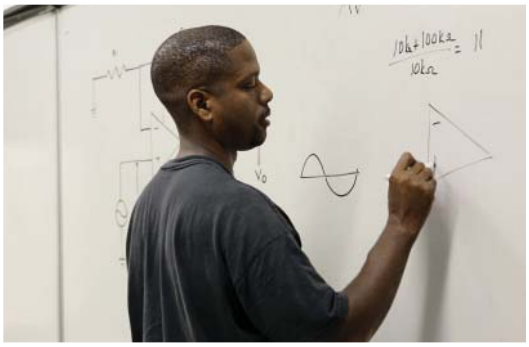
cde Improving Academic Achievement

Colorado Academic STANDARDS

Eighth Grade

Science

Science



Colorado Academic Standards
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.*

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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.
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Standards Organization and Construction

As the subcommittee began the revision process to improve the existing standards, it became evident that the way the standards information was organized, defined, and constructed needed to change from the existing documents. The new design is intended to provide more clarity and direction for teachers, and to show how 21st century skills and the elements of school readiness and postsecondary and workforce readiness indicators give depth and context to essential learning.

The "Continuum of State Standards Definitions" section that follows shows the hierarchical order of the standards components. The "Standards Template" section demonstrates how this continuum is put into practice.

The elements of the revised standards are:

Prepared Graduate Competencies: The preschool through twelfth-grade concepts and skills that all students who complete the Colorado education system must master to ensure their success in a postsecondary and workforce setting.

Standard: The topical organization of an academic content area.

High School Expectations: The articulation of the concepts and skills of a standard that indicates a student is making progress toward being a prepared graduate. *What do students need to know in high school?*

Grade Level Expectations: The articulation (at each grade level), concepts, and skills of a standard that indicate a student is making progress toward being ready for high school. *What do students need to know from preschool through eighth grade?*

Evidence Outcomes: The indication that a student is meeting an expectation at the mastery level. *How do we know that a student can do it?*

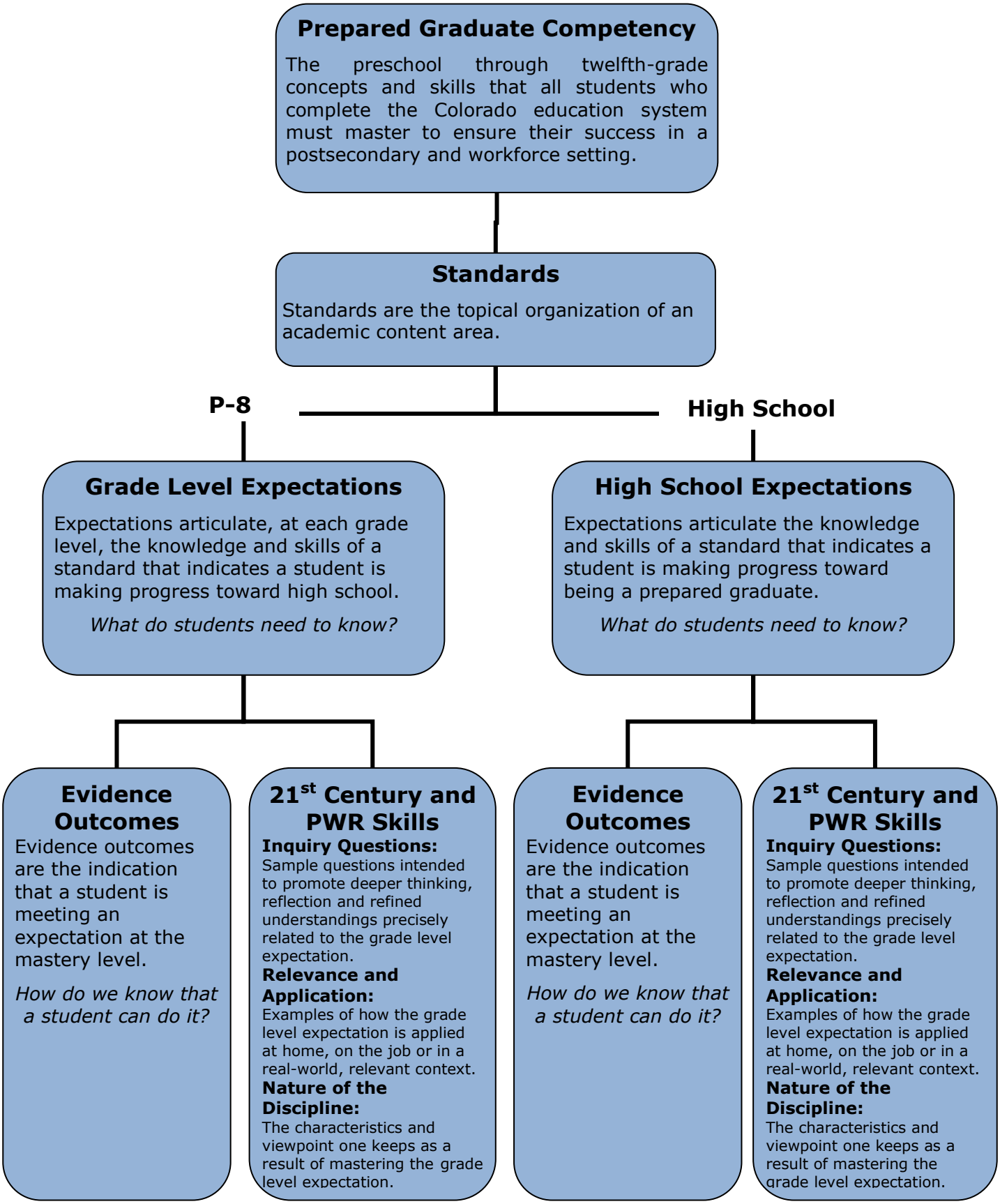
21st Century Skills and Readiness Competencies: Includes the following:

- ***Inquiry Questions:***
  Sample questions are intended to promote deeper thinking, reflection and refined understandings precisely related to the grade level expectation.

- ***Relevance and Application:***
  Examples of how the grade level expectation is applied at home, on the job or in a real-world, relevant context.

- ***Nature of the Discipline:***
  The characteristics and viewpoint one keeps as a result of mastering the grade level expectation.

Continuum of State Standards Definitions



STANDARDS TEMPLATE

Content Area: NAME OF CONTENT AREA

Standard: The topical organization of an academic content area.

Prepared Graduates:

- The preschool through twelfth-grade concepts and skills that all students who complete the Colorado education system must master to ensure their success in a postsecondary and workforce setting.

High School and Grade Level Expectations

Concepts and skills students master:

Grade Level Expectation: High Schools: The articulation of the concepts and skills of a standard that indicates a student is making progress toward being a prepared graduate.

Grade Level Expectations: The articulation, at each grade level, the concepts and skills of a standard that indicates a student is making progress toward being ready for high school.

What do students need to know?

Evidence Outcomes	**21st Century Skills and Readiness Competencies**
Students can: Evidence outcomes are the indication that a student is meeting an expectation at the mastery level. *How do we know that a student can do it?*	**Inquiry Questions:** Sample questions intended to promote deeper thinking, reflection and refined understandings precisely related to the grade level expectation.
	Relevance and Application: Examples of how the grade level expectation is applied at home, on the job or in a real-world, relevant context.
	Nature of the Discipline: The characteristics and viewpoint one keeps as a result of mastering the grade level expectation.

Prepared Graduate Competencies in Science

The preschool through twelfth-grade concepts and skills that all students who complete the Colorado education system must master to ensure their success in a postsecondary and workforce setting.

Prepared Graduates:

- Observe, explain, and predict natural phenomena governed by Newton's laws of motion, acknowledging the limitations of their application to very small or very fast objects
- Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions
- Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable
- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection
- Explain and illustrate with examples how living systems interact with the biotic and abiotic environment
- Analyze how various organisms grow, develop, and differentiate during their lifetimes based on an interplay between genetics and their environment
- Explain how biological evolution accounts for the unity and diversity of living organisms
- Describe and interpret how Earth's geologic history and place in space are relevant to our understanding of the processes that have shaped our planet
- Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system
- Describe how humans are dependent on the diversity of resources provided by Earth and Sun

Standards in Science

Standards are the topical organization of an academic content area. The three standards of science are:

1. **Physical Science**
   Students know and understand common properties, forms, and changes in matter and energy.

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.

3. **Earth Systems 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.

Science
Grade Level Expectations at a Glance

Standard	Grade Level Expectation
Eighth Grade	
1. Physical Science	1. Identify and calculate the direction and magnitude of forces that act on an object, and explain the results in the object's change of motion 2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved 3. Distinguish between physical and chemical changes, noting that mass is conserved during any change 4. Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties
2. Life Science	1. Human activities can deliberately or inadvertently alter ecosystems and their resiliency 2. Organisms reproduce and transmit genetic information (genes) to offspring, which influences individuals' traits in the next generation
3. Earth Systems Science	1. Weather is a result of complex interactions of Earth's atmosphere, land and water, that are driven by energy from the sun, and can be predicted and described through complex models 2. Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location 3. The solar system is comprised of various objects that orbit the Sun and are classified based on their characteristics 4. The relative positions and motions of Earth, Moon, and Sun can be used to explain observable effects such as seasons, eclipses, and Moon phases

21st Century Skills and Readiness Competencies in Science

Colorado's Description of 21st Century Skills

Colorado's description of 21st century skills is a synthesis of the essential abilities students must apply in our rapidly changing world. Today's students need a repertoire of knowledge and skills that are more diverse, complex, and integrated than any previous generation. These skills do not stand alone in the standards, but are woven into the evidence outcomes, inquiry questions, and application and are within the nature of science. Science inherently demonstrates each of Colorado's 21st century skills, as follows:

Critical Thinking and Reasoning

Science requires students to analyze evidence and draw conclusions based on that evidence. Scientific investigation involves defining problems and designing studies to test hypotheses related to those problems. In science, students must justify and defend scientific explanations and distinguish between correlation and causation.

Information Literacy

Understanding science requires students to research current ideas about the natural world. Students must be able to distinguish fact from opinion and truth from fantasy. Science requires a degree of skepticism because the ideas of science are subject to change. Science students must be able to understand what constitutes reliable sources of information and how to validate those sources. One key to science is understanding that converging different lines of evidence from multiple sources strengthens a scientific conclusion.

Collaboration

Science students must be able to listen to others' ideas, and engage in scientific dialogs that are based on evidence – not opinion. These types of conversations allow them to compare and evaluate the merit of different ideas. The peer review process helps to ensure the validity of scientific explanations.

Self-Direction

Students in science must have persistence and perseverance when exploring scientific concepts. Students must generate their own questions, and design investigations to find the answers. Students must be open to revising and redefining their thinking based on evidence.

Invention

Designing investigations and engineering new products involves a large degree of invention. Scientists and engineers often have to think "outside the box" as they push the limits of our current knowledge. They must learn from their failures to take the next steps in understanding. Science students also must integrate ideas from multiple disciplines to formulate an understanding of the natural world. In addition to using invention to design investigations, scientists also use findings from investigations to help them to invent new products.

Colorado's Description for School Readiness
(Adopted by the State Board of Education, December 2008)
School readiness describes both the preparedness of a child to engage in and benefit from learning experiences, and the ability of a school to meet the needs of all students enrolled in publicly funded preschools or kindergartens. School readiness is enhanced when schools, families, and community service providers work collaboratively to ensure that every child is ready for higher levels of learning in academic content.

Colorado's Description of Postsecondary and Workforce Readiness
(Adopted by the State Board of Education, June 2009)
Postsecondary and workforce readiness describes the knowledge, skills, and behaviors essential for high school graduates to be prepared to enter college and the workforce and to compete in the global economy. The description assumes students have developed consistent intellectual growth throughout their high school career as a result of academic work that is increasingly challenging, engaging, and coherent. Postsecondary education and workforce readiness assumes that students are ready and able to demonstrate the following without the need for remediation: Critical thinking and problem-solving; finding and using information/information technology; creativity and innovation; global and cultural awareness; civic responsibility; work ethic; personal responsibility; communication; and collaboration.

How These Skills and Competencies are Embedded in the Revised Standards
Three themes are used to describe these important skills and competencies and are interwoven throughout the standards: *inquiry questions; relevance and application; and the nature of each discipline.* These competencies should not be thought of stand-alone concepts, but should be integrated throughout the curriculum in all grade levels. Just as it is impossible to teach thinking skills to students without the content to think about, it is equally impossible for students to understand the content of a discipline without grappling with complex questions and the investigation of topics.

Inquiry Questions – Inquiry is a multifaceted process requiring students to think and pursue understanding. Inquiry demands that students (a) engage in an active observation and questioning process; (b) investigate to gather evidence; (c) formulate explanations based on evidence; (d) communicate and justify explanations, and; (e) reflect and refine ideas. Inquiry is more than hands-on activities; it requires students to cognitively wrestle with core concepts as they make sense of new ideas.

Relevance and Application – The hallmark of learning a discipline is the ability to apply the knowledge, skills, and concepts in real-world, relevant contexts. Components of this include solving problems, developing, adapting, and refining solutions for the betterment of society. The application of a discipline, including how technology assists or accelerates the work, enables students to more fully appreciate how the mastery of the grade level expectation matters after formal schooling is complete.

Nature of Discipline – The unique advantage of a discipline is the perspective it gives the mind to see the world and situations differently. The characteristics and viewpoint one keeps as a result of mastering the grade level expectation is the nature of the discipline retained in the mind's eye.

1. Physical Science

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

Prepared Graduates
The preschool through twelfth-grade concepts and skills that all students who complete the Colorado education system must master to ensure their success in a postsecondary and workforce setting.

Prepared Graduate Competencies in the Physical Science standard:

- Observe, explain, and predict natural phenomena governed by Newton's laws of motion, acknowledging the limitations of their application to very small or very fast objects
- Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions
- Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable

Content Area: Science
Standard: 1. Physical Science

Prepared Graduates:

- Observe, explain, and predict natural phenomena governed by Newton's laws of motion, acknowledging the limitations of their application to very small or very fast objects

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

1. Identify and calculate the direction and magnitude of forces that act on an object, and explain the results in the object's change of motion

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Predict and evaluate the movement of an object by examining the forces applied to it (DOK 1-2) b. Use mathematical expressions to describe the movement of an object (DOK 1-2) c. Develop and design a scientific investigation to collect and analyze speed and acceleration data to determine the net forces acting on a moving object (DOK 2-4)	**Inquiry Questions:** 1. What relationships exists among force, mass, speed, and acceleration? 2. What evidence indicates a force has acted on a system? Is it possible for a force to act on a system without having an effect?
	Relevance and Application: 1. Engineers take forces into account when designing moving objects such as car tires, roller coasters, and rockets. 2. Vehicles and their propulsion systems are designed by analyzing the forces that act on the vehicle. For example, the designs of propellers and jet engines are based on the aerodynamics of airplanes.
	Nature of Science: 1. Recognize that our current understanding of forces has developed over centuries of studies by many scientists, and that we will continue to refine our understanding of forces through continued scientific investigations and advances in data collection. 2. Find, evaluate, and select appropriate information from reference books, journals, magazines, online references, and databases to answer scientific questions about motion and acceleration. (DOK 1-2)

Content Area: Science
Standard: 1. Physical Science

Prepared Graduates:

- Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Gather, analyze, and interpret data to describe the different forms of energy and energy transfer (DOK 1-2) b. Develop a research-based analysis of different forms of energy and energy transfer (DOK 1-3) c. Use research-based models to describe energy transfer mechanisms, and predict amounts of energy transferred (DOK 1-2)	**Inquiry Questions:** 1. Which forms of energy can be directly observed, and which forms of energy must be inferred? 2. What evidence supports the existence of potential and kinetic energy? 3. Is there a limit to how many times energy can be transferred? Explain your answer. **Relevance and Application:** 1. Photos and measurements of accident investigation provide evidence of energy transfers during such events. 2. Kinetic energy often is turned into heat such as when brakes are applied to a vehicle or when space vehicles re-enter Earth's atmosphere. 3. Energy transfers convert electricity to light, heat, or kinetic energy in motors. 4. There are ways of producing electricity using both nonrenewable resources such as such as coal or natural gas and renewable sources such as hydroelectricity or solar, wind, and nuclear power. **Nature of Science:** 1. Share experimental data, and respectfully discuss conflicting results. (DOK 2-3) 2. Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others. 3. Use tools to gather, view, analyze, and report results for scientific investigations designed to answer questions about energy transformations. (DOK 1-2)

Content Area: Science
Standard: 1. Physical Science

Prepared Graduates:

- Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

3. Distinguish between physical and chemical changes, noting that mass is conserved during any change

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Identify the distinguishing characteristics between a chemical and a physical change (DOK 1) b. Gather, analyze, and interpret data on physical and chemical changes (DOK 1-2) c. Gather, analyze, and interpret data that show mass is conserved in a given chemical or physical change (DOK 1-2) d. Identify evidence that suggests that matter is always conserved in physical and chemical changes (DOK 1) e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate physical and chemical changes (DOK 1-2)	**Inquiry Questions:** 1. What evidence can indicate whether a change is physical or chemical? 2. Is it easier to observe the conservation of mass in physical or chemical changes? Why? 3. What would happen if mass were not conserved? **Relevance and Application:** 1. The freezing, thawing, and vaporization of Earth's water provide examples of physical changes. 2. An understanding of chemical changes have resulted in the design various products such as refrigerants in air conditioners and refrigerators. 3. Physical and chemical changes are involved in the collection and refinement of natural resources such as using arsenic in gold mining. 4. Living systems conserve mass when waste products from some organisms are nutrients for others. **Nature of Science:** 1. Evaluate the reproducibility of an experiment, and critically examine conflicts in experimental results. (DOK 2-3) 2. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists. (DOK 2-3)

Content Area: Science
Standard: 1. Physical Science

Prepared Graduates:

- Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

4. Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Compare and contrast different types of waves (DOK 1-2) b. Describe for various waves the amplitude, frequency, wavelength, and speed (DOK 1) c. Describe the relationship between pitch and frequency in sound (DOK 1) d. Develop and design a scientific investigation regarding absorption, reflection, and refraction of light (DOK 2-4)	**Inquiry Questions:** 1. What are some different ways to describe waves? **Relevance and Application:** 1. Different vibrations create waves with different characteristics. For example, a vibrating low-pitch guitar string feels different to the touch than a high-pitch guitar string. 2. Dealing with different types of waves presents design challenges. For example, higher frequency waves have shorter wavelengths, which affect ships, buildings, and antenna design. 3. Energy from different types of waves can affect the environment. For example, natural waves cause different beach erosion and boat wakes 4. There are many applications of light and lasers such as using fiber optics in high speed communication and lasers in surgery. 5. Living organisms collect and use light and sound waves – such as for hearing and vision – to gather information about their surroundings. **Nature of Science:** 1. Evaluate models used to explain and predict wave phenomena that cannot be directly measured. (DOK 2-3) 2. Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere. For example, the speed of light in a vacuum is constant across space and time. 3. Select and use technology tools to gather, view, analyze, and report results for scientific investigations about the characteristics and properties of waves. (DOK 1-2)

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.

Prepared Graduates
The preschool through twelfth-grade concepts and skills that all students who complete the Colorado education system must master to ensure their success in a postsecondary and workforce setting.

Prepared Graduate Competencies in the Life Science standard:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection
- Explain and illustrate with examples how living systems interact with the biotic and abiotic environment
- Analyze how various organisms grow, develop, and differentiate during their lifetimes based on an interplay between genetics and their environment
- Explain how biological evolution accounts for the unity and diversity of living organisms

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Explain and illustrate with examples how living systems interact with the biotic and abiotic environment

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

1. Human activities can deliberately or inadvertently alter ecosystems and their resiliency

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Develop, communicate, and justify an evidence-based scientific example of how humans can alter ecosystems (DOK 1-3) b. Analyze and interpret data about human impact on local ecosystems (DOK 1-3) c. Recognize and infer bias in print and digital resources while researching an environmental issue (DOK 1-3) d. Use technology resources such as online encyclopedias, online databases, and credible websites to locate, organize, analyze, evaluate, and synthesize information about human impact on local ecosystems (DOK 1-2) e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate an environmental issue (DOK 1-2)	**Inquiry Questions:** 1. Do humans have a unique responsibility to the ecosystems in which they live? 2. How can a young person be a steward of an ecosystem? **Relevance and Application:** 1. Human activities such as cutting down forests and polluting water or covering deserts with fields of solar panels are constantly changing various cycles and habitats in the natural world. 2. There are laws that preserve and protect wilderness areas such as national parks and other natural areas but such laws also limit the utilization of the natural resources in those areas. **Nature of Science:** 1. Critically evaluate scientific claims in popular media and peer generated explanations regarding interactions in ecosystems, and determine if the evidence presented is appropriate and sufficient to support the claims.

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze how various organisms grow, develop, and differentiate during their lifetimes based on an interplay between genetics and their environment

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

2. Organisms reproduce and transmit genetic information (genes) to offspring, which influences individuals' traits in the next generation

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Develop, communicate, and justify an evidence-based scientific explanation for how genetic information is passed to the next generation (DOK 1-3) b. Use direct and indirect observations, evidence, and data to support claims about genetic reproduction and traits of individuals (DOK 1-3) c. Gather, analyze, and interpret data on transmitting genetic information (DOK 1-2) d. Use models and diagrams to predict the phenotype and genotype of offspring based on the genotype of the parents (DOK 1-2) e. Use computer simulations to model and predict phenotype and genotype of offspring based on the genotype of the parents (DOK 1-2)	**Inquiry Questions:** 1. How are traits passed from one generation to the next? 2. What traits can be passed to the next generation and what traits cannot? 3. How can patterns in the inheritance of traits be used to predict how frequently they appear in offspring? **Relevance and Application:** 1. There are benefits and risks to genetic engineering such as cloning, genetically modifying organisms, and replacing genes for therapy. 2. Genome sequencing has many potential applications to the field of medicine. **Nature of Science:** 1. Understand the interconnected nature of math and science by utilizing math in the prediction of future generations. (DOK 2) 2. Recognize that current understanding of genetics has developed over time and become more sophisticated as new technologies have lead to new evidence. (DOK 1) 3. Critically evaluate models used to represent deoxyribonucleic acid (DNA) and genes; identify strengths and weaknesses of these models for representing complex natural phenomena. (DOK 2-3)

3. Earth Systems 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.

Prepared Graduates:
The preschool through twelfth-grade concepts and skills that all students who complete the Colorado education system must master to ensure their success in a postsecondary and workforce setting.

Prepared Graduate Competencies in the Earth Systems Science standard:

- Describe and interpret how Earth's geologic history and place in space are relevant to our understanding of the processes that have shaped our planet
- Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system
- Describe how humans are dependent on the diversity of resources provided by Earth and Sun

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

1. Weather is a result of complex interactions of Earth's atmosphere, land and water, that are driven by energy from the sun, and can be predicted and described through complex models

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Differentiate between basic and severe weather conditions, and develop an appropriate action plan for personal safety and the safety of others (DOK 1-3) b. Observe and gather data for various weather conditions and compare to historical data for that date and location (DOK 1-2) c. Use models to develop and communicate a weather prediction (DOK 1-2)	**Inquiry Questions:** 1. Why does weather vary from day to day? 2. What are the strengths and limitations of different types of weather models? 3. What are the variables that make predicting weather challenging? 4. How do weather patterns relate to climate?
	Relevance and Application: 1. Weather stations, buoys, satellites, radar, and computer modeling are examples of technology used to help forecast weather. 2. Weather prediction is based on the interaction of many variables. 3. Weather prediction can save lives, protect property, and conserve resources.
	Nature of Science: 1. Evaluate of the accuracy of various tools used in forecasting weather. (DOK 2-3) 2. Use the historical context and impact of early weather research and consider the potential implications for current weather studies on science and our society. (DOK 1-3)

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

2. Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Develop, communicate and justify an evidence-based scientific explanation to account for Earth's different climates (DOK 1-3) b. Research and evaluate direct and indirect evidence to explain how climates vary from one location to another on Earth (DOK 2-3) c. Examine, evaluate, and question information from a variety of sources and media to investigate how climates vary from one location to another on Earth (DOK 2-3)	**Inquiry Questions:** 1. How does the climate in one area compare and contrast with another area? 2. Why are there different climates on Earth? 3. How has Earth's climate changed over time? 4. What evidence supports and/or contradicts human influence on climate change? 5. What is the difference between weather and climate?
	Relevance and Application: 1. Data tables, charts, and graphs allow people to compare and contrast various climates around the globe. 2. Computer models help people understand past, present, and future climates.
	Nature of Science: 1. Ask testable questions and make a falsifiable hypothesis about earth's climate and use an inquiry based approach to find an answer. (DOK 1-4) 2. Describe various techniques that scientists use to study climate, and suggest ways that each technique can be used to better understand various climates and changes in climate. (DOK 1-2)

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Describe and interpret how Earth's geologic history and place in space are relevant to our understanding of the processes that have shaped our planet

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

3. The solar system is comprised of various objects that orbit the Sun and are classified based on their characteristics

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Construct a scale model of the solar system, and use it to explain the motion of objects in the system such a planets, Sun, Moons, asteroids, comets, and dwarf planets (DOK 2-3) b. Describe methods and equipment used to explore the solar system and beyond (DOK 1) c. Design an investigation that involves direct observation of objects in the sky, and analyze and explain results (DOK 2-4) d. Research, critique, and communicate scientific theories that explain how the solar system was formed (DOK 1-3) e. Use computer data sets and simulations to explore objects in the solar system (DOK 1-2) f. Recognize that mathematical models are used to predict orbital paths and events (DOK 1)	**Inquiry Questions:** 1. How are the various bodies in the solar system similar and different? 2. How does investigating characteristics of the various bodies in the solar system provide clues to Earth's origin and evolution? 3. Why do objects such as satellites, Moons and planets stay in orbit? 4. How is the life cycle of a star such as the Sun similar to the cycle of life on Earth? **Relevance and Application:** 1. Various technological methods and equipment such as telescopes are used to investigate far-away objects in the solar system and beyond. 2. By representing galaxies and solar systems, planetariums allow people to simulate the experience of outer space. **Nature of Science:** 1. Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere – that planets follow the same rules about forces as other objects. (DOK 1) 2. Recognize that our current understanding of the solar system has developed over centuries of studies by many scientists, and that through continued scientific investigations and advances in data collection, we will continue to refine our understanding of the solar system.

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Describe and interpret how Earth's geologic history and place in space are relevant to our understanding of the processes that have shaped our planet

Grade Level Expectation: Eighth Grade

Concepts and skills students master:

4. The relative positions and motions of Earth, Moon, and Sun can be used to explain observable effects such as seasons, eclipses, and Moon phases

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Develop, communicate, and justify an evidence-based explanation using relative positions of Earth, Moon, and Sun to explain the following natural phenomenon: 1. Tides 2. Eclipses of the Sun and Moon 3. Different shapes of the Moon as viewed from Earth b. Analyze and interpret data to explain why we have seasons (DOK 1-2) c. Use models to explain the relative motions of Earth, Moon, and Sun over time (DOK 1-2)	**Inquiry Questions:** 1. Why do we observe changes in the relative positions of Earth, Moon, and Sun from Earth over time? 2. How do the relative positions of Earth, Moon and Sun affect natural phenomenon on Earth? **Relevance and Application:** 1. Different tools are used to help understand motion in the solar system. 2. Space missions can be planned because we understand planetary motion. **Nature of Science:** 1. Explore the global consequences of the interrelationships among science, technology and human activity. (DOK 1-4) 2. Evaluate visual and print media for scientific evidence, bias, and conjecture related to the historical ideas about relative positions of the Earth, Moon and Sun. (DOK 1-3)

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