

Colorado Academic Standards

SCIENCE

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Draft

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Office of Standards and Assessments

cde Improving
Academic
Achievement

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A call for Feedback

The Science Standards Sub-committee spent four months examining national documents such as AAAS's *Science for All Americans*, *Benchmarks 2061* and *Atlas of Science Literacy*, NAS's *National Science Education Standards*, and international benchmarks such as the science standards from Singapore, Finland, Massachusetts, and Virginia. We also looked at national studies on standards such as the National Research Council's *Ready, Set, Science* and *Taking Science to school*, Committee on Test Design for K–12 Science Achievement's *Systems for States Science Assessment*, The National Commission on Mathematics and Science Teaching for the 21st Century's *Before Its Too Late*, and the American Educational Research Association's *Science Education that Makes Sense* to help guide the standards revision. The committee also carefully considered an analysis of our current standards by WestEd.

What we found were recommendations to focus the standards around a few big ideas in science and that the standards should focus more on concepts and how we know them, rather than detailed facts. The committee identified 13 themes that students should focus on during their P – 12 science education: inquiry, application to society and technology, nature of science, motion, matter, energy, organismal biology, genetics, reproduction and growth, ecology, evolution, Earth's history and place in space, Earth's processes, and Earth's resources. All grade level expectations were written to support the building of understanding around these thirteen themes in an incremental fashion.

Three of these themes come from previous versions of the Colorado Content Standards, Inquiry and Nature of Science come from the current standards 1 and 5, and application to society and technology come from standard 6 of the original science content standards. It was thought by the committee that these themes cross cut all the others. Therefore instead of treating them as standalone themes or standards, they are now addressed specifically in every grade level expectation. This type of inclusion is also what is being recommended in NSTA's Science Anchors project.

The sub-committee spent significant time discussing other common themes that occur in science and are addressed in AAAS's *Science for All American's* and in the *National Science Education Standards*. These include the history of science, systems, models, constancy and change, scale, and habits of mind. By the end of these discussions the consensus of the committee is that, while critically important aspects of science, these areas were better left as curriculum and instruction decisions rather than part of the standards. This allowed us to focus the standards more on big ideas and the skills needed to support those ideas.

The sub-committee was tasked by the Standards Stakeholders Group to create grade by grade standards P – 8 as well as high school standards. The committee did its best to ground grade level decisions on development level of the students and in a manner that builds knowledge in a coherent fashion.

It is the desire of the standards committee to create standards that not only ensure that graduates from the Colorado P - 12 system are ready to apply knowledge, processes, and thinking skills that come from studying science, but also to create standards that both present and future teachers will be excited about teaching and students will enjoy studying. Please help us reach this lofty goal by giving us feedback on the scope, sequence, teachability, and overall feel of these standards. Have we identified the right content and the right skills at the right grade levels?

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DRAFT Public Overview

Background of the draft 2009 Colorado Academic Standards

Colorado has had state model content standards in 13 disciplines for 14 years. They have been the broad articulation of the ideas, themes, facts, and agendas which have been of value to this state for more than a decade. In 2007, the State Board of Education recommended a comprehensive revision of these standards for some elemental changes in the direction of these documents. In 2008, the state's legislature affirmed and further articulated the nature of these changes by passing Senate Bill 08-212.

The timeline for revising the content standards in 13 areas is ambitious. State content standards are to be revised and adopted by December 2009. Unlike the time it took to initially create content standards, this one year project was undertaken with select design features in mind.

Senate Bill 08-212 expanded the vision of public education outcomes by including higher education and early childhood education goals into one seamless standards policy.

The vision calls for students to have the knowledge and skills necessary for both the opportunity for college entrance and the capacity of new skill sets in all courses of life.

The four important design features...

This version of state standards will include four changes; 1) adding 21st century skills, 2) ensuring fewer, clearer and higher standards, 3) adding early childhood, postsecondary and workforce readiness expectations, and 4) mastering concepts and skills....not facts.

Design Feature 1: 21st Century Skills

The speed with which information, business, culture and new knowledge now moves is a new challenge for all of us. Unlike the historical two decade-long apprenticeships of the Renaissance or the understanding that a person stays in a job for a lifetime, shifts in communication, art, technical sectors and the marketplace now demand that our students be nimble and anticipate problems, solve critical issues and work with others in effective and ethical ways, and function under faster time pressures. Retaining only one body of facts for life does not work anymore. The eight to five workdays have been replaced by twenty-four hour schedules. New skills are needed to thrive under these conditions.

"21st century skills" is a term that most commonly resonates as a way to describe the skills necessary to respond and lead well in a globally-based culture.

Research (21st Century Partnership, SCANS report, EPIC, College Board, etc.) points to the importance of five essential skills. These five include problem solving/critical thinking, information management, collaboration, self direction and innovation. Coloradans have been surveyed, interviewed and engaged on these five skills and the

vast majority agrees on their importance. Colorado's draft description of 21st century skills is now linked to the Colorado Department of Education at http://www.cde.state.co.us/index_home.htm. These skills are prominently embedded in the new standards and change the original version from academic content standards to essential concepts and skill standards.

Design Feature 2: Fewer, Clearer and Higher

Standards are written in broad terms in order to capture the volume of facts they represent. Colorado is designing its new expectations based on the best standards in national and international circles. Central to this work is the notion that internationally competitive standards tend to be fewer, higher and clearer than those typically seen in the U.S. today.

- Fewer: The challenge has been to develop standards that reduce lengthy litany of hopes, facts and agendas into essential concepts which are intelligent building blocks grade by grade.
- Clearer: The aim has been to use jargon-free terms that crisply convey knowledge and skill outcomes. Simple language and terms give students and teachers tangible and meaningful endpoints.
- Higher: The aim has been to chart what all students should know and be able to do in order to be successful. Short-changing students with minimal expectations diminishes their life options. These new Colorado expectations are authentic and include goals which invite both a stretch of effort and accomplishment. They convey the message that all students have the capacity to achieve highly.

Design Feature 3: Early Childhood and Higher Education Expectations

To ensure a seamless extension of standards that provides for each level of learning throughout Colorado's entire education system, these standards begin with postsecondary and workforce competencies. They begin with the end in mind. For example, what should every citizen in Colorado regardless of life experience, career, college or military service necessarily know to be considered a successful high school graduate? These big ideas that describe a prepared graduate are listed at the top of each page in the new Colorado academic standards. The Building Blocks of early learning are now coherently added to each content area and represent what is needed in order for a youngster to progress from early understandings to twelfth grade mastery.

Design Feature 4: Concepts...not facts

Our body of collective knowledge in any discipline grows so rapidly that the concept that schooling is static and a common information transmission system is now untenable. Standards become unwieldy when they attempt to capture the sum of what information students “should” know.

This design feature transforms Colorado academic standards into fewer, crucial *concepts* and *skill* standards that serve to give a mind the essential background, fluency of the topic in depth and the problem solving levers that are the qualities of knowledgeable people in each content area.

The Revision Process

Colorado’s standards are being revised using a few deliberate processes. The assumptions behind this approach are:

- These are Colorado’s standards. While we invite outside advice, these expectations represent the place where we live.
- The best national and international standards must be used to improve expectations of our kids. We close the gap when we require the quality of what we accept about the worthiness of our student outcomes.
- College opportunities occur when students are stretched beyond mediocre activities and when they do intellectual exercises that model what academic and solution leaders do.
- Research matters. Reinventing what we think about just within our own local circles insults the collective advances others have made.
- Public feedback and improvement informs the next generation of student standards. Different formats were used to gather public feedback:
 - Regional face to face conversation
 - Webinars
 - Listening logs
 - Surveys
 - Stakeholder meetings
 - Colorado experts as subcommittee members
 - Public notes posted with full transparency
 - Professional and association sector outreach
 - Public hearings

A brief overview of the year's revision process

The beginning of the entire process started with research and gap analysis of benchmarked states and nations which have the best standards. Analysis about the existing strengths and weaknesses simultaneously occurred with the current Colorado standards. Additionally, a study was commissioned which examined the formats and grade span structure of other states' standards.

A stakeholder advisory group was assembled to help define terms, frame the issues, determine grade by grade articulation and select subcommittee members from a pool of untitled applicants. These subcommittees were formed – one for each subject – in order to undertake the revision of standards.

Applicants were solicited from across the state to apply the subject-specific education (early, k-12, and higher education) and business sector expertise. Seven hundred and eighty six people applied to fill 255 unpaid roles. Selection was made by Colorado stakeholders in a name-blind process using the merits of both the application and resumes.

Eight districts that demonstrated early success in revising their local content and skill standards were asked to advise the process.

Advisory committees were identified in P-3, Higher Education, Business, and Education Associations in order to check the rigor and relevance.

Content subcommittees were formed in three phases Phase I: Math, Science, Reading and Writing and Music, Phase II: History, Civics, Geography and Economics, Phase III: Visual Arts, Theatre, Dance, Physical Education/Health and World Language). Each take the research, gap analyses, reports on best benchmarked states and nations, the 21st century skills and a draft of the postsecondary and workforce readiness draft description into consideration in order to revise the content standards of Colorado.

Regional tours after each Phase revision will launch a campaign to gather feedback and suggestions for improvement. The Colorado Department of Education content specialists will identify common themes that emerge from the feedback provided by the field. The first feedback window will be in April, the second in August and the third tour and electronic outreach will be in September.

In June 2009 the Colorado Council of Higher Education and Colorado State Board of Education intend to reach agreement on a working description of postsecondary and workforce readiness. This description may prompt the state to modify the standards drafts.

National experts will also on-going advice and will provide needed editing. They also will provide suggestions of technique.

UCLA's Director of the Center for Research, Evaluation, Standards and Student Testing will compile the complete drafts to write the final version in October 2009.

Official public hearings will take place in November 2009 before the State Board of Education. These hearings will provide the final recommendations.

The State Board of Education will decide which standards are adopted. This will occur by December 2009.

What can I do to help?

1. First read to understand.
 - a. These standards are not like the existing ones
 - b. They are not a curriculum or an exhaustive detail of each lesson or fact.
 - c. They represent the few, crucial concepts and skills students need to have mastered by the end of each grade. By design, no mention is made of when they actually are taught in the classroom.
2. Learn the new structure.
 - a. At the top of each discipline are the final prepared graduate competencies all students should be able to do in twelfth grade. This is the goal or the "end in mind" behind the rest of the text.
 - b. The standards are the "buckets" of how we organize the big ideas of one subject of study into those which are related to one another. (For example, pattern finding and algebraic thinking are similar and therefore are organized together within mathematics)
 - c. Each grade or grade span now has grade levels of expectation (of mastery), not "benchmarks". These represent a distinct concept and skills a student should know.
 - d. Now, each expectation also has an evidence outcome for a student to make meaning of the knowledge and *prove* how they know it. This is intended to engage the student and help them find relevance in the study. The 21st century skills are a part of this evidence element.
3. Examine this document as a prototype. It is a first draft of revised state standards. It is by no means perfect or finished. Does this conceptually work? How would you improve it?
4. Let us know your comments and stay engaged early this year.
 - a. Write us your specific ideas about what needs to be kept and what needs improvement at our web page.
 - b. Attend a face to face evening town meeting at one of 24 city sites across the state of Colorado.

One final comment:

These drafts represent a new kind of state standards. It is not a resource or a substitution for curriculum. It is intentionally only the outline of the most crucial concepts and skills students must master at grade level or high school level to be successful for opportunities at higher learning institutions.

It begs for new kinds of professional development, teacher education, state curriculum supports and new assessments.

...And *that* was the genesis of the change mentioned at the beginning of the 2008 Colorado education reform.

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Principles of the Standards Review Process

The Colorado Model Content Standards revision process has been informed by these guiding principles:

- Begin with the end in mind; define what prepared graduates need to be successful using 21st century skills in our global economy.
- Align K-12 standards with early childhood expectations and higher education.
- Change is necessary.
- Standards will be deliberately designed for clarity, rigor, and coherence.
- Standards will be fewer, higher, and clearer.
- Standards will be actionable.

Notable Changes to the Colorado Science Model Content Standards

1. **Embedding scientific inquiry and scientific process skills.** The largest change to the science standards is acknowledging that scientific inquiry, science process skills and content cannot be taught separately. These important aspects of science have been integrated into the three content standards.
2. **Readiness Competencies.** Another change is the realization that there are other important aspects of science such as the general nature of science and application of science concepts that also can not be easily separated from the content. These are represented as cross cutting themes. They differ significantly from evidence outcomes in their nature and their assessability. They are essential elements of the current Colorado State Standards and are directly addressed.
3. **Impact of standards articulation by grade level.** The original Colorado Content Standards for science provided learning benchmarks for grades 3, 5, 8, and 12. The science standards revision subcommittee was charged with defining what grade students should master various concepts and skills in science. Efforts were made by the committee members to articulate expectations at appropriate grade levels, based on national works such as *Benchmarks for Science Literacy* and the *Atlas for Science Literacy* so that students would build their knowledge of various topics.
4. **Articulation of High School Standards.** High School standards are articulated by standard, not grade level. This is intended to allow districts flexibility in designing high school curriculum and courses. The standards represent what is sufficient for a high school graduate to know and be able to do in science, and is not intended to suggest there be three years of science or three science courses in high school. For many students this will represent only a foundation for more advanced studies in science.
5. **Integration of P-2 Council's recommendations.** The science subcommittee has integrated the skills from the *P-2 Building Blocks* into P-12 science standards with inclusion of five preschool science standards.

Below is a quick guide to other changes in the science standards:

Area	Summary of changes	
	Current Standards	Proposed Revision
Number of standards	Colorado has 5 standards in Science	By embedding and using readiness competencies the proposed number of standards is 3.
Names of standards	Standard 1 Scientific investigations Standard 2 Physical Science Standard 3 Life Science Standard 4 Earth Science Standard 5 Nature of Science	Standard 1 Physical Science Standard 2 Life Science Standard 3 Earth Science
Integration of 21st century and post-secondary workforce readiness skills	These skills are primarily associated with the scientific investigations and nature of science standards (1 and 5)	These skills have been embedded in every grade level expectation.
P-2	<ul style="list-style-type: none"> Standards articulated for grade band beginning with Kindergarten Benchmarks articulated K – 3. 	<ul style="list-style-type: none"> Pre-K included. Grade level expectations articulated for each elementary grade.
Number of grade level expectations (GLE)	Currently there are 155 benchmarks	There 85 proposed GLEs.

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Scott Marion, Ph.D. is the Vice President of the National Center for the Improvement in Educational Assessment, Inc. where his current projects include developing and implementing a framework for evaluating the technical quality of state alternate assessment systems, exploring the instructional usefulness of interim assessment approaches, and helping states design valid accountability systems. Dr. Marion coordinates and/or serves on six state technical advisory committees and is an expert panelist for three major national initiatives. Dr. Marion is a regular advisor to the United States Department of Education (USED) on a host of assessment and accountability issues and is a member of USED's National Technical Advisory Committee. Dr. Marion is currently serving on a National Research Committee (NRC) investigating the issues and challenges associated with incorporating value-added measures in educational accountability systems. A former field biologist for eight years and high school science teacher, Dr. Marion earned a Bachelor's degree in biology from The State University of New York and a Master's in Science Education from the University of Maine. Dr. Marion received his Ph.D. in measurement and evaluation from the University of Colorado, Boulder. Prior to joining the Center for Assessment six years ago, Dr. Marion was most recently the Director of Assessment and Accountability for the Wyoming Department of Education and was responsible for overseeing the Wyoming Comprehensive Assessment System and designing the technical and policy structures to implement the Body of Evidence assessment system, a multiple-measures, locally-created collection of evidence used to determine whether high school students met the state graduation requirements. Dr. Marion regularly presents the results of his work at several national conferences (AERA, NCME, and CCSSO) and has published dozens of articles in peer-reviewed journals and edited volumes.

References used by the science sub-committee

The science subcommittee used a variety of resources representing a broad range of perspectives to inform their work. Those references include:

- WestEd Colorado Model Content Standards Review
- AAAS's *Science for all Americans*
- AAAS's *Benchmarks for science literacy*
- AAAS's *The Atlas for Science Literacy*
- NAS's *The National Science Standards*
- National Research Council's *Taking Science to School*
- National Research Council's *Ready, Set, Science*
- Committee on Test Design for K–12 Science Achievement's *Systems for States Science Assessment*
- The National Commission on Mathematics and Science Teaching for the 21st Century's *Before It's Too Late*
- American Educational Research Association's *Science Education that Makes Sense*
- NAEP *Science Frameworks*
- *Singapore National Curriculum*
- *Massachusetts Curriculum Framework*
- *Virginia Standards of Learning*
- *Finland – National Core Curriculum*

Colorado Academic Standards Science

Science is facts; just as houses are made of stone, so is science made of facts; but a pile of stones is not a house, and a collection of facts is not necessarily science.

Jules Henri Poincaré (1854-1912) French mathematician.

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

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

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

A major aspect of science is the continual interpretation of evidence. All scientific ideas are constantly being challenged by new evidence and evolving to fit the new evidence. Students must understand the collaborative social processes that guide these changes so that they can reason through and think critically about popular scientific information, as well as draw valid conclusions based on evidence, which is often limited. Imbedded in the cognitive process, students learn and apply the social and cultural skills expected of all citizens in school and in the workplace. For example, during class activities, laboratory exercises, and projects, students learn and practice self-discipline, collaboration and working in groups.

The Colorado Model Content Standards in Science represent what all Colorado students should know and be able to do in science as a result of their preschool through grade 12 science education. Specific expectations are given for students completing each grade from preschool through 8th grade, and for High School. These standards outline the essential level of science content knowledge and the application of the skills needed by all Colorado citizens to participate productively in our increasingly global, information-driven society.

Prepared Graduate Competencies in Science

The Prepared Graduate Competencies are the Preschool through Grade 12 concepts and skills that all students leaving the Colorado education system must have to ensure success in a postsecondary and workforce setting.

Prepared Graduates:

- Observe, explain based on evidence, and predict natural phenomena governed by Newton's Theories of Motion. When forces are balanced, objects are observed to remain at rest or moving with constant velocity. Motion can be changed in predictable and measurable ways when unbalanced forces act by direct contact or at a distance (gravity, electromagnetic, nuclear). Whenever one object exerts a force on another object, it experiences an exactly equal but opposite force which ensures that the total momentum of the system of objects remains constant.
- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions. Students apply the idea that matter has various forms and its transformation occurs in processes that are predictable and explainable. Matter has characteristic properties which can be used for identification, classification, and/or separations. Matter is made of atoms which are built out of protons, neutrons, and electrons. Different elements have unique numbers of these sub-atomic particles. There are relationships between and among atoms, molecules, elements, compounds, mixtures, and solutions. Interactions between matter and energy result in physical and chemical changes. These interactions occur in predictable patterns. Matter cannot be created or destroyed, but is constantly changing forms.
- Apply the idea that energy has various forms and its transformation occurs in processes that are predictable and explainable. This working understanding should include concepts such as: all physical events involve transferring energy or changing one form of energy into another; when energy is reduced in one place it is increased somewhere else by exactly the same amount; and when there is a transformation of energy, some of it is likely to become heat which spreads around and is not available for use.
- Explore the complex and highly organized systems of living organisms. Analyze their requirements for energy and matter to maintain this organization. Structure and function is the physical arrangement and assembly of parts of a complex unit, such as an organism or a machine and how those parts work together to perform tasks. Structure and function are important aspects to understand as students develop conceptual understandings of living organisms and systems, and how those parts and functions maintain stability. The goal is not to know terms, but rather to use structures and functions to understand life.
- Explore how living systems interact with their environment and are interdependent with other systems, including humans. The study of ecosystems allows us to understand interrelationships among species and predict environmental changes, while at the same time providing us with information on how to use our natural resources wisely. An ecosystem is a community of organisms that live in a particular area, along with their nonliving resources. Ecosystems, populations, and individual organisms exist through a series of interdependent relationships between Earth's physical environment and the actions of organisms. Students should understand

interrelationship and how the decisions they make can impact other organisms and the environment, in turn affecting themselves.

- Analyze how various organisms grow, develop, and differentiate during their lifetimes based on an interplay between genetics and their environment. Living systems are related to other generations by genetic materials (genes, DNA, RNA) passed on through reproduction. Understand the DNA code is universal; the genetic information in DNA molecules provides instruction for assembling proteins which control the everyday activities of cells in all organisms.
- Evaluate evidence regarding the history of living organisms and how populations change their inherited traits from generation to generation to adapt to environmental and ecological pressures. Evolution is the unifying theory of biology, connecting seemingly random and disparate observations about living organisms. This theory has been clarified and developed through the examination of evidence over the course of more than a century. Understanding processes that lead to change in inherited characteristics from generation to generation has influenced knowledge in every branch of biology, from cellular biology to ecology, anatomy to behavior. Essential to the basic understanding of evolution is the knowledge that all living things share a genetic code and a system for translating that code into living proteins. Also, the process of evolution is an active process that continues to change and produce diverse living populations and systems.
- Explore Earth's geologic history and place in space and how these are relevant to our understanding of the processes that have shaped our planet. Earth is part of a larger solar system. Our place in this solar system helps to explain many attributes of a living world both past and present. With an understanding of geologic time dating back over 4 billion years, the evolution of this planet can be studied. Preserved in the rock record of this dynamic planet, is fossil evidence which indicates that life began with single-celled organisms over 3 billion years ago.
- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere. The geosphere includes a metallic core, solid and liquid rock, soil and sediments. The atmosphere is the envelope of gas surrounding Earth. The hydrosphere includes ice, water vapor and liquid water in the atmosphere, oceans, lakes, streams, soils and underground in rocks. The biosphere is Earth's life, which can be found in many parts of the geosphere, hydrosphere, and atmosphere. Humans are part of the biosphere and human activities have important impacts on all four spheres that change the rates of many Earth processes. All of Earth's systems interact over a wide range of scales of space and time and are continually adjusting to changing influences. Changes in part of one system can cause new changes to that or other systems, often in surprising and complex ways.
- Explore human dependency on the Earth for resources. As Earth is our home, its resources mold civilizations, drive human exploration, and inspire human endeavors that include art, literature and science. Throughout history natural resource exploitation has both fueled the growth of civilizations and caused their demise. Natural resources are finite and distributed unevenly around the planet. New technologies are developed to extract resources while reducing the pollution, waste, and ecosystem degradation caused by extraction. These new technologies also lead humans toward greater sustainability. Application of scientific ideas and engineering design create a technology which can lead humans toward greater sustainability.

Readiness Competencies

Students should find enjoyment and beauty in the study of science. Inquiry and the nature of science as well as application, technology and engineering, should not be thought of as standalone concepts, but should be taught throughout the curriculum within all the grade level expectations. Inquiry is the heart and joy of science and must be the heart of science teaching. While the standards are organized into life, earth, and physical science there are a core set of principals that unify the study of all scientific disciplines throughout the natural world.

Three themes are used to describe these important competencies and are interwoven throughout the science standards: *inquiry*, *application of science to society*, and *the nature of science*. These competencies should not be thought of stand-alone concepts but should be integrated throughout the science curriculum in all grade levels. Just as it is impossible to teach thinking skills to students without content to think about, it is equally impossible for students to understand the science without grappling with and investigating.

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

Applying the Discipline in Society and Using Technology. The hallmark of learning a discipline is the ability to demonstrate the knowledge, skills, and concepts in real-world, relevant contexts. Components of this include solving problems, and developing, adapting, and refining solutions for the betterment of civilization. The application of a discipline, including the use of technology, enables students to fully engage in and contribute to a global, interdependent society.

Nature of the Discipline. A discipline is defined by the concepts, skills, and processes that are unique to it. These characteristics are enacted through particular habits of the mind, which define the ways of knowing and thought processes. An understanding of the characteristics innate to the discipline allows students to expand their understanding of its unique contributions to society and the greater good of humanity.

Science in the 21st Century

Colorado's description of 21st century skills is a synthesis of the essential abilities students must apply in our fast changing world. Today's students need a repertoire of knowledge and skills that are more diverse, complex, and integrated than any previous generation. Science is inherently demonstrated in each of Colorado 21st Century Skills, as follows:

Critical Thinking & Reasoning

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

Information Literacy

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

Collaboration

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

Self-direction

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

Invention

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

These skills do not live in any one particular place in the standards, but instead will be found throughout the standards especially in the areas of evidence outcomes, application to society and technology, and the nature of science.

Colorado Academic Standards in Science

The Colorado Academic Standards in Science are the topical organization of the concepts and skills every Colorado student should know and be able to do throughout their Preschool through Grade 12 experience.

Physical Science. Students know and understand common properties, forms, and changes in matter and energy. (*Focus: Physics and Chemistry*)

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. (*Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Microbiology, Ecology*)

Earth and Space Science. Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. (*Focus: Geology, Meteorology, Astronomy, Oceanography*)

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Grade Level Expectations at a Glance by Grade

High School	
Physical Science	<ol style="list-style-type: none"> 1. Newton's theories of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion. 2. Matter has definite structure which determines characteristic physical and chemical properties. 3. Matter can change form through chemical or nuclear (fusion and fission) reactions that rearrange the molecules and structure of atoms while abiding by the laws of conservation of mass and energy. 4. Energy exists in many forms: potential or kinetic, mechanical, electrical, chemical, nuclear, light and heat. 5. Energy can be transformed through a variety of mechanisms as explained by the laws of thermodynamics; in any transformation, energy is neither created nor destroyed, but loss of energy to heat reduces the efficiency of the transformations. On their own, energy transformations lead to more disordered arrangements (increased entropy).
Life Science	<ol style="list-style-type: none"> 1. Chemical reactions render a cell alive, and are carried out by biomolecules, which are produced by living organisms. 2. Cells carry out the interrelated processes of photosynthesis and respiration in order to incorporate sunlight into energy-rich molecules that are subsequently utilized by all cells. 3. Osmosis, diffusion, and active transport of substances across membranes are used by cells to maintain stable intracellular environments. 4. Organ systems maintain stable internal environments in response to changing external stimuli. 5. Matter is cycled and energy is transformed while moving through ecosystems. 6. Populations interact with each other, as well as abiotic factors in an ecosystem, establishing a state of dynamic equilibrium. 7. Physical and behavioral characteristics of an organism are encoded in heritable genes that serve as blueprints for proteins. 8. Cells in multi-cellular organisms differentiate to carry out specialized functions by expressing some of their genes but not others. 9. Evolution occurs as the heritable characteristics of populations are altered over time in response to changing environments, producing global biodiversity.

High School	
Earth Science	<ol style="list-style-type: none"> 1. Earth's history can be inferred from evidence left from past events in the geosphere. 2. As part of the solar system, Earth interacts with various extraterrestrial forces and energies (eg, gravity, solar phenomena, electromagnetic radiation, impact events) which influence the planet's geosphere, atmosphere, and biosphere in a variety of ways. 3. The theory of plate tectonics helps to explain geological, physical and geographical features of Earth. 4. Climate is the result of energy transfer among interactions of the atmosphere, hydrosphere, geosphere, and biosphere. 5. There are natural and man-made factors that influence weather and climate. 6. There are costs, benefits, and consequences of exploration, development, and consumption of renewable and non-renewable resources. 7. The interaction of Earth's surface with water, air, gravity, and biological activity cause physical and chemical change. 8. Natural hazards have local, national and global impacts (volcanoes, earthquakes, tsunamis, hurricanes, thunderstorms, etc.). 9. The atmosphere has a current structure and composition and has evolved over geologic time.
Eighth Grade	
Physical Science	<ol style="list-style-type: none"> 1. The relationships between energy and waves as encountered in everyday experiences (i.e. radio, light, microwave, x-ray, sound, seismic, and water.) 2. Identify the direction and the magnitude of the forces acting on an object and explain the resultant change in its motion. 3. Mixtures of substances can be separated based on their properties (for example: solubility, boiling points, magnetic properties and densities). 4. Distinguish between physical and chemical changes and use specific examples to demonstrate that mass is conserved in these changes.
Life Science	<ol style="list-style-type: none"> 1. Humans are part of Earth's ecosystems. Human activities can deliberately or inadvertently, alter the equilibrium in ecosystems. 2. Organisms reproduce and transmit genetic information (genes) which influence traits of individuals in the next generation.

Eighth Grade (continued)	
Earth Science	<ol style="list-style-type: none"> 1. Weather is a result of complex interactions of earth's atmosphere, both land and water driven, by energy from the sun. 2. The relative positions and motions, of Earth, Moon, and Sun can be used to explain observable effects from Earth. (e.g. seasons, eclipses, moon phases). 3. Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind over time in a particular place.
Seventh Grade	
Physical Science	<ol style="list-style-type: none"> 1. The physical characteristics and changes of solid, liquid, gas states can be explained using the particulate model.
Life Science	<ol style="list-style-type: none"> 1. Individual organisms with certain traits are more likely than others to survive and have offspring. 2. Changes or constancy in groups of organisms over geologic time can be revealed through evidence. 3. Photosynthesis and cellular respiration are basic processes of life. 4. The human body is composed of atoms, molecules, cells, tissues, organs and organ systems, all of which have specific functions and interactions. 5. Cells are the basic unit of structure and function in living things and have basic structures, components and functions.
Earth Science	<ol style="list-style-type: none"> 1. Major geological events such as earthquakes, volcanic eruptions, and mountain building are associated with plate boundaries and attributed to plate motions. 2. Geologic time, history, and changing life forms are indicated by fossils and successive sedimentation, folding, faulting and uplifting of layers of sedimentary rock. 3. The Solar System is comprised of various objects that orbit the Sun. These bodies (including planets, asteroids, comets, moons, and dwarf planets) can be classified based on their characteristics (orbits, size, composition, surface features, etc).

Sixth Grade	
Physical Science	<ol style="list-style-type: none"> 1. There are different forms of energy and those forms of energy can be transferred and stored (for example: kinetic and potential) but total energy is conserved. 2. Straight line motion can be described in terms of distance traveled, time spent traveling, and rate or speed of travel. 3. All matter is made up of atoms, which are far too small to see directly through a microscope. The atoms of any element are alike but are different from atoms of other elements. Atoms may stick together in well-defined molecules or may be packed together in large arrays. Different arrangements of atoms into groups compose all substances. 4. Distinguish between and explain the relationships among mass, weight, volume and density.
Life Science	<ol style="list-style-type: none"> 1. Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species. 2. Organisms interact with one another in various ways providing a flow of energy and matter in an ecosystem.
Earth Science	<ol style="list-style-type: none"> 1. Complex interrelationships exist between Earth's structure, (landforms, rocks, minerals, soils) and natural processes over time that are constructive (mountain building, volcanic activity, deposition) and destructive (landslides, weathering, earthquakes, erosion) processes. 2. Water on Earth is distributed and circulated through oceans; glaciers, rivers, ground water; and the atmosphere. 3. Earth's natural resources provide the foundation for all of the physical needs of human society. Soil, rocks and minerals provide essential metals and other materials for agriculture, manufacturing and building. These natural resources are finite. Most resources are non-renewable on human time scales.
Fifth Grade	
Physical Science	<ol style="list-style-type: none"> 1. Changes in speed or direction of motion are caused by forces (pushes and pulls). The size of the change is related to the magnitude and direction of the push or the pull and the mass of the object. 2. Mixtures of matter can be created or separated regardless of how these mixtures are created or changed, the total weight/mass is the same as the sum of its parts.
Life Science	<ol style="list-style-type: none"> 1. Human body systems and the body systems of other organisms have basic structures, functions, and needs. 2. All living things share similar characteristics, but they also have differences that allow us to describe and classify them.

Fifth Grade (continued)	
Earth Science	<ol style="list-style-type: none"> 1. Earth's surface is constantly changing through a variety of processes and forces. 2. 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 as it cycles through the atmosphere and type of precipitation. 3. Earth and Sun provide a diversity of resources.
Fourth Grade	
Physical Science	<ol style="list-style-type: none"> 1. Energy, which causes change, comes in many forms such as light, heat, and electrical.
Life Science	<ol style="list-style-type: none"> 1. All organisms have structures and systems with separate functions that help keep them alive. 2. Fossils can be compared to one another and to living organisms in order to identify similarities and differences and provide evidence about the features of prehistoric environments and give us information about organisms today. 3. There is interaction and interdependence between and among living and nonliving components of systems.
Earth Science	<ol style="list-style-type: none"> 1. Earth is part of our solar system, which includes the Sun, Moon, and other bodies that orbit the Sun in predictable patterns. These patterns lead to observable paths of objects in the sky as seen from Earth.
Third Grade	
Physical Science	<ol style="list-style-type: none"> 1. Matter exists in different states and can change from one state to another by heating and cooling.
Life Science	<ol style="list-style-type: none"> 1. Life cycles vary from organism to organism.
Earth Science	<ol style="list-style-type: none"> 1. Earth's materials can be broken down and/or combined into different materials (e.g., rock cycle, formation of soil, sand). Some of these materials are usable resources for human activity.
Second Grade	
Physical Science	
Life Science	<ol style="list-style-type: none"> 1. Each plant or animal has different structures or behaviors that serve different functions. 2. Organisms interact with each other and with non-living parts of their habitat to meet their basic needs.
Earth Science	<ol style="list-style-type: none"> 1. Weather and the changing seasons impact organisms (e.g. humans, plants, other animals) and the environment.

First Grade	
Physical Science	1. Solids and liquids have unique properties. They each can be sorted/classified by their physical properties (shape, size, texture, color, etc.)
Life Science	1. Offspring have characteristics that are similar to but not exactly like their parents (For both plants and animals). 2. An organism is a living thing that has physical characteristics that help it survive.
Earth Science	1. It is important to use resources wisely and to reduce, reuse, and recycle.
Kindergarten	
Physical Science	1. Objects can move in a variety of ways. We can describe this movement as fast, slow, straight, and back and forth. 2. Objects can be sorted by their physical properties. These properties can be observed and measured.
Life Science	1. There are essential differences between living and non-living things.
Earth Science	1. The Sun provides heat and light to Earth.
PreK	
Physical Science	1. Objects have properties, characteristics and different states. 2. There are cause and effect relationships in everyday experiences.
Life Science	1. Living things have characteristics, life cycles and basic needs. 2. Living things develop in predictable patterns.
Earth Science	1. Earth materials and objects in the sky have properties and characteristics. 2. Earth materials can be compared and classified. 3. Events such as night and day and the seasons have patterns.

Physical Science

*Students know and understand common properties, forms, and changes in matter and energy.
(Focus: Physics and Chemistry)*

Prepared Graduate Competencies

The Prepared Graduate Competencies are the Preschool through Grade 12 concepts and skills that all students leaving the Colorado education system must have to ensure success in a postsecondary and workforce setting.

Prepared Graduate Competencies in the Physical Science standard:

1. Observe, explain based on evidence, and predict natural phenomena governed by Newton's Laws of Motion.
2. Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.
3. Apply the idea that energy has various forms and its transformation occurs in processes that are predictable and explainable.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Observe, explain based on evidence, and predict natural phenomena governed by Newton's Laws of Motion.

High School Expectations

Concepts and Skills students know include:

1. Newton's theories of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion.

Evidence Outcomes

Students can:

- a. Gather, analyze and interpret data and 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. Identify and analyze the factors involved when applying Newton's law of universal gravitation to a system of two bodies.
- e. Construct free-body diagrams to analyze the forces acting on an object and calculate the acceleration produced by a net force.

21st Century Skills and Readiness Competencies

Inquiry:

- How can forces be acting on an object without changing its motion?
- How can friction be described as an example of a fundamental force?

Applying Science in Society and Using Technology:

- Explain how Newton's Laws make space travel possible.
- Explain how seat belts and air bags apply Newton's first law in automobile safety design.
- Analyze how forces in static equilibrium lead to safe building designs.
- Describe how electromagnetic forces are put to use in electric motors and generators.

Nature of Science:

- Critically evaluate scientific explanations or publications and determine if the research methodology and the evidence presented is appropriate and sufficient to support the claims.
- Share experimental data and respectfully discuss discrepant results, describing their work as emulating the practice of scientists.
- Design an experimental investigation to collect evidence in order to answer a testable question about an application of Newton's Laws of motion.
- Differentiate between the use of the terms "law" and "theory" as they are defined and used in science compared to the usage of these terms in other disciplines or common day use.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

High School Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, communicate, and justify an evidence-based scientific explanation supporting the current model of an atom. b. Gather, analyze and interpret data on chemical and physical properties of elements (e.g., density, melting point, boiling point, pH, conductivity). c. Use characteristic physical and chemical properties to develop predictions and supporting claims about elements' positions on the periodic table. d. Develop and design a scientific investigation to differentiate between the following: atoms and molecules, elements and compounds, pure substances and mixtures. e. Make inferences based on indirect evidence used to draw conclusions about the structure of an atom and its subatomic particles. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What patterns can be observed in the properties of elements/families in the periodic table? • Certain elements (e.g., C) and substances (e.g., water) are closely tied to life on earth. What characteristics of these elements and substances makes them uniquely suited to support life?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explain how related compounds may share some properties. • Identify properties of metals and nonmetals in semiconductors that are useful in electronic applications. • Recognize that scientists create alloys by combining metals with elements to produce materials with different properties. • Recognize that the ability of carbon atoms to bond in many ways provides the foundation for a wide range of applications, from large molecules essential to life, to the development of synthetic polymers and oils.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Recognize the current understandings of molecular structure related to the physical and chemical properties of matter has developed over time and has become more sophisticated as new technologies have lead to new evidence.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

High School Expectations

Concepts and Skills students know include:

3. Matter can change form through chemical or nuclear (fusion and fission) reactions that rearrange the molecules and structure of atoms while abiding by the laws of conservation of mass and energy.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Recognize, analyze, interpret and balance chemical (synthesis, decomposition, combustion and replacement) or nuclear (fusion and fission) equations. b. Develop, communicate, and justify an evidence based scientific explanation regarding balanced chemical or nuclear equations. c. Develop and design a scientific investigation to model balanced chemical or nuclear reactions. d. Predict the type of bonding that will occur between elements based on their position in the periodic table. e. Predict reactants and products for different types of chemical and nuclear reactions.	Inquiry: <ul style="list-style-type: none"> • What patterns of chemical reactions exist? • How do you distinguish a chemical from a nuclear reaction?
	Applying Science in Society and Using Technology: <ul style="list-style-type: none"> • Explain how the energy used or produced in different types of reactions makes them useful to people (e.g., hand-warmers, first-aid cold packs, burning of fossil fuels or nuclear processes to generate electrical energy). • Conduct a cost/benefit analysis of different ways of providing power to our society. • Investigate the chemical source/ origin of common household items. • Explain how the societal use of chemicals can have both positive and negative environmental effects.
	Nature of Science: <ul style="list-style-type: none"> • Critically evaluate models, identifying the strengths and weaknesses of the model in representing complex natural phenomena. • Share experimental data and respectfully discuss discrepant results, describing their work as emulating the practice of scientists. • 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.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Apply the idea that energy has various forms and its transformation occurs in processes that are predictable and explainable.

High School Expectations

Concepts and Skills students know include:

4. Energy exists in many forms: potential or kinetic mechanical energy, electrical, chemical, nuclear, light and heat.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, communicate and justify an evidence based scientific explanation regarding the potential or kinetic nature of a type of energy. b. Gather, analyze and interpret data on the quantity of energy in a system or object using appropriate measurements, equations and graphs. 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. e. differentiate between mechanical and electromagnetic waves by examining their unique characteristics. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What factors can be measured to determine the amount of energy associated with an object? • Which energy forms have the most practical applications? • What makes an energy form "alternative"? • Which energy form is the easiest (or most difficult) to observe and measure? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Research and evaluate the pros and cons of various ways of generating electricity for the power grid. • Investigate the pros and cons of various energy sources as transportation fuel.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Reflect on and describe their work in class as it compares to the practice of professional scientists. • Consider the historical context and impact of early energy research and the potential implications for current energy studies on science and our society.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Understand and apply the idea that energy has various forms and its transformation occurs in processes that are predictable and explainable

High School Expectations

Concepts and Skills students know include:

5. Energy can be transformed through a variety of mechanisms as explained by the laws of thermodynamics; in any transformation, energy is neither created nor destroyed, but loss of energy to heat reduces the efficiency of the transformations. On their own, energy transformations lead to more disordered arrangements (increased entropy).

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, communicate, and justify an evidence-based scientific explanation for the conservation of energy. b. Use direct and indirect evidence in developing and supporting claims about the conservation of energy in a variety of systems, including transformations to heat. c. Evaluate the efficiency of a variety of energy transformations. d. Describe both quantitatively and qualitatively the energy transformations that occur when energy changes form. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • Can 100% efficiency be achieved in an energy transformation? • What evidence supports the principle of conservation of energy? • Why is the idea of conservation of energy important in science and engineering? • What would happen if energy were not conserved? • Scientists or engineers often say energy is “lost.” Is there a word that might be better than “lost?” Why?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Investigate the strides made in improving the efficiency of different machines' ability to do useful work versus the amount of energy wasted as heat.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate scientific explanations or publications and determine if the research methodology and the evidence presented is appropriate and sufficient to support the claims. • Share experimental data and respectfully discuss discrepant results, describing their work as emulating the practice of scientists.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Understand and apply the idea that energy has various forms and its transformation occurs in processes that are predictable and explainable

Eighth Grade Expectations

Concepts and Skills students know include:

1. The relationships between energy and waves as encountered in everyday experiences (i.e. radio, light, microwave, x-ray, sound, seismic, and water.)

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Describe how the energy of different types of waves can affect the environment. b. Describe the properties that differentiate waves from each other. c. Identify the basic relationships between frequency, wavelength, energy, and amplitude. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What are some different ways to describe waves? • What do all waves have in common? How are some waves different? • How do waves change when energy is added or removed?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that skipping rope faster requires more energy than skipping rope slowly. • Describe why a low pitch vs. high pitch guitar string feels different to the touch when it is vibrating. • Explain why higher frequency waves have shorter wavelengths, as seen in the lengths of cell phone antennas vs. radio antennas.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Understand that models are developed to explain and predict wave phenomena that cannot be directly measured. • Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere (e.g., energy behaves the same all across the universe).

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Observe, explain based on evidence, and predict natural phenomena governed by Newton's Laws of Motion.

Eighth Grade Expectations

Concepts and Skills students know include:

2. Identify the direction and the magnitude of the forces acting on an object and explain the resultant change in its motion.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Predict and evaluate the movement of an object by examining the forces applied to it. b. Develop and design a scientific investigation to analyze and interpret acceleration data in order to determine the net forces acting on a moving object. c. Develop and design a scientific investigation to analyze and interpret data regarding the differences and changes in potential and kinetic energy.	Inquiry: <ul style="list-style-type: none"> • What relationship(s) exists between force, mass, and acceleration? • What evidence tells you a force has acted on a system? Is it possible for a force to act on a system without having an effect?
	Applying Science in Society and Using Technology: <ul style="list-style-type: none"> • Explore how engineers take g-forces into account when designing moving objects such as car tires, roller coasters, and rockets.
	Nature of Science: <ul style="list-style-type: none"> • Recognize that our current understandings about forces 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 understandings of forces. • Find, evaluate, and select appropriate information from reference books, journals, magazines, online references, and databases in order to answer scientific questions.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

Eighth Grade Expectations

Concepts and Skills students know include:

3. Mixtures of substances can be separated based on their properties (for example: solubility, boiling points, magnetic properties and densities).

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Identify, explain, and demonstrate that substances in a mixture have different properties and these properties might be used to separate substances from each other.</p> <p>b. Develop and design a scientific investigation to separate the components of a mixture.</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • What techniques can be used to separate mixtures of substances based their properties? • Which properties are the most useful in trying to separate mixtures of substances? • How much difference must there be between the properties of substances in order for the properties to be useful in separating the substances? • A mixture is made of substances with different properties. By how many properties must the substances differ in order to be separated? • Is it easier to separate substances that differ in many properties or substances that differ in only one property?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that water filtration systems rely on the solubility, density, and physical size of substances for filtering. • Explain that recycling plants separate cans out from other garbage by using the magnetic properties of metals. • Understand how mining and oil refining processes use properties and states of matter to perform separation of materials.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Follow and describe sound experimental designs to collect data around the separation of mixtures. • Share experimental data and respectfully discuss discrepant results. • Describe several ways in which scientists would study mixtures and suggest ways that this has contributed to our understandings about materials.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

Eighth Grade Expectations

Concepts and Skills students know include:

4. Distinguish between physical and chemical changes and use specific examples to demonstrate that mass is conserved in these changes.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Identify the distinguishing characteristics between a chemical and a physical change. b. Justify and communicate how mass is conserved in a given chemical or physical change.	<p>Inquiry:</p> <ul style="list-style-type: none"> • Does the law of conservation of mass apply to systems undergoing both physical and chemical changes? • Is it easier to observe the conservation of mass in physical or chemical changes? Why? • What would happen if mass was not conserved?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • The freezing, thawing, and vaporization of our Earth's water provide examples of physical changes. • Chemical changes benefit us in countless ways. The creation of plastics, metallic compounds, and countless other things are a result of chemical changes.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Evaluate the reproducibility of an experiment and justify discrepancies in experimental results. • Understand that all scientific knowledge is subject to new findings. • Share experimental data and respectfully discuss discrepant results, describing their work as emulating the practice of scientists. • Collaborate to evaluate scientific conclusions provided in print and visual media for appropriateness of scientific evidence, and to identify conjecture or bias.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

Seventh Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Explain how the arrangement and motion of particles in a substance (i.e., water) determine its state. b. Distinguish between changes in temperature and changes of state using the particle model of matter. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What determines whether matter is in the form of a solid, liquid, gas, or plasma? • What is the kinetic molecular theory and how does temperature affect the behavior of particles in a gas?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Identify examples of practical applications of solids, liquids and gases that capitalize on their unique physical characteristics (e.g., hot air balloons, liquid hydrogen as fuel, and solid rocket fuels). • Recognize that fluorescent lights were developed from an understanding of plasmas. • Use boiling water to demonstrate kinetic molecular theory.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Understand that models are developed to explain and predict molecular phenomena that cannot be directly measured. • Understand the difference between scientific theory and hypothesis, and that hypotheses are only used in certain types of experimental designs.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Apply the idea that energy has various forms and its transformation occurs in processes that are predictable and explainable.

Sixth Grade Expectations

Concepts and Skills students know include:

1. There are different forms of energy and those forms of energy can be transferred and stored (for example: kinetic and potential) but total energy is conserved.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> 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. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • Which forms of energy can be directly observed and which forms of energy must be inferred? • What evidence supports the existence of potential and kinetic energy? • Is there a limit to how many times energy can be transferred and stored? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Describe how accident investigation photos and measurements provide evidence of energy transfers during such events. • Identify when kinetic energy is often turned into heat (e.g., when applying brakes to a vehicle or during space vehicle re-entry).
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Share experimental data and respectfully discuss discrepant results. • 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. • Reflect on and describe their work in class as it compares to the practice of professional scientists.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Observe, explain based on evidence, and predict natural phenomena governed by Newton's Laws of Motion.

Sixth Grade Expectations

Concepts and Skills students know include:

2. Straight line motion can be described in terms of distance traveled, time spent traveling, and rate or speed of travel.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Use calculated measurements to compare the motions of different objects. b. Create and analyze simple graphs to communicate the relationship between distance, speed and time.	Inquiry: <ul style="list-style-type: none"> • What are some ways we can describe the way things move? What quantities are connected to these descriptions? • How can we compare the motion of two objects?
	Applying Science in Society and Using Technology: <ul style="list-style-type: none"> • Explain how people's interstate travel planning would change if a Maglev (Magnetic Levitation) train were to be constructed along the I-70 corridor.
	Nature of Science: <ul style="list-style-type: none"> • Evaluate the reproducibility of an experiment and justify discrepancies in experimental results. • Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere (e.g., straight line motion can be described the same anywhere in the universe).

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

Sixth Grade Expectations

Concepts and Skills students know include:

3. All matter is made up of atoms, which are far too small to see directly through a microscope. The atoms of any element are alike but are different from atoms of other elements. Atoms may stick together in well-defined molecules or may be packed together in large arrays. Different arrangements of atoms into groups compose all substances.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Evaluate evidence suggests that there is a fundamental building block of matter. b. Use the particle model of matter to explain characteristics of different substances. c. Find, evaluate, and select appropriate information from reference books, journals, magazines, online references, and databases in order to compare and contrast historical explanations for the nature of matter. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • Why do substances behave differently (e.g. water pours rapidly while syrup pours slowly)? • In science we often talk about “building blocks.” What makes something a building block? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that atoms and the atomic model are the foundation for explaining all matter in our universe, and are the foundation for all of Chemistry. • Understand that very small devices, such as nearly all the parts of a cell phone, are made up of large numbers of specially arranged groups of atoms, that are designed to perform a specific function.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Use the writing process, a variety of media and/or technology tools to create models that explain the particle theory of matter. • Understand that models are used to explain and predict atomic phenomena that cannot be directly measured. • Understand that our current understanding of atoms has developed through centuries of scientific investigations.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

Sixth Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> 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 gravity will affect the mass and weight of an object. c. Predict how changes in mass, weight, and volume affect density of an object. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • Which of the following is the best recommendation for a person trying to lose weight – reduce the number of calories he is eating, exercise more, go to the moon? Why? • If weight and mass are not the same thing, why do people use the words interchangeably? • Describe a situation in which mass would be the most useful information to know about an object? Weight? Volume? Density? • If you were only allowed to know one thing – mass, weight, volume, or density – about an object, what would you choose? Why? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Understand that the study of mass, weight and gravitational forces are critical for space travel (weightlessness) and for future visits and perhaps colonization of places like the Moon or Mars. <p>Nature of Science:</p> <ul style="list-style-type: none"> • Evaluate the density of a sample, predict its ability to float or sink in a liquid, and justify discrepancies in the experimental outcome.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Observe, explain based on evidence, and predict natural phenomena governed by Newton's Laws of Motion.

Fifth Grade Expectations

Concepts and Skills students know include:

1. Changes in speed or direction of motion are caused by forces (pushes and pulls). The size of the change is related to the magnitude and direction of the push or the pull and the mass of the object.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Identify and explain how the direction or speed of an object will change due to an outside force. b. Analyze and interpret observable data about the impact of forces on the motion of objects. c. Share evidence based on the understanding that the mass of an object and the magnitude of a force are related. d. Assess and provide feedback on other scientific explanations regarding the impact of forces on an object's motion. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What do you need to know about a force to predict how it will change the motion of an object? • Are there any forces that do NOT result in a change in motion of an object?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Identify technologies we have created to make our lives easier (e.g., design of tires, bicycles, snow throwers, etc.) , because we know how forces can affect objects. • Apply relationships between force and changes in motion in many of our recreational activities.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Select an appropriate tool for data collection. • Design an experiment, identifying the constants and variables.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

Fifth Grade Expectations

Concepts and Skills students know include:

2. Mixtures of matter can be created or separated regardless of how these mixtures are created or changed, the total weight/mass is the same as the sum of its parts.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul 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 mixture before and after it is broken into pieces. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How does the creation of mixtures act similar and different from the original materials? • What are some ways that mixtures can be separated?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explain how properties help determine how to separate mixtures. • Understand that creating and separating mixtures allows humans to use materials that do not exist naturally.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Students understand that scientific explanations require claims to be supported by evidence and the thinking (reasoning) used to get to the claim. • Student can select an appropriate tool to conduct an experiment.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Apply the idea that energy has various forms and its transformation occurs in processes that are predictable and explainable.

Fourth Grade Expectations

Concepts and Skills students know include:

1. Energy, which causes change, comes in many forms such as light, heat, and electrical.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Develop, communicate, and justify an evidence-based scientific explanation about the about how energy exists in our world this includes light, heat and electrical b. Identify and describe the variety of energy sources and how it cause change within a system. c. Provide evidence-based conclusions describing why energy flows within a given system d. Apply a model to explain the energy transformations among electric circuits and the light, heat, sound, and magnetic effects that are produced. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do we know that energy exists within a system such as in an electrical cuircuit? How can heat be transferred from one object to another? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Identify multiple sources of energy, renewable and non renewable • Describe how energy causes motion or creates change in many systems. • Describe how energy can be used in positive and negative ways in our society.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Share results of experiments with others and respectfully discuss results that are not expected. • Collaborate to design an electric circuit that lights bulbs with both parallel and series arrangements.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

Third Grade Expectations

Concepts and Skills students know include:

1. Matter exists in different states and can change from one state to another by heating and cooling.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Analyze and interpret observations about matter as it melts and boils, freezes and condenses. b. Develop, communicate, and justify an evidence-based scientific explanation around how heating and cooling affects changes in states of matter. c. Identify the state of any sample of matter. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • If water keeps getting recycled on Earth, why do we worry about running out? • The water cycle may be represented in different ways (e.g., pictures, words). In your opinion, which one is the best representation? Why?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that there is a finite amount of water on our planet, and as the water flows through the water cycle, it is conserved. Understand all of this water keeps cycling through and it is not unlimited. • Describe how moving air and water can be used as a source of energy.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Share results of experiments with others and respectfully discuss results that are not expected. • Recognize the importance of keeping accurate observations and notes in science.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

First Grade Expectations

Concepts and Skills students know include:

1. Solids and liquids have unique properties. They each can be sorted/classified by their physical properties (shape, size, texture, color, etc.).

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> 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/liquids. c. Develop, communicate and justify an evidence based scientific explanation regarding the unique properties of solids and liquids. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What do all liquids have in common? What are some differences they can have and still be considered liquids? • What do all solids have in common? What are some differences they can have and still be considered solids? • What properties of liquids can be used to sort/classify them? • What properties of solids can be used to sort/classify them? • What are some practical reasons for sorting/classifying liquids or solids?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explain that the properties of solids and liquids help us understand how to use matter (e.g., you would not build a bridge out of tissue).
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Share results of experiments with others. • Recognize that observations are an important part of science.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Observe, explain based on evidence, and predict natural phenomena governed by Newton's Laws of Motion.

Kindergarten Expectations

Concepts and Skills students know include:

1. Objects can move in a variety of ways. We can describe this movement as fast, slow, straight, and back and forth.

Evidence Outcomes
Students can:

- a. Observe, investigate and describe how different objects move using a variety of observations.
- b. Observe, investigate and describe how physical properties can affect how an object moves.

21st Century Skills and
Readiness Competencies

Inquiry:

- How can you change how fast or slow an object travels?
- How can you tell which objects will be easier or harder to move?

Applying Science in Society and Using Technology:

- Explain why you have to work harder to move your bike/skateboard/scooter as you go faster, or as you go up a hill.
- Describe a variety of forces that are acting upon a student at play.

Nature of Science:

- Recognize that scientists try to be clear and specific when they describe things.
- Share their observations with others being clear and precise like a scientist.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

Kindergarten Expectations

Concepts and Skills students know include:

2. Objects can be sorted by their physical properties. These properties can be observed and measured.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Observe, investigate and describe how objects can be sorted using their physical properties. b. Justify why objects are sorted into categories.	Inquiry: <ul style="list-style-type: none"> • Can objects ever belong in more than one group? How do you decide in which group they belong?
	Applying Science in Society and Using Technology: <ul style="list-style-type: none"> • Understand that properties of objects tell us how we can use that material. • Describe how machines can be designed to sort things efficiently (e.g., coin sorting machines).
	Nature of Science: <ul style="list-style-type: none"> • Recognize that scientists try to be clear and specific when they describe things. • Share their observations with others being clear and precise like a scientist.

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

PreK Expectations

Concepts and Skills students know include:

1. Objects have properties, characteristics and different states.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Use senses to gather information about objects. b. Use scientific tools in their investigations and play (i.e. magnets, magnifying glasses, scales, rulers, etc.) c. Make simple observations, predictions, explanations and generalizations based on real life experiences. 	<p>Approaches to Learning:</p> <ul style="list-style-type: none"> • Openness to and curiosity about new tasks and challenges (Predisposition to explore and experiment) • Initiative, task persistence, and attentiveness • Approach to reflection and interpretation • Capacity for invention and imagination <p>(Scott-Little, Kagan, & Frelow. March, 2005)</p>
<ul style="list-style-type: none"> d. Ask questions based upon discoveries made while playing. e. Collect, describe and record information through discussion, drawings and charts. 	

Content Area: Science
Standard: Physical Science

Prepared Graduate Competencies:

- Analyze the evidence for the nature and structure of matter, which is essential for understanding its properties and predicting outcomes of chemical and nuclear reactions.

PreK Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Recognize and investigate cause and effect relationships in every day experiences (i.e. pushing, pulling, kicking, rolling, or blowing objects).</p>	<p>Approaches to Learning:</p> <ul style="list-style-type: none"> • Openness to and curiosity about new tasks and challenges (Predisposition to explore and experiment) • Initiative, task persistence, and attentiveness • Approach to reflection and interpretation • Capacity for invention and imagination <p>(Scott-Little, Kagan, & Frelow. March, 2005)</p>

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. (Focus: Biology--Anatomy, Physiology, Botany, Zoology, Microbiology, Ecology)

Prepared Graduate Competencies

The Prepared Graduate Competencies are the Preschool through Grade 12 concepts and skills that all students leaving the Colorado education system must have to ensure success in a postsecondary and workforce setting.

Prepared Graduate Competencies in the Life Science standard:

1. Explore the complex and highly organized systems of living organisms.
2. Explore how living systems interact with their environment and are interdependent with other systems, including humans.
3. Analyze how various organisms grow, develop, and differentiate during their lifetimes based on an interplay between genetics and their environment.
4. Evaluate evidence regarding the history of living organisms and how populations change their inherited traits from generation to generation to adapt to environmental and ecological pressures.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

High School Expectations

Concepts and Skills students know include:

1. Chemical reactions render a cell alive, and are carried out by biomolecules, which are produced by living organisms.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Identify biomolecules and their precursors/building blocks. b. Develop, communicate and justify an evidence based explanation regarding the optimal conditions required for enzyme activity. c. Infer the consequences to organisms of suboptimal enzyme function (e.g. altered blood pH, high fever), using direct and indirect evidence. d. Analyze and interpret data on the body's utilization of carbohydrates, lipids, and proteins for energy, in order to support a claim that they are used differentially during rest versus activity. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How can non-living chemicals carry out the processes needed to be alive? • What roles do enzymes play in living organisms? • What distinguishes chemical reactions associated with cells from other chemical reactions? • How are the chemical reactions in cells interdependent?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Apply knowledge of biomolecular structure and activity to make consumer decisions, especially about diet (i.e. saturated/unsaturated fatty acids, essential/nonessential amino acids, simple/complex carbohydrates). • Discern how altered cellular enzyme activity during a high fever endangers the life of an organism.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate scientific explanations or publications and determine if the research methodology and the evidence presented is appropriate and sufficient to support the claims. • Design an experimental investigation to collect evidence in order to answer a testable question about the interplay between chemical reactions and life. • Model how biological macromolecules are constructed from smaller molecules.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

High School Expectations

Concepts and Skills students know include:

2. Cells carry out the interrelated processes of photosynthesis and respiration in order to incorporate sunlight into energy-rich molecules that are subsequently utilized by all cells.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Explain how carbon compounds are gradually combusted to provide energy in the form of ATP, which drives many chemical reactions in the cell.</p> <p>b. Discuss the interdependence of autotrophic and heterotrophic life forms (e.g. label a diagram depicting the flow of a carbon atom from the atmosphere, to a leaf, through the food chain, and back to the atmosphere).</p> <p>c. Develop, communicate, and justify an evidence-based scientific explanation addressing questions about the optimal environment for photosynthetic activity, including global food production (e.g., hydroponics, greenhouses, sea farming).</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • What variables can be manipulated to change the rate of photosynthesis? • What variables affect the rate of cell respiration? • How does body heat (temperature) relate to cellular respiration?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Investigate the importance of agriculture to human health. • Explain how various foods (cheeses, yogurts, alcohol and breads) are produced through the use of anaerobic respiration by various organisms. • Connect the experience of muscles cramping after intense exercise to anaerobic respiration in muscle cells. • Assess the integral role of primary producers (marine phytoplankton, rainforest flora) in sustaining all life on Earth.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Recognize the current understandings of photosynthesis and cellular respiration has developed over time and has become more sophisticated as new technologies have lead to new evidence. • Critically evaluate models, identifying the strengths and weaknesses of the model in representing complex natural phenomena.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

High School Expectations

Concepts and Skills students know include:

3. Osmosis, diffusion, and active transport of substances across membranes are used by cells to maintain stable intracellular environments.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Analyze and interpret data to determine the energy requirements and/or rates of substance transport across cell membranes. b. Infer the relative importance of membrane phospholipids versus membrane proteins in regulating the activities of a cell, using observations of drug action to support the claim. c. Develop, communicate and justify an evidence based scientific explanation for damages incurred by the use of an unbalanced osmotic solution in a medical setting. d. Compare organisms that live in freshwater and marine environments, identifying the challenges of osmotic regulation for these organisms. e. Diagram the cell membrane schematically, including receptor proteins as active links between intra and extracellular environments. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What variables affect the rate of transport across a membrane? • How do living cells maintain stable internal conditions?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Assess the importance of osmotically balanced solutions used for medical purposes, (e.g., intravenous and ophthalmic solutions). • Demonstrate how drugs target receptor proteins in membranes and mimic the action of natural signals there (e.g. hormones, neurotransmitters). • Understand the use of technology used to support humans on dialysis.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Share experimental data and respectfully discuss discrepant results, describing their work as emulating the practice of scientists. • 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.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

High School Expectations

Concepts and Skills students know include:

4. Organ systems maintain stable internal environments in response to changing external stimuli.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Discuss how two or more body systems interact to promote health for the whole organism. b. Develop, communicate, and justify an evidence-based scientific explanation regarding an organism's ability to maintain homeostasis in response to changing external conditions. c. Analyze and interpret data on homeostatic mechanisms using direct and indirect evidence in developing and supporting claims about the effectiveness of feedback loops to maintain homeostasis. d. Clearly identify assumptions behind conclusions drawn about how disrupted homeostasis leads to a particular disease, in order to provide feedback on the validity of alternative explanations (i.e., distinguish between causation and correlation in analyzing epidemiological data). 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How can an experiment be designed and conducted to test for homeostasis during exercise and other body activities? • Why do negative rather than positive feedback loops predominate in the human body?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Identify how the disruption of homeostatic mechanisms may lead to disease, and if severe enough, death. • Compare aspects of a body system in a state of health and disease (e.g. buildup and rupture of atherosclerotic plaque inside a blood vessel to cause a heart attack).
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Research and present findings about the results of dietary deficiencies or excesses. • Research and present findings about how medical problems that impact life span have changed throughout history due to altered lifestyles and advances in medicine (e.g. farm accidents/infections versus modern stress/inactivity).

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore how living systems interact with their environment and are interdependent with other systems, including humans.

High School Expectations

Concepts and Skills students know include:

5. Matter is cycled and energy is transformed while moving through ecosystems.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Analyze how energy flows through trophic levels and evaluate the ecological impacts of a plant-based or meat-laden diet. b. Analyze and interpret data from experiments on ecosystems where matter has been infused or withdrawn (e.g. drought, fertilizers). c. Develop, communicate, and justify an evidence-based scientific explanation about the effects of removing a decomposer from a local environment. d. Define and distinguish between matter and energy, and how they are cycled or lost through life processes. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How does a change in abiotic factors influence the stability of an ecosystem? • What happens when the cycling of matter in ecosystems is disrupted? • What energy transformations occur in ecosystems? Is energy ever transferred without being transformed? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Analyze how energy flows through trophic levels, and evaluate the ecological impact of plant-based vs. meat-laden human diets on land use, eutrophication of waters, and global climate change. • Compare how national parks and reserves do not interfere with the natural death and disease of flora and fauna within park borders, whereas farmers and ranchers ship crops and manure to remote areas to compensate for disrupted natural cycles.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate models, identifying the strengths and weaknesses of the model in representing complex natural phenomena. • Share experimental data and respectfully discuss discrepant results, describing their work as emulating the practice of scientists. • Compare the process of burning carbon-rich fossil fuels to the oxidation of carbon biomolecules in cells.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Explore how living systems interact with their environment and are interdependent with other systems, including humans.

High School Expectations

Concepts and Skills students know include:

6. Populations interact with each other, as well as abiotic factors in an ecosystem, establishing a state of dynamic equilibrium.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Develop, communicate and justify an evidence-based scientific explanation about the impact of removing keystone species from an ecosystem, or introducing non-native species into an ecosystem.</p> <p>b. Analyze and interpret data about the ecological consequences of humans transferring natural resources from their origin to their disposal (e.g., from one reservoir to another) that support claims that the practice is beneficial or risky.</p> <p>c. Analyze the processes that lead to a climax community from its origin.</p> <p>d. Clearly identify assumptions behind conclusions drawn about the need for zero population growth in order to provide feedback about the validity of alternative viewpoints.</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do keystone species maintain balance in ecosystems? • How does the introduction of a non-native species influence the balance of an ecosystem? • How is the succession of local organisms altered in an area that is disturbed or destroyed? • What factors help determine the stability of ecosystems?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Trace the flow of an abiotic factor from a natural reservoir, to human-manufactured good, to disposal (i.e., from source to sink), and describe the resulting influence on ecosystems (e.g., petroleum, to plastic, to landfill). • Apply the concept of carrying capacity to humans on Earth, while brainstorming ideas that could expand the present carrying capacity.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Use models and field data to analyze dynamic equilibrium in ecosystems and can describe their work in comparison to that of working ecologists.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

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

High School Expectations

Concepts and Skills students know include:

7. Physical and behavioral characteristics of an organism are encoded in heritable genes that serve as blueprints for proteins.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Analyze and interpret data that genes are long strands of DNA. b. Analyze and interpret data on the processes of DNA replicates, transcription and translation, and gene regulation. c. Recognize that proteins carry out most cell activities, mediating the effect of genes on physical and behavioral traits in an organism. d. Analyze and interpret data showing how offspring are not genetic clones of their parents or siblings due to the random inheritance of some chromosomes from the mother and some from the father. e. Develop, communicate and justify an evidence-based scientific explanation about how a genetic mutation benefits, harms, or has neutral effects on an organism. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How is it possible for a cell from one species to express genes from another species as in genetic modification of organisms? • Why are human offspring not genetic clones of their parents or siblings? • How do organisms come to display certain behaviors (e.g. imprinting, rooting by newborn mammals) that clearly have not been learned?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Evaluate the benefits and risks of genetically modifying plants in the food supply. • Investigate how recombinant DNA technology is used in medicine. • Discern how selective breeding differs from genetic modification, yet shares a common goal of producing progeny with desirable characteristics. • Discuss the implications of inheriting DNA replication errors, with most mutations being fatal or neutral, and a few being beneficial (providing the basis for evolution)
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • 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. • Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere (e.g., basic principles for genetics apply to all organisms).

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

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

High School Expectations

Concepts and Skills students know include:

8. Cells in multi-cellular organisms differentiate to carry out specialized functions by expressing some of their genes but not others.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Develop, communicate, and justify an evidence-based scientific explanation on how cells become specialized tissues, due to the expression of some genes and not others.</p> <p>b. Analyze and interpret data that shows most eukaryotic DNA does not actively code for proteins within cells but still has important functions.</p> <p>c. Develop, communicate, and justify an evidence-based scientific explanation of how a whole organism can be cloned from a differentiated (adult) cell.</p> <p>d. Analyze and interpret data on radiation sickness using direct and indirect evidence in developing and supporting claims that genetic mutations (and cancer) are brought about by exposure to radiation.</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • Why is it possible to clone a whole organism from a undifferentiated cell? • Why are stem cells sought by researchers as potential cures to medical problems?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Investigate how stem cells may be used to ameliorate medical disorders (e.g. diabetes, Parkinson's, torn cartilage, and damaged hearts). Discuss the ethical and political issues associated with stem cell research, and how these affect research. • Infer how recent research and insights into the human genome have changed the criminal justice system, impacted the food supply, and broadened medical treatment strategies.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Debate with peers the advantages and disadvantages of cloning organisms in the food supply. • Debate the ethical and political issues associated with stem cell research.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Evaluate evidence regarding the history of living organisms and how populations change their inherited traits from generation to generation to adapt to environmental and ecological pressures.

High School Expectations

Concepts and Skills students know include:

9. Evolution occurs as the heritable characteristics of populations are altered over time in response to changing environments, producing global biodiversity.

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 data from a wide range of sources such as molecular studies, comparative anatomy and island biography that supports the claims of relatedness of different species.
- c. Analyze and interpret data that over geologic time, discrete bursts of rapid genetic change result in biodiversity through speciation, such that all life forms stem from a common ancestor.
- d. Analyze and interpret data on the mechanism of overproduction of offspring, genetic variation, and selective pressure driving evolution.

21st Century Skills and Readiness Competencies

Inquiry:

- How are subtle differences in representative fossils evidence of environmental change and speciation?
- How does studying extinct species contribute to our current understanding of evolution?
- How can unity (shared characteristics) be used to organize diversity?

Applying Science in Society and Using Technology:

- Evaluate human practices that contribute to antibiotic and pesticide resistance.
- Explain how some human activities create a selective pressure, causing speciation.

Nature of Science:

- Create a model which shows the relationship of organisms (eg. Tree of Life).
- Understand that all scientific knowledge is subject to new findings and that reproducible, corroborated, and converging lines of data yield a scientific theory.
- Differentiate between 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 common day use.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore how living systems interact with their environment and are interdependent with other systems, including humans.

Eighth Grade Expectations

Concepts and Skills students know include:

1. Humans are part of Earth’s ecosystems. Human activities can deliberately or inadvertently, alter the equilibrium in ecosystems.

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.

21st Century Skills and
Readiness Competencies

Inquiry:

- Why do humans have a unique responsibility to the ecosystems in which they live?
- How can a student be a steward of an ecosystem?

Applying Science in Society and Using Technology:

- Describe how human activities are constantly changing and disrupting various cycles and habitats in the natural world.

Nature of Science:

- Reflect on and describe their work in class as it compares to the practice of professional scientists.
- Critically evaluate scientific explanations or publications and determine if the research methodology and the evidence presented is appropriate and sufficient to support the claims.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

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

Eighth Grade Expectations

Concepts and Skills students know include:

2. Organisms reproduce and transmit genetic information (genes) which influence traits of individuals in the next generation.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, communicate and justify an evidence based scientific explanation regarding 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. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How are traits passed from one generation to the next?
<ul style="list-style-type: none"> c. Gather, analyze and interpret data on transmitting genetic information d. Using models and diagrams, infer the phenotype of offspring based on the genotype of the parents. 	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explore the ethics of genetic engineering (e.g. cloning, genetically modified organisms, gene replacement therapy). • Explain the technology involved with mapping the human genome.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Understand the interconnected nature of math and science by utilizing math in the prediction future generations. • Recognize current understandings of genetics has developed over time and has become more sophisticated as new technologies have lead to new evidence. • Critically evaluate models (e.g., genetic modeling), identifying the strengths and weaknesses of the model in representing complex natural phenomena.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Evaluate evidence regarding the history of living organisms and how populations change their inherited traits from generation to generation to adapt to environmental and ecological pressures.

Seventh Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Develop, communicate and justify an evidence-based explanation as to why a given organism with specific traits will or will not survive and 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. Critique the reasoning in scientific explanations about the relationship between adaptations and survival/reproduction, by differentiating between fact and opinion while also identifying when conclusions are not logically supported by the evidence given. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What is the relationship between an organism’s adaptations and its potential for survival and reproduction? • How is the use of the word “adaptation” different in everyday usage than it is in biology? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explore how bacteria have evolved to survive in the presence of the environmental pressure of antibiotics.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Follow and describe sound experimental designs to collect data around survival and genetic traits. • Describe several ways in which scientists would study genetics and suggest ways that this has contributed to our understandings about survival and populations.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Evaluate evidence regarding the history of living organisms and how populations change their inherited traits from generation to generation to adapt to environmental and ecological pressures.

Seventh Grade Expectations

Concepts and Skills students know include:

2. Changes or constancy in groups of organisms over geologic time can be revealed through evidence.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Interpret and analyze data from the fossil record to provide evidence supporting a claim that organisms and environments have changed over time.</p> <p>b. Analyze and critique the reasoning behind arguments regarding the causes/effects of a mass extinction event, by identifying when opinion and fact are intermingled, or when conclusions are not logically supported by the evidence given.</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • What was life on Earth like in the distant past and how do we know? • Has the frequency of changes in life on Earth always occurred at a constant rate? • How does the evidence of how life has changed on Earth in the past tell us about Earth today?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Evaluate current concerns over the extinction of organisms around the world, and explore the possible consequences of these extinctions.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Share data and conclusions, respectfully discussing discrepant interpretations (alternate explanations), describing their work as emulating the practice of scientists. • Consider the historical context and impact of early fossil research and the potential implications for current organism studies.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

Seventh Grade Expectations

Concepts and Skills students know include:

3. Photosynthesis and cellular respiration are basic processes of life.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Gather, analyze and interpret data regarding photosynthesis and cellular respiration. b. Develop, communicate and justify an evidence based scientific explanation regarding the processes of life. c. Use direct and indirect evidence to describe the relationship between photosynthesis and cellular respiration within plants and between plants and animals. d. Develop and design a scientific investigation about basic life processes. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How would you describe the relationship between photosynthesis and cellular respiration? • Describe the relationship between the raw materials and products of photosynthesis and cellular respiration.
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explore the significance of plants for human health, as well as the health and survival of Earth's ecosystems. • Explain where food comes from.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Design an experiment to observe photosynthesis or respiration, clearly defining controls and variables. • Share experimental data and respectfully discuss discrepant results, describing their work as emulating the practice of scientists.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

Seventh Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Gather, analyze and interpret data and models on the functions and interactions of the human body. b. Develop, communicate and justify an evidence based scientific explanation regarding the functions and interactions of the human body. c. Develop and design a scientific investigation about the human body systems. d. Identify and analyze major organs and organ systems and their functions. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do various organ systems interact with each other? • Which body system is most critical to supporting the life of the organism? • How do organs and organ systems in the human body interact to perform specific functions?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Describe how various organ systems interact with each other. • Explain if one body system is more important to supporting the life of an organism than another body system.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate models, identifying the strengths and weaknesses of the model in representing complex natural phenomena.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

Seventh Grade Expectations

Concepts and Skills students know include:

5. Cells are the basic unit of structure and function in living things and have basic structures, components and functions.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
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 functions. c. Compare and contrast the basic structures and functions of plant cells, animal cells and single-celled organisms.	<p>Inquiry:</p> <ul style="list-style-type: none"> • How is the basic structure of a cell related to its function? • How are the components/organelles of a cell related to its function?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Understand what is meant by a stem cell, and their potential use in medicine. • Describe what happens to a cell that causes cancer. • Explore how cells can be manipulated for the benefit of humanity.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate models, identifying the strengths and weaknesses of the model in representing complex natural phenomena. • Recognize that our current understandings about 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 understandings of cells.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Explore how living systems interact with their environment and are interdependent with other systems, including humans.

Sixth Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Interpret and analyze data about changes in environmental conditions and populations (e.g., climate change) 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 affect the global environment. c. Model equilibrium in an ecosystem, including basic inputs and outputs, to predict how a change to that ecosystem might impact the organisms, populations and species within it (e.g., climate change, removal of a top predator, and introduction of a new species). 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How ecosystem changes affect biodiversity? • How does biodiversity contribute to ecosystem's equilibrium?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Understand how the creation of green technology helps preserve Earth's biodiversity.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • 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. • Reflect on and describe their work in class as it compares to the practice of professional scientists.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Explore how living systems interact with their environment and are interdependent with other systems, including humans.

Sixth Grade Expectations

Concepts and Skills students know include:

2. Organisms interact with one another in various ways providing a flow of energy and matter in an ecosystem.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, communicate and justify an evidence-based explanation about why there are generally 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. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do different ecosystems cycle matter differently? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explore how humans use an understanding of the cycling of matter and energy to help mitigate environmental problems.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere, e.g., energy follows the same rules in an ecosystem as it does in physic experiments.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

Fifth Grade Expectations

Concepts and Skills students know include:

1. Human body systems and the body systems of other organisms have basic structures, functions, and needs.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Develop, communicate and justify 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 and provide feedback on other scientific explanations regarding how one or more human body systems function to meet basic needs. d. Create and evaluate models of human body systems or parts. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How are human body systems similar to and different from those found in other organisms? • How is the organ impacted when different body systems fail to work correctly?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Create goals about one's own lifestyle based on an understanding of human body systems. • Define societal norms/laws intended to protect your health, that are based on scientific evidence.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate models, identifying the strengths and weaknesses of the model in representing complex natural phenomena.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

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

Fifth Grade Expectations

Concepts and Skills students know include:

2. All living things share similar characteristics, but they also have differences that allow us to describe and classify them.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, communicate and justify an evidence based scientific explanation of what plants and animals need to survive. b. Develop, communicate, and justify an evidence based scientific explanation for similarities and/or differences between different organisms (species). c. Analyze and interpret data representing variation in a trait. d. Evaluate and provide feedback on evidence used by others to justify how they classified organisms. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How have classification systems changed over time? • How are individuals in related species similar and different? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explore how human beings have used technology to be able to live in a variety of climates.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Collaborate with peers on similarities and differences of related species. • Understand that all scientific knowledge is subject to new findings and that the presence of reproducible results yields a scientific theory

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

Fourth Grade Expectations

Concepts and Skills students know include:

1. All organisms have structures and systems with separate functions that help keep them alive.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Develop, communicate and justify 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. Assess and provide feedback on other's scientific explanations about the importance of different structures to the organism in both plants and animals. d. Create and evaluate models of plant and/or animal systems or parts. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do plants and animals carry out processes necessary for life? • What different structures to plants and animals use to carry out the same functions? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that different organism structures are adapted to different functions to ensure survival, and humans often manipulate these different structures for our own uses (e.g., building materials, food, and medicines). • Describe how humans have long exploited animals in order to manage them as renewable food resources (e.g., fishing and herding).
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Assess and provide feedback on other's scientific explanations about the importance of different structures to the organism in both plants and animals.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Evaluate evidence regarding the history of living organisms and how populations change their inherited traits from generation to generation to adapt to environmental and ecological pressures.

Fourth Grade Expectations

Concepts and Skills students know include:

2. Fossils can be compared to one another and to living organisms in order to identify similarities and differences and provide evidence about the features of prehistoric environments and give us information about organisms today.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Develop, communicate and justify an evidence-based scientific explanation of:</p> <ol style="list-style-type: none"> 1. what fossils tell us about a prehistoric environment. 2. what conclusions can be drawn from similarities between fossil evidence and living organisms. <p>b. Analyze and interpret data to generate evidence about the prehistoric environment.</p> <p>c. Evaluate whether reasoning and conclusions about given fossils are supported by evidence.</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • What are some things fossils can't tell us? • If you wanted something to turn into a fossil, where would you put it to increase its chances of becoming a fossil?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that different interpretations of evidence are possible.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Students can make predictions about past environments based on fossil evidence.

**Content Area: Science
Standard: Life Science**

Prepared Graduate Competencies:

- Explore how living systems interact with their environment and are interdependent with other systems, including humans.

Fourth Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Describe the components, living and non-living, that compose a habitat. b. Model the relationship (food web) between producers and consumers in a specific habitat. c. Identify the components that make a habitat type unique. Compare and contrast different habitat types. d. Create and evaluate models of the flow of non-living components/resources through an ecosystem. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do plants capture the sun's energy and how do other organisms use this energy? • How are resources shared among organisms in a specific ecosystem/habitat? • How do non-living components of an ecosystem affect the living components? • How do non-living components of ecosystem influence living components? • What would happen if the Sun's energy no longer made it to Earth? • What would happen if water were removed from an ecosystem?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Describe how humans can have positive impacts on an ecosystem. • Recognize that nonliving components which are cycled and recycled through ecosystems need to be protected and conserved.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate models, identifying the strengths and weaknesses of the model in representing complex natural phenomena.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

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

Third Grade Expectations

Concepts and Skills students know include:

1. Life cycles vary from organism to organism.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Develop, communicate and justify an evidence-based 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. Share observations, and provide and respond to feedback on other scientific explanations, regarding how organisms develop. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How are life cycles from a variety of organisms similar and different? • How does an organism change throughout its life cycle?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explore how living things may have different needs at different points in their life cycles. • Explore how humans interact and depend on other species.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Compare what is done in class to the work of scientists: <ol style="list-style-type: none"> a. Scientists evaluate and use data generated by other scientists to further their own ideas. b. A community of scientists weaves together different evidence and ideas to deepen understanding.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

Second Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Develop, communicate and justify 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. c. Share observations, and provide and respond to feedback on ideas about the advantages of specific structures and behaviors. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • Are any plant (or animal) structures seen in vastly different environments similar? • Which plant or animal has the most unique structure or behavior?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explore how a single environment can support a variety of living things that use different kinds/amounts of resources.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Share reasoning about the advantages of certain structures or behaviors.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore how living systems interact with their environment and are interdependent with other systems, including humans.

Second Grade Expectations

Concepts and Skills students know include:

2. Organisms interact with each other and with non-living parts of their habitat to meet their basic needs.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Describe a habitat type for a given organism. b. Develop, communicate, and justify an evidence based scientific explanation about the relationship between an organism and its habitat. c. Analyze and interpret data about non-living components of a habitat. d. Assess and provide feedback on other scientific explanations regarding why an organism can survive in its habitat. e. Use instruments to help 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).	<p>Inquiry:</p> <ul style="list-style-type: none"> • What are the basic needs of plants and animals? • Are the basic needs of all living things the same? Why? • How do living things depend on their environment? • How does an organism respond when basic needs are not met?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explain how living things depend on the health of their habitats, which need to be protected.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Describe several ways that scientists have come to understand about organisms and their interactions with the environment.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

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

First Grade Expectations

Concepts and Skills students know include:

1. Offspring have characteristics that are similar to but not exactly like their parents (For both plants and animals).

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Develop, communicate and justify evidence-based ideas regarding similarities and differences between parents and offspring. b. Analyze and interpret data regarding the similarities and differences between offspring and their parents. c. Question peers about evidence used in developing ideas about similarities and differences between parents and offspring. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How are you like your parents? • In what ways do offspring resemble their parents? <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Understand how diversity, or variation, within populations and species is important for health and survival.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Compare and contrast their data with their peers, recognizing this is a process scientists would do in their work.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

First Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Identify organisms and develop, communicate, and justify 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 and respond to feedback about ideas concerning physical characteristics that help plants/animals survive.	Inquiry: <ul style="list-style-type: none"> • How do the needs of plants and animals differ? • What helps a (specific plant or animal) survive?
	Applying Science in Society and Using Technology: <ul style="list-style-type: none"> • Recognize that a living thing can be harmed or killed if needed resources are lacking or contaminated.
	Nature of Science: <ul style="list-style-type: none"> • Predict the outcome for an organism if a need is removed.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.

Kindergarten Expectations

Concepts and Skills students know include:

1. There are essential differences between living and non-living things.

Evidence Outcomes
Students can:

- a. Sort a group of items into living and non-living categories.
- b. Communicate, and justify an evidence based scientific rationale for sorting items into categories.

21st Century Skills and
Readiness Competencies

Inquiry:

- How do you know if something is living or non-living?
- What do living things have in common?

Applying Science in Society and Using Technology:

- Develop ideas by observing patterns in the world.
- Show how the world is composed of living and non-living things.

Nature of Science:

- Share scientific ideas verbally in a clear way.
- Question peers about reasons for their sort and push for use of evidence to support their ideas.

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.
- Explore how living systems interact with their environment and are interdependent with other systems,

PreK Expectations

Concepts and Skills students know include:

1. Living things have characteristics, life cycles 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 their 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

Approaches to Learning:

- Openness to and curiosity about new tasks and challenges (Predisposition to explore and experiment)
 - Initiative, task persistence, and attentiveness
 - Approach to reflection and interpretation
 - Capacity for invention and imagination
- (Scott-Little, Kagan, & Frelow. March, 2005)

Content Area: Science
Standard: Life Science

Prepared Graduate Competencies:

- Explore the complex and highly organized systems of living organisms.
- Explore how living systems interact with their environment and are interdependent with other systems,

PreK Expectations

Concepts and Skills students know include:

2. Living things develop in predictable patterns.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Identify common needs of familiar living things (e.g. food, air, water). b. Predict, explain and infer patterns based on observations and representations of living things, their needs and life cycles. 	<p>Approaches to Learning:</p> <ul style="list-style-type: none"> • Openness to and curiosity about new tasks and challenges (Predisposition to explore and experiment) • Initiative, task persistence, and attentiveness • Approach to reflection and interpretation • Capacity for invention and imagination <p>(Scott-Little, Kagan, & Frelow. March, 2005)</p>

DRAFT

Earth 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. (Focus: Geology, Meteorology, Astronomy, Oceanography)

Prepared Graduate Competencies

The Prepared Graduate Competencies are the Preschool through Grade 12 concepts and skills that all students leaving the Colorado education system must have to ensure success in a postsecondary and workforce setting.

Prepared Graduate Competencies in the Earth Science standard:

1. Explore Earth's geologic history and place in space and how these are relevant to our understanding of the processes that have shaped our planet.
2. Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.
3. Explore human dependency on the Earth for resources.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

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

High School Expectations

Concepts and Skills students know include:

1. Earth's history can be inferred from evidence left from past events in the geosphere

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> 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. Clearly identify assumptions behind conclusions regarding Earth's history, in order to provide feedback on the validity of alternative explanations. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How did the solar system form? • How do we know that the earth is 4.6 billion years old? • How did the formation of the Earth help shape its' features today? • How can we interpret the geologic history of an area?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Use satellite imagery and other remote sensing data. • Apply GPS and GIS tools and analyze relevant data. • Describe how geologic principles (e.g., original horizontality, superposition, cross-cutting relationship, unconformities, index fossils) allow us to accurately interpret geologic history. • Recognize that Doppler shifts (red and blue) have allowed us to determine if objects are moving closer to Earth or further away.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Understand that all scientific knowledge is subject to new findings and that the presence of reproducible results yields a scientific theory. • Critically evaluate scientific explanations or publications and determine if the research methodology and the evidence presented is appropriate and sufficient to support the claims.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Explore Earth’s geologic history and place in space and how these are relevant to our understanding of the processes that have shaped our planet.

High School Expectations

Concepts and Skills students know include:

2. As part of the solar system, Earth interacts with various extraterrestrial forces and energies (eg, gravity, solar phenomena, electromagnetic radiation, impact events) which influence the planet’s geosphere, atmosphere, and biosphere in a variety of ways.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
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, in order to provide feedback on the validity of alternative explanations.	<p>Inquiry:</p> <ul style="list-style-type: none"> • Will the earth be involved in a collision with an extraterrestrial object? • What influences Earth’s position in the universe? • How does Earth get it’s energy? • How did the moon form? • How does the moon – sun – earth system interact? • How does the electromagnetic spectrum impact Earth – positively and negatively?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Use specific equipment to explore the universe (e.g., satellite imagery, GPS, GIS, telescopes, video and image libraries, computers). • Understand that 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. • Describe how different types of telescopes have given us data about the universe, our galaxy, and our solar system
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Understand the physical laws that govern Earth are the same physical laws that govern the rest of the Universe. • Critically evaluate models, identifying the strengths and weaknesses of the model in representing complex natural phenomena.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

High School Expectations

Concepts and Skills students know include:

3. The theory of plate tectonics helps to explain geological, physical and geographical features of the earth.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Develop, communicate and justify an evidence-based scientific explanation addressing questions surrounding plate tectonics and the 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. Evaluate both negative and positive impacts on the planet as a result of plate tectonics. d. Investigate and explain how new conceptual interpretations of data and innovative geophysical technologies led to the current theory of plate tectonics.	<p>Inquiry:</p> <ul style="list-style-type: none"> • How has the theory of plate tectonics developed over time? • How do the different types of plate boundaries create different landforms on Earth? • How have scientists “discovered” the layers of Earth? • What drives plate motion? • What might happen to Earth’s landforms in the future? • How does matter and energy change, flow and transform through and between Earth’s systems?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Use the equipment necessary to provide evidence of plate tectonics (e.g., GIS, GPS, computer simulations and models, remote sensing, satellite imagery). • Explain that new conceptual interpretations of data and innovative geophysical technologies led to the current theory of plate tectonics. • Understand the role plate tectonics has had in respect to long-term global changes in Earth’s systems, such as continental buildup, glaciations, sea-level fluctuations, mass extinctions and climate change.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Understand that all scientific knowledge is subject to new findings and that the presence of reproducible results yields a scientific theory. • Share experimental data and respectfully discuss discrepant results. • Recognize the current understandings of plate tectonics has developed over time and has become more sophisticated as new technologies have lead to new evidence.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

High School Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Develop, communicate, and justify an evidence-based scientific explanation addressing climate as a result of energy transfer among interactions of the atmosphere, hydrosphere, geosphere and biosphere. b. Analyze and interpret data on Earth's climate. c. Clearly identify assumptions behind conclusions regarding climate change, in order to provide feedback on the validity of alternative explanations.	Inquiry: <ul style="list-style-type: none"> • How have climate changes impacted human society? • Why are there different climates on Earth? • How can changes in the ocean create climate change? • How have climates changed over Earth's history? • How are humans potentially impacting Earth's climates? • How might global warming impact all of Earth's systems?
	Applying Science in Society and Using Technology: <ul style="list-style-type: none"> • Recognize that much of the data we receive about the ocean and the atmosphere is from satellites. • Interpret evidence from tree rings, ice cores, geologic sediments, glacial sediments and fossil pollen. • Understand how many different factors determine a location's climate (e.g., Earth's tilt, seasons, geophysical location, proximity to oceans, landmass location, latitude, elevation, etc.).
	Nature of Science: <ul style="list-style-type: none"> • Critically evaluate climate models or publications and determine if the evidence presented is backed by unbiased rigorous scientific research. • Share experimental data and respectfully discuss discrepant results.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

High School Expectations

Concepts and Skills students know include:

5. There are natural and man-made factors that influence weather and climate

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Develop, communicate and justify an evidence-based scientific explanation addressing questions about the natural and man-made factors that influence weather and climate. b. Analyze and interpret data on natural and man-made factors that influence weather and climate.	Inquiry: <ul style="list-style-type: none"> • How can weather change through natural factors? • How can weather change through man-made factors? • How can we mitigate damage from weather hazards? • How can humans stay safe during weather related hazards?
	Applying Science in Society and Using Technology: <ul style="list-style-type: none"> • Describe how weather instruments have been designed to give us data about weather patterns. • Read and interpret weather maps using a simplified station model. • Understand how weather systems are formed, in order to accurately predict future weather patterns. • Recognize factors that influence and allow us to more accurately predict weather patterns (e.g., elevation, proximity to oceans, prevailing winds, volcanoes, etc.).
	Nature of Science: <ul style="list-style-type: none"> • Critically evaluate climate models and/or publications to determine if the evidence presented is backed by rigorous, replicable scientific research • Recognize that similar scientific investigations can lead to different results, sometimes because of unexpected things in what is being studied, sometimes due to unexpected differences in the experimental methods or conditions (experimental errors), sometimes due to observational errors and that it may be hard to tell what lead to the variance.

**Content Area: Science
Standard: Earth Science**

Prepared Graduate Competencies:

- Explore human dependency on the Earth for resources.

High School Expectations

Concepts and Skills students know include:

6. There are costs, benefits, and consequences of exploration, development, and consumption of renewable and non-renewable resources.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development and consumption of renewable and non-renewable resources. b. Clearly identify the assumptions behind emotional, political and data driven conclusions regarding renewable and non-renewable resource use. c. Evaluate positive and negative impacts on the geosphere, atmosphere, hydrosphere and biosphere in regards to resource use. d. Defend the motto "If it can't be grown, it must be mined" using sound scientific principles. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do humans use resources? • How can resource use impact all of Earth's systems? • How can humans reduce the impact of resource use? • How are resources used within our community? • What are the advantages and disadvantages to using energy?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Identify the impact of various technologies on how resources are located, extracted and consumed. • Recognize that technology development has reduced the pollution, waste and ecosystem degradation caused by extraction and use. • Create a plan to reduce environmental impacts due to resource consumption. • Analyze and interpret data about the effect of resource consumption and development on resource reserves to draw conclusions about sustainable use.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate environmental models, products or publications and determine if the evidence presented is backed by unbiased rigorous scientific research. • Clearly identify assumptions behind emotional, political and data driven conclusions about renewable and non-renewable resource use.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

High School Expectations

Concepts and Skills students know include:

7. The interaction of Earth's surface with water, air, gravity, and biological activity cause physical and chemical change.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
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.	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do Earth systems interact to create new landforms? • What are positive changes on Earth's geosphere due to water, air, gravity and biological activity? • What are negative changes on Earth's geosphere due to water, air, gravity and biological activity?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Use remote sensing and GIS to interpret landforms and landform impact on human activity.. • Use geologic, physical and topographic maps to interpret surface features. • Recognize that landform models help us understand the interaction among Earth systems. • Explore the impact of human activity on soil formation and agricultural practices.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Share experimental data and respectfully discuss discrepant results.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

High School Expectations

Concepts and Skills students know include:

8. Natural hazards have local, national and global impacts (volcanoes, earthquakes, tsunamis, hurricanes, thunderstorms, etc.).

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Develop, communicate and justify an evidence-based scientific explanation addressing questions regarding natural hazards and their local, national 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, nationally and globally.	<p>Inquiry:</p> <ul style="list-style-type: none"> • Why are some natural hazards difficult to predict, while others are easier to predict? • How are humans impacted by natural hazards? • How do natural hazards impact the different systems on Earth? • How can we prepare for natural hazards?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explore how Doppler Radar helps save lives. • Use earthquake monitoring on Google Earth or other similar public venues. • Explain how to build in earthquake, hurricane, tsunami, or tornado zones. • Understand that monitoring volcanic eruptions is crucial to global air traffic safety. • Identify that differing technologies are used to study different types of natural hazards. • Understand how natural hazards develop in order to help us prepare for them.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Collaborate with local, national and global organizations to report and review natural disaster data., comparing their conclusion to others posed by other scientists (alternate explanations).

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

High School Expectations

Concepts and Skills students know include:

9. The atmosphere has a current structure and composition and has evolved over geologic time.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, communicate, and justify an evidence-based scientific explanation addressing questions regarding the evolution and current structures of Earth's atmosphere. b. Analyze and interpret data on Earth's atmosphere using direct and indirect evidence to develop and support claims about current and past structures of Earth's atmosphere. c. Clearly identify assumptions behind conclusions regarding structures of Earth's atmosphere, in order to provide feedback on the validity of alternative explanations. d. Evaluate negative and positive impacts on the planet in response to naturally induced and man-made changes in atmospheric component concentrations. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do we know what the atmosphere was like in the past? • How can changes in geosphere and biosphere influence the atmosphere? • How does energy exchanges in the atmosphere and between geo-sphere and biosphere impact human activity?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that evaluating aerosols on a daily basis aides in smog diversion in major cities. • Explore how induced sequestration of atmospheric components in the biosphere and geosphere can effectively reduce pollutants created by human activity.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate atmospheric models, products or publications and determine if the evidence presented is backed by rigorous scientific research.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

Eighth Grade Expectations

Concepts and Skills students know include:

1. Weather is a result of complex interactions of Earth’s atmosphere, both land and water driven, by energy from the sun.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Differentiate between basic and severe weather conditions, and take appropriate action for personal safety and the safety of others. b. Observe and gather data for various weather conditions then analyze the data and explain the results. c. Model explanations of ways weather, land and water interact 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How does weather affect both living and non living aspects of our surroundings? • How can weather be predicted? • What causes weather? • Why does weather vary from day to day?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that weather stations, buoys, satellites, radar, and computer modeling are examples of technology used to help forecast weather. • Research the complicated process of weather prediction and the interaction of many variables it is based on • Explain how weather prediction can save lives, protect property and conserve resources.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Evaluate of the accuracy of various tools used in forecasting weather. • Consider the historical context and impact of early weather research and the potential implications for current weather studies on science and our society.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

Eighth Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Develop, and communicate 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.	Inquiry: <ul style="list-style-type: none"> • How can someone define a particular places climate? • How does the climate in one area compare and contrast with another area? • Why are there different climates on Earth? • How has Earth's climate changed over time? • What evidence supports human influence on climate change?
	Applying Science in Society and Using Technology: <ul style="list-style-type: none"> • Use data tables, charts and graphs to compare and contrast various climates around the globe. • Use computer models help understand past, present and future climates.
	Nature of Science: <ul style="list-style-type: none"> • 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.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Understand the Earth’s geologic history and place in space are relevant to our understanding of the processes that have shaped our planet.

Eighth Grade Expectations

Concepts and Skills students know include:

3. The relative positions and motions, of Earth, Moon, and Sun can be used to explain observable effects from Earth (e.g. seasons, eclipses, moon phases).

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Develop an evidence based explanation, using relative positions of the Earth, Moon and Sun, for each of the following natural phenomenon:</p> <ol style="list-style-type: none"> 1. Tides 2. Eclipses of the Sun and Moon 3. Different shapes of the Moon as viewed from Earth. <p>b. Analyze and interpret data to explain why we have seasons.</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • Why do we observe changes in the relative positions of the Earth, Moon, and Sun from Earth over time? • How does the relative positions of the Earth, Moon and Sun affect natural phenomenon on Earth?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Use computer simulation models to explain the relative motions of Earth, Moon and Sun over time. • Describe how different tools are used to help understand motion in the Solar System • Describe how space missions can be planned because we understand planetary motion. • Recognize that the GPS system is based on relative motion and has many applications to human endeavors.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Understand there are interrelationships among science, technology and human activity have global consequences. • Evaluate visual and print media for scientific evidence, bias, and conjecture related to the relative positions of the Earth, Moon and Sun.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Understand the earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

Seventh Grade Expectations

Concepts and Skills students know include:

1. Major geological events such as earthquakes, volcanic eruptions, and mountain building are associated with plate boundaries and attributed to plate motions.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Gather, analyze and communicate data, which explains Earth's plates, plate motions and the results of plate motions. b. Identify, interpret and explain models of Earth's plates motions. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How can major geological events be attributed to plate movement? • What evidence supports the theory of plate tectonics? • What are the effects of plate movement along plate boundaries?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that computer models and simulations help us understand and make informed decisions about major geological events • Recognize that building codes and emergency plans are affected by natural threats in an area. • Use maps to locate geologic "hot spots", earthquakes and volcanic activity.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Construct a model to explain how plate movement results in geologic events. • Trace the development of a scientific theory using the theory of plate tectonics. • 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.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Explore Earth’s geologic history and place in space and how these are relevant to our understanding of the processes that have shaped our planet.

Seventh Grade Expectations

Concepts and Skills students know include:

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:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> 1. Describe the geologic time scale and why it is used. 2. Identify and describe major developments of life on Earth. 3. Identify and describe major events in Earth’s geologic history. 4. Use direct and indirect evidence to determine sequence of events in geologic time. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How can we “read” the rock layers? • What is geologic time?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Consider how knowledge of Earth’s structure helps mankind locate and extract resources. • Recognize how dating fossils absolutely, and relatively, helps assemble the story of the evolution of life on Earth.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Describe how scientists study fossils and suggest ways that understanding fossil evidence contributed to our knowledge about life on Earth over geologic time.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Explore Earth’s geologic history and place in space and how these are relevant to our understanding of the processes that have shaped our planet.

Seventh Grade Expectations

Concepts and Skills students know include:

3. The Solar System is comprised of various objects that orbit the Sun. These bodies (including planets, asteroids, comets, moons, and dwarf planets) can be classified based on their characteristics (orbits, size, composition, and surface features)

Evidence Outcomes
Students can:

1. Construct a scale model of the Solar System and use it to explain the motion of objects in the system (planets, Sun, moons, asteroids, comets, dwarf planets) in the Solar System.
2. Describe methods and equipment used to explore the Solar System and beyond.
3. Design a data collecting investigation that involves direct observation of objects in the sky then analyze and explain your results.
4. Research, critique and communicate theories that explain how the Solar System was formed.

21st Century Skills and
Readiness Competencies

Inquiry:

- How are the various bodies in the Solar System similar and different?
- How does investigating characteristics of the various bodies in the Solar System provide clues to Earth’s origin and evolution?
- Why do objects stay in orbit (satellites, moons, planets...)
- How is the life cycle of a star such as our Sun similar to the cycle of life on Earth?

Applying Science in Society and Using Technology:

- Explore the methods and equipment used to investigate far away objects like those in the Solar System and beyond.
- Use computer data sets and simulations to explore objects in the Solar System.
- Recognize that mathematical models are used to predict orbital paths and events.

Nature of Science:

- Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere, e.g., planets follow the same rules about forces as other objects.
- Recognize that our current understandings about 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 understandings of the solar system.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

Sixth Grade Expectations

Concepts and Skills students know include:

1. Complex interrelationships exist between Earth's structure, (landforms, rocks, minerals, soils) and natural processes over time that are constructive (mountain building, volcanic activity, deposition) and destructive (landslides, weathering, earthquakes)

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
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 that explains the formation of Earth's surface features.	<p>Inquiry:</p> <ul style="list-style-type: none"> • How do forces inside the Earth and on the surface build, destroy and change Earth's crust? • How does Earth's surface change over time?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Identify the benefits/ costs of building in areas prone to, changes resulting from constructive and destructive forces such as earthquakes, landslide, etc. • Use or create a computer simulation for Earth's changing crust.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Practice the collaborative inquiry process that scientists use to identify local evidence of Earth's constructive and destructive processes.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Explore human dependency on the Earth for resources.

Sixth Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Gather and analyze data to account for local and world-wide water circulation and distribution patterns. b. Model how water is transferred throughout the earth using various forms of evidence. 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. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How is water cycled on Earth? • How does the lack of water (or abundance) impact human civilizations and populations?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Analyze home water quality and consumption. • Use computer data sets and simulations to investigate how water is distributed and transferred from one location to another. • Explain how water systems affect local, regional and world development. • Analyze water use patterns in Colorado and how these effect development in the state.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate models, identifying the strengths and weaknesses of the model in representing complex natural phenomena. • Reflect on and describe their work in class as it compares to the practice of professional scientists.

**Content Area: Science
Standard: Earth Science**

Prepared Graduate Competencies:	
➤ Explore human dependency on the Earth for resources.	
Sixth Grade Expectations	
Concepts and Skills students know include:	
3. Earth’s natural resources provide the foundation for all of the physical needs of human society. Soil, rocks and minerals provide essential metals and other materials for agriculture, manufacturing and building. These natural resources are finite. Most resources are non-renewable on human time scales.	
Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Research and evaluate data and information to learn about the types and availability of various natural resources and use this knowledge to made evidence based decisions b. Identify and evaluate types and availability of renewable and non-renewable resources. c. Use direct and indirect evidence to determine the types of resources and their applications used in your community. d. Research and critically evaluate data and information to learn about the advantages and disadvantages of using fossil fuels and alternative energy sources. 	Inquiry: <ul style="list-style-type: none"> • What resources are found and used in our community? • How can natural resources be identified and classified? • How do we use resources on a daily basis?
	Applying Science in Society and Using Technology: <ul style="list-style-type: none"> • Recognize that natural resources come from a variety of locations and have to be mined or harvested depending on the type. • Recognize that a resource can be used in a variety of ways depending on the product being made (plastics, textiles, medications and fertilizers are produced from petroleum). • Explain how resources in Colorado directly affect the state economy and society by providing employment and sources of revenue. • Recognize that fossil fuels and uranium currently provide most of our energy resources.
	Nature of Science: <ul style="list-style-type: none"> • 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.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

Fifth Grade Expectations

Concepts and Skills students know include:

1. Earth's surface is constantly changing through a variety of processes and forces.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Develop, justify, and communicate an evidence based scientific explanation around one or more factors that change Earth's surface. b. Analyze and interpret data identifying ways Earth's surface is constantly changing through a variety of processes and forces (e.g., plate tectonics, erosion, deposition, solar influences, climate, human activity, and so forth). c. Assess and provide feedback on other's scientific explanations about factors that change Earth's surface. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • How does Earth's surface change? • How do changes on Earth's surface impact humans?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Develop an awareness of the benefits and dangers to humans as Earth's surface constantly changes. • Describe the construction techniques used to take into account the effects of the changing Earth: springs, stilts, drainage, frost heaving. • Recognize that some cities have emergency plans for earthquakes, flooding, eruptions, and tornadoes. • Understand that the development of technology led to tools that made the establishment of measurement standards possible (the Richter Scale).
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Assess and provide feedback on other's scientific explanations about factors that change Earth's surface. • Utilize a variety of media sources to collect and analyze data around Earth processes and the changing surface.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

Fifth Grade Expectations

Concepts and Skills students know include:

2. 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:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, justify, 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. Share their reasoning on how they came to conclusions based on the evidence and their understanding of how weather conditions change. e. Assess and provide feedback on other's scientific explanations about weather, pushing for reasoning based on evidence and scientific principles. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • Why does the Sun heat different surfaces at different rates? • Why does the weather change from day to day?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that the Sun's energy helps to change our weather daily by influencing the water cycle, air movement and temperature. • Explain how gliders and birds exploit updrafts created by thermals. • Understand that deicing planes in winter is sometimes necessary so that they can fly. • Explore how weather satellites generate data that measures and monitors changes in weather.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Assess and provide feedback on other's scientific explanations about weather, pushing for reasoning based on evidence and scientific principles. • Understand how weather maps are utilized to predict the weather from day to day.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

Fifth Grade Expectations

Concepts and Skills students know include:

3. Weather and the changing seasons impacts the organisms (e.g. humans, plants, other animals) and the environment.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Develop and communicate an evidence based scientific explanation for how the weather and changing seasons impacts the organisms (e.g. humans, plants, other animals) and the environment.</p> <p>b. Analyze and interpret data such as temperatures in different locations (sun/shade), at different times and different seasons as evidence of how organisms and the environment are influenced by the weather and changing seasons.</p> <p>c. Make predictions, share their thinking, and ask others how they know that organisms and the environment are influenced by the weather and changing seasons.</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • Does the temperature change at different times during the day (morning, noon, evening) and from day to day? • What changes do we make in our daily lives based on changes in the weather? • What are the weather patterns that happen during different seasons (fall, winter, spring, and summer)?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that the Sun is a principal source of heat and light. • Recognize how our daily activities are affected by the weather and the changes in seasons.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Collect weather data from various cities, which are either on a similar latitude or longitude. Give explanations for the differences in the data.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Explore human dependency on the Earth for resources. .

Fifth Grade Expectations

Concepts and Skills students know include:

4. Earth and Sun provide a diversity of resources.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Develop, communicate and justify a scientific explanation addressing a scientifically oriented question of local relevance around one or more resources generated by the sun or Earth.</p> <p>b. Analyze and interpret a variety of data to understand the origin, utilization, and concerns associated with natural resources.</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • How can the Sun be used as an energy source? • How can wind be used as an energy source? • What types of energy sources exist in Earth?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Describe how mining operations provide non-renewable resources. • Understand that resources are not distributed evenly and require transportation systems to move them to where they are needed. • Discuss how towns and laws are often built around resource extraction.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Review and analyze scientific explanations about natural resources presented by their peers, providing feedback to push their peers to be scientifically accurate and base their claims on adequate and reasonable scientific evidence, not opinion. • Earth and Sun provide a variety of resources some are renewable and some are not.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Explore Earth’s geologic history and place in space and how these are relevant to our understanding of the processes that have shaped our planet.

Fourth Grade Expectations

Concepts and Skills students know include:

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

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ul style="list-style-type: none"> a. Develop, communicate and justify a scientific explanation addressing a scientifically oriented question about the components of the solar system. b. Gather, analyze and interpret data about components of the solar system. c. Utilize direct and indirect evidence to investigate the components of the solar system. d. Gather, analyze, and interpret data about the sun rise and set, moon movements and phases, and star movements. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What are the patterns of movement for Sun and Moon across the sky? • How does the Earth compare to other objects orbiting the Sun? • How do we study the solar system?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Understand that space exploration has produced data to answer questions about our solar system.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Examine how space exploration has produced data to answer questions about our solar system.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

Third Grade Expectations

Concepts and Skills students know include:

1. Earth’s materials can be broken down and/or combined into different materials (e.g., rock cycle, formation of soil, sand). Some of these materials are usable resources for human activity.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>a. Investigate and identify two or more ways the Earth’s surface is constantly changing through a variety of processes and forces (e.g., plate tectonics, erosion, deposition, solar influences, climate, human activity, and so forth).</p> <p>b. Develop an evidence-based, scientific explanation around one or more factors that change Earth’s surface.</p>	<p>Inquiry:</p> <ul style="list-style-type: none"> • What are some of the ways that Earth’s materials are formed? • Where do these different Earth materials (e.g., soil, sand, rocks, oil) come from? What is the process and materials by which they were formed? • How is Earth’s surface changing? • How do rocks “cycle?”
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that many of Earth’s materials are usable resources for building or energy. • Recognize the process and time (rates) required for various materials to be formed (e.g., fossil fuels, soils) and the implications of human use of these resources. • Utilize a variety of media sources to collect and analyze data around Earth materials and the processes by which they are formed.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Use models to demonstrate the rock cycle.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Evaluate evidence that the Earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

Second Grade Expectations

Concepts and Skills students know include:

1. Weather and the changing seasons impact organisms (e.g. humans, plants, other animals) and the environment.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
a. Develop and communicate an evidence based scientific explanation for how the weather and changing seasons impacts the organisms (e.g. humans, plants, other animals) and the environment. b. Analyze and interpret data such as temperatures in different locations (sun/shade), at different times and different seasons as evidence of how organisms and the environment are influenced by the weather and changing seasons.	<p>Inquiry:</p> <ul style="list-style-type: none"> • Does the temperature change at different times during the day (morning, noon, evening) and from day to day? • What changes do we make in our daily lives based on changes in the weather? • What are the weather patterns that happen during different seasons (fall, winter, spring, summer)?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Develop and communicate an evidence based scientific explanation for how the weather and changing seasons impacts organisms (e.g. humans, plants, other animals) and the environment. • Analyze and interpret data such as temperatures in different locations (sun/shade), at different times and different seasons as evidence of how organisms and the environment are influenced by the weather and changing seasons.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Make predictions, share their thinking, and ask others how they know that organisms and the environment are influenced by the weather and changing seasons.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Explore human dependency on the Earth for resources. .

First Grade Expectations

Concepts and Skills students know include:

1. It is important to use resources wisely and to reduce, reuse, and recycle.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Discuss the similarities and differences between reduce, reuse, and recycle. b. Analyze the impact of reduce, reuse, recycle. c. Question peers and push for understanding on why it is important to reduce, reuse and recycle. 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What impacts (positive and negative) does reduce, reuse and recycle have?
<ol style="list-style-type: none"> d. Describe ways to reduce, reuse and recycle. 	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Explore how materials are recycled. • Calculate how much it costs consumers to use (or not use) recycling services or products. • Find out what types of products use recycled materials. • Understand that there are limits on resources and materials extracted from the natural environment (e.g., mines).
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Question peers and push for understanding on why it is important to reduce, reuse and recycle. • Collaborate on alternate uses of products beyond their intended use.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Apply the idea that energy has various forms and its transformation occurs in processes that are predictable and explainable.

Kindergarten Expectations

Concepts and Skills students know include:

1. The Sun provides heat and light to Earth.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> 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 you block the sun's light (exploring shadows and temperature changes). 	<p>Inquiry:</p> <ul style="list-style-type: none"> • What impact does the Sun have on Earth? • What happens when you block or change the Sun's light?
	<p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Recognize that the Sun provides light and heat (energy) for Earth. • Read a thermometer and identify it as a tool for measuring heat.
	<p>Nature of Science:</p> <ul style="list-style-type: none"> • Question peers to push for clarity of reasoning as to why they think the Sun provides heat and light to Earth.

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Understand the earth is a complex system of interactions between the geosphere, atmosphere, hydrosphere and biosphere.

PreK Expectations

Concepts and Skills students know include:

1. Earth materials and objects in the sky have properties and characteristics.

Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<ol style="list-style-type: none"> a. Use senses to gather information about earth materials and objects in the sky. b. Use scientific tools in their investigations and play with materials such as rocks, soil, sand, water. c. Make simple observations, explanations and generalizations about earth materials and objects in the sky based on real life experiences. d. Ask questions based upon discoveries made while playing. e. Collect, describe and record information through discussion, drawings and charts. 	<p>Approaches to Learning:</p> <ul style="list-style-type: none"> • Openness to and curiosity about new tasks and challenges (Predisposition to explore and experiment) • Initiative, task persistence, and attentiveness • Approach to reflection and interpretation • Capacity for invention and imagination <p>(Scott-Little, Kagan, & Frelow. March, 2005)</p>

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Understand the Earth’s geologic history and place in space are relevant to our understanding of the processes that have shaped our planet.

PreK Expectations

Concepts and Skills students know include:

2. Earth materials can be compared and classified.

Evidence Outcomes
Students can:

- a. Identify and represent similarities and differences such as texture, color, and shape.
- b. Sort, group and classify earth materials based on observations and explorations.

21st Century Skills and Readiness Competencies

Approaches to Learning:

- Openness to and curiosity about new tasks and challenges (Predisposition to explore and experiment)
 - Initiative, task persistence, and attentiveness
 - Approach to reflection and interpretation
 - Capacity for invention and imagination
- (Scott-Little, Kagan, & Frelow. March, 2005)

Content Area: Science
Standard: Earth Science

Prepared Graduate Competencies:

- Understand the Earth’s geologic history and place in space are relevant to our understanding of the processes that have shaped our planet.

PreK Expectations

Concepts and Skills students know include:

3. Events such as night and day and the 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.

21st Century Skills and Readiness Competencies

Approaches to Learning:

- Openness to and curiosity about new tasks and challenges (Predisposition to explore and experiment)
- Initiative, task persistence, and attentiveness
- Approach to reflection and interpretation
- Capacity for invention and imagination
 (Scott-Little, Kagan, & Frelow. March, 2005)

Nature of Science: