

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: High School

Concepts and skills students master:

1. Newton's laws of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion – but have limitations

Evidence Outcomes

Students can:

- a. Gather, analyze and interpret data and create graphs regarding position, velocity and acceleration of moving objects
- b. Develop, communicate and justify an evidence-based analysis of the forces acting on an object and the resultant acceleration produced by a net force
- c. Develop, communicate and justify an evidence-based scientific prediction regarding the effects of the action-reaction force pairs on the motion of two interacting objects
- d. Examine the effect of changing masses and distance when applying Newton's law of universal gravitation to a system of two bodies
- e. Identify the limitations of Newton's laws in extreme situations

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How can forces be acting on an object without changing the object's motion?
2. Why do equal but opposite action and reaction forces not cancel?

Relevance and Application:

1. Newton's laws are used in a variety of design processes such as vehicle safety, aerospace, bridge design and interplanetary probes.
2. An understanding of forces leads to safer building designs such as earthquake-safe buildings.
3. Forces present in the earth lead to plate tectonics.

Nature of Science:

1. Use an inquiry approach to answer a testable question about an application of Newton's laws of motion.
2. Share experimental data, respectfully discuss conflicting results, and analyze ways to minimize error and uncertainty in measurement.
3. Differentiate between the use of the terms "law" and "theory" as they are defined and used in science compared to how they are used in other disciplines or common use.
4. Use technology to perform calculations and to organize, analyze and report data.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Gather, record and interpret data about speed and direction of moving objects
- II. Demonstrate that objects with greater mass require greater force to initiate or change movement
- III. Predict action-reaction relationships between moving objects

Extended Readiness Competencies

Content based access skills:

1. Expressing an understanding of change due to mass and speed
2. Expressing an understanding of differences in speed
3. Connecting meaning to a symbol related to movement and mass of an object

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: High School

Concepts and skills students master:

2. Matter has definite structure that determines characteristic physical and chemical properties

Evidence Outcomes

Students can:

- Develop, communicate, and justify an evidence-based scientific explanation supporting the current model of an atom
- Gather, analyze and interpret data on chemical and physical properties of elements such as density, melting point, boiling point, and conductivity
- Use characteristic physical and chemical properties to develop predictions and supporting claims about elements' positions on the periodic table
- Develop a model that differentiates atoms and molecules, elements and compounds, and pure substances and mixtures

21st Century Skills and Readiness Competencies

Inquiry Questions:

- What patterns can be observed in the properties of elements and families in the periodic table?
- What properties do nanoscale particles have that are different than those of macroscopic samples of the same substance?

Relevance and Application:

- The unique properties of various elements make them useful for specific applications. For example, metalloids and semiconductors are useful in electronic applications.
- Alloys are created by combining metals with other elements to produce materials with useful properties that are not found in nature. For example, iron and carbon make steel.
- Consumers can make informed decisions regarding the purchase of household chemicals when they understand chemical properties and their implications. For example, choosing lead based versus non-lead based paints weighs safety concerns against color and durability in applications.
- The unique properties of nanoscale particles provide special benefits and dangers.

Nature of Science:

- Recognize that the current understanding of molecular structure related to the physical and chemical properties of matter has developed over time and become more sophisticated as new technologies have led to new evidence.
- Ask testable questions about the nature of matter, and use an inquiry approach to investigate it.

Extended Evidence Outcomes

With appropriate supports, students can:

- Gather data and justify grouping of objects or materials based on chemical and physical properties (e.g. melting point, boiling, conductivity)
- Demonstrate that different ratios of substances can be combined to create unique mixtures
- Explore the relationship between atoms, molecules, elements and compounds

Extended Readiness Competencies

Content based access skills:

- Working cooperatively with others in a group science experiment or lab related to chemical and physical properties of objects
- Manipulating materials to create different mixtures
- Manipulating and using scientific tools

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: High School

Concepts and skills students master:

- 3. Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy

Evidence Outcomes

Students can:

- a. Recognize, analyze, interpret, and balance chemical equations (synthesis, decomposition, combustion, and replacement) or nuclear equations (fusion and fission)
- b. Predict reactants and products for different types of chemical and nuclear reactions
- c. Predict and calculate the amount of products produced in a chemical reaction based on the amount of reactants
- d. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate the conservation of mass and energy

21st Century Skills and Readiness Competencies

Inquiry Questions:

- 1. What patterns of chemical reactions exist?
- 2. How are chemical reactions distinguished from nuclear reactions?

Relevance and Application:

- 1. Products formed in different types of reactions are useful to people. For example, polymerase reactions making nylon.
- 2. The use of chemicals can have both positive and negative environmental effects. For example, the use of lime to make acidic soils more productive or the use of CFCs causing the ozone hole.
- 3. When using radioactive substances, there are benefits such as medicine and energy production as well as dangers such as environmental and health concerns.

Nature of Science:

- 1. Critically evaluate chemical and nuclear change models.
- 2. Identify the strengths and weaknesses of a model which represents complex natural phenomenon.
- 3. Use an inquiry approach to test predictions about chemical reactions.
- 4. Share experimental data, and respectfully discuss conflicting results.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify common household products or processes that use chemical reactions

Extended Readiness Competencies

Content based access skills:

- 1. Attaching meaning to symbols related to hazardous materials

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: High School

Concepts and skills students master:

4. Atoms bond in different ways to form molecules and compounds that have definite properties

Evidence Outcomes

Students can:

- Develop, communicate, and justify an evidence-based scientific explanation supporting the current models of chemical bonding
- Gather, analyze, and interpret data on chemical and physical properties of different compounds such as density, melting point, boiling point, pH, and conductivity
- Use characteristic physical and chemical properties to develop predictions and supporting claims about compounds' classification as ionic, polar or covalent
- Describe the role electrons play in atomic bonding
- Predict the type of bonding that will occur among elements based on their position in the periodic table

21st Century Skills and Readiness Competencies

Inquiry Questions:

- How can various substances be classified as ionic or covalent compounds?
- What role do electrons play in different types of chemical bonds?

Relevance and Application:

- Related compounds share some properties that help focus chemists when looking for a substance with particular properties for a specific application. For example, finding new super conductors.
- Carbon atoms bond in ways that provide the foundation for a wide range of applications. For example, forming chains and rings such as sugars and fats that are essential to life and developing synthetic fibers and oils.
- Living systems create and use various chemical compounds such as plants making sugars from photosynthesis and chemicals that can be used as medicine, and endocrine glands producing hormones.

Nature of Science:

- Recognize that the current understanding of molecular structure related to the physical and chemical properties of matter has developed over time and become more sophisticated as new technologies have led to new evidence.
- Employ data-collection technology to gather, view, analyze, and interpret data about chemical and physical properties of different compounds.

Extended Evidence Outcomes

With appropriate supports, students can:

- Demonstrate how two or more objects can be connected together to create a different product or outcome
- Demonstrate that different bonding agents have different properties

Extended Readiness Competencies

Content based access skills:

- Manipulating materials to bond two or more objects
- Using and organizing objects based on combining two substances

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: High School

Concepts and skills students master:

5. Energy exists in many forms such as mechanical, chemical, electrical, radiant, thermal, and nuclear, that can be quantified and experimentally determined

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation regarding the potential and kinetic nature of mechanical energy
- b. Use appropriate measurements, equations and graphs to gather, analyze, and interpret data on the quantity of energy in a system or an object
- c. Use direct and indirect evidence to develop predictions of the types of energy associated with objects
- d. Identify different energy forms, and calculate their amounts by measuring their defining characteristics

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What factors can be measured to determine the amount of energy associated with an object?
2. What are the most common forms of energy in our physical world?
3. What makes an energy form renewable or nonrenewable?
4. What makes some forms of energy hard to measure?

Relevance and Application:

1. Society and energy providers must conduct a cost-benefit analysis of different ways to provide electricity to our society.
2. An understanding of energy transformations is necessary when designing clean energy systems that convert any type of energy into electricity such as wind generators and solar cells.
3. There are advantages and disadvantages to using various energy sources such as gasoline, diesel, ethanol, hydrogen, and electricity as transportation fuel.
4. Politics plays a role in shaping energy policy such as balancing conflicting stakeholder needs.
5. Energy plays a role in living systems and Earth's systems. For example, cells convert sugar to ATP and then to energy, energy inside the earth drives plate tectonic phenomena such as earthquakes and volcanoes, and energy from the Sun drives weather.

Nature of Science:

1. Critically evaluate scientific claims made in popular media or by peers regarding the application of energy forms, and determine if the evidence presented is appropriate and sufficient to support the claims.
2. Use the historical context and impact of early energy research and consider the potential implications for current energy studies on science and our society.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Describe ways in which nonliving objects get energy
- II. Identify a source for each type of energy (heat, sound, light, mechanical, electrical)
- III. Predict types of energy associated with objects (heat, sound, light, mechanical, electrical)

Extended Readiness Competencies

Content based access skills:

1. Gaining and maintaining attention to energy sources
2. Expressing an understanding of change in sound, heat and light
3. Expressing an understanding of differences in electrical sources
4. Selecting careers related energy

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: High School

Concepts and skills students master:

6. When energy changes form, it is neither created nor destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases

Evidence Outcomes

Students can:

- a. Use direct and indirect evidence to develop and support claims about the conservation of energy in a variety of systems, including transformations to heat
- b. Evaluate the energy conversion efficiency of a variety of energy transformations
- c. Describe energy transformations both quantitatively and qualitatively
- d. Differentiate among the characteristics of mechanical and electromagnetic waves that determine their energy
- e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate energy conservation and loss

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. Why is 100 percent efficiency impossible in an energy transformation?
2. How does the law of conservation of energy help us solve problems involving complex systems?
3. Scientists or engineers often say energy is "lost." Is there a word that might be better than "lost?" Why?

Relevance and Application:

1. Incremental strides have been made in improving the efficiency of different forms of energy production and consumption. For example, today's engines are much more efficient than those from 50 years ago, and batteries are more powerful and last longer than those from just a few years ago.
2. Different technologies such as light-emitting diodes, compact fluorescent lights, and incandescent light bulbs have different efficiencies and environmental impacts.

Nature of Science:

1. Critically evaluate scientific claims made in popular media or by peers regarding the application of energy transformations, and determine if the evidence presented is appropriate and sufficient to support the claims.
2. Ask testable questions and make a falsifiable hypothesis about the conservation of energy, and use an inquiry approach to find an answer.
3. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Predict and experiment with energy transformations.
- II. Select examples of energy transformations

Extended Readiness Competencies

Content based access skills:

1. Connecting meaning to symbols related to movement and force of movement
2. Expressing an understanding of change of movement in inanimate objects
3. Expressing an understanding of differences in force

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

Students can:

- a. Predict and evaluate the movement of an object by examining the forces applied to it
- b. Use mathematical expressions to describe the movement of an object
- 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

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What relationships exist 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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Gather and record data about speed of moving objects
- II. Gather and record data about the direction force causes an object to move

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to movement and speed
2. Gaining and maintaining attention to direction and speed
3. Expressing an understanding of change due to speed of a moving object

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

Students can:

- a. Gather, analyze, and interpret data to describe the different forms of energy and energy transfer
- b. Develop a research-based analysis of different forms of energy and energy transfer
- c. Use research-based models to describe energy transfer mechanisms, and predict amounts of energy transferred

21st Century Skills and Readiness Competencies

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 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.
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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Select examples of different forms of energy (heat, sound, light, mechanical, and electrical)

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to light and heat
2. Making choices related to sources of light, heat, sound, and electricity
3. Selecting careers related to electricity

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

Students can:

- Identify the distinguishing characteristics between a chemical and a physical change
- Gather, analyze, and interpret data on physical and chemical changes
- Gather, analyze, and interpret data that show mass is conserved in a given chemical or physical change
- Identify evidence that suggests that matter is always conserved in physical and chemical changes
- Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate physical and chemical changes

21st Century Skills and Readiness Competencies

Inquiry Questions:

- What evidence can indicate whether a change is physical or chemical?
- Is it easier to observe the conservation of mass in physical or chemical changes? Why?
- What would happen if mass were not conserved?

Relevance and Application:

- The freezing, thawing, and vaporization of Earth's water provide examples of physical changes.
- An understanding of chemical changes have resulted in the design various products such as refrigerants in air conditioners and refrigerators.
- Physical and chemical changes are involved in the collection and refinement of natural resources such as using arsenic in gold mining.
- Living systems conserve mass when waste products from some organisms are nutrients for others.

Nature of Science:

- Evaluate the reproducibility of an experiment, and critically examine conflicts in experimental results.
- Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.

Extended Evidence Outcomes

With appropriate supports, students can:

- Identify an object/substance as having undergone a chemical or physical change
- Identify an object before and after a chemical change or physical change

Extended Readiness Competencies

Content based access skills:

- Attaching meaning to symbols related to chemical and physical changes
- Recognizing changes in objects due to a physical change

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

Students can:

- a. Compare and contrast different types of waves
- b. Describe for various waves the amplitude, frequency, wavelength, and speed
- c. Describe the relationship between pitch and frequency in sound
- d. Develop and design a scientific investigation regarding absorption, reflection, and refraction of light

21st Century Skills and Readiness Competencies

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.
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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify sources of waves (e.g. bell, sun, vibration, seismic, water)
- II. Compare and contrast different water or sound waves using amplitude, frequency, wavelength, and speed.
- III. Identify materials that absorb, reflect, and refract light.

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to sources of waves
2. Making choices related to light, heat and sound
3. Selecting technology appropriate to demonstrating waves

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: Seventh Grade

Concepts and skills students master:

1. Mixtures of substances can be separated based on their properties such as solubility, boiling points, magnetic properties, and densities

Evidence Outcomes

Students can:

- a. Identify properties of substances in a mixture that could be used to separate those substances from each other
- b. Develop and design a scientific investigation to separate the components of a mixture

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What techniques can be used to separate mixtures of substances based their properties?
2. Which properties are the most useful in trying to separate mixtures of substances?
3. How much difference must there be among the properties of substances for the properties to be useful in separating the substances?

Relevance and Application:

1. Materials are sorted based on their properties in a variety of applications. For example, water filtration systems rely on the solubility, density, and physical sizes of substances and recycling facilities use the properties of materials to separate substances in single-stream recycling systems.
2. Mining and oil refining processes use properties to separate materials.
3. The kidneys use properties to filter wastes from the blood.

Nature of Science:

1. Ask testable questions and make a falsifiable hypothesis about using properties in perform separations, and design a method to find an answer.
2. Evaluate and critique experimental procedures designed to separate mixtures.
3. Share experimental data, and respectfully discuss inconsistent results.
4. Describe several ways in which scientists would study mixtures, and suggest ways that this has contributed to our understanding of materials.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Conduct a simple experiment to separate the components of a mixture
- II. Identify properties of different substances in a simple mixture
- III. Identify tools used to separate substances in a simple mixture

Extended Readiness Competencies

Content based access skills:

1. Working cooperatively with others in a group science experiment or lab
2. Manipulating materials in a mixture
3. Using and organizing objects based on physical properties

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: Sixth Grade

Concepts and skills students master:

1. All matter is made of atoms, which are far too small to see directly through a light microscope. Elements have unique atoms and thus, unique properties. Atoms themselves are made of even smaller particles

Evidence Outcomes

Students can:

- a. Identify evidence that suggests there is a fundamental building block of matter
- b. Use the particle model of matter to illustrate characteristics of different substances
- c. Develop an evidence based scientific explanation of the atomic model as the foundation for all chemistry
- d. Find and evaluate appropriate information from reference books, journals, magazines, online references, and databases to compare and contrast historical explanations for the nature of matter

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. In the world of science what makes something a building block?

Relevance and Application:

1. Living things consist of the same matter as the rest of the universe.

Nature of Science:

1. Work in groups using the writing process to effectively communicate an understanding of the particle model of matter.
2. Use technology to share research findings about historical explanations for the nature of matter and to publish information to various audiences.
3. Create models that explain the particle theory of matter.
4. 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 others work.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify tools that are used to observe objects that are too small to be seen by the human eye
- II. Identify the representation of an atom and molecule

Extended Readiness Competencies

Content based access skills:

1. Manipulating and using magnification tools
2. Following and giving directions related to a science lab

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: Sixth Grade

Concepts and skills students master:

2. Atoms may stick together in well-defined molecules or be packed together in large arrays. Different arrangements of atoms into groups compose all substances

Evidence Outcomes

Students can:

- Explain the similarities and differences between elements and compounds
- Identify evidence suggesting that atoms form into molecules with different properties than their components
- Find and evaluate information from a variety of resources about molecules

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. Why do substances behave differently? For example, why does water pour rapidly while syrup pours slowly?

Relevance and Application:

1. Different arrangements of atoms provide different properties.
2. Very small devices consist of large numbers of arranged groups of atoms that perform a specific function.

Nature of Science:

1. Use models and/or electronic media to show and understand how molecules are made of atoms.
2. Investigate how our current understanding of matter has developed through centuries of scientific investigations.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Demonstrate that objects (that are made of parts) can be separated into its individual parts

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to a whole and a part of an object
2. Gaining and maintaining attention to objects and how they can be separated into parts
3. Expressing an understanding of change due to separation of parts
4. Expressing an understanding of differences in whole and parts of objects

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: Sixth Grade

Concepts and skills students master:

3. The physical characteristics and changes of solid, liquid, and gas states can be explained using the particulate model

Evidence Outcomes

Students can:

- Explain how the arrangement and motion of particles in a substance such as water determine its state
- Distinguish between changes in temperature and changes of state using the particle model of matter

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What determines whether matter is in the form of a solid, liquid, or gas?
2. What is the kinetic molecular theory, and how does temperature affect the behavior of particles in a gas?

Relevance and Application:

1. Solids, liquids, and gasses all have unique properties that make them useful in different situations. For example, solids are useful building materials.

Nature of Science:

1. Use models and technology tools to help visualize what is happening at the molecular level during phase changes.
2. Understand and apply the difference between scientific laws, theories and hypotheses.
3. Work in groups using the writing process to communicate an understanding how the particle model of matter explains various states of matter.

Extended Evidence Outcomes

With appropriate supports, students can:

- Explain the relationship between changes in temperature and changes of state of water
- Identify objects or substances as a solid, liquid or gas
- Identify the qualitative characteristics of solids, liquids and gases

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to states of water
2. Expressing an understanding of differences between solids and liquids
3. Manipulating states of water

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: Sixth Grade

Concepts and skills students master:

4. Distinguish among, explain, and apply the relationships among mass, weight, volume, and density

Evidence Outcomes

Students can:

- a. Explain that the mass of an object does not change, but its weight changes based on the gravitational forces acting upon it
- b. Predict how changes in acceleration due to gravity will affect the mass and weight of an object
- c. Predict how mass, weight, and volume affect density
- d. Measure mass and volume, and use these quantities to calculate density
- e. Use tools to gather, view, analyze, and report results for scientific investigations about the relationships among mass, weight, volume, and density

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. Which of the following is the best recommendation for a person trying to lose weight and why?
 - Reduce the number of calories he or she eats.
 - Exercise more.
 - Go to the Moon.
2. If weight and mass are not the same thing, why might people use the words interchangeably?
3. Describe a situation in which mass would be the most useful information to know about an object? Do the same for weight, volume, and density.

Relevance and Application:

1. Mass, weight, and gravitational forces are critical for space travel, future visits to outer space, and possibly the colonization of places like the Moon or Mars.

Nature of Science:

1. Calculate the density of a sample, predict its ability to float or sink in a liquid of known density, design and perform the experiment, and justify discrepancies in the experimental outcome.
2. Ask testable questions and make a falsifiable hypothesis about density and design an inquiry based method to find an answer.
3. Select proper tools to measure the mass and volume of an object and use appropriate units.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Measure mass, weight and volume using appropriate tools
- II. Predict the effect of gravity when objects of different size and weight are dropped

Extended Readiness Competencies

Content based access skills:

1. Making choices related to scientific tools to measure mass and volume
2. Following and giving directions related to science experiments or labs
3. Manipulating and using scientific tools related to mass and volume

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: Fifth Grade

Concepts and skills students master:

1. Mixtures of matter can be separated regardless of how they were created; all weight and mass of the mixture are the same as the sum of weight and mass of its parts

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ol style="list-style-type: none"> a. Develop, communicate, and justify a procedure to separate simple mixtures based on physical properties b. Share evidence-based conclusions and an understanding of the impact on the weight/mass of a liquid or gas mixture before and after it is separated into parts 	Inquiry Questions: <ol style="list-style-type: none"> 1. How do mixtures act similarly and differently from their original materials? 2. What are some ways that mixtures can be separated?
	Relevance and Application: <ol style="list-style-type: none"> 1. Knowing properties helps determine how to separate mixtures. 2. Mixtures make up Earth's layers. For example, rocks are mixtures of minerals, and minerals are mixtures of elements and compounds.
	Nature of Science: <ol style="list-style-type: none"> 1. Ask testable questions about mixtures, make a falsifiable hypothesis, design an inquiry based method of finding the answer, collect data, and form a conclusion. 2. Select appropriate tools to conduct an experiment, use them correctly, and report the data in proper units. 3. Share results of experiments with others and respectfully discuss results that are not expected. 4. Review and analyze information presented by peers and provide feedback on their evidence and scientific reasoning about the separation of mixtures and how the separation impacts its total weight/mass.
Extended Evidence Outcomes	Extended Readiness Competencies
With appropriate supports, students can: <ol style="list-style-type: none"> I. Separate simple mixtures based on physical properties II. Demonstrate that the weight of a mixture of solid objects before and after it is separated into parts is the same 	Content based access skills: <ol style="list-style-type: none"> 1. Using and organizing objects based on physical properties 2. Working cooperatively with others in a group situation related to a science lab 3. Manipulating materials in a mixture

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: Fourth Grade

Concepts and skills students master:

1. Energy comes in many forms such as light, heat, sound, magnetic, chemical, and electrical

Evidence Outcomes

Students can:

- a. Identify and describe the variety of energy sources
- b. Show that electricity in circuits requires a complete loop through which current can pass
- c. Describe the energy transformation that takes place in electrical circuits where light, heat, sound, and magnetic effects are produced
- d. Use multiple resources – including print, electronic, and human – to locate information about different sources of renewable and nonrenewable energy

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do we know that energy exists within a system such as in an electrical circuit?
2. How can heat be transferred from one object to another?

Relevance and Application:

1. There are multiple energy sources, both renewable and nonrenewable.
2. Energy can be used or stored. For example, it can be stored in a battery and then used when running a portable media player such as an iPod.
3. Transportation, manufacturing, and technology are driven by energy.

Nature of Science:

1. Ask testable questions about energy, make a falsifiable hypothesis and design an inquiry based method of finding the answer, collect data, and form a conclusion.
2. Understand that models are developed to explain and predict phenomena that cannot be directly observed.
3. Critically evaluate models of energy, identifying the strengths and weaknesses of the model in representing what happens in the real world.
4. Create plans to decrease electrical energy use for one week and evaluate the results.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Select sources of light, heat and sound energy
- II. Identify a resource as renewable or non-renewable

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to light, heat and sound
2. Attaching meaning to symbols related to sources of light, heat and sound
3. Making choices related to light, heat and sound
4. Selecting technology appropriate to the situation to manipulate light, heat and sound

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

Third Grade

Concepts and skills students master:

1. Matter exists in different states such as solids, liquids, and gases and can change from one state to another by heating and cooling

Evidence Outcomes

Students can:

- a. Analyze and interpret observations about matter as it freezes and melts, and boils and condenses
- b. Use evidence to develop a scientific explanation around how heating and cooling affects states of matter
- c. Identify the state of any sample of matter

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How can the state of matter of any object be decided?
2. Where around the school would snow take the longest to melt? Why?

Relevance and Application:

1. Water is distributed on Earth in different forms such as vapor, ice or glaciers, rivers, and freshwater or saltwater oceans.
2. There is only a certain amount of water available for human use.

Nature of Science:

1. Ask a testable question about the heating and cooling of a substance, design a method to find the answer, collect data, and form a conclusion.
2. Demonstrate the importance of keeping accurate observations and notes in science.
3. Share results of experiments with others, and respectfully discuss results that are not expected.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Report observations about matter as it freezes and melts, and boils and condenses
- II. Identify two states of water (liquid, solid)

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to states of water
2. Making choices related to solids and liquids
3. Manipulating states of water

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: Second Grade

Concepts and skills students master:

1. Changes in speed or direction of motion are caused by forces such as pushes and pulls

Evidence Outcomes

Students can:

- a. Identify and predict how the direction or speed of an object may change due to an outside force
- b. Analyze and interpret observable data about the impact of forces on the motion of objects

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What must be known about a force to predict how it will change an object's motion?
2. How does applying a force affect the way an object moves?
3. How do an object's properties affect how it will move when a force is applied?

Relevance and Application:

1. Technology makes our lives easier by applying what we know about how forces can affect objects such as tires, bicycles, and snow throwers.
2. In many recreational activities, such as tug-of-war, there is a relationship between forces and changes in motion.

Nature of Science:

1. Select appropriate tools for data collection.
2. Measure the change in speed or direction of an object using appropriate units.
3. Collaboratively design an experiment, identifying the constants and variables.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Demonstrate how the direction or speed (fast/slow, straight, back and forth, push/pull) of an object will change due to an outside force

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to movement and force of movement
2. Expressing an understanding of change in motion
3. Expressing an understanding of differences in direction

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: First Grade

Concepts and skills students master:

1. Solids and liquids have unique properties that distinguish them

Evidence Outcomes

Students can:

- a. Analyze and interpret observations about solids and liquids and their unique properties
- b. Identify the similarities and differences of two or more groups of solids or liquids
- c. Classify solids and liquids based on their properties, and justify your choice based on evidence

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What do all liquids have in common? What are some differences they can have and still be considered liquids?
2. What do all solids have in common? What are some differences they can have and still be considered solids?
3. What properties of liquids can be used to sort them?
4. What properties of solids can be used to sort them?

Relevance and Application:

1. The properties of solids and liquids help us understand how to use matter. For example, we not build a bridge out of tissue because it is not strong enough.
2. There are practical reasons for sorting liquids or solids.

Nature of Science:

1. Share results of experiments with others.
2. Recognize that observations are an important part of science.
3. Conduct collaborative experiments.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Classify materials as solids or liquids based on their properties

Extended Readiness Competencies

Content based access skills:

1. Making choices related to solids and liquids
2. Manipulate solids and liquids
3. Using and organizing objects based on properties of solids and liquids

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: Kindergarten

Concepts and skills students master:

1. Objects can move in a variety of ways that can be described by speed and direction

Evidence Outcomes

Students can:

- a. Observe, investigate, and describe how different objects move
- b. Describe the motion of a child who is playing

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What can change how fast or slow an object travels?
2. What indicates which objects will be easier or harder to move?

Relevance and Application:

1. People must push harder to move their bikes, skateboards, or scooters as they go faster or as they go up a hill.
2. Information about motion can be represented in pictures, illustrations, and simple charts.

Nature of Science

1. Recognize that scientists try to be clear and specific when they describe things.
2. Make predictions about the motion of an object.
3. Ask testable questions about the movement of objects.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Investigate how different objects move

Extended Readiness Competencies

Content based access skills:

1. Expressing an understanding of change in motion
2. Attending to objects that move

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: Kindergarten

Concepts and skills students master:

2. Objects can be sorted by physical properties, which can be observed and measured

Evidence Outcomes

Students can:

- a. Observe, investigate, and describe how objects can be sorted using their physical properties
- b. Explain why objects are sorted into categories
- c. Sort a set of objects based on their physical characteristics, and then explain how the objects are sorted

21st Century Skills and Readiness Competencies

Inquiry Questions:

- 1. How can objects belong to more than one group?
- 2. How do you decide which properties are most important when putting objects into groups?

Relevance and Application:

- 1. Materials have uses based on properties such as whether they are glass or plastic.
- 2. Machines such as coin sorting machines can be designed to sort things efficiently.

Nature of Science:

- 1. Recognize that scientists try to be clear and specific when they describe things.
- 2. Share observations with others; be clear and precise like scientists.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Investigate how objects can be sorted using their physical properties

Extended Readiness Competencies

Content based access skills:

- 1. Making choices related to physical properties
- 2. Using and organizing objects based on physical properties

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: Preschool

Concepts and skills students master:

1. Objects have properties and characteristics

Evidence Outcomes

Students can:

- Use senses to gather information about objects
- Make simple observations, predictions, explanations, and generalizations based on real-life experiences
- Collect, describe, and record information through discussion, drawings, and charts

21st Century Skills and Readiness Competencies

Inquiry Questions:

- How are various objects similar and different?

Relevance and Application:

- Use scientific tools such as magnets, magnifying glasses, scales, and rulers in investigations and play.

Nature of Science:

- Be open to and curious about new tasks and challenges.
- Explore and experiment.
- Show capacity for invention and imagination.
- Ask questions based on discoveries made while playing.

Extended Evidence Outcomes

With appropriate supports, students can:

- Investigate by looking at, touching, listening to, tasting or smelling things in the environment

Extended Readiness Competencies

Content based access skills:

- Expressing personal preferences and choices related to things in the environment

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: Preschool
Concepts and skills students master:

2. There are cause-and-effect relationships in everyday experiences

Evidence Outcomes

Students can:

- a. Recognize and investigate cause-and-effect relationships in everyday experiences – pushing, pulling, kicking, rolling, or blowing objects

21st Century Skills and Readiness Competencies

Inquiry Questions:

- 1. How do various objects react differently to the same cause?

Relevance and Application:

- 1. Use scientific tools such as magnets, magnifying glasses, scales, and rulers in investigations and play.

Nature of Science:

- 1. Be open to and curious about new tasks and challenges.
- 2. Explore and experiment.
- 3. Reflect on and interpret cause-and-effect relationships.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Demonstrate cause and effect relationships in every day experiences (i.e. pushing, pulling, kicking, rolling, or blowing objects)

Extended Readiness Competencies

Content based access skills:

- 1. Attaching meaning to symbols related to cause and effect
- 2. Expressing an understanding that objects move
- 3. Engaging and sustaining participation in an activity related to cause and effect

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: High School

Concepts and skills students master:

1. Matter tends to be cycled within an ecosystem, while energy is transformed and eventually exits an ecosystem

Evidence Outcomes

Students can:

- a. Analyze how energy flows through trophic levels
- b. Evaluate the potential ecological impacts of a plant-based or meat-based diet
- c. Analyze and interpret data from experiments on ecosystems where matter such as fertilizer has been added or withdrawn such as through drought
- d. Develop, communicate, and justify an evidence-based scientific explanation showing how ecosystems follow the laws of conservation of matter and energy
- e. Define and distinguish between matter and energy, and how they are cycled or lost through life processes
- f. Describe how carbon, nitrogen, phosphorus, and water cycles work
- g. Use computer simulations to analyze how energy flows through trophic levels

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How does a change in abiotic factors influence the stability or progression of an ecosystem?
2. What happens when the cycling of matter in ecosystems is disrupted?
3. What energy transformations occur in ecosystems?
4. How does the process of burning carbon-rich fossil fuels compare to the oxidation of carbon biomolecules in cells?

Relevance and Application:

1. When the matter or energy flow in an ecosystem is disturbed, there are measurable effects such as the eutrophication of water.
2. Matter and energy are cycled in natural systems such as wetlands in both similar and different ways than in human-managed systems such as waste water treatment plants.

Nature of Science:

1. Address differences between experiments where variables can be controlled and those where extensive observations on a highly variable natural system are necessary to determine what is happening – such as dead zones in the Gulf of Mexico.
2. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.
3. Design ecological experiments in a closed system.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Compare and contrast carnivores, herbivores and omnivores

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to food
2. Manipulating scientific materials related to food choices

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: High School

Concepts and skills students master:

2. The size and persistence of populations depend on their interactions with each other and on the abiotic factors in an ecosystem

Evidence Outcomes

Students can:

- a. Analyze and interpret data about the impact of removing keystone species from an ecosystem or introducing non-native species into an ecosystem
- b. Describe or evaluate communities in terms of primary and secondary succession as they progress over time
- c. Evaluate data and assumptions regarding different scenarios for future human population growth and their projected consequences
- d. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate ecosystem interactions

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do keystone species maintain balance in ecosystems?
2. How does the introduction of a non-native species influence the balance of an ecosystem?
3. How is the succession of local organisms altered in an area that is disturbed or destroyed?

Relevance and Application:

1. Earth's carrying capacity is limited, and as the human population grows, we must find ways to increase the production of resources all people need to live.
2. The extraction of resources by humans impacts nature ecosystems.

Nature of Science:

1. Critically evaluate scientific explanations in popular media to determine if the research methodology and evidence presented are appropriate and sufficient to support the claims.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Compare and contrast positive and/or negative impacts humans have on our ecosystem
- II. Describe what happens when an organisms area is destroyed or disturbed

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to the ecosystem
2. Manipulating materials related to the ecosystem

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: High School

Concepts and skills students master:

3. Cellular metabolic activities are carried out by biomolecules produced by organisms

Evidence Outcomes

Students can:

- a. Identify biomolecules and their precursors/building blocks
- b. Develop, communicate, and justify an evidence-based explanation that biomolecules follow the same rules of chemistry as any other molecule
- c. Develop, communicate, and justify an evidence-based explanation regarding the optimal conditions required for enzyme activity
- d. Infer the consequences to organisms of suboptimal enzyme function – such as altered blood pH or high fever – using direct and indirect evidence
- e. Analyze and interpret data on the body's utilization of carbohydrates, lipids, and proteins

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How are rates of enzyme activity in cells affected by various factors such as pH or temperature?
2. How does one know that enzymes speed up chemical reactions?

Relevance and Application:

1. Apply knowledge of biomolecular structure and activity to make consumer decisions, especially about diet with respect to saturated and unsaturated fatty acids, essential and nonessential amino acids, and simple and complex carbohydrates.
2. Explain how high temperatures such as a fever may alter cellular enzyme activity.
3. Recognize that many biomolecules can be made in the lab and have the exact same structure and function as ones made by living organisms.

Nature of Science:

1. Critically evaluate scientific explanations in popular media to determine if the research methodology and evidence presented are appropriate and sufficient to support the claims.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Demonstrate how like cells group together to make a structure
- II. Identify common food sources of fats, carbohydrates and proteins
- III. Explain how lifestyle choices impact the body

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to cells and structures
2. Expressing an understanding of similarities and differences related to lifestyle choices
3. Expressing an understanding of healthy foods

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: High School

Concepts and skills students master:

4. The energy for life primarily derives from the interrelated processes of photosynthesis and cellular respiration. Photosynthesis transforms the sun's light energy into the chemical energy of molecular bonds. Cellular respiration allows cells to utilize chemical energy when these bonds are broken.

Evidence Outcomes	21st Century Skills and Readiness Competencies
<p>Students can:</p> <ol style="list-style-type: none"> a. Develop, communicate, and justify an evidence-based scientific explanation the optimal environment for photosynthetic activity b. Discuss the interdependence of autotrophic and heterotrophic life forms such as depicting the flow of a carbon atom from the atmosphere, to a leaf, through the food chain, and back to the atmosphere c. Explain how carbon compounds are gradually oxidized to provide energy in the form of adenosine triphosphate (ATP), which drives many chemical reactions in the cell 	<p>Inquiry Questions:</p> <ol style="list-style-type: none"> 1. What variables can be manipulated to change the rate of photosynthesis? 2. What variables affect the rate of cell respiration? 3. How does body heat relate to cellular respiration? <p>Relevance and Application:</p> <ol style="list-style-type: none"> 1. Agriculture is of great importance to humans. For example, most food comes from agriculture. 2. Various foods such as cheeses, yogurts, alcohol, and breads are produced by fermentation – anaerobic respiration – that is carried out by various organisms. 3. The experience of muscle fatigue after intense exercise is related to anaerobic respiration in muscle cells. 4. Primary producers such as marine phytoplankton and rainforest flora play an integral role in sustaining all life on Earth. <p>Nature of Science:</p> <ol style="list-style-type: none"> 1. Recognize that the current understanding of photosynthesis and cellular respiration has developed over time and become more sophisticated as new technologies have lead to new evidence. 2. Critically evaluate models for photosynthesis and cellular respiration, and identify their strengths and weaknesses.
Extended Evidence Outcomes	Extended Readiness Competencies
<p>With appropriate supports, students can:</p> <ol style="list-style-type: none"> I. Identify chemical reactions within organisms (respiration and digestion ensure survival) II. Describe three components in the environment that are necessary for photosynthesis (sunlight, water, nutrients) and what occurs when one component is lacking 	<p>Content based access skills:</p> <ol style="list-style-type: none"> 1. Attaching meaning to symbols related to specific systems in the human body

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: High School

Concepts and skills students master:

5. Cells use passive and active transport of substances across membranes to maintain relatively stable intracellular environments

Evidence Outcomes

Students can:

- a. Analyze and interpret data to determine the energy requirements and/or rates of substance transport across cell membranes
- b. Compare organisms that live in freshwater and marine environments, and identify the challenges of osmotic regulation for these organisms
- c. Diagram the cell membrane schematically, and highlight receptor proteins as targets of hormones, neurotransmitters, or drugs that serve as active links between intra and extracellular environments
- d. Use tools to gather, view, analyze, and interpret data produced during scientific investigations that involve passive and active transport
- e. Use computer simulations and models to analyze cell transport mechanisms

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What variables affect the rate of transport across a membrane?
2. Why is it important that cell membranes are selectively permeable?

Relevance and Application:

1. Osmotically balanced solutions such as intravenous and ophthalmic solutions are critical in medical settings.
2. Drugs target receptor proteins such as hormones and neurotransmitters in membranes and mimic the action of natural signals there.
3. Technology is used to support humans on dialysis.

Nature of Science:

1. Ask testable questions and make a falsifiable hypothesis about how cells transport materials into and out of the cell and use an inquiry approach to find the answer.
2. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.
3. 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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify common symptoms that show when a body system is not functioning properly
- II. Identify the three major components of a plant or animal cell (nucleus, cell membrane/cell wall and cytoplasm)

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to parts of a cell
2. Demonstrating an understanding of illness

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: High School

Concepts and skills students master:

6. Cells, tissues, organs, and organ systems maintain relatively stable internal environments, even in the face of changing external environments

Evidence Outcomes

Students can:

- a. Discuss how two or more body systems interact to promote health for the whole organism
- b. Analyze and interpret data on homeostatic mechanisms using direct and indirect evidence to develop and support claims about the effectiveness of feedback loops to maintain homeostasis
- c. Distinguish between causation and correlation in epidemiological data, such as examining scientifically valid evidence regarding disrupted homeostasis in particular diseases
- d. Use computer simulations and models of homeostatic mechanisms

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How can an experiment be designed and conducted to test for adaptive homeostasis during exercise and other body activities?
2. Where and when are negative versus positive feedback loops more effective in the human body?

Relevance and Application:

1. The disruption of homeostatic mechanisms may lead to disease, and if severe enough, death.
2. Body systems differ when in a state of health and disease. For example, buildup and rupture of atherosclerotic plaque inside a blood vessel can cause a heart attack.
3. The regulatory responses of autoimmune diseases such as Type I diabetes, multiple sclerosis and rheumatoid arthritis are different than those of healthy immune systems.

Nature of Science:

1. Research and present findings about the results of dietary deficiencies or excesses.
2. Research and present findings about how medical problems that impact life span have changed throughout history due to altered lifestyles and advances in medicine.
3. Differentiate between scientific evidence evaluated by the Food and Drug Administration (FDA) for drug approval and anecdotal evidence shared among individuals or in magazines/newspapers that a food or supplement is effective for a given problem.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Describe how two organ systems work together to promote health
- II. Identify two or more health decisions influencing organ health

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to parts of an organ system
2. Demonstrating an understanding of wellness

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: High School

Concepts and skills students master:

7. Physical and behavioral characteristics of an organism are influenced to varying degrees by heritable genes, many of which encode instructions for the production of proteins

Evidence Outcomes

Students can:

- a. Analyze and interpret data that genes are expressed portions of DNA.
- b. Analyze and interpret data on the processes of DNA replication, transcription, translation, and gene regulation, and show how these processes are the same in all organisms
- c. Recognize that proteins carry out most cell activities and mediate the effect of genes on physical and behavioral traits in an organism
- d. Evaluate data showing that offspring are not clones of their parents or siblings due to the meiotic processes of independent assortment of chromosomes, crossing over, and mutations
- e. Explain using examples how genetic mutations can benefit, harm, or have neutral effects on an organism

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. Why is it possible for a cell from one species to express genes from another species as in genetic modification of organisms?
2. Why are human offspring not genetic clones of their parents or siblings?
3. How is it possible to distinguish learned from instinctual behaviors such as imprinting etiquette, and suckling by mammals?

Relevance and Application:

1. Recombinant DNA technology has many uses in society such as the development of new medical therapies and increased production of drugs.
2. Selective breeding differs from genetic modification, yet shares a common goal.
3. There are benefits and risks to having genetically modified organisms in the food supply.
4. There are implications to inheriting DNA replication errors.

Nature of Science:

1. Recognizing that research on genetically modified organisms is done in university laboratories and seed companies, discuss the implications of different types of funding and 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.
2. Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere – that basic principles for genetics apply to all organisms.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Compare and contrast the inheritable traits between parents and their offspring (single allele such as tongue rolling, ear lobes, hitchhikers thumb, widows peak, long second toe)
- II. Identify learned versus instinctual behaviors

Extended Readiness Competencies

Content based access skills:

1. Understanding differences related to physical characteristic between parents and their children

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: High School

Concepts and skills students master:

8. Multicellularity makes possible a division of labor at the cellular level through the expression of select genes, but not the entire genome.

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation of how cells form specialized tissues due to the expression of some genes and not others
- b. Analyze and interpret data that show most eukaryotic deoxyribonucleic acid (DNA) does not actively code for proteins within cells
- c. Develop, communicate, and justify an evidence-based scientific explanation for how a whole organism can be cloned from a differentiated – or adult – cell
- d. Analyze and interpret data on medical problems using direct and indirect evidence in developing and supporting claims that genetic mutations and cancer are brought about by exposure to environmental toxins, radiation, or smoking

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. Why is it possible to clone a whole organism from an undifferentiated cell?
2. Why are stem cells sought by researchers as potential cures to medical problems?

Relevance and Application:

1. Stem cells may be used to improve medical disorders such as diabetes, Parkinson’s disease, torn cartilage, and damaged hearts.
2. Recent research and insights into DNA and genes have changed many aspects of society such as the criminal justice system, food supply, and medical treatments.

Nature of Science:

1. Debate the advantages and disadvantages of bioengineering – cloning or genetically modifying – organisms in the food supply.
2. Science is influenced by the cultural norms of a society. Discuss the ethical and political issues associated with stem cell research and how these have impacted both the research done and its applications.
3. Debate the ethical and political issues associated with stem cell research and how these affect research.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify environmental toxins that are harmful to humans

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to toxic substances
2. Developing and maintaining a supportive network of people related to the human life cycle (doctor, care givers etc.)

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Explain how biological evolution accounts for the unity and diversity of living organisms

Grade Level Expectation: High School

Concepts and skills students master:

9. Evolution occurs as the heritable characteristics of populations change across generations and can lead populations to become better adapted to their environment

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation for how Earth's diverse life forms today evolved from common ancestors
- b. Analyze and interpret multiple lines of evidence supporting the idea that all species are related by common ancestry such as molecular studies, comparative anatomy, biogeography, fossil record and embryology
- c. Analyze and interpret data suggesting that over geologic time, discrete bursts of rapid genetic changes and gradual changes have resulted in speciation
- d. Analyze and interpret data on how evolution can be driven by three key components of natural selection – heritability, genetic variation, and differential survival and reproduction
- e. Generate a model – an evolutionary tree – showing how a group of organisms is most likely diverged from common ancestry

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do subtle differences among closely-related fossil species provide evidence of environmental change and speciation?
2. How does studying extinct species contribute to our current understanding of evolution?
3. How can patterns of characteristics shared among organisms be used to categorize life's diversity according to relatedness?
4. How does modern agriculture affect biodiversity?

Relevance and Application:

1. Resistance can occur when antibiotics and pesticides are overused or abused.
2. Human activities can generate selective pressures on organisms, such as breeding new kinds of dogs and improving livestock.

Nature of Science:

1. Understand that all scientific knowledge is subject to new findings and that reproducible, corroborated, and converging lines of data yield a scientific theory.
2. Differentiate among the use of the terms "hypothesis," "theory," and "law" as they are defined and used in science compared to the usage of these terms in other disciplines or everyday use.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify changes in the environment over time that have driven adaptations of living things

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbol related to change in the environment
2. Indicating understanding of cause/effect the environment and living things

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

Students can:

- a. Develop, communicate, and justify an evidence-based scientific example of how humans can alter ecosystems
- b. Analyze and interpret data about human impact on local ecosystems
- c. Recognize and infer bias in print and digital resources while researching an environmental issue
- 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
- e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate an environmental issue

21st Century Skills and Readiness Competencies

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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Predict the effect of a human activity on a local ecosystem

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to the concept of reduce, reuse and recycle
2. Using technology to explore the ecosystem

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

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation for how genetic information is passed to the next generation
- b. Use direct and indirect observations, evidence, and data to support claims about genetic reproduction and traits of individuals
- c. Gather, analyze, and interpret data on transmitting genetic information
- d. Use models and diagrams to predict the phenotype and genotype of offspring based on the genotype of the parents
- e. Use computer simulations to model and predict phenotype and genotype of offspring based on the genotype of the parents

21st Century Skills and Readiness Competencies

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.
2. Recognize that current understanding of genetics has developed over time and become more sophisticated as new technologies have lead to new evidence.
3. Critically evaluate models used to represent deoxyribonucleic acid (DNA) and genes; identify strengths and weaknesses of these models for representing complex natural phenomena.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Label the stages of human aging/ maturation (birth, infancy, early childhood, adolescence, adulthood, death)
- II. Identify two human traits that are passed from one generation to the next

Extended Readiness Competencies

Content based access skills:

1. Developing and maintaining a supportive network of people related to the human life cycle (doctor, care givers etc.)
2. Attaching meaning to symbols related to the life cycle

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Explain how biological evolution accounts for the unity and diversity of living organisms

Grade Level Expectation: Seventh Grade

Concepts and skills students master:

1. Individual organisms with certain traits are more likely than others to survive and have offspring in a specific environment

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based explanation for why a given organism with specific traits will or will not survive to have offspring in a given environment
- b. Analyze and interpret data about specific adaptations to provide evidence and develop claims about differential survival and reproductive success
- c. Use information and communication technology tools to gather information from credible sources, analyze findings, and draw conclusions to create and justify an evidence-based scientific explanation
- d. Use computer simulations to model differential survival and reproductive success associated with specific traits in a given environment

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What is the relationship between an organism’s traits and its potential for survival and reproduction?
2. How is the use of the word “adaptation” different in everyday usage than in biology?

Relevance and Application:

1. Bacteria have evolved to survive in the presence of the environmental pressure of antibiotics – giving rise to antibiotic resistance.
2. Species that can live with humans –such as rats and pigeons – are more common around towns and cities.

Nature of Science:

1. Create and use sound experimental designs to collect data around survival and genetic traits.
2. Describe several ways in which scientists would study genetics, and suggest ways that this has contributed to our understanding of survival and populations.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Explain why specific traits of organisms help them survive and reproduce in a given environment.
- II. Identify traits of organisms living in different ecosystems

Extended Readiness Competencies

Content based access skills:

1. Demonstrating an understanding of different ecosystems
2. Attaching meaning to symbols related to ecosystems

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: Seventh Grade

Concepts and skills students master:

2. The human body is composed of atoms, molecules, cells, tissues, organs, and organ systems that have specific functions and interactions

Evidence Outcomes

Students can:

- a. Develop and design a scientific investigation about human body systems
- b. Develop, communicate, and justify an evidence-based scientific explanation regarding the functions and interactions of the human body
- c. Gather, analyze, and interpret data and models on the functions and interactions of the human body

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How does each body system contribute to supporting the life of the organism?
2. How do organs and organ systems in the human body interact to perform specific functions?

Relevance and Application:

1. There are technologies such as magnetic resonance imaging (MRI), computed tomography (CT) scans, and chemical lab tests that are related to the diagnosis and treatment of the human body's diseases

Nature of Science:

1. Critically evaluate models, and identify the strengths and weaknesses of the model in representing our understanding of the human body

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify the major organs that make up a specific system (respiratory, circulatory and digestive)
- II. Identify common organ systems in the human body (respiratory, circulatory, digestive, musculoskeletal, and reproductive)

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to specific systems in the human body
2. Identifying careers in the medical field

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: Seventh Grade

Concepts and skills students master:

3. Cells are the smallest unit of life that can function independently and perform all the necessary functions of life

Evidence Outcomes	21 st Century Skills and Readiness Competencies
<p>Students can:</p> <ul style="list-style-type: none"> a. Gather, analyze, and interpret data and models on the different types of cells, their structures, components and functions b. Develop, communicate, and justify an evidence-based scientific explanation regarding cell structures, components, and their specific functions c. Compare and contrast the basic structures and functions of plant cells, animal cells, and single-celled organisms d. Employ tools to gather, view, analyze, and report results for the scientific investigations of cells 	<p>Inquiry Questions:</p> <ul style="list-style-type: none"> 1. How is the basic structure of a cell related to its function? 2. How are the components – or organelles – of a cell related to the cell's function? 3. How are various cells unique, and what do they have in common with other cells? <p>Relevance and Application:</p> <ul style="list-style-type: none"> 1. Stem cells are undifferentiated cells that have potential use in medicine. 2. Cancer is caused by a cell that isn't functioning correctly. 3. Cells can be cultured to benefit humanity. <p>Nature of Science:</p> <ul style="list-style-type: none"> 1. Recognize that our current understanding of cells 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 cells.

Extended Evidence Outcomes	Extended Readiness Competencies
<p>With appropriate supports, students can:</p> <ul style="list-style-type: none"> I. Compare the physical characteristics of plant and animal cells 	<p>Content based access skills:</p> <ul style="list-style-type: none"> 1. Attaching meaning symbols related to plants and animal cells 2. Making choices related to shape of plants and animals cells 3. Manipulating science materials to explore cells

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: Seventh Grade

Concepts and skills students master:

4. Photosynthesis and cellular respiration are important processes by which energy is acquired and utilized by organisms

Evidence Outcomes

Students can:

- a. Gather, analyze, and interpret data regarding the basic functions of photosynthesis and cellular respiration
- b. Use direct and indirect evidence to describe the relationship between photosynthesis and cellular respiration within plants – and between plants and animals
- c. Use computer simulations to model the relationship between photosynthesis and cellular respiration within plants – and between plants and animals

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What is the relationship between photosynthesis and cellular respiration?
2. What energy transformations occur in both the processes of photosynthesis and cellular respiration?

Relevance and Application:

1. Plants are essential for human health and the health and survival of Earth's ecosystems.
2. The energy in food comes from Sunlight via photosynthesis and is the basis for most ecosystems on earth.
3. Fossil fuels come from the photosynthesis of organisms that lived millions of years ago.

Nature of Science:

1. Ask a testable question and make a falsifiable hypothesis about photosynthesis or respiration and design an inquiry based method to find an answer.
2. Design an experiment to observe photosynthesis or respiration, and clearly define controls and variables.
3. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Conduct a simple scientific investigation about photosynthesis in plants
- II. Identify three components in the environment that are necessary for photosynthesis (sunlight, water, nutrients)

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbols related to plants and energy
2. Manipulating science materials related to the plants needs

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Explain how biological evolution accounts for the unity and diversity of living organisms

Grade Level Expectation: Seventh Grade

Concepts and skills students master:

5. Multiple lines of evidence show the evolution of organisms over geologic time

Evidence Outcomes

Students can:

- Interpret and analyze data from the fossil record to support a claim that organisms and environments have evolved over time
- Analyze and critique the evidence regarding the causes and effects of a mass extinction event
- Analyze and interpret data that show human evolution
- Use technology to share research findings about the evidence regarding the causes and effects of a mass extinction event

21st Century Skills and Readiness Competencies

Inquiry Questions:

- What might life on Earth have been like in the distant past, and what evidence is there for this?
- How does the evidence about the way life has evolved on Earth from long ago tell us about Earth today?

Relevance and Application:

- There is growing concern over the current extinction of organisms around the world – and the consequences of these extinctions.

Nature of Science:

- Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.
- Cite various scientific arguments regarding the causes and effects of mass extinctions.

Extended Evidence Outcomes

With appropriate supports, students can:

- Identify animals that have become extinct
- Identify suspected causes of a mass extinction event
- Compare physical characteristics of animals today with extinct organisms

Extended Readiness Competencies

Content based access skills:

- Attaching meaning to a symbols related to extinct animals
- Expressing an understanding of similarities and differences between extinct and living animals
- Selecting jobs related to working with animals

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: Sixth Grade

Concepts and skills students master:

1. Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species

Evidence Outcomes

Students can:

- a. Interpret and analyze data about changes in environmental conditions – such as climate change – and populations that support a claim describing why a specific population might be increasing or decreasing
- b. Develop, communicate, and justify an evidence-based explanation about how ecosystems interact with and impact the global environment
- c. Model equilibrium in an ecosystem, including basic inputs and outputs, to predict how a change to that ecosystem such as climate change might impact the organisms, populations, and species within it such as the removal of a top predator or introduction of a new species
- d. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate how environmental conditions affect the survival of individual organisms

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do ecosystem changes affect biodiversity?
2. How does biodiversity contribute to an ecosystem's equilibrium?

Relevance and Application:

1. The development and application of technologies intended to aid some populations and ecosystems.

Nature of Science:

1. Ask testable questions and make a falsifiable hypothesis about how environmental conditions affect organisms, populations, or entire species and design a method to find the answer.
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 models and technology tools to show what might happen to individuals, populations, and species as environmental conditions change.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify how environmental conditions can affect people and their actions
- II. Identify environmental changes

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to environment
2. Expressing personal preferences and choices related to environmental conditions

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: Sixth Grade

Concepts and skills students master:

2. Organisms interact with each other and their environment in various ways that create a flow of energy and cycling of matter in an ecosystem

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based explanation about why there generally are more producers than consumers in an ecosystem
- b. Design a food web diagram to show the flow of energy through an ecosystem
- c. Compare and contrast the flow of energy with the cycling of matter in ecosystems

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do different ecosystems cycle matter differently?
2. What "jobs" do organisms do to facilitate the flow of energy and cycling of matter?

Relevance and Application:

1. Humans use an understanding of the cycling of matter and energy to help mitigate environmental problems. For example, they treat waste water and clean up oil spills.

Nature of Science:

1. Scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere – that energy follows the same rules in an ecosystem as it does in physics experiments.
2. Generate solutions to help mitigate environmental problems based on an understanding of the cycling of matter and energy.
3. Create and evaluate models that show how interactions create a flow of energy and a cycling of matter in an ecosystem.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Show how a simple three-step food web is affected by other living and nonliving things in the ecosystem.
- II. Organize the elements of a three-step food web

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbols related to a food web
2. Following simple directions as related to a scientific activity
3. Indicating and understanding of cause and effect relationships between items in a food web

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: Fifth Grade

Concepts and skills students master:

1. All organisms have structures and systems with separate functions

Evidence Outcomes

Students can:

- a. Develop and communicate an evidence-based scientific explanation of the role of different organs or structures that are important for an organism's survival – in both plants and animals
- b. Analyze and interpret data to generate evidence that all organisms have structures that are required for survival in both plants and animals
- c. Create and evaluate models of plant and/or animal systems or parts

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do plants and animals carry out processes necessary for life?
2. What different structures do plants and animals use to carry out the same functions?
3. What adaptations or characteristics help humans survive?

Relevance and Application:

1. Different organism structures are adapted to different functions to ensure survival, and humans often manipulate these different structures for their own uses such as making building materials, food, and medicines.
2. Humans have long exploited animals and plants through fishing, herding, and agriculture in order to manage them as renewable food resources.
3. There are tools and materials – such as Velcro – made by humans that were inspired by animal or plant adaptations.

Nature of Science:

1. Review and analyze information presented by peers and provide feedback on their evidence regarding the importance of various structures to plants and animals.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Compare and contrast physical characteristics in plants and animals (plant/plant, animal/animal)
- II. Sort animals by observable characteristics based on a given group (birds, reptiles, insects and mammals)
- III. Identify how living organisms attain basic needs for survival

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to plants, animals, birds and insects
2. Organizing groups of living organisms based on similarities and differences

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: Fifth Grade

Concepts and skills students master:

2. Human body systems have basic structures, functions, and needs

Evidence Outcomes

Students can:

- a. Develop and communicate an evidence-based scientific explanation regarding how humans address basic survival needs
- b. Analyze and interpret data to generate evidence that human systems are interdependent
- c. Assess further scientific explanations regarding basic human body system functions
- d. Create and evaluate models of human body systems and organs
- e. Compare and contrast a human system to that of another organism, and provide hypotheses about why the similarities and differences exist

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How are human body systems similar to and different from those found in other organisms?
2. How are organs impacted when different body systems fail to work correctly?

Relevance and Application:

1. People can create goals about their own lifestyle such as exercising every day and eating healthy foods based on an understanding of human body systems.
2. Societal norms and practices that are intended to protect our health such as wearing a bicycle helmet can be based on scientific evidence.

Nature of Science:

1. Review and analyze information presented by peers on the structure and function of the human body and provide feedback on their evidence and scientific conclusions.
2. Critically evaluate models of the human body, identifying the strengths and weaknesses of the model in representing complex natural phenomena.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify the function of the main internal organs of the body
- II. Describe ways to maintain a healthy body

Extended Readiness Competencies

Content based access skills:

1. Managing physical/medical needs to maintain a healthy body
2. Indicating and understanding of cause and effect as related to organ systems
3. Indicating and understanding of self care for survival

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: Fourth Grade

Concepts and skills students master:

1. All living things share similar characteristics, but they also have differences that can be described and classified

Evidence Outcomes

Students can:

- a. Use evidence to develop a scientific explanation of what plants and animals need to survive
- b. Use evidence to develop a scientific explanation for similarities and/or differences among different organisms (species)
- c. Analyze and interpret data representing variation in a trait
- d. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate questions about characteristics of living things

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How have classification systems changed over time?
2. How are individuals in a related species similar and different?

Relevance and Application:

1. Human beings have use technology in order to survive in a variety of climates, such as heating and air conditioning.

Nature of Science:

1. Understand that all scientific knowledge is subject to new findings and that the presence of reproducible results yields a scientific theory.
2. Evaluate and provide feedback on evidence used by others to justify how they classified organisms.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify basic parts of plants and animals
- II. Identify common internal organs of the human body
- III. Explain what plants and animals need to survive

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to parts of plants and animals
2. Making choices related to texture and/or appearance of plants and/or animals

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Explain how biological evolution accounts for the unity and diversity of living organisms

Grade Level Expectation: Fourth Grade

Concepts and skills students master:

2. Comparing fossils to each other or to living organisms reveals features of prehistoric environments and provides information about organisms today

Evidence Outcomes

Students can:

- a. Use evidence to develop a scientific explanation for:
 1. What fossils tell us about a prehistoric environment
 2. What conclusions can be drawn from similarities between fossil evidence and living organisms
- b. Analyze and interpret data to generate evidence about the prehistoric environment
- c. Evaluate whether reasoning and conclusions about given fossils are supported by evidence
- d. Use computer simulations that model and recreate past environments for study and entertainment

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What are some things fossils can't tell us?
2. What conditions would most likely lead to something becoming a fossil?

Relevance and Application:

1. Computers are used to model and recreate past environments for study and entertainment.

Nature of Science:

1. Ask testable questions about past environments.
2. Make predictions about past environments based on fossil evidence.
3. Recognize that different interpretations of evidence are possible.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify plant versus animal fossils

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to plants and animals
2. Expressing an understanding of differences related texture and/or appearance of fossils
3. Manipulating fossils of plants and animals

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: Fourth Grade

Concepts and skills students master:

3. There is interaction and interdependence between and among living and nonliving components of ecosystems

Evidence Outcomes

Students can:

- a. Use evidence to develop a scientific explanation on how organisms adapt to their habitat
- b. Identify the components that make a habitat type unique
- c. Compare and contrast different habitat types
- d. Create and evaluate models of the flow of nonliving components or resources through an ecosystem
- e. Make a plan to positively impact a local ecosystem
- f. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate endangered habitats

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How are resources shared among organisms in a specific ecosystem or habitat?
2. How do nonliving components of an ecosystem influence living components?
3. What would happen if the Sun's energy no longer reached Earth?
4. What would happen if water were removed from an ecosystem?

Relevance and Application:

1. Humans can have positive and negative impacts on an ecosystem.
2. Nonliving components are cycled and recycled through ecosystems and need to be protected and conserved.

Nature of Science:

1. Understand that models are developed to explain and predict natural phenomena that cannot be directly observed because they happen over long periods of time.
2. Evaluate models that show interactions between living and nonliving components of ecosystems, identifying the strengths and weaknesses of the model in representing what happens in the real world.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify the consumer and producer in a familiar habitat
- II. Identify living and nonliving components of a habitat
- III. Identify sources of food for humans

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to food sources
2. Expressing an understanding of differences in food and/or environment

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: Third Grade

Concepts and skills students master:

1. The duration and timing of life cycle events such as reproduction and longevity vary across organisms and species

Evidence Outcomes

Students can:

- a. Use evidence to develop a scientific explanation regarding the stages of how organisms develop and change over time
- b. Analyze and interpret data to generate evidence that different organisms develop differently over time
- c. Use a variety of media to collect and analyze data regarding how organisms develop

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How are life cycles from a variety of organisms similar and different?
2. How does an organism change throughout its life cycle?

Relevance and Application:

1. Living things may have different needs at different points in their life cycles.

Nature of Science:

1. Ask a testable question about the life cycles of a variety of organisms.
2. Compare what is done in class to the work of scientists:
 - a. Scientists evaluate and use data generated by other scientists to further their own ideas, just like students compare data in class.
 - b. A community of scientists weaves together different evidence and ideas to deepen understanding, similar to how students do investigations and read books to deepen understanding about a concept.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify the life cycle of familiar living things
- II. Sequence three stages of a life cycle of familiar organisms

Extended Readiness Competencies

Content based access skills:

1. Engaging in sustained participation in science activity related to the life cycle
2. Expressing simple feeling states related to life cycle
3. Sequencing events related to life cycle

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: Second Grade

Concepts and skills students master:

1. Organisms depend on their habitat's nonliving parts to satisfy their needs

Evidence Outcomes

Students can:

- a. Use evidence to develop a scientific explanation about how organisms depend on their habitat.
- b. Analyze and interpret data about nonliving components of a habitat
- c. Assess and provide feedback on other scientific explanations regarding why an organism can survive in its habitat
- d. Use instruments to make observations about habitat components – for example, data can be collected from a fish tank to assess the environmental health (dissolved oxygen, pH, Nitrogen content).

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What are the basic needs of plants and animals?
2. How are the basic needs of all living things similar and different?
3. How do living things depend on their environment?
4. How does an organism respond when basic needs are not met?

Relevance and Application:

1. Living things depend on the health of their habitats.
2. Different organisms have different needs.

Nature of Science:

1. Describe different ways that scientists seek to understand about organisms and their interactions with the environment.
2. Collaborate with other students in developing a scientific explanation about how organisms depend on their habitat.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Observe and identify nonliving components of a habitat
- II. Match the living organism to its habitat
- III. Identify suitable features of a habitat for a specific organism

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to habitat
2. Transitioning from one environment to another
3. Expressing an understanding of difference (living vs. nonliving)

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: Second Grade

Concepts and skills students master:

2. Each plant or animal has different structures or behaviors that serve different functions

Evidence Outcomes

Students can:

- a. Use evidence to develop an explanation as to why a habitat is or is not suitable for a specific organism
- b. Analyze and interpret data about structures or behaviors of a population that help that population survive

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What different structures do plants and animals have that perform the same functions? For example, what different structure do plants and animals have to get water?

Relevance and Application:

1. A single environment can support a variety of living things that use different kinds and amounts of resources.
2. Body designs, such as the skull of a woodpecker or the nose of a dog, serves specific and unique jobs.

Nature of Science:

1. Give feedback regarding the advantages of specific structures and behaviors.
2. Share observations, and provide and respond to feedback on ideas about the advantages of specific structures and behaviors.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify structures and/or behaviors that help plants and animals survive

Extended Readiness Competencies

Content based access skills:

1. Recognizing dangerous / unsafe situations

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: First Grade

Concepts and skills students master:

1. Offspring have characteristics that are similar to but not exactly like their parents' characteristics

Evidence Outcomes

Students can:

- a. Use evidence to analyze similarities and differences between parents and offspring in a variety of organisms including both plants and animals
- b. Analyze and interpret data regarding the similarities and differences between parents and offspring
- c. Question peers about evidence used in developing ideas about similarities and differences between parents and offspring
- d. Interpret information represented in pictures, illustrations, and simple charts

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How are you like your parents?
2. In what ways do offspring resemble their parents?

Relevance and Application:

1. Diversity – or variation – exists within populations of living organisms.
2. Family photographs often reveal similar physical traits.
3. Parents eye color can be different their child's.

Nature of Science:

1. Compare and contrast data, recognizing that this is a process scientists would do in their work.
2. Question peers about the evidence used in developing their ideas about the similarities and differences between parents and offspring.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify similarities between parents and offspring
- II. Identify differences between parents and offspring

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbol related physical characteristics of a person
2. Expressing an understanding of similarities and differences of people

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: First Grade

Concepts and skills students master:

2. An organism is a living thing that has physical characteristics to help it survive

Evidence Outcomes

Students can:

- a. Identify organisms and use evidence based scientific explanations for classifying them into groups
- b. Analyze and interpret data about the needs of plants and animals
- c. Use direct observations and other evidence to support ideas concerning physical characteristics that help plants and animals survive

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do the needs of plants and animals differ?
2. What helps a specific plant or animal survive?

Relevance and Application:

1. Animals and plants have characteristics that help them survive in the local environment. For example, the thick fur of animals such as raccoons, bears, and mule deer helps them survive the cold winters in Colorado.
2. A living thing can be harmed if needed resources are lacking.

Nature of Science:

1. Ask testable questions about the needs of an organism.
2. Predict the outcome for an organism if a need is removed.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify living and nonliving things
- II. Identify organisms and classify into groups (plants and animals)
- III. Identify needs of plants and animals (food, water, air and sun)
- IV. Identify and describe the functions of observable parts of the body
- V. Match human or plant responses to a simple environmental stimulus

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to plants and animals
2. Expressing an understanding of differences (plants and animals, living and nonliving)

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

Grade Level Expectation: Kindergarten

Concepts and skills students master:

1. Organisms can be described and sorted by their physical characteristics

Evidence Outcomes

Students can:

- a. Sort a group of items based on observable characteristics
- b. Communicate and justify an evidence-based scientific rationale for sorting organisms into categories

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What do living things have in common?
2. What characteristics are useful for sorting and classifying organisms?

Relevance and Application:

1. There are patterns in the natural world.
2. There are many ways to classify a group of organisms.

Nature of Science:

1. Ask questions about physical characteristics that will help them sort organisms.
2. Share scientific ideas verbally in a clear way.
3. Question peers about reasons for how they sort organisms, and encourage them to use evidence to support their ideas.
4. Use scientific tools such as magnifying glasses, sorting blocks, and rulers in investigations and play.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Sort a group of items based on size, shape or color
- II. Identify the similar attributes of sorted items

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbol related to color, shape and/or size
2. Expressing an understanding of differences in attributes

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- 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

Grade Level Expectation: Preschool

Concepts and skills students master:

1. Living things have characteristics and basic needs

Evidence Outcomes

Students can:

- a. Use senses to gather information about living things
- b. Observe and explore the natural processes of growing, changing, and adapting to the environment
- c. Ask and pursue questions through simple investigations and observations of living things
- d. Collect, describe, and record information about living things through discussion, drawings, and charts

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What do living things need to survive?

Relevance and Application:

1. Mittens and hats keep people warm when the weather is cold.
2. Gills on a fish allow them to "breathe" under water.

Nature of Science:

1. Be open to and curious about new tasks and challenges.
2. Explore and experiment.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Gather information about living things by using senses
- II. Observe and explore the natural processes of growing, changing, and adapting to the environment
- III. Ask and pursue their questions through simple investigations and observations of living things
- IV. Collect, describe and/ or record information about living things through discussion, pictures and other visual representations

Extended Readiness Competencies

Content based access skills:

1. Attending to living things
2. Manipulating materials and equipment relating to living things

Content Area: Science
Standard: 2. Life Science

Prepared Graduates:

- 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

Grade Level Expectation: Preschool

Concepts and skills students master:

2. Living things develop in predictable patterns

Evidence Outcomes

Students can:

- a. Identify the common needs such as food, air, and water of familiar living things
- b. Predict, explain, and infer patterns based on observations and representations of living things, their needs, and life cycles
- c. Make and record by drawing, acting out, or describing observations of living things and how they change over time

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do different living things change over time?
2. What are some similarities and differences in how living things develop?
3. How do the adults of various animals compare to younger versions of those same animals?

Relevance and Application:

1. Butterflies have a predictable growth cycle.
2. Leaves on a tree change color and fall every year.

Nature of Science:

1. Show a capacity for invention and imagination when looking for patterns of development.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify food, water and air as needs of humans

Extended Readiness Competencies

Content based access skills:

1. Advocating for self and needs
2. Expressing physical needs

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:

- 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: High School

Concepts and skills students master:

1. The history of the universe, solar system and Earth can be inferred from evidence left from past events

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation addressing questions about Earth's history
- b. Analyze and interpret data regarding Earth's history using direct and indirect evidence
- c. Analyze and interpret data regarding the history of the universe using direct and indirect evidence
- d. Seek, evaluate, and use a variety of specialized resources available from libraries, the Internet, and the community to find scientific information on Earth's history
- e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate the history of the universe, solar system and Earth

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do we know the age of Earth, Sun and universe?
2. How did the formation of Earth help shape its features today?
3. How can we interpret the geologic history of an area?

Relevance and Application:

1. Geologic principles such as original horizontality, superposition, cross-cutting relationships, unconformities, and index fossils allow us to accurately interpret geologic history.
2. Employ data-collection technology such as geographic mapping systems and visualization tools to gather and analyze data and scientific information about Earth's history.

Nature of Science:

1. Understand that all scientific knowledge is subject to new evidence and that the presence of reproducible results yields a scientific theory.
2. Critically evaluate scientific claims in popular media and by peers regarding Earth's history, and determine if evidence presented is appropriate and sufficient to support the claims.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify ways how the Earth has changed over time to accommodate a variety of life forms (sea life, dinosaurs, land animals, mammals)
- II. Identify the Solar System as having formed around the sun

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbol related to changes in the earth's surface
2. Interpreting meaning related to geologic time
3. Expressing an understanding of differences related to fossils and earth surfaces
4. Selecting skills for careers involving the recovery of fossils

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: High School

Concepts and skills students master:

2. As part of the solar system, Earth interacts with various extraterrestrial forces and energies such as gravity, solar phenomena, electromagnetic radiation, and impact events that influence the planet's geosphere, atmosphere, and biosphere in a variety of ways

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation addressing questions around the extraterrestrial forces and energies that influence Earth
- b. Analyze and interpret data regarding extraterrestrial forces and energies
- c. Clearly identify assumptions behind conclusions regarding extraterrestrial forces and energies and provide feedback on the validity of alternative explanations
- d. Use specific equipment, technology, and resources such as satellite imagery, global positioning systems (GPS), global information systems (GIS), telescopes, video and image libraries, and computers to explore the universe

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What influences Earth's position in the universe?
2. How does Earth get its energy?
3. How does the electromagnetic spectrum positively and negatively impact Earth's systems?

Relevance and Application:

1. Fusion is the most common source of energy in the universe, and it provides the basis of Earth's energy through fusion reactions in the Sun.
2. Different types of telescopes have given us data about the universe, galaxy, and solar system.

Nature of Science:

1. Understand the physical laws that govern Earth are the same physical laws that govern the rest of the universe.
2. Critically evaluate strengths and weaknesses of a model which represents complex natural phenomena.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify how aerospace design impacts space travel (e.g. Where you can go on an airplane vs where you can go on a space shuttle)
- II. Describe ways in which basic needs can be met in space compared to needs on Earth (e.g. air, water, heat, food)

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to space travel
2. Selecting career options related to space and exploration

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: High School

Concepts and skills students master:

3. The theory of plate tectonics helps explain geological, physical, and geographical features of Earth

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation about the theory of plate tectonics and how it can be used to understand geological, physical, and geographical features of Earth
- b. Analyze and interpret data on plate tectonics and the geological, physical, and geographical features of Earth
- c. Understand the role plate tectonics has had with respect to long-term global changes in Earth’s systems such as continental buildup, glaciations, sea-level fluctuations, and climate change
- d. Investigate and explain how new conceptual interpretations of data and innovative geophysical technologies led to the current theory of plate tectonics

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do the different types of plate boundaries create different landforms on Earth?
2. How have scientists “discovered” the layers of Earth?
3. What drives plate motion?
4. What might happen to Earth’s landforms in the future?

Relevance and Application:

1. New conceptual interpretations of data and innovative geophysical technologies led to the current theory of plate tectonics.

Nature of Science:

1. Understand that all scientific knowledge is subject to new findings and that the presence of reproducible results yields a scientific theory.
2. Ask testable questions and make a falsifiable hypothesis about plate tectonics and design a method to find an answer.
3. Share experimental data, and respectfully discuss conflicting results.
4. Recognize that the current understanding of plate tectonics has developed over time and become more sophisticated as new technologies have led to new evidence.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify and locate places on Earth where earthquakes and volcanoes occur
- II. Label the layers of the Earth (inner core, core, mantle and crust)

Extended Readiness Competencies

Content based access skills:

1. Attending to natural landforms and catastrophic events
2. Attaching meaning to symbols related the layers of the earth
3. Self advocating for needs related to natural disasters
4. Selecting the educational needs for a career path in geology

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: High School

Concepts and skills students master:

4. Climate is the result of energy transfer among interactions of the atmosphere, hydrosphere, geosphere, and biosphere

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation that shows climate is a result of energy transfer among the atmosphere, hydrosphere, geosphere and biosphere
- b. Analyze and interpret data on Earth’s climate
- c. Explain how a combination of factors such as Earth’s tilt, seasons, geophysical location, proximity to oceans, landmass location, latitude, and elevation determine a location’s climate
- d. Identify mechanisms in the past and present that have changed Earth’s climate
- e. Analyze the evidence and assumptions regarding climate change
- f. Interpret evidence from weather stations, buoys, satellites, radars, ice and ocean sediment cores, tree rings, cave deposits, native knowledge, and other sources in relation to climate change

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How can changes in the ocean create climate change?
2. How is climate influenced by changes in Earth’s energy balance?
3. How have climates changed over Earth’s history?
4. How does climate change impact all of Earth’s systems?
5. How have climate changes impacted human society?

Relevance and Application:

1. Much of the data we receive about the ocean and the atmosphere is from satellites.
2. Human actions such as burning fossil fuels might impact Earth’s climate.
3. Technological solutions and personal choices such as driving higher mileage cars and using less electricity could reduce the human impact on climate.

Nature of Science:

1. Understand how observations, experiments, and theory are used to construct and refine computer models.
2. Examine how computer models are used in predicting the impacts of climate change.
3. Critically evaluate scientific claims in popular media and by peers regarding climate and climate change, and determine if the evidence presented is appropriate and sufficient to support the claims.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Describe how climate affects humans
- II. Explain how human behavior affect climate
- III. Identify Earth’s tilt, seasons, elevation, proximity to oceans as factors that determine a location’s climate
- IV. Use tools to measure temperature, wind, precipitation and then analyze information from the sources about climate change

Extended Readiness Competencies

Content based access skills:

1. Consistently attaching meaning to a symbol related to climate
2. Understanding the impact of change in climate and weather

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Describe how humans are dependent on the diversity of resources provided by Earth and Sun

Grade Level Expectation: High School

Concepts and skills students master:

5. There are costs, benefits, and consequences of exploration, development, and consumption of renewable and nonrenewable resources

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development, and consumption of renewable and nonrenewable resources
- b. Evaluate positive and negative impacts on the geosphere, atmosphere, hydrosphere, and biosphere in regards to resource use
- c. Create a plan to reduce environmental impacts due to resource consumption
- d. Analyze and interpret data about the effect of resource consumption and development on resource reserves to draw conclusions about sustainable use

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do humans use resources?
2. How can humans reduce the impact of resource use?
3. How are resources used in our community?
4. What are the advantages and disadvantages of using different types of energy?

Relevance and Application:

1. Technologies have had a variety of impacts on how resources are located, extracted, and consumed.
2. Technology development has reduced the pollution, waste, and ecosystem degradation caused by extraction and use.

Nature of Science:

1. Infer assumptions behind emotional, political, and data-driven conclusions about renewable and nonrenewable resource use.
2. Critically evaluate scientific claims in popular media and by peers, and determine if evidence presented is appropriate and sufficient to support the claims.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Determine the effects of using natural resources
- II. Compare the advantages and disadvantages of renewable and non-renewable resources

Extended Readiness Competencies

Content based access skills:

1. Consistently attaching meaning to a symbol related to natural resources
2. Selecting careers related to natural resources (coal miners, trash collectors, tree trimmers, etc.)

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: High School

Concepts and skills students master:

6. The interaction of Earth's surface with water, air, gravity, and biological activity causes physical and chemical changes

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation addressing questions regarding the interaction of Earth’s surface with water, air, gravity, and biological activity
- b. Analyze and interpret data, maps, and models concerning the direct and indirect evidence produced by physical and chemical changes that water, air, gravity, and biological activity create
- c. Evaluate negative and positive consequences of physical and chemical changes on the geosphere
- d. Use remote sensing and geographic information systems (GIS) data to interpret landforms and landform impact on human activity

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do Earth’s systems interact to create new landforms?
2. What are positive changes on Earth’s geosphere due to water, air, gravity, and biological activity?
3. What are negative changes on Earth’s geosphere due to water, air, gravity, and biological activity?

Relevance and Application:

1. Geologic, physical, and topographic maps can be used to interpret surface features
2. Recognize that landform models help us understand the interaction among Earth’s systems.
3. Human activities such as agricultural practices have impacts on soil formation and soil loss.)

Nature of Science:

1. Ask testable questions and make a falsifiable hypothesis about physical and chemical changes on the geosphere and use an inquiry based approach to find an answer.
2. Share experimental data, and respectfully discuss conflicting results.
3. Use appropriate technology to help gather and analyze data, find background information, and communicate scientific information on physical and chemical changes.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify the properties of gravity
- II. Investigate how human activity can cause physical and chemical changes in water and air

Extended Readiness Competencies

Content based access skills:

1. Consistently attaching meaning to a symbol related to humans impacting air and water
2. Understanding changes in water and air due to human influence

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: High School

Concepts and skills students master:

7. Natural hazards have local, national and global impacts such as volcanoes, earthquakes, tsunamis, hurricanes, and thunderstorms

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation regarding natural hazards, and explain their potential local and global impacts
- b. Analyze and interpret data about natural hazards using direct and indirect evidence
- c. Make predictions and draw conclusions about the impact of natural hazards on human activity – locally and globally

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. Why are some natural hazards difficult to predict, while others are easier to predict?
2. How are humans impacted by natural hazards?
3. How can we prepare for natural hazards?
4. How is climate change expected to change the incidence of natural hazards?

Relevance and Application:

1. Engineers must know the hazards of a local area and design for it such as building safe structures in zones prone to earthquakes, hurricanes, tsunamis, or tornadoes.
2. Differing technologies are used to study different types of natural hazards.
3. Natural hazard zones affect construction or explain why monitoring natural hazards through air traffic safety, evacuations, and protecting property is important.
4. Science is used by disaster planners who work with the scientific community to develop diverse ways to mitigate the impacts of natural hazards on the human population and on a given ecosystem.

Nature of Science:

1. Collaborate with local, national, and global organizations to report and review natural disaster data, and compare their conclusions to alternate explanations.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify impacts of natural hazards (blizzard, tornado, flood, volcanoes, fire and earthquakes)
- II. Select appropriate ways to prepare for natural hazards (blizzards, tornadoes, floods)

Extended Readiness Competencies

Content based access skills:

1. Consistently attaching meaning to a symbol related to natural hazards
2. Manipulating materials needed during a natural disaster

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

Students can:

- a. Differentiate between basic and severe weather conditions, and develop an appropriate action plan for personal safety and the safety of others
- b. Observe and gather data for various weather conditions and compare to historical data for that date and location
- c. Use models to develop and communicate a weather prediction

21st Century Skills and Readiness Competencies

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.
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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify severe weather conditions
- II. Follow a simple action plan for severe weather
- III. Compare safe versus unsafe practices during severe weather conditions (blizzards, flood, tornado, lightning)

Extended Readiness Competencies

Content based access skills:

1. Consistently attach meaning to a symbol related to weather
2. Self advocating for needs during severe weather conditions

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

Students can:

- a. Develop, communicate and justify an evidence-based scientific explanation to account for Earth’s different climates
- b. Research and evaluate direct and indirect evidence to explain how climates vary from one location to another on Earth
- 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

21st Century Skills and Readiness Competencies

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.
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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Compare different climates on Earth using characteristics such as temperature, hot/cold, precipitation, rain/snow etc.
- II. Identify tools to measure temperature, wind, and precipitation

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbol related to climate and weather characteristics
2. Responding to changes in the climate and weather characteristics
3. Manipulating tools related to weather

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
<p>Students can:</p> <ol style="list-style-type: none"> 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 b. Describe methods and equipment used to explore the solar system and beyond c. Design an investigation that involves direct observation of objects in the sky, and analyze and explain results d. Research, critique, and communicate scientific theories that explain how the solar system was formed e. Use computer data sets and simulations to explore objects in the solar system f. Recognize that mathematical models are used to predict orbital paths and events 	<p>Inquiry Questions:</p> <ol style="list-style-type: none"> 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? <p>Relevance and Application:</p> <ol style="list-style-type: none"> 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. <p>Nature of Science:</p> <ol style="list-style-type: none"> 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. 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.

Extended Evidence Outcomes	Extended Readiness Competencies
<p>With appropriate supports, students can:</p> <ol style="list-style-type: none"> I. Demonstrate that Earth's rotation causes the Sun to appear differently throughout the day (ex. sunrise, high noon, sunset) II. Recognizes that celestial objects have patterns of movement (moon and stars around sun) III. Explain why planets' temperatures are dependent on their proximity to the Sun IV. Distinguish between fact and fiction regarding space exploration (e.g. Star Wars vs. factual space exploration) 	<p>Content based access skills:</p> <ol style="list-style-type: none"> 1. Attaching meaning to symbols related to the patterns of movement in the solar system 2. Understanding of proximity and negotiating adjustments in relation to the solar system 3. Exploring technology related to space exploration

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

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
- c. Use models to explain the relative motions of Earth, Moon, and Sun over time

21st Century Skills and Readiness Competencies

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.
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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Provide reasoning for the Moon's appearance during the Moon's common phases (crescent, half and, full moon)
- II. Conduct an investigation of how the Moon changes appearance during the month (crescent, new, half and, full moon)
- III. Identify the relationship between orientation of the Earth and seasons
- IV. Distinguish features of solar and lunar eclipses
- V. Identify tools to view objects in the sky and space

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to the appearance of the moon and the sun
2. Following directions related to a task related to the moon and the sun
3. Expressing an understanding of events in space
4. Manipulating science materials and equipment related to objects in space

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: Seventh Grade

Concepts and skills students master:

1. Major geologic events such as earthquakes, volcanic eruptions, mid-ocean ridges, and mountain formation are associated with plate boundaries and attributed to plate motions

Evidence Outcomes

Students can:

- a. Gather, analyze, and communicate data that explains Earth’s plates, plate motions, and the results of plate motions
- b. Identify, interpret, and explain models of plates motions on Earth
- c. Use maps to locate likely geologic “hot spots”, using evidence of earthquakes and volcanic activity
- d. Use web-based or other technology tools to show connections and patterns in data about tectonic plate boundaries and earthquakes, volcanic eruptions, and mountain formation

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How can major geologic events be attributed to plate movement?
2. What evidence supports the theory of plate tectonics?
3. What are the effects of plate movement along plate boundaries?

Relevance and Application:

1. Computer models and simulations help us understand and make informed decisions about major geologic events.
2. Building codes and emergency plans often reflect natural threats in an area.

Nature of Science:

1. Construct a model to demonstrate how plate movement results in geologic events.
2. Trace the development of a scientific theory using the theory of plate tectonics.
3. 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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Conduct a demonstration of movement along plate boundaries of the Earth’s surface
- II. Describe the result of plate movement

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbol related natural landforms and events
2. Understanding of changes in events of the Earth
3. Self advocating for needs related to natural disasters (this is connected to the national movement for preparedness for individuals with disabilities)

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: Seventh Grade

Concepts and skills students master:

2. Geologic time, history, and changing life forms are indicated by fossils and successive sedimentation, folding, faulting, and uplifting of layers of sedimentary rock

Evidence Outcomes

Students can:

- a. Describe the geologic time scale and why it is used
- b. Identify and describe the impact of major geologic events on life on Earth
- c. Identify and describe major events in Earth's geologic history
- d. Use direct and indirect evidence to determine the sequence of events in geologic time

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How can we interpret data from layers of rock?
2. What is geologic time?

Relevance and Application:

1. Knowledge of Earth's structure such as knowing where to mine for gold or drill for oil helps humans locate and extract resources.
2. Dating fossils absolutely and relatively helps assemble the story of the evolution of life on Earth.

Nature of Science:

1. Ask testable questions and make falsifiable hypotheses on the history of the earth and design a method to find an answer.
2. Describe how scientists study fossils, and suggest ways that understanding fossil evidence contributed to our knowledge about life on Earth over geologic time.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Examine fossils as a record of a previous living organism
- II. Identify types of rocks where fossils are most likely to be found
- III. Distinguish between fact and fiction regarding geologic time (e.g. "Ice Age" the movie vs the actual ice age)

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbol related to changing life forms
2. Interpreting meaning related to geologic time
3. Manipulating rocks and fossils

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: Sixth Grade

Concepts and skills students master:

1. Complex interrelationships exist between Earth’s structure and natural processes that over time are both constructive and destructive

Evidence Outcomes

Students can:

- a. Gather, analyze, and communicate an evidence-based explanation for the complex interaction between Earth’s constructive and destructive forces
- b. Gather, analyze and communicate evidence form text and other sources that explains the formation of Earth’s surface features
- c. Use a computer simulation for Earth’s changing crust

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do forces inside Earth and on the surface build, destroy, and change Earth’s crust?
2. How does Earth's surface change over time?

Relevance and Application:

1. There are costs and benefits to building in areas that are prone to constructive and destructive forces such as earthquakes and landslides.
2. Harbors, glaciers, and geysers change over time based on geologic and natural events.

Nature of Science:

1. Practice the collaborative inquiry process that scientists use to identify local evidence of Earth’s constructive and destructive processes.
2. Create and compare models that show how natural processes affect Earth’s structures.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Classify natural geologic structures versus manmade structures
- II. Identify that landforms are made by constructive and destructive processes
- III. Identify differences in land forms (rivers vs. lakes, mountains vs. valleys, plains etc.)

Extended Readiness Competencies

Content based access skills:

1. Attending to natural and man-made materials Understanding of changes in events of the Earth
2. Attaching meaning to a symbol related to land structures
3. Making choices related to natural and man-made materials
4. Expressing an understanding of differences related the earth surface

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Describe how humans are dependent on the diversity of resources provided by Earth and Sun

Grade Level Expectation: Sixth Grade

Concepts and skills students master:

2. Water on Earth is distributed and circulated through oceans, glaciers, rivers, ground water, and the atmosphere

Evidence Outcomes

Students can:

- a. Gather and analyze data from a variety of print resources and investigations to account for local and world-wide water circulation and distribution patterns
- b. Use evidence to model how water is transferred throughout the earth
- c. Identify problems, and propose solutions related to water quality, circulation, and distribution – both locally and worldwide
- d. Identify the various causes and effects of water pollution in local and world water distributions
- e. Describe where water goes after it is used in houses or buildings

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How is water cycled on Earth?
2. How does the lack or abundance of water impact human civilizations and populations?
3. How do your daily decisions impact the quality of water in the water cycle?

Relevance and Application:

1. Home water quality and consumption affects for health and conservation policies.
2. Water systems affect local, regional, and world population development.
3. Water-use irrigation patterns in Colorado affect economic development in the state.

Nature of Science:

1. Ask testable questions and make falsifiable hypotheses research about water distribution.
2. Create and evaluate models; identifying the strengths and weaknesses of the model in representing water circulation and distribution.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify natural sources of water (rivers, lakes, springs, oceans)
- II. Describe ways to conserve water
- III. Identify the causes and effects of water pollution

Extended Readiness Competencies

Content based access skills:

1. Expressing an understanding of limitations of water
2. Manipulating materials and equipment around water
3. Selecting tasks that can be done with water

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Describe how humans are dependent on the diversity of resources provided by Earth and Sun

Grade Level Expectation: Sixth Grade

Concepts and skills students master:

3. Earth’s natural resources provide the foundation for human society’s physical needs. Many natural resources are nonrenewable on human timescales, while others can be renewed or recycled

Evidence Outcomes

Students can:

- a. Research and evaluate data and information to learn about the types and availability of various natural resources, and use this knowledge to make evidence-based decisions
- b. Identify and evaluate types and availability of renewable and nonrenewable resources
- c. Use direct and indirect evidence to determine the types of resources and their applications used in communities
- d. Research and critically evaluate data and information about the advantages and disadvantages of using fossil fuels and alternative energy sources

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What resources are found and used in our community?
2. How can natural resources be identified and classified?
3. How can we make responsible choices about the resources we use on a daily basis?

Relevance and Application:

1. Natural resources come from a variety of locations and have to be mined or harvested, depending on the type.
2. A resource can be used in a variety of ways, depending on the product being made. For example plastics, textiles, medications, and fertilizers are produced from petroleum.
3. Resources in Colorado directly affect the state economy and society by providing employment and sources of revenue.

Nature of Science:

1. 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.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify uses of Earth’s resources (wood, water, fossil fuels)
- II. Identify common materials that can be recycled

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to Earth's resources
2. Expressing an understanding of reuse, and recycle

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Describe how humans are dependent on the diversity of resources provided by Earth and Sun

Grade Level Expectation: Fifth Grade

Concepts and skills students master:

1. Earth and Sun provide a diversity of renewable and nonrenewable resources

Evidence Outcomes

Students can:

- a. Develop and communicate a scientific explanation addressing a question of local relevance about resources generated by the sun or Earth
- b. Analyze and interpret a variety of data to understand the origin, utilization, and concerns associated with natural resources

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How can the Sun be used as an energy source?
2. How can wind be used as an energy source?
3. What types of energy sources exist on Earth?

Relevance and Application:

1. Mining operations provide nonrenewable resources.
2. Resources are not distributed evenly and require transportation systems to move them to where they are needed.
3. Towns and laws are often built around resource extraction.

Nature of Science:

1. Review and analyze scientific explanations about natural resources presented by their peers, and provide feedback to push their peers to be scientifically accurate and base their claims on adequate and reasonable scientific evidence, not opinion.
2. Earth and Sun provide a variety of renewable and nonrenewable resources.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify Earth's resources (water, wind, and some fossil fuels such as coal, gas, solar)
- II. Identify ways to conserve resources (turn off lights, turn off water when brushing teeth)
- III. Distinguish between renewable and nonrenewable resources

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning of symbols related to natural resources
2. Expressing an understanding of limitations of natural resources

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: Fifth Grade

Concepts and skills students master:

2. Earth’s surface changes constantly through a variety of processes and forces

Evidence Outcomes

Students can:

- a. Analyze and interpret data identifying ways Earth’s surface is constantly changing through a variety of processes and forces such as plate tectonics, erosion, deposition, solar influences, climate, and human activity
- b. Develop and communicate an evidence based scientific explanation around one or more factors that change Earth’s surface

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How does Earth’s surface change?
2. How do changes on Earth’s surface impact humans?

Relevance and Application:

1. There are benefits and dangers to humans as Earth’s surface constantly changes.
2. Communities take into account the effects of the changing Earth in a variety of ways. For example, they might use springs, stilts, drainage techniques, or build off the ground because of frost heaving.
3. Some cities have emergency plans for earthquakes, flooding, eruptions, and tornadoes.
4. The development of technology led to tools that made the establishment of measurement standards – the Richter Scale – possible.

Nature of Science:

1. Ask testable questions about how the earth surface changes.
2. Utilize a variety of media sources to collect data for analysis regarding Earth processes and the changing surface.
3. Assess and provide feedback on other’s scientific explanations about factors that change Earth’s surface, pushing for reasoning based on evidence and scientific principles

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify features of the Earth’s surface (river, lakes, beaches, mountains, desert)
- II. Match Earth’s materials to land forms (sand to beaches, rocks to mountains)
- III. Identify forces that can change the Earth’s surface (erosion, deposition, climate, and human activity)

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbol related to earth surface features
2. Expressing an understanding of differences related the earth surface
3. Selecting tasks that can be done with earth materials

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: Fifth Grade

Concepts and skills students master:

3. Weather conditions change because of the uneven heating of Earth’s surface by the Sun’s energy. Weather changes are measured by differences in temperature, air pressure, wind and water in the atmosphere and type of precipitation

Evidence Outcomes

Students can:

- a. Develop and communicate an evidence-based scientific explanation for changes in weather conditions
- b. Gather, analyze, and interpret data such as temperature, air pressure, wind, and humidity in relation to daily weather conditions
- c. Describe weather conditions based on data collected using a variety of weather tools
- d. Use data collection tools and measuring devices to gather, organize, and analyze data such as temperature, air pressure, wind, and humidity in relation to daily weather conditions

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. Why does the Sun heat different surfaces at different rates?
2. Why does the weather change from day to day?

Relevance and Application:

1. The Sun’s energy helps change daily weather by influencing the water cycle, air movement, and temperature.
2. Gliders and birds exploit updrafts created by thermals.
3. Deicing airplanes in the winter is sometimes necessary so that they can fly.
4. Weather satellites generate data that measure and monitor changes in weather.

Nature of Science:

1. Support explanations of weather using evidence.
2. Understand how weather maps are utilized to predict the weather from day to day.
3. Assess and provide feedback on other student’s scientific explanations about weather, pushing for reasoning based on evidence and scientific principles.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Make and record daily qualitative observations about the weather (temperature, wind, precipitation)
- II. Identify sources for daily/weekly weather information
- III. Compare forms of precipitation (rain, snow, hail)

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to a symbol related to weather
2. Setting goals to plan for action related to observations about the weather
3. Responding to precipitation changes
4. Selecting jobs related to weather

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: Fourth Grade

Concepts and skills students master:

1. Earth is part of the solar system, which includes the Sun, Moon, and other bodies that orbit the Sun in predictable patterns that lead to observable paths of objects in the sky as seen from Earth

Evidence Outcomes

Students can:

- a. Gather, analyze, and interpret data about components of the solar system
- b. Utilize direct and indirect evidence to investigate the components of the solar system
- c. Gather, analyze, and interpret data about the Sunrise and Sunset, and Moon movements and phases
- d. Develop a scientific explanation regarding relationships of the components of the solar system

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What are the patterns of movement for the Sun and Moon across the sky?
2. How does Earth compare to other objects orbiting the Sun?
3. How do we study the solar system?

Relevance and Application:

1. Space exploration has produced data to answer questions about the solar system.
2. Comets are observable objects seen from Earth which provide scientists data about the solar system.
3. Orbits in a predictable pattern in space influence season's on Earth.

Nature of Science:

1. Understand that models are developed to explain and predict natural phenomena that cannot be directly observed because they happen over long periods of time.
2. Critically evaluate models of the solar system, identifying the strengths and weaknesses of the model in representing what happens in the real solar system.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify the common parts of a solar system (sun, planets, stars, moons)
- II. Identify phases of moon.

Extended Readiness Competencies

Content based access skills:

1. Following directions related to a task related to the solar system
2. Attaching meaning to symbols related to the solar system
3. Expressing an understanding of parts of a solar system
4. Engaging and sustaining participation in an activity related to the earth and/or solar system

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: Third Grade

Concepts and skills students master:

1. Earth’s materials can be broken down and/or combined into different materials such as rocks, minerals, rock cycle, formation of soil, and sand – some of which are usable resources for human activity

Evidence Outcomes

Students can:

- a. Investigate and identify two or more ways that Earth’s materials can be broken down and/or combined in different ways such as minerals into rocks, rock cycle, formation of soil, and sand
- b. Use evidence to develop a scientific explanation about one or more processes that break down and/or combine Earth materials
- c. Utilize a variety of media sources to collect and analyze data around Earth’s materials and the processes by which they are formed

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What are some of the ways that Earth’s materials are formed?
2. Where do these different materials such as soil, sand, rocks, and oil come from? What is the process by which the materials were formed?
3. How is Earth’s surface changing?
4. How do rocks “cycle?”

Relevance and Application:

1. Many of Earth’s materials are usable building or energy resources. Extended processes and time are required to convert fossil fuels and soil into useful material.

Nature of Science:

1. Ask testable questions about the composition and formation of rocks.
2. Use models to demonstrate the rock cycle or other ways Earth’s materials are broken down or combined.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Illustrate that rocks change due to weathering
- II. Identify common uses of sand, soil and/or rocks
- III. Explain how rocks can change into soil

Extended Readiness Competencies

Content based access skills:

1. Making choices related to texture and color of earth materials
2. Expressing an understanding of differences related texture and color of earth materials
3. Manipulating rocks, sand and soil
4. Using and organizing earth materials
5. Selecting tasks that can be done with earth materials

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: Second Grade

Concepts and skills students master:

1. Weather and the changing seasons impact the environment and organisms such as humans, plants, and other animals

Evidence Outcomes

Students can:

- a. Use evidence to develop a scientific explanation for how the weather and changing seasons impacts the organisms such as humans, plants, and other animals – and the environment
- b. Analyze and interpret data such as temperatures in different locations (Sun or shade) at different times and seasons as evidence of how organisms and the environment are influenced by the weather and changing seasons
- c. Analyze ways in which severe weather contributes to catastrophic events such as floods and forest fires

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How does the temperature change at different times during the day (morning, noon, and evening) and from day to day?
2. What changes do we make in our daily lives based on changes in the weather?
3. How do weather patterns change throughout the year?

Relevance and Application:

1. The weather and changing seasons impact organisms such as humans, plants, and other animals – and the environment.
2. Organisms and the environment are influenced by the weather and changing seasons.

Nature of Science:

1. Ask testable questions about weather and the seasons.
2. Make predictions, share thinking, and ask others how they know that organisms and the environment are influenced by the weather and changing seasons.
3. Select and use appropriate tools to measure, record, and communicate data about the weather using appropriate units.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify materials / clothing/ recreation/ transportation appropriate to the weather
- II. Identify common types of weather related to a typical season

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to weather and/or seasons
2. Responding to weather changes

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Describe how humans are dependent on the diversity of resources provided by Earth and Sun

Grade Level Expectation: First Grade

Concepts and skills students master:

1. Earth's materials can be compared and classified based on their properties

Evidence Outcomes

Students can:

- a. Identify and represent similarities and differences such as the texture, size, color, and shape of various materials on Earth
- b. Sort, group, and classify Earth's materials based on observations and explorations
- c. Make predictions about how a material on Earth might be useful based on its properties
- d. Communicate ideas about the differences between soils from different places
- e. Use a variety of tools to observe, analyze, record, and compare Earth's materials
- f. Analyze the impact of reducing, reusing, and recycling various materials

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How are various materials on Earth similar and different?
2. How do the properties of various materials on Earth affect the way we can use them?
3. How does soil differ from different places?

Relevance and Application:

1. Humans use natural resources in our daily lives and in a variety of ways. For example, wood for building and furniture.
2. There are limits on resources and materials extracted from the natural environment.

Nature of Science:

1. The same materials can be sorted in a number of ways based on different characteristics.
2. Scientists make predictions based on what they know.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Use qualitative labels to describe properties of common Earth's materials (wet, hard, rough, dry)
- II. Distinguish between Earth materials (soil, water, sand, rock)

Extended Readiness Competencies

Content based access skills:

1. Making choices related to texture of earth materials
2. Expressing personal preferences and choices related to qualitative labels of materials

Content Area: Science
Standard: 3. Earth Systems 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
- 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: Kindergarten

Concepts and skills students master:

1. The Sun provides heat and light to Earth

Evidence Outcomes

Students can:

- a. Investigate, explain, and describe that the Sun provides heat and light to Earth
- b. Analyze and interpret temperature data between day (when the Sun shines on our area) and night (when the Sun does not shine on our area)
- c. Investigate and communicate findings about what happens when the Sun's light is blocked
- d. Investigate and communicate the effect of varying heat and light on the growth of plants through a scientific study

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How does the Sun impact Earth?
2. What happens when the Sun's light is blocked?

Relevance and Application:

1. Decisions about activities to do on school grounds can be based on the light and heat from the sun (i.e. read under a tree to stay cool or avoid the slide when it is too hot from the sun, etc.)
2. People make decisions about where to live based on temperature and how much sun that place gets.

Nature of Science:

1. Question peers and encourage clarity of reasoning about why they think the Sun provides heat and light to Earth.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify the impact of the sun on the Earth (heat and light)
- II. Describe heat and light by using simple qualitative labels (hot, cold, light, dark)

Extended Readiness Competencies

Content based access skills:

1. Connecting symbols to qualitative labels to describe heat and light
2. Responding to change in the properties of weather and the sun

Content Area: Science
Standard: 3. Earth Systems Science

Prepared Graduates:

- Describe how humans are dependent on the diversity of resources provided by Earth and Sun

Grade Level Expectation: Preschool

Concepts and skills students master:

1. Earth's materials have properties and characteristics that affect how we use those materials

Evidence Outcomes

Students can:

- a. Use senses to gather information about Earth's materials
- b. Make simple observations, explanations, and generalizations about Earth's materials based on real-life experiences
- c. Describe how various materials might be used based on characteristics or properties

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. What are the similarities and differences among various earth materials?
2. How do scientists study and describe Earth's materials?

Relevance and Application:

1. Use scientific tools in investigations, and play with materials such as rocks, soil, sand, and water.

Nature of Science:

1. Ask testable question based on discoveries made while playing.
2. Collect, describe, and record information through discussions, drawings, and charts.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Gather information about Earth's materials by using senses

Extended Readiness Competencies

Content based access skills:

1. Attaching meaning to symbols related to objects in the sky
2. Expressing an understanding of using different senses

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: Preschool

Concepts and skills students master:

- 2. Events such as night, day, the movement of objects in the sky, weather, and seasons have patterns

Evidence Outcomes

Students can:

- a. Identify, predict, and extend patterns based on observations and representations of objects in the sky, daily weather, and seasonal changes
- b. Observe and describe patterns observed over the course of a number of days and nights, possibly including differences in the activities or appearance of plants and animals

21st Century Skills and Readiness Competencies

Inquiry Questions:

- 2. What natural patterns do you notice during the day?
- 3. What natural patterns do you notice at night?
- 4. What patterns do you notice in the seasons?
- 5. What patterns do you notice in weather?

Relevance and Application:

- 1. Different activities of various animals – including humans – are aligned with daily and seasonal patterns.

Nature of Science:

- 1. Be open to and curious about new tasks and challenges.
- 2. Explore and experiment.

Extended Evidence Outcomes

With appropriate supports, students can:

- I. Identify night and day
- II. Identify sun, moon and stars
- III. Identify daily weather

Extended Readiness Competencies

Content based access skills:

- 1. Attending to changes in the environment conditions
- 2. Sequencing events based on a naturally occurring pattern

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