

UTAH SCIENCE WITH ENGINEERING EDUCATION (SEEd) STANDARDS

UTAH K–12
SCIENCE

WITH ENGINEERING EDUCATION (SEEd) STANDARDS



Grades 6–8 Standards
Adopted December 2015

Grades K–2, 3–5, High School (Biology, Chemistry, Earth and
Space Science, and Physics) Standards
Adopted June 2019

by the
Utah State Board of Education
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State Superintendent of Public Instruction

<https://www.schools.utah.gov>



The Utah State Board of Education, in January of 1984, established policy requiring the identification of specific core standards to be met by all K–12 students in order to graduate from Utah’s secondary schools. The Utah State Board of Education regularly updates the Utah Core Standards, while parents, teachers, and local school boards continue to control the curriculum choices that reflect local values.

The Utah Core Standards are aligned to scientifically based content standards. They drive high quality instruction through statewide comprehensive expectations for all students. The standards outline essential knowledge, concepts, and skills to be mastered at each grade level or within a critical content area. The standards provide a foundation for ensuring learning within the classroom.



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5/2019

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Utah Science with Engineering Education Standards

Utah’s Science and Engineering Education (SEEd) standards were written by Utah educators and scientists, using a wide array of resources and expertise. A great deal is known about good science instruction. The writing team used sources including *A Framework for K–12 Science Education*¹, the *Next Generation Science Standards*², and related works to craft research-based standards for Utah. These standards were written with students in mind, including developmentally appropriate progressions that foster learning that is simultaneously age-appropriate and enduring. The aim was to address what an educated citizenry should know and understand to embrace the value of scientific thinking and make informed decisions. The SEEd standards are founded on what science is, how science is learned, and the multiple dimensions of scientific work.

Principles of Scientific Literacy

Science is a way of knowing, a process for understanding the natural world. Engineering applies the fields of science, technology, and mathematics to produce solutions to real-world problems. The process of developing scientific knowledge includes ongoing questioning, testing, and refinement of ideas when supported by empirical evidence. Since progress in modern society is tied so closely to this way of knowing, scientific literacy is essential for a society to be engaged in political and economic choices on personal, local, regional, and global scales. As such, the Utah SEEd standards are based on the following essential elements of scientific literacy.

Science is valuable, relevant, and applicable.

Science produces knowledge that is inherently important to our society and culture. Science and engineering support innovation and enhance the lives of individuals and society. Science is supported from and benefited by an equitable and democratic culture. Science is for all people, at all levels of education, and from all backgrounds.

Science is a shared way of knowing and doing.

Science learning experiences should celebrate curiosity, wonder, skepticism, precision, and accuracy. Scientific habits of mind include questioning, communicating, reasoning, analyzing, collaborating, and thinking critically. These values are shared within and across scientific disciplines, and should be embraced by students, teachers, and society at large.

Science is principled and enduring.

Scientific knowledge is constructed from empirical evidence; therefore, it is both changeable and durable. Science is based on observations and inferences, an understanding of scientific laws and theories, use of scientific methods, creativity, and collaboration. The Utah SEEd standards are based on current scientific theories, which are powerful and broad explanations of a wide range of phenomena; they are not simply guesses nor are they unchangeable facts. Science is principled in that it is limited to observable evidence. Science is also enduring in that theories are only accepted when they are robustly supported by multiple lines of peer reviewed evidence. The history of science demonstrates

how scientific knowledge can change and progress, and it is rooted in the cultures from which it emerged. Scientists, engineers, and society, are responsible for developing scientific understandings with integrity, supporting claims with existing and new evidence, interpreting competing explanations of phenomena, changing models purposefully, and finding applications that are ethical.

Principles of Science Learning

Just as science is an active endeavor, students best learn science by engaging in it. This includes gathering information through observations, reasoning, and communicating with others. It is not enough for students to read about or watch science from a distance; learners must become active participants in forming their ideas and engaging in scientific practice. The Utah SEEd standards are based on several core philosophical and research-based underpinnings of science learning.

Science learning is personal and engaging.

Research in science education supports the assertion that students at all levels learn most when they are able to construct and reflect upon their ideas, both by themselves and in collaboration with others. Learning is not merely an act of retaining information but creating ideas informed by evidence and linked to previous ideas and experiences. Therefore, the most productive learning settings engage students in authentic experiences with natural phenomena or problems to be solved. Learners develop tools for understanding as they look for patterns, develop explanations, and communicate with others. Science education is most effective when learners invest in their own sense-making and their learning context provides an opportunity to engage with real-world problems.

Science learning is multi-purposed.

Science learning serves many purposes. We learn science because it brings us joy and appreciation but also because it solves problems, expands understanding, and informs society. It allows us to make predictions, improve our world, and mitigate challenges. An understanding of science and how it works is necessary in order to participate in a democratic society. So, not only is science a tool to be used by the future engineer or lab scientist but also by every citizen, every artist, and every other human who shares an appreciation for the world in which we live.

All students are capable of science learning.

Science learning is a right of all individuals and must be accessible to all students in equitable ways. Independent of grade level, geography, gender, economic status, cultural background, or any other demographic descriptor, all K–12 students are capable of science learning and science literacy. Science learning is most equitable when students have agency and can engage in practices of science and sense-making for themselves, under the guidance and mentoring of an effective teacher and within an environment that puts student experience at the center of instruction. Moreover, all students are capable learners of science, and all grades and classes should provide authentic, developmentally appropriate science instruction.

Three Dimensions of Science

Science is composed of multiple types of knowledge and tools. These include the processes of doing science, the structures that help us organize and connect our understandings, and the deep explanatory pieces of knowledge that provide predictive power. These facets of science are represented as “three dimensions” of science learning, and together these help us to make sense of all that science does and represents. These include science and engineering practices, crosscutting concepts, and disciplinary core ideas. Taken together, these represent how we use science to make sense of phenomena, and they are most meaningful when learned in concert with one another. These are described in *A Framework for K–12 Science Education*, referenced above, and briefly described here:

Science and Engineering Practices (SEPs): Practices refer to the things that scientists and engineers do and how they actively engage in their work. Scientists do much more than make hypotheses and test them with experiments. They engage in wonder, design, modeling, construction, communication, and collaboration. The practices describe the variety of activities that are necessary to do science, and they also imply how scientific thinking is related to thinking in other subjects, including math, writing, and the arts. For a further understanding of science and engineering practices see Chapter 3 in *A Framework for K–12 Science Education*.

Crosscutting Concepts (CCCs): Crosscutting concepts are the organizing structures that provide a framework for assembling pieces of scientific knowledge. They reach across disciplines and demonstrate how specific ideas are united into overarching principles. For example, a mechanical engineer might design some process that transfers energy from a fuel source into a moving part, while a biologist might study how predators and prey are interrelated. Both of these would need to model systems of energy to understand how all of the features interact, even though they are studying different subjects. Understanding crosscutting concepts enables us to make connections among different subjects and to utilize science in diverse settings. Additional information on crosscutting concepts can be found in Chapter 4 of *A Framework for K-12 Science Education*.

Disciplinary Core Ideas (DCIs): Core ideas within the SEEd Standards include those most fundamental and explanatory pieces of knowledge in a discipline. They are often what we traditionally associate with science knowledge and specific subject areas within science. These core ideas are organized within physical, life, and earth sciences, but within each area further specific organization is appropriate. All these core ideas are described in chapters 5 through 8 in the K–12 *Framework* text, and these are employed by the Utah SEEd standards to help clarify the focus of each strand in a grade level or content area.

Even though the science content covered by SEPs, CCCs, and DCIs is substantial, the Utah SEEd standards are not meant to address every scientific concept. Instead, these standards were written to address and engage in an appropriate depth of knowledge, including perspectives into how that knowledge is obtained and where it fits in broader contexts, for students to continue to use and expand their understandings over a lifetime.

Articulation of SEPs, CCCs, and DCIs

Science and Engineering Practices	Crosscutting Concepts	Disciplinary Core Ideas
<p>Asking questions or defining problems: Students engage in asking testable questions and defining problems to pursue understandings of phenomena.</p> <p>Developing and using models: Students develop physical, conceptual, and other models to represent relationships, explain mechanisms, and predict outcomes.</p> <p>Planning and carrying out investigations: Students plan and conduct scientific investigations in order to test, revise, or develop explanations.</p> <p>Analyzing and interpreting data: Students analyze various types of data in order to create valid interpretations or to assess claims/conclusions.</p> <p>Using mathematics and computational thinking: Students use fundamental tools in science to compute relationships and interpret results.</p> <p>Constructing explanations and designing solutions: Students construct explanations about the world and design solutions to problems using observations that are consistent with current evidence and scientific principles.</p> <p>Engaging in argument from evidence: Students support their best explanations with lines of reasoning using evidence to defend their claims.</p> <p>Obtaining, evaluating, and communicating information: Students obtain, evaluate, and derive meaning from scientific information or presented evidence using appropriate scientific language. They communicate their findings clearly and persuasively in a variety of ways including written text, graphs, diagrams, charts, tables, or orally.</p>	<p><u>Patterns:</u> Students observe patterns to organize and classify factors that influence relationships</p> <p><u>Cause and effect:</u> Students investigate and explain causal relationships in order to make tests and predictions.</p> <p><u>Scale, proportion, and quantity:</u> Students compare the scale, proportions, and quantities of measurements within and between various systems.</p> <p><u>Systems and system models:</u> Students use models to explain the parameters and relationships that describe complex systems.</p> <p><u>Energy and matter:</u> Students describe cycling of matter and flow of energy through systems, including transfer, transformation, and conservation of energy and matter.</p> <p><u>Structure and function:</u> Students relate the shape and structure of an object or living thing to its properties and functions.</p> <p><u>Stability and change:</u> Students evaluate how and why a natural or constructed system can change or remain stable over time.</p>	<p>Physical Sciences:</p> <ul style="list-style-type: none"> (PS1) Matter and Its Interactions (PS2) Motion and Stability: Forces and Interactions (PS3) Energy (PS4) Waves <p>Life Sciences:</p> <ul style="list-style-type: none"> (LS1) Molecules to Organisms (LS2) Ecosystems (LS3) Heredity (LS4) Biological Evolution <p>Earth and Space Sciences:</p> <ul style="list-style-type: none"> (ESS1) Earth’s Place in the Universe (ESS2) Earth’s Systems (ESS3) Earth and Human Activity <p>Engineering Design:</p> <ul style="list-style-type: none"> (ETS1.A) Defining and Delimiting an Engineering Problem (ETS1.B) Developing Possible Solutions (ETS1.C) Optimizing the Design Solution

Organization of Standards

The Utah SEEd standards are organized into **strands** which represent significant areas of learning within grade level progressions and content areas. Each strand introduction is an orientation for the teacher in order to provide an overall view of the concepts needed for foundational understanding. These include descriptions of how the standards tie together thematically and which DCIs are used to unite that theme. Within each strand are **standards**. A standard is an articulation of how a learner may demonstrate their proficiency, incorporating not only the disciplinary core idea but also a crosscutting concept and a science and engineering practice. While a standard represents an essential element of what is expected, it does not dictate curriculum—it only represents a proficiency level for that grade. While some standards within a strand may be more comprehensive than others, all standards are essential for a comprehensive understanding of a strand’s purpose.

The standards of any given grade or course are not independent. SEEd standards are written with developmental levels and learning progressions in mind so that many topics are built upon from one grade to another. In addition, SEPs and CCCs are especially well paralleled with other disciplines, including English language arts, fine arts, mathematics, and social sciences. Therefore, SEEd standards should be considered to exist not as an island unto themselves, but as a part of an integrated, comprehensive, and holistic educational experience.

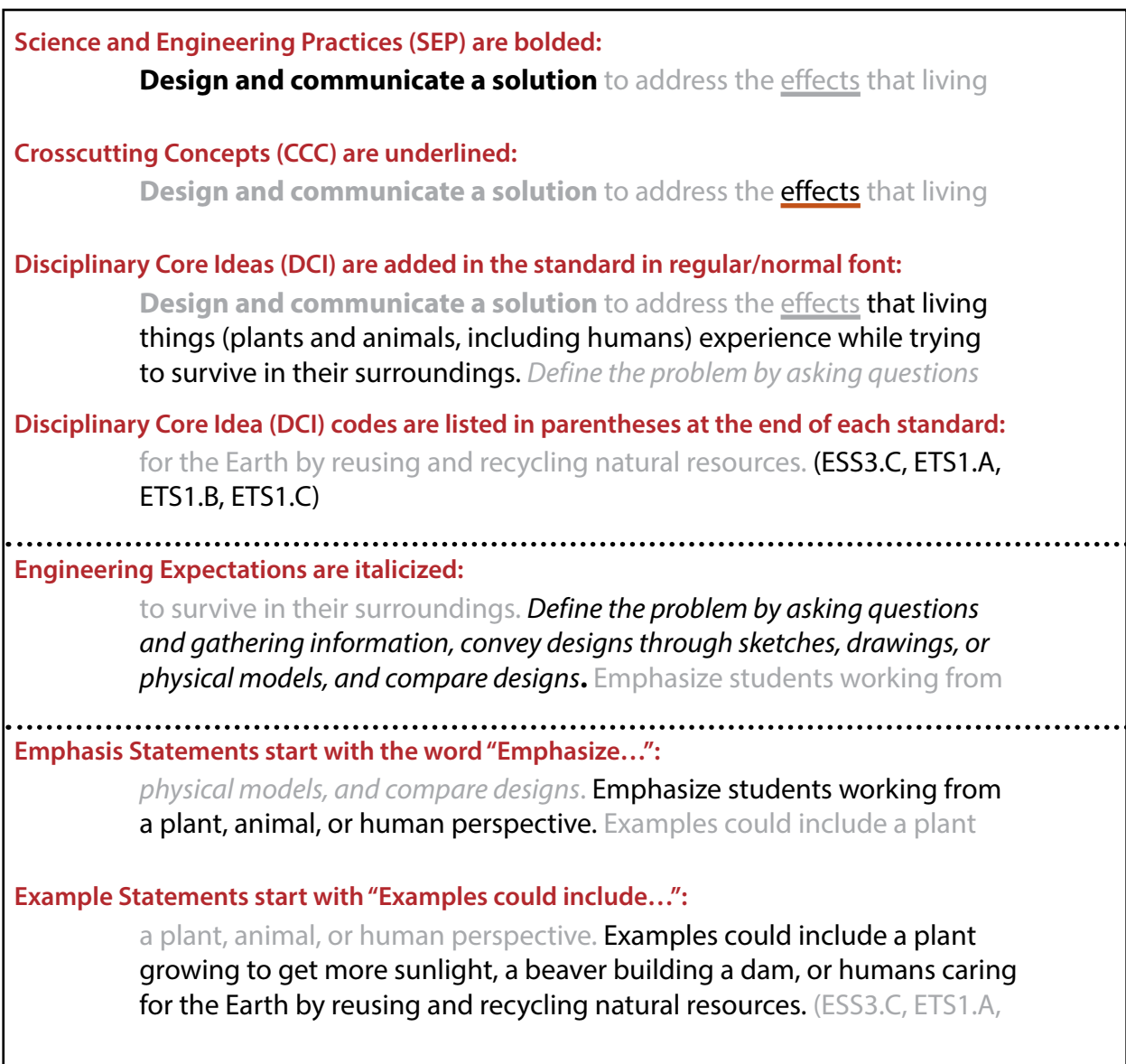
Each standard is framed upon the three dimensions of science to represent a cohesive, multi-faceted science learning outcome.

- Within each SEEd Standard **Science and Engineering Practices are bolded**.
- Crosscutting Concepts are underlined.
- Disciplinary Core Ideas are added to the standard in normal font with the relevant DCIs codes from the *K–12 Framework* (indicated in parentheses after each standard) to provide further clarity.
- Standards with *specific engineering expectations are italicized*.
- Many standards contain additional emphasis and example statements that clarify the learning goals for students.
 - Emphasis statements highlight a required and necessary part of the student learning to satisfy that standard.
 - Example statements help to clarify the meaning of the standard and are not required for instruction.

An example of a SEEd standard:

- Standard K.2.4 Design and communicate a solution** to address the effects that living things (plants and animals, including humans) experience while trying to survive in their surroundings. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare designs.* Emphasize students working from a plant, animal, or human perspective. Examples could include a plant growing to get more sunlight, a beaver building a dam, or humans caring for the Earth by reusing and recycling natural resources. (ESS3.C, ETS1.A, ETS1.B, ETS1.C)

Each part of the above SEEd standard is identified in the following diagram:



Goal of the SEEd Standards

The Utah SEEd Standards is a research-grounded document aimed at providing accurate and appropriate guidance for educators and stakeholders. But above all else, the goal of this document is to provide students with the education they deserve, honoring their abilities, their potential, and their right to utilize scientific thought and skills for themselves and the world that they will build.

¹ National Research Council. 2012. *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/13165>. This consensus research document and its chapters are referred to throughout this document as a research basis for much of Utah’s SEEd standards.

² Most Utah SEEd Standards are based on the Next Generation Science Standards (NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press) <http://www.nextgenscience.org>

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KINDERGARTEN

INTRODUCTION

The kindergarten SEEd standards provide a framework for students to obtain, evaluate, and communicate information about how the Sun causes our weather patterns and how these patterns affect living systems. Students analyze information about the needs of living things (plants and animals, including humans) and how living things interact with their surroundings. Students investigate the effects of forces through push and pull interactions. Additionally, students design and evaluate solutions to problems that exist in these areas.

Strand K.1: WEATHER PATTERNS

Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather to identify patterns over time. Weather scientists forecast severe weather so that communities can prepare for and respond to these events. Sunlight warms Earth's surface.

- **Standard K.1.1 Obtain, evaluate, and communicate information** about local, observable weather conditions to describe patterns over time. Emphasize the students' collection and sharing of data. Examples of data could include sunny, cloudy, windy, rainy, cold, or warm. (ESS2.D)
- **Standard K.1.2 Obtain, evaluate, and communicate information** on the effect of forecasted weather patterns on human behavior. Examples could include how humans respond to local forecasts of typical and severe weather such as extreme heat, high winds, flash floods, thunderstorms, or snowstorms. (ESS3.B)
- **Standard K.1.3 Carry out an investigation** using the five senses, to determine the effect of sunlight on different surfaces and materials. Examples could include measuring temperature, through touch or other methods, on natural and man-made materials in various locations throughout the day. (PS3.B)
- **Standard K.1.4 Design a solution** that will reduce the warming effect of sunlight on an area. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs.* (PS3.B, ETS1.A, ETS1.B, ETS1.C)

Strand K.2: LIVING THINGS AND THEIR SURROUNDINGS

Living things (plants and animals, including humans) depend on their surroundings to get what they need, including food, water, shelter, and a favorable temperature. The characteristics of surroundings influence where living things are naturally found. Plants and animals affect and respond to their surroundings.

- **Standard K.2.1 Obtain, evaluate, and communicate information** to describe patterns of what living things (plants and animals, including humans) need to survive. Emphasize the similarities and differences between the survival needs of all living things. Examples could include that plants depend on air, water, minerals, and light to survive, or animals depend on plants or other animals to survive. (LS1.C)
- **Standard K.2.2 Obtain, evaluate, and communicate information** about patterns in the relationships between the needs of different living things (plants and animals, including humans) and the places they live. Emphasize that living things need water, air, and resources and that they live in places that have the things they need. Examples could include investigating plants grown in various locations and comparing the results or comparing animals with the places they live. (LS2.B, ESS3.A)
- **Standard K.2.3 Obtain, evaluate, and communicate information** about how living things (plants and animals, including humans) affect their surroundings to survive. Examples could include squirrels digging in the ground to hide their food, plant roots breaking concrete, or humans building shelters. (ESS2.E)
- **Standard K.2.4 Design and communicate a solution** to address the effects that living things (plants and animals, including humans) experience while trying to survive in their surroundings. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare designs.* Emphasize students working from a plant, animal, or human perspective. Examples could include a plant growing to get more sunlight, a beaver building a dam, or humans caring for the Earth by reusing and recycling natural resources. (ESS3.C, ETS1.A, ETS1.B, ETS1.C)

Strand K.3: FORCES, MOTION, AND INTERACTIONS

The motion of objects can be observed and described. Pushing or pulling on an object can change the speed or direction of an object's motion and can start or stop it. Pushes and pulls can have different strengths and different directions. A bigger push or pull makes things go faster and when objects touch or collide, they push on one another and can change motion.

- **Standard K.3.1 Plan and conduct an investigation** to compare the effects of different strengths or different directions of forces on the motion of an object. Emphasize forces as a push and pull on an object. The idea of strength should be kept separate from the idea of direction. Non-contact forces, such as magnets and static electricity, will be taught in Grades 3 through 5. (PS2.A, PS2.B, PS2.C, PS3.C)

- **Standard K.3.2 Analyze data** to determine how a **design solution** causes a change in the speed or direction of an object with a push or a pull. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs.* Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, or knock down other objects. (PS2.A, PS2.B, PS2.C, PS3.C, ETS1.A, ETS1.B, ETS1.C)

GRADE 1

INTRODUCTION

The first-grade SEEd standards provide a framework for students to obtain, evaluate, and communicate information about seasonal and space patterns. Students investigate the needs of all living things including their offspring. Students model and investigate the effects of light and sound on objects or the effects of objects on light and sound. Additionally, students design and evaluate solutions to problems that exist in these areas.

Strand 1.1: SEASONS AND SPACE PATTERNS

Seasonal patterns of motion of the Sun, Moon, and stars can be observed, described, and predicted. These patterns may vary depending on the region, location, or time of year.

- **Standard 1.1.1 Obtain, evaluate, and communicate information** about the movement of the Sun, Moon, and stars to describe predictable patterns. Examples of patterns could include how the Sun and Moon appear to rise in one part of the sky, move across the sky, and set; or how stars, other than the Sun, are visible at night but not during the day. (ESS1.A)
- **Standard 1.1.2 Obtain, evaluate, and communicate information** about the patterns observed at different times of the year to relate the amount of daylight to the time of year. Emphasize the variation in daylight patterns at different times of the day and different times of the year. Examples could include varying locations and regions throughout the state, country, and world. (ESS1.B)
- **Standard 1.1.3 Design** a device that measures the varying patterns of daylight. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs.* Examples could include sundials for telling the time or tracking the movement of shadows throughout the day. (ESS1.B, ETS1.A, ETS1.B, ETS1.C)

Strand 1.2: THE NEEDS OF LIVING THINGS AND THEIR OFFSPRING

Living things (plants and animals, including humans) depend on their surroundings to get what they need, including food, water, shelter, and a favorable temperature. Plants and animals have external features that allow them to survive in a variety of environments. Young plants and animals are similar but not exactly like their parents. In many kinds of animals, parents and offspring engage in behaviors that help the offspring to survive.

- **Standard 1.2.1 Plan and carry out an investigation** to determine the effect of sunlight and water on plant growth. Emphasize investigations that test one variable at a time. (LS1.C)
- **Standard 1.2.2 Construct an explanation** by observing patterns of external features of living things that survive in different locations. Emphasize how plants and nonhuman animals, found in specific surroundings, share similar physical characteristics. Examples could include that plants living in dry areas are more likely to have thick outer coatings that hold in water, animals living in cold locations have longer and thicker fur, or most desert animals are awake at night. (LS1.A, LS1.D)
- **Standard 1.2.3 Obtain, evaluate, and communicate information** about the patterns of plants and nonhuman animals that are alike, but not exactly like, their parents. An example could include that most carrots are orange and shaped like a cone but may be different sizes or have differing tastes. (LS3.A, LS3.B)
- **Standard 1.2.4 Construct an explanation** of the patterns in the behaviors of parents and offspring which help offspring to survive. Examples of behavioral patterns could include the signals that offspring make such as crying, chirping, and other vocalizations or the responses of the parents such as feeding, comforting, and protecting the offspring. (LS1.B)

Strand 1.3: LIGHT AND SOUND

Sound can make matter vibrate, and vibrating matter can make sound. Objects can only be seen when light is available to illuminate them. Some objects give off their own light. Some materials allow light to pass through them, others allow only some light to pass through them, and still others block light and create a dark shadow on the surface beyond them where the light cannot reach. Mirrors can be used to redirect light. People use a variety of devices that may include sound and light to communicate over long distances.

- **Standard 1.3.1 Plan and carry out an investigation** to show the cause and effect relationship between sound and vibrating matter. Emphasize that vibrating matter can make sound and that sound can make matter vibrate. (PS4.A)
- **Standard 1.3.2 Use a model** to show the effect of light on objects. Emphasize that objects can be seen when light is available to illuminate them or if they give off their own light. (PS4.B)
- **Standard 1.3.3 Plan and carry out an investigation** to determine the effect of materials in the path of a beam of light. Emphasize that light can travel through some materials, can be reflected off some materials, and some materials block light causing shadows. Examples of materials could include clear plastic, wax paper, cardboard, or a mirror. (PS4.B)
- **Standard 1.3.4 Design a device** in which the structure of the device uses light or sound to solve the problem of communicating over a distance. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs.* Examples of devices could include a light source to send signals, paper-cup-and-string telephones, or a pattern of drum beats. (PS4.C, ETS1.A, ETS1.B, ETS1.C)

GRADE 2

INTRODUCTION

The second-grade SEEd standards provide a framework for students to construct explanations for how matter on Earth's surface changes. Students investigate how living things live in habitats and have body structures that best fit their needs. Students use models to explain the forms and properties of matter. Additionally, students design solutions to problems that exist in these areas.

Strand 2.1: CHANGES IN THE EARTH'S SURFACE

Earth has an ancient history of slow and gradual surface changes, punctuated with quick but powerful geologic events like volcanic eruptions, flooding, and earthquakes. Water and wind play a significant role in changing Earth's surface. The effects of wind and water can cause both slow and quick changes to the surface of the Earth. Scientists and engineers design solutions to slow or prevent wind or water from changing the land.

- **Standard 2.1.1** **Develop and use models** illustrating the patterns of landforms and water on Earth. Examples of models could include valleys, canyons, or floodplains and could depict water in the solid or liquid state. (ESS2.B)
- **Standard 2.1.2** **Construct an explanation** about changes in Earth's surface that happen quickly or slowly. Emphasize the contrast between fast and slow changes. Examples of fast changes could include volcanic eruptions, earthquakes, or landslides. Examples of slow changes could include the erosion of mountains or the shaping of canyons. (ESS1.C)
- **Standard 2.1.3** **Design solutions** to slow or prevent wind or water from changing the shape of land. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs.* Examples of solutions could include retaining walls, dikes, windbreaks, shrubs, trees, and grass to hold back wind, water, and land. (ESS2.A, ESS2.C, ETS1.A, ETS1.B, ETS1.C)

Strand 2.2: LIVING THINGS AND THEIR HABITATS

Living things (plants and animals, including humans) need water, air, and resources from the land to survive and live in habitats that provide these necessities. The physical characteristics of plants and animals reflect the habitat in which they live. Animals also have modified behaviors that help them survive, grow, and meet their needs. Humans sometimes mimic plant and animal adaptations to survive in their environment.

- **Standard 2.2.1 Obtain, evaluate, and communicate information** about patterns of living things (plants and animals, including humans) in different habitats. Emphasize the diversity of living things in land and water habitats. Examples of patterns in habitats could include descriptions of temperature or precipitation and the types of plants and animals found in land habitats. (LS2.C, LS4.C, LS4.D)
- **Standard 2.2.2 Plan and carry out an investigation** of the structure and function of plant and animal parts in different habitats. Emphasize how different plants and animals have different structures to survive in their habitat. Examples could include the shallow roots of a cactus in the desert or the seasonal changes in the fur coat of a wolf. (LS1.A, LS4.A, LS4.D)
- **Standard 2.2.3 Develop and use a model** that mimics the function of an animal dispersing seeds or pollinating plants. Examples could include plants that have seeds with hooks or barbs that attach themselves to animal fur, feathers, or human clothing, or dispersal through the wind, or consumption of fruit and the disposal of the pits or seeds. (LS2.A)
- **Standard 2.2.4 Design a solution** to a human problem by mimicking the structure and function of plants and/or animals and how they use their external parts to help them survive, grow, and meet their needs. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs.* Examples could include a human wearing a jacket to mimic the fur of an animal or a webbed foot to design a better swimming fin. (LS1.A, LS1.D, ETS1.A, ETS1.B, ETS1.C)

Strand 2.3: PROPERTIES OF MATTER

All things are made of matter which exists with different forms and properties. Matter can be described and classified by its observable properties. Materials with certain properties are well-suited for specific uses. Heating or cooling some types of matter may or may not irreversibly change their properties.

- **Standard 2.3.1 Plan and carry out an investigation** to classify different kinds of materials based on patterns in their observable properties. Examples could include sorting materials based on similar properties such as strength, color, flexibility, hardness, texture, or whether the materials are solids or liquids. (PS1.A)
- **Standard 2.3.2 Construct an explanation** showing how the properties of materials influence their intended use and function. Examples could include using wood as a building material because it is lightweight and strong or the use of concrete, steel, or cotton due to their unique properties. (PS1.A)
- **Standard 2.3.3 Develop and use a model** to describe how an object, made of a small set of pieces, can be disassembled and reshaped into a new object with a different function. Emphasize that a great variety of objects can be built from a small set of pieces. Examples of pieces could include wooden blocks or building bricks. (PS1.A)
- **Standard 2.3.4 Obtain, evaluate, and communicate information** about changes in matter caused by heating or cooling. Emphasize that some changes can be reversed and some cannot. Examples of reversible changes could include freezing water or melting crayons. Examples of irreversible changes could include cooking an egg or burning wood. (PS1.B)



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