefferson County Schools

Kathy Nall
Teaching and Learning Coach
Colorado Springs School District 11

Jessica Noffsinger
Middle School Science Teacher
Presidential Awardee for Excellence in Mathematics or Science Teaching
Adams 12 Five Star Schools

Angela Outlaw
Elementary Science Coordinator
Harrison School District 2

William Penuel
Professor
University of Colorado Boulder

Dorothy Shapland
Faculty Lecturer, Special Education, Early Childhood Education, & Culturally and Linguistically Diverse Education
Metropolitan State University of Denver

Stephanie Spiris
Science Technology Engineering Mathematics (STEM) Curriculum Specialist
Denver Public Schools

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

Laura Spruce
Elementary Teacher
Harrison School District 2

Shannon Wachowski
High School Science Teacher
Poudre School District

Matt Zehner
District 9-12 Curriculum, Instruction, &
Assessment Coordinator
Harrison School District 2

State Board of Education and Colorado Department of Education

Colorado State Board of Education

Angelika Schroeder (D, Chair)
2nd Congressional District
Boulder

Joyce Rankin (R, Vice Chair)
3rd Congressional District
Carbondale

Steve Durham (R)
5th Congressional District
Colorado Springs

Valentina (Val) Flores (D)
1st Congressional District
Denver

Jane Goff (D)
7th Congressional District
Arvada

Rebecca McClellan (D)
6th Congressional District
Centennial

Debora Scheffel (R)
4th Congressional District
Douglas County

Colorado Department of Education

Katy Anthes, Ph.D.
Commissioner of Education
Secretary to the Board of Education

Melissa Colsman, Ph.D.
Associate Commissioner of Education
Student Learning Division

Floyd Cobb, Ph.D.
Executive Director
Teaching and Learning Unit

CDE Standards and Instructional Support Office

Karol Gates
Director

Carla Aguilar, Ph.D.
Music Content Specialist

Ariana Antonio
Standards Project Manager

Joanna Bruno, Ph.D.
Science Content Specialist

Lourdes (Lulu) Buck
World Languages Content Specialist

Donna Goodwin, Ph.D.
Visual Arts Content Specialist

Stephanie Hartman, Ph.D.
Social Studies Content Specialist

Judi Hofmeister
Dance Content Specialist
Drama and Theatre Arts Content Specialist

Jamie Hurley, Ph.D.
Comprehensive Health Content Specialist
Physical Education Content Specialist

Raymond Johnson
Mathematics Content Specialist

Christine Liebe
Computer Science Content Specialist

Vince Puzick
Reading, Writing, and Communicating Content Specialist

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

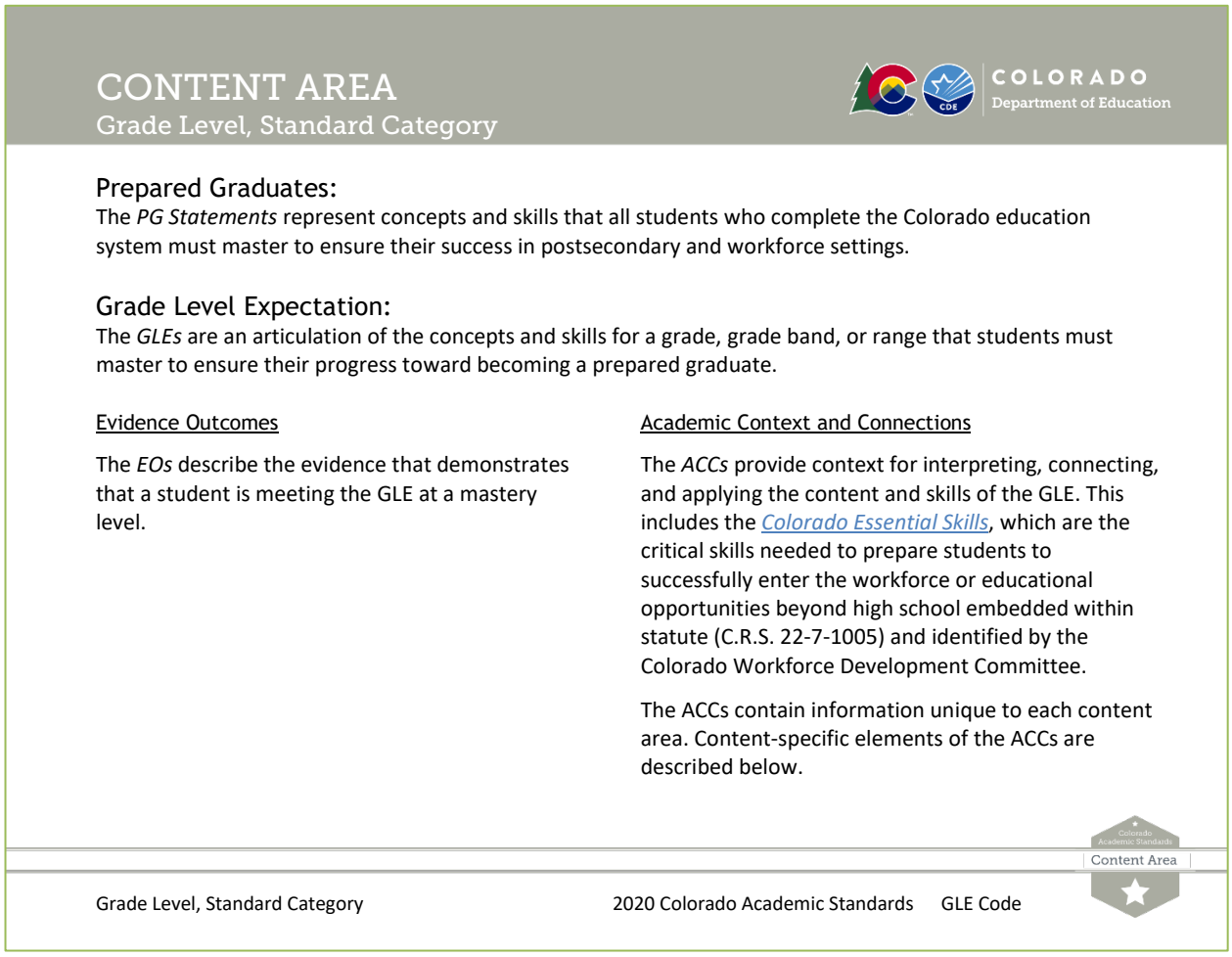
Science and Engineering Practices

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.

COLORADO
Department of Education

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. Patterns of motion can be used to predict future motion.

Evidence Outcomes

Students Can:

a. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. (3-PS2-1) *(Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving and balanced forces pushing on a box from both sides will not produce any motion at all.) (Boundary Statements: Limited to one variable at a time: number, size or direction of forces and to gravity being addressed as a force that pulls objects down. Does not include quantitative force size, only qualitative and relative.)*

b. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. (3-PS2-2) *(Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl and two children on a see-saw.) (Boundary Statement: Does not include technical terms such as period and frequency.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Ask questions that can be investigated based on patterns such as cause and effect relationships. (Asking Questions and Defining Problems) (Entrepreneurial: Inquiry/Analysis)
2. Define a simple problem that can be solved through the development of a new or improved object or tool. (Asking Questions and Defining Problems) (Entrepreneurial: Inquiry/Analysis)
3. 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. (Planning and Carrying Out Investigations) (Entrepreneurial: Inquiry/Analysis)
4. 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. (Planning and Carrying Out Investigations) (Entrepreneurial: Inquiry/Analysis)

Elaboration on the GLE:

1. Students can answer the questions: How can one predict an object's continued motion, changes in motion or stability? What underlying forces explain the variety of interactions observed?
2. PS2:A Forces and Motion: Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces is used at this level). The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)
3. PS2:B Types of Interactions: Objects in contact exert forces on each other.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships are routinely identified.
2. Patterns: Patterns of change can be used to make predictions.

COLORADO
Department of Education

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. Objects in contact exert forces on each other; electric and magnetic forces between a pair of objects do not require contact.

Evidence Outcomes

Students Can:

a. Ask questions to determine cause - and - effect relationships of electric or magnetic interactions between two objects not in contact with each other. (3-PS2-3) *(Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause - and - effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.) (Boundary Statement: Limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.)*

b. Define a simple design problem that can be solved by applying scientific ideas about magnets. (3-PS2-4)*(Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Ask questions that can be investigated based on patterns such as cause - and - effect relationships. (Asking Questions and Defining Problems) (Entrepreneurial: Inquiry/Analysis).
2. Define a simple problem that can be solved through the development of a new or improved object or tool. (Asking Questions and Defining Problems) (Personal: Personal responsibility).
3. Plan and conduct an investigation that control variables and provide evidence to support explanations or design solutions. (Planning and Carrying Out Investigations) (Entrepreneurial: Inquiry/Analysis).

Elaboration on the GLE:

1. Students can answer the question: Why are some physical systems more stable than others?
2. PS2:B Types of Interactions: Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and for forces between two magnets on their orientation relative to each other.

Cross Cutting Concepts:

1. Cause and Effect: Cause and effect relationships are routinely identified, tested and used to explain change.
2. Connections to Engineering, Technology and Applications of Science: Interdependence of Science, Engineering and Technology-Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process.

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. Organisms have unique and diverse life cycles.

Evidence Outcomes

Students Can:

a. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction and death. (3-LS1-1) *(Clarification Statement: Changes organisms go through during their life form a pattern.) (Boundary Statement: Limited to those of flowering plants and does not include details of human reproduction.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Develop models to describe phenomena (Developing and Using Models) (Personal: Initiative/Self-direction).

Elaboration on the GLE:

1. Students can answer the question: How do the structures of organisms enable life's functions?
2. LS1:B Growth and Development of Organisms: Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

Cross Cutting Concepts:

1. Patterns: Patterns of change can be used to make predictions.

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:

2. Being part of a group helps animals obtain food, defend themselves and cope with changes.

Evidence Outcomes

Students Can:

a. Construct an argument that some animals form groups that help members survive. (3-LS2-1)

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Construct an argument with evidence, data and/or a model. (Engaging in Argument from Evidence) (Personal: Initiative/Self-direction)

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:D Social Interactions and Group Behavior: Being part of a group helps animals obtain food, defend themselves and cope with changes. Groups may serve different functions and vary dramatically in size.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships are routinely identified and used to explain change.

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:

3. Different organisms vary in how they look and function because they have different inherited information; the environment also affects the traits that an organism develops.

Evidence Outcomes

Students Can:

a. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. (3-LS3-1) *(Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.) (Boundary Statement: Does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.)*

b. Use evidence to support the explanation that traits can be influenced by the environment. (3-LS3-2) *(Clarification Statement: Examples of the environment affecting a trait could that include normally tall plants grown with insufficient water are stunted; and a pet dog that is given too much food and little exercise may become overweight.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Analyze and interpret data to make sense of phenomena using logical reasoning. (Analyzing and Interpreting Data) (Entrepreneurial: Critical thinking/Problem solving)
2. Use evidence (e.g., observations, patterns) to support an explanation. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Critical thinking/Problem solving)
3. Use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Critical thinking/Problem solving)

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: Many characteristics of organisms are inherited from their parents. Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.
3. LS3:B Variation of Traits: Different organisms vary in how they look and function because they have different inherited information. The environment also affects the traits that an organism develops.

Cross Cutting Concepts:

1. Patterns: Similarities and differences in patterns can be used to sort and classify natural phenomena.
2. Cause and Effect: Cause - and - effect relationships are routinely identified and used to explain change.

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:

4. Some living organisms resemble organisms that once lived on Earth .

Evidence Outcomes

Students Can:

a. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. (3-LS4-1) *(Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas and fossils of extinct organisms.) (Boundary Statement: Does not include identification of specific fossils or present plants and animals and is limited to major fossil types and relative ages.)*

b. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates and reproducing. (3-LS4-2) *(Clarification Statement: Examples of cause - and - effect relationships could be that plants that have larger thorns than other plants may be less likely to be eaten by predators; and animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Analyze and interpret data to make sense of phenomena using logical reasoning. (Analyzing and Interpreting Data) (Entrepreneurial: Critical thinking/Problem solving).
2. Use evidence (e.g., observations, patterns) to construct an explanation. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Critical thinking/Problem solving).
3. Critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). (Engaging in Argument from Evidence) (Entrepreneurial: Critical thinking/Problem solving).

Elaboration on the GLE:

1. Students can answer the questions: What evidence shows that different species are related? How does genetic variation among organisms affect survival and reproduction?
2. LS4:A Evidence of Common Ancestry and Diversity: Some kinds of plants and animals that once lived on Earth are no longer found anywhere. Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.
3. LS4:B Natural Selection: Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates and reproducing.

Cross Cutting Concepts:

1. Scale, Proportion and Quantity: Observable phenomena exist from very short to very long time periods.
2. Systems and System Models
3. Cause and Effect: Cause - and - effect relationships are routinely identified and used to explain change.

COLORADO
Department of Education

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:

5. Sometimes differences in characteristics between individuals of the same species provide advantages in survival and reproduction.

Evidence Outcomes

Students Can:

a. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well and some cannot survive at all. (3-LS4-3) *(Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.)*
b. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. (3-LS4-4) *(Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food and other organisms.) (Boundary Statement: Limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Analyze and interpret data to make sense of phenomena using logical reasoning. (Analyzing and Interpreting Data) (Entrepreneurial: Critical thinking/Problem solving)
2. Use evidence to construct an explanation. (Constructing Explanations and Designing Solutions) (Personal: Initiative/Self-direction)
3. Construct an argument with evidence. (Engaging in Argument from Evidence) (Entrepreneurial: Critical thinking/Problem solving)
4. 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) (Entrepreneurial: Critical thinking/Problem solving).

Elaboration on the GLE:

1. Students can answer the questions: How does the environment influence populations of organisms over multiple generations? What is biodiversity, how do humans affect it, and how does it affect humans?
2. LS2.C Ecosystem Dynamics, Functioning, and Resilience: When the environment changes in ways that affect a place's characteristics, temperature or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.
3. LS4:C Adaptation: For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.
4. LS4:D Biodiversity and Humans: Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships are routinely identified and used to explain change.
2. Systems and System Models: A system can be described in terms of its components and their interactions.

COLORADO
Department of Education

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. Climate describes patterns of typical weather conditions over different scales and variations; historical weather patterns can be analyzed.

Evidence Outcomes

Students Can:

a. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. (3-ESS2-1) *(Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction. Obtain and combine information to describe climates in different regions of the world.) (Boundary Statement: Graphical displays are limited to pictographs and bar graphs. Does not include climate change.)*
b. Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (Analyzing and Interpreting Data) (Entrepreneurial: Critical thinking/Problem solving)
2. Obtain and combine information from books and other reliable media to explain phenomena. (Obtaining, Evaluating, and Communicating Information) (Professional: Information literacy).

Elaboration on the GLE:

1. Students can answer the question: What regulates weather and climate?
2. ESS2:D Weather and Climate: Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.

Cross Cutting Concepts:

1. Patterns: Patterns of change can be used to make predictions.

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. A variety of weather hazards result from natural process; humans cannot eliminate weather-related hazards but can reduce their impacts.

Evidence Outcomes

Students Can:

a. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. (3-ESS3-1) *(Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs and lightning rods.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. 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) (Personal: Initiative/Self-direction).

Elaboration on the GLE:

1. Students can answer the question: How do natural hazards affect individuals and societies?
2. ESS3:B Natural Hazards: A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships are routinely identified, tested and used to explain change.

COLORADO
Department of Education

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:

1. The faster an object moves the more energy it has.

Evidence Outcomes

Students Can:

a. Use evidence to construct an explanation relating the speed of an object to the energy of that object. (4-PS3-1) *(Clarification Statement: Examples of evidence relating speed and energy could include change of shape on impact or other results of collisions.) (Boundary Statement: Does not include quantitative measures of changes in speed of an object or on any precise or quantitative definition of energy.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Use evidence (e.g., measurements, observations, patterns) to construct an explanation (Constructing Explanations and Designing Solutions) (Entrepreneurial: Inquiry/Analysis)

Elaboration on the GLE:

1. Students can answer the questions: What is energy?
2. PS3:A Definitions of Energy: The faster a given object is moving, the more energy it possesses. Energy can be moved from place to place by moving objects or through sound, light or electric currents.

Cross Cutting Concepts:

1. Energy and Matter: Energy can be transferred in various ways and between objects.

COLORADO
Department of Education

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. Energy can be moved from place to place.

Evidence Outcomes

Students Can:

a. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat and electric currents. (4-PS3-2) *(Boundary Statement: Does not include quantitative measurement of energy.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause - and - effect relationships. (Asking Questions and Defining Problems) (Entrepreneurial: Inquiry/Analysis).
2. Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (Planning and Carrying Out Investigations) (Personal: Personal responsibility).

Elaboration on the GLE:

1. Students can answer the questions: What is meant by conservation of energy? How is energy transferred between objects or systems?
2. PS3:B Conservation of Energy and Energy Transfer: Energy is present whenever there are moving objects, sound, light or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. Light also transfers energy from place to place. Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.

Cross Cutting Concepts:

1. Energy and Matter: Energy can be transferred in various ways and between objects

COLORADO
Department of Education

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:

3. When objects collide contact forces transfer so as to change objects' motion.

Evidence Outcomes

Students Can:

a. Ask questions and predict outcomes about the changes in energy that occur when objects collide. (4-PS3-3) *(Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.) (Boundary Statement: Does not include quantitative measures of energy.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause - and - effect relationships (Asking Questions and Defining Problems) (Personal: Personal responsibility).

Elaboration on the GLE:

1. Students can answer the question: How are forces related to energy?
2. PS3:C Relationships Between Energy and Forces: When objects collide, the contact forces transfer energy so as to change the objects' motions.

Cross Cutting Concepts:

1. Energy and Matter: Energy can be transferred in various ways and between objects.

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:

4. Energy can be produced, used or released by converting stored energy.

Evidence Outcomes

Students Can:

a. Apply scientific ideas to design, test and refine a device that converts energy from one form to another. (4-PS3-4) *(Clarification Statement: Examples of evidence relating speed and energy could include change of shape on impact or other results of collisions.) (Boundary Statement: Does not include quantitative measures of changes in speed of an object or on any precise or quantitative definition of energy.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Apply scientific ideas to solve design problems. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Inquiry/Analysis).

Elaboration on the GLE:

1. Students can answer the questions: How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used?
2. PS3:D Energy in Chemical Processes and Everyday Life: The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.

Cross Cutting Concepts:

1. Energy and Matter: Energy can be transferred in various ways and between objects.
2. Influence of Engineering, Technology and Science on Society and the Natural World: Engineers improve existing technologies or develop new ones.
3. Science is a Human Endeavor: Most scientists and engineers work in teams. Science affects everyday life.

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:

5. Waves are regular patterns of motion.

Evidence Outcomes

Students Can:

a. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. (4-PS4-1) *(Clarification Statement: Examples of models could include diagrams, analogies and physical models using wire to illustrate wavelength and amplitude of waves.) (Boundary Statement: Does not include interference effects, electromagnetic waves, non-periodic waves or quantitative models of amplitude and wavelength.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Develop a model using an analogy, example or abstract representation to describe a scientific principle. (Developing and Using Models) ((Personal: Initiative/Self-direction).

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; there is no net motion in the direction of the wave except when the water meets the beach. Waves of the same type can differ in amplitude (height of waves) and wavelength (spacing between wave peaks).

Cross Cutting Concepts:

1. Patterns: Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.

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:

6. An object can be seen when light reflected from its surface enters the eyes.

Evidence Outcomes

Students Can:

a. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. (4-PS4-2) *(Boundary Statement: Does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision or how the retina works.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Develop a model to describe phenomena. (Developing and Using Models) (Personal: Initiative/Self-direction).

Elaboration on the GLE:

1. Students can answer the questions: What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?
2. PS4:B Electromagnetic Radiation: An object can be seen when light reflected from its surface enters the eyes.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships are routinely identified.

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:

7. Patterns can encode, send, receive and decode information.

Evidence Outcomes

Students Can:

a. Generate and compare multiple solutions that use patterns to transfer information. (4-PS4-3) *(Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1s and 0s representing black and white to send information about a picture and using Morse code to send text.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. 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) (Entrepreneurial: Inquiry/Analysis).

Elaboration on the GLE:

1. Students can answer the question: How are instruments that transmit and detect waves used to extend human senses?
2. PS4:C Information Technologies and Instrumentation: Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information – convert it from digitized form to voice – and vice versa.

Cross Cutting Concepts:

1. Patterns: Similarities and Differences in patterns can be used to sort and classify designed products.
2. Interdependence of Science and Engineering, and Technology: Knowledge of relevant scientific concepts and research findings is important in engineering.

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. Organisms have both internal and external structures that serve various functions.

Evidence Outcomes

Students Can:

a. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction. (4-LS1-1) *(Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lungs, brain and skin.) (Boundary Statement: Stress at this level is on understanding the macroscale systems and their functions, not the microscopic scale.)*

b. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. (4-LS1-2) *(Clarification Statement: Emphasis is on systems information transfer.) (Boundary Statement: Does not include the mechanisms by which the brain stores and recalls information or the mechanism of how sensory receptors function.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Construct and argument with evidence, data, and/or a model. (Engaging in Argument from Evidence) (Personal: Initiative/Self-direction)
2. Use a model to test interactions concerning the functioning of a natural system (Engaging in Argument from Evidence) (Personal: Initiative/Self-direction)

Elaboration on the GLE:

1. Students can answer the question: How do internal and external structures support the survival, growth, behavior and reproduction of plants and animals?
2. LS1:A Structure and Function: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior and reproduction.
3. LS1:D Information Processing: Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.

Cross Cutting Concepts:

1. Systems and System Models: A system can be described in terms of its components and their interactions.

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:

1. Earth has changed over time.

Evidence Outcomes

Students Can:

a. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (4-ESS1-1) *(Clarification Statement: Examples of evidence from patterns could include rock layers with shell fossils above rock layers with plant fossils and no shells, indicating a change from water to land over time; and a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.) (Boundary Statement: Does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers, and should only include relative time.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Identify the evidence that supports particular points in an explanation. (Constructing Explanations and Designing Solutions) (Entrepreneurial: Creativity/Innovation)

Elaboration on the GLE:

1. Students can answer the question: How can water, ice, wind and vegetation change the land?
2. ESS1:C The History of the Planet Earth: Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers.

Cross Cutting Concepts:

1. Patterns: Patterns can be used as evidence to support an explanation.
2. Scientific Knowledge Assumes an Order and Consistency in Natural Systems: Science assumes consistent patterns in natural systems.

COLORADO
Department of Education

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. Four major earth systems interact.

Evidence Outcomes

Students Can:

a. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (4-ESS2-1) *(Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling and volume of water flow.) (Boundary Statement: Limited to a single form of weathering or erosion.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomena. (Planning and Carrying out Investigations) (Entrepreneurial: Inquiry/Analysis)

Elaboration on the GLE:

1. Students can answer the questions: What patterns of Earth's features can be determined with the use of maps? How do living organisms alter Earth's processes and structures?
2. ESS2:A Earth Materials and Systems: Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms and gravity break rocks, soils and sediments into smaller particles and move them around.
3. ESS2:E Biogeology: Living things affect the physical characteristics of their regions.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships are routinely identified, tested, and used to explain change.

COLORADO
Department of Education

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:

3. Earth's physical features occur in patterns.

Evidence Outcomes

Students Can:

a. Analyze and interpret data from maps to describe patterns of Earth's features. (4-ESS2-2) *(Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes and earthquakes.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Analyze and interpret data to make sense of phenomena using logical reasoning. (Analyze and Interpret Data) (Entrepreneurial: Critical thinking/Problem solving)

Elaboration on the GLE:

1. Students can answer the question: Why do the continents move, and what causes earthquakes and volcanoes?
2. ESS2.B: Plate Tectonics and Large-Scale System Interactions: The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.

Cross Cutting Concepts:

1. Patterns: Patterns can be used as evidence to support an explanation.

COLORADO
Department of Education

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:

4. Energy and fuels that humans use are derived from natural sources and their use affects the environment in multiple ways.

Evidence Outcomes

Students Can:

a. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. (4-ESS3-1) *(Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Obtain and combine information from books and other reliable media to explain phenomena(Obtaining, Evaluating, and Communicating Information) (Entrepreneurial: Critical thinking/Problem solving)

Elaboration on the GLE:

1. Students can answer the question: How do humans depend on Earth's resources?
2. ESS3.A: Natural Resources: Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships are routinely identified and used to explain change.
2. Interdependence of Science, Engineering and Technology: Knowledge of relevant scientific concepts and research findings is important in engineering.
3. Influence of Science, Engineering and Technology on Society and the Natural World: Over time, people's needs and wants change, as do their demands for new and improved technologies.

COLORADO
Department of Education

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:

5. A variety of hazards result from natural process; humans cannot eliminate natural hazards but can reduce their impacts' effect.

Evidence Outcomes

Students Can:

a. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. (4-ESS3-2) *(Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.)(Boundary: Limited to earthquakes, floods, tsunamis, and volcanic eruptions.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. 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) (Entrepreneurial: Critical thinking/Problem solving)

Elaboration on the GLE:

1. Students can answer the question: How do natural hazards affect individuals and societies?
2. ESS3.B: Natural Hazards: A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.

Cross Cutting Concepts:

1. Interdependence of Science, Engineering and Technology: Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks and to meet societal demands.
2. Cause and Effect: Cause - and - effect relationships are routinely identified, tested, and used to explain change.

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 particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.

Evidence Outcomes

Students Can:

a. Develop a model to describe that matter is made of particles too small to be seen. (5-PS1-1) *(Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water and evaporating salt water. Does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.)*

b. Make observations and measurements to identify materials based on their properties. (5-PS1-3) *(Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility; density is not intended as an identifiable property. Does not include density or distinguishing mass and weight.) (Boundary Statement: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Use models to describe phenomena (Developing and Using Models) (Personal: Initiative/Self-direction).
2. Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon (Planning and Carrying Out Investigations) (Personal: Personal responsibility).

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: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. Measurements of a variety of properties can be used to identify materials.

Cross Cutting Concepts:

1. Scale, Proportion and Quantity: Natural objects exist from the very small to the immensely large. Standard units are used to measure and describe physical quantities such as weight, time, temperature and volume.

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:

2. Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.

Evidence Outcomes

Students Can:

a. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling or mixing substances, the total weight of matter is conserved. (5-PS1-1) *(Clarification Statement: Examples of reactions or changes could include phase changes, dissolving and mixing that form new substances. Does not include distinguishing mass and weight.) (Boundary Statement: Mass and weight are not distinguished at this grade level.)*
b. Conduct an investigation to determine whether the mixing of two or more substances results in new substances. (5-PS1-4)

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Measure and graph quantities such as weight to address scientific and engineering questions and problems (Using Mathematics and Computational Thinking) (Entrepreneurial: Critical thinking/Problem solving).

Elaboration on the GLE:

1. Students can answer the questions: How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?
2. PS1:B Chemical Reactions: No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary Statement: Mass and weight are not distinguished at this grade level.) When two or more different substances are mixed, a new substance with different properties may be formed.

Cross Cutting Concepts:

1. Scale, Proportion and Quantity: Standard units are used to measure and describe physical quantities such as weight, time, temperature and volume.
2. Scientific Knowledge to Assumes an Order and Consistency in Natural Systems: Science assumes consistent patterns in natural systems.
3. Cause and Effect: Cause - and - effect relationships are routinely identified, tested and used to explain change.

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:

3. The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

Evidence Outcomes

Students Can:

a. Support an argument that the gravitational force exerted by Earth on objects is directed down. (5-PS2-1) *(Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.) (Boundary Statement: Does not include mathematical representation of gravitational force).*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Support an argument with evidence, data or a model (Engaging in Argument from Evidence) (Personal: Initiative/Self-direction).

Elaboration on the GLE:

1. Students can answer the question: What underlying forces explain the variety of interactions observed?
2. PS2:B Types of Interactions: The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

Cross Cutting Concepts:

1. Cause and Effect: Cause - and - effect relationships are routinely identified and used to explain change.

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:

4. The energy released from food was once energy from the sun.

Evidence Outcomes

Students Can:

a. Use models to describe that energy in animals' food (used for body repair, growth and motion and to maintain body warmth) was once energy from the sun. (5-PS3-1) *(Clarification Statement: Examples of models could include diagrams and flowcharts.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Use models to describe phenomena (Developing and Using Models) (Personal: Initiative/Self-direction).

Elaboration on the GLE:

1. Students can answer the questions: How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used?
2. PS3:D Energy in Chemical Processes and Everyday Life: The energy released from food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

Cross Cutting Concepts:

1. Energy and Matter: Energy can be transferred in various ways and between objects.

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 acquire their material from growth chiefly from air and water.

Evidence Outcomes

Students Can:

a. Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1) *(Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Support an argument with evidence, data or a model (Engaging in Argument from Evidence) (Personal: Initiative/Self-direction).

Elaboration on the GLE:

1. Students can answer the question: How do organisms obtain and use the matter and energy they need to live and grow?
2. LS1:C Organization for Matter and Energy Flow in Organisms: Plants acquire their material for growth chiefly from air and water.

Cross Cutting Concepts:

1. Energy and Matter: Matter is transported into, out of and within systems.

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:

2. Matter cycles between air and soil and among plants, animals and microbes as these organisms live and die.

Evidence Outcomes

Students Can:

a. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (5-LS2-1) *(Clarification Statement: Emphasis is on the idea that matter that is not food [air, water, decomposed materials in soil] is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.) (Boundary Statement: Does not include molecular explanations.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Develop a model to describe phenomena (Developing and Using Models) (Personal: Initiative/Self-direction).
2. Connections to the Nature of Science: Science Models, Laws, Mechanisms and Theories Explain Natural Phenomena. Science explanations describe the mechanisms for natural events.

Elaboration on the GLE:

1. Students can answer the questions: How do organisms interact with the living and nonliving environments to obtain matter and energy? How do matter and energy move through an ecosystem?
2. LS2:A Interdependent Relationships in Ecosystems: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.
3. LS2:B Cycles of Matter and Energy Transfer in Ecosystems: Matter cycles between the air and soil and among plants, animals and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid or solid) back into the environment.

Cross Cutting Concepts:

1. Systems and System Models: A system can be described in terms of its components and their interactions.

COLORADO
Department of Education

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. Stars range greatly in size and distance from Earth, and this can explain their relative brightness.

Evidence Outcomes

Students Can:

a. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth. (5-ESS1-1) *(Clarification Statement: Limited to relative distances, not sizes, of stars. Does not include other factors that affect apparent brightness [such as stellar masses, age and stage].)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Support an argument with evidence, data or a model (Engaging in Argument from Evidence) (Civic/Interpersonal: Collaboration/Teamwork).

Elaboration on the GLE:

1. Students can answer the question: What is the universe, and what goes on in stars?
2. ESS1:A The Universe and its Stars: The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.

Cross Cutting Concepts:

1. Scale, Proportion and Quantity: Natural objects exist from the very small to the immensely large.

COLORADO
Department of Education

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:

2. Earth's orbit and rotation and the orbit of the moon around earth cause observable patterns.

Evidence Outcomes

Students Can:

a. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. (5-ESS1-2) *(Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.) (Boundary Statement: Does not include causes of seasons.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (Analyzing and Interpreting Data) (Entrepreneurial: Critical thinking/Problem solving).

Elaboration on the GLE:

1. Students can answer the question: What are the predictable patterns caused by Earth's movement in the solar system?
2. ESS1:B Earth and the Solar System: The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon and stars at different times of the day, month and year.

Cross Cutting Concepts:

1. Patterns: Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.

COLORADO
Department of Education

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:

3. Earth's major systems interact in multiple ways to affect Earth's surface materials and processes.

Evidence Outcomes

Students Can:

a. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere and/or atmosphere interact. (5-ESS2-1) *(Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.) (Boundary Statement: Limited to the interactions of two systems at a time.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Develop a model using an example to describe a scientific principle. (Developing and Using Models) (Personal: Initiative/Self-direction).

Elaboration on the GLE:

1. Students can answer the question: How do Earth's major systems interact? How do the properties and movements of water shape Earth's surface and affect its systems?
2. ESS2:A Earth Materials and Systems: Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.

Cross Cutting Concepts:

1. Systems and System Models: A system can be described in terms of its components and their interactions.

COLORADO
Department of Education

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:

4. Most of Earth's water is in the ocean and much of Earth's freshwater in glaciers or underground.

Evidence Outcomes

Students Can:

a. Describe and graph the amounts and percentages of saltwater and freshwater in various reservoirs to provide evidence about the distribution of water on Earth. (5-ESS2-2) *(Boundary Statement: Limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.)*

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Describe and graph quantities such as area and volume to address scientific questions (Using Mathematics and Computational Thinking) (Entrepreneurial: Critical thinking/Problem solving).

Elaboration on the GLE:

1. Students can answer the question: How do the properties and movements of water shape Earth's surface and affect its systems?
2. ESS2:C The Roles of Water in Earth's Surface Processes: Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands and the atmosphere.

Cross Cutting Concepts:

1. Scale, Proportion, and Quantity: Standard units are used to measure and describe physical quantities such as weight and volume.

COLORADO
Department of Education

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:

5. Societal activities have had major effects on land, ocean, atmosphere and even outer space

Evidence Outcomes

Students Can:

a. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. (5-ESS3-1)

Academic Context and Connections

Colorado Essential Skills and Science and Engineering Practices:

1. Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (Obtaining, Evaluating, and Communicating Information) (Civic/Interpersonal: Communication)

Elaboration on the GLE:

1. Students can answer the question: How do humans change the planet?
2. ESS3:C Human Impacts on Earth Systems: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

Cross Cutting Concepts:

1. Systems and System Models: A system can be described in terms of its components and their interactions.
2. Science Addresses Questions About the Natural and Material World: Science findings are limited to questions that can be answered with empirical evidence.