

Utah State Office of Education

core standards

for

SCIENCE

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.



250 East 500 South P.O. Box 144200 Salt Lake City, UT 84114-4200
Larry K. Shumway, Ed.D. State Superintendent of Public Instruction

Core Standards FOR

3-5 Science

Adopted March 2002 by Utah State Board of Education



BOARD OF EDUCATION

<i>District</i>	<i>Name</i>	<i>Address</i>	<i>City</i>	<i>Phone</i>
District 1	Tami W. Pyfer	52 Ballard Way	Logan, UT 84321	(435) 753-7529
District 2	Keith M. Buswell	1027 West 3800 North	Pleasant View, UT 84414	(801) 510-1773
District 3	Craig E. Coleman	621 South Main Street	Genola, UT 84655	(801) 754-3655
District 4	Dave L. Thomas	7875 South 2250 East	South Weber, UT 84405	(801) 479-7479
District 5	Kim R. Burningham	932 Canyon Crest Drive	Bountiful, UT 84010	(801) 292-9261
District 6	Michael G. Jensen	4139 South Aubrey Lane	West Valley City, UT 84128	(801) 955-5550
District 7	Leslie B. Castle	2465 St. Mary's Drive	Salt Lake City, UT 84108	(801) 581-9752
District 8	Janet A. Cannon	5256 Holladay Blvd.	Salt Lake City, UT 84117	(801) 272-3516
District 9	Joel Coleman	3740 Bawden Ave.	West Valley City, UT 84120	(801) 634-6251
District 10	Laurel O. Brown	5311 S. Lucky Clover Lane	Murray, UT 84123	(801) 261-4221
District 11	David L. Crandall	13464 Saddle Ridge Drive	Draper, UT 84020	(801) 232-0795
District 12	Carol Murphy	463 West 140 North	Midway, UT 84049	(435) 729-0941
District 13	C. Mark Openshaw	3329 Piute Drive	Provo, UT 84604	(801) 377-0790
District 14	Dixie L. Allen	218 West 5250 North	Vernal, UT 84078	(435) 789-0534
District 15	Debra G. Roberts	P.O. Box 1780	Beaver, UT 84713	(435) 438-5843
	Teresa L. Theurer ¹	33 Canterbury Lane	Logan, UT 84321	(435) 753-0740
	Wilford Clyde ¹	1324 East 950 South	Springville, UT 84663	(801) 802-6900
	Tim Beagley ²	3974 South 3550 West	West Valley City, UT 84119	(801) 969-6454
	Isaiah (Ike) Spencer ³	1029 East 11780 South	Sandy, UT 84094	(801) 949-0858
	James V. (Jim) Olsen ⁴	5657 West 10770 North	Highland, UT 84003	(801) 599-1095
	R. Dean Rowley ⁵	526 South 170 West	Springville, UT 84663	(801) 489-6935
	Larry K. Shumway	Executive Officer		
	Lorraine Austin	Secretary		

¹ Board of Regents Representatives

² Charter Schools Representative

³ Coalition of Minorities Advisory Committee (CMAC) Representative

⁴ UCAT Representative

⁵ Utah School Boards Association (USBA) Representative

1/8/2012

Utah Elementary 3-5 Science Core Curriculum
Adopted by Utah State Board of Education
March 12, 2002

Introduction

Science is a way of knowing, a process for gaining knowledge and understanding of the natural world. The Science Core Curriculum places emphasis on understanding and using skills. Students should be active learners. It is not enough for students to read about science; they must do science. They should observe, inquire, question, formulate and test hypotheses, analyze data, report, and evaluate findings. The students, as scientists, should have hands-on, active experiences throughout the instruction of the science curriculum.

The Elementary Science Core describes what students should know and be able to do at the end of each of the K–5 grade levels. It was developed, critiqued, piloted, and revised by a community of Utah science teachers, university science educators, State Office of Education specialists, scientists, expert national consultants, and an advisory committee representing a wide variety of people from the community. The Core reflects the current philosophy of science education that is expressed in national documents developed by the American Association for the Advancement of Science, the National Academies of Science. This Science Core has the endorsement of the Utah Science Teachers Association. The Core reflects high standards of achievement in science for all students.

Organization of the Elementary Science Core

The Core is designed to help teachers organize and deliver instruction.

The Science Core Curriculum's organization:

- ✓ Each grade level begins with a brief course description.
- ✓ The INTENDED LEARNING OUTCOMES (ILOs) describe the goals for science skills and attitudes. They are found at the beginning of each grade, and are an integral part of the Core that should be included as part of instruction.
- ✓ The SCIENCE BENCHMARKS describe the science content students should know. Each grade level has three to five Science Benchmarks. The ILOs and Benchmarks intersect in the Standards, Objectives and Indicators.
- ✓ A STANDARD is a broad statement of what students are expected to understand. Several Objectives are listed under each Standard.
- ✓ An OBJECTIVE is a more focused description of what students need to know and be able to do at the completion of instruction. If students have mastered the Objectives associated with a given Standard, they are judged to have mastered that Standard at that grade level. Several Indicators are described for each Objective.
- ✓ An INDICATOR is a measurable or observable student action that enables one to judge whether a student has mastered a particular Objective. Indicators are not meant to be classroom activities, but they can help guide classroom instruction.

Eight Guidelines Were Used in Developing the Elementary Science Core

Reflects the Nature of Science: Science is a way of knowing, a process of gaining knowledge and understanding of the natural world. The Core is designed to produce an integrated set of Intended Learning Outcomes (ILOs) for students. Please see the Intended Learning Outcomes document for each grade level core.

As described in these ILOs, students will:

1. Use science process and thinking skills.
2. Manifest science interests and attitudes.
3. Understand important science concepts and principles.
4. Communicate effectively using science language and reasoning.
5. Demonstrate awareness of the social and historical aspects of science.
6. Understand the nature of science.

Coherent: The Core has been designed so that, wherever possible, the science ideas taught within a particular grade level have a logical and natural connection with each other and with those of earlier grades. Efforts have also been made to select topics and skills that integrate well with one another and with other subject areas appropriate to grade level. In addition, there is an upward articulation of science concepts, skills, and content. This spiraling is intended to prepare students to understand and use more complex science concepts and skills as they advance through their science learning.

Developmentally Appropriate: The Core takes into account the psychological and social readiness of students. It builds from concrete experiences to more abstract understandings. The Core describes science language students should use that is appropriate to each grade level. A more extensive vocabulary should not be emphasized. In the past, many educators may have mistakenly thought that students understood abstract concepts (such as the nature of the atom), because they repeated appropriate names and vocabulary (such as electron and neutron). The Core resists the temptation to tell about abstract concepts at inappropriate grade levels, but focuses on providing experiences with concepts that students can explore and understand in depth to build a foundation for future science learning.

Encourages Good Teaching Practices: It is impossible to accomplish the full intent of the Core by lecturing and having students read from textbooks. The Elementary Science Core emphasizes student inquiry. Science process skills are central in each standard. Good science encourages students to gain knowledge by doing science: observing, questioning, exploring, making and testing hypotheses, comparing predictions, evaluating data, and communicating conclusions. The Core is designed to encourage instruction with students working in cooperative groups. Instruction should connect lessons with students' daily lives. The Core directs experiential science instruction for all students, not just those who have traditionally succeeded in science classes. The vignettes listed on the "Utah Science Home Page" at <http://schools.utah.gov/curr/science/> for each of the Core standards provide examples, based on actual practice, that demonstrate that excellent teaching of the Science Core is possible.

Comprehensive: The Elementary Science Core does not cover all topics that have traditionally been in the elementary science curriculum; however, it does provide a comprehensive background in science. By emphasizing depth rather than breadth, the Core seeks to empower students rather than intimidate them with a collection of isolated and eminently forgettable facts.

Teachers are free to add related concepts and skills, but they are expected to teach all the standards and objectives specified in the Core for their grade level.

Feasible: Teachers and others who are familiar with Utah students, classrooms, teachers, and schools have designed the Core. It can be taught with easily obtained resources and materials. A Teacher Resource Book (TRB) is available for elementary grades and has sample lessons on each topic for each grade level. The TRB is a document that will grow as teachers add exemplary lessons aligned with the new Core. The middle grade levels have electronic textbooks available at the Utah State Office of Education's "Utah Science Home Page" at <http://schools.utah.gov/curr/science/>.

Useful and Relevant: This curriculum relates directly to student needs and interests. It is grounded in the natural world in which we live. Relevance of science to other endeavors enables students to transfer skills gained from science instruction into their other school subjects and into their lives outside the classroom.

Encourages Good Assessment Practices: Student achievement of the standards and objectives in this Core are best assessed using a variety of assessment instruments. One's purpose should be clearly in mind as assessment is planned and implemented. Performance tests are particularly appropriate to evaluate student mastery of science processes and problem-solving skills. Teachers should use a variety of classroom assessment approaches in conjunction with standard assessment instruments to inform their instruction. Sample test items, keyed to each Core Standard, may be located on the Utah Science Home Page. Observation of students engaged in science activities is highly recommended as a way to assess students' skills as well as attitudes in science. The nature of the questions posed by students provides important evidence of students' understanding of science.

The Most Important Goal: Elementary school reaches the greatest number of students for a longer period of time during the most formative years of the school experience. Effective elementary science instruction engages students actively in enjoyable learning experiences. Science instruction should be as thrilling an experience for a child as seeing a rainbow, growing a flower, or holding a toad. Science is not just for those who have traditionally succeeded in the subject, and it is not just for those who will choose science-related careers. In a world of rapidly expanding knowledge and technology, all students must gain the skills they will need to understand and function responsibly and successfully in the world. The Core provides skills in a context that enables students to experience the joy of doing science.

Third Grade Science Core Curriculum

In third grade students learn about **interactions, relationships, relative motion, and cause and effect**. They study the movement of Earth and the moon. They begin to learn of forces that move things; they learn of heat and light. Third graders observe, classify, predict, measure, and record.

Third graders should be encouraged to be curious. They should be helped and encouraged to pose their own questions about objects, events, processes, and results. Effective teachers provide students with hands-on science investigations in which student inquiry is an important goal. Teachers should provide opportunities for all students to experience many things. Third graders should use their senses as they feel the warmth of the sun on their face, watch the moon as it seems to move through broken clouds, sort and arrange their favorite rocks, look for patterns in rocks and flowers, observe a snail move ever so slowly up the side of a terrarium, test materials for slipping and sliding, measure the speed of rolling objects, and invent ways to resist gravity. They should come to enjoy science as a process of learning about the world.

Third grade Core concepts should be integrated with concepts and skills from other curriculum areas. Reading, writing, and mathematics skills should be emphasized as integral to the instruction of science. Personal relevance of science in students' lives is always an important part of helping students to value science, and should be emphasized at this grade level.

This Core was designed using the American Association for the Advancement of Science's Project 2061: Benchmarks For Science Literacy and the National Academy of Science's National Science Education Standards as guides to determine appropriate content and skills.

The third grade Science Core has three online resources designed to help with classroom instruction; they include Teacher Resource Book—a set of lesson plans, assessment items and science information specific to third grade; Sci-ber Text—an electronic science text book specific to the Utah Core; and the science test item pool. This pool includes multiple-choice questions, performance tasks, and interpretive items aligned to the standards and objectives of the third grade curriculum. These resources are all available on the Utah Science Home Page at: <http://schools.utah.gov/curr/science/>

SAFETY PRECAUTIONS:

The hands-on nature of this science curriculum increases the need for teachers to use appropriate precautions in the classroom and field. Teachers must adhere to the published guidelines for the proper use of animals, equipment, and chemicals in the classroom. These guidelines are available on the Utah Science Home Page.

Intended Learning Outcomes for Third Grade Science

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of science instruction. They are an essential part of the Science Core Curriculum and provide teachers with a standard for evaluation of student learning in science. Instruction should include significant science experiences that lead to student understanding using the ILOs.

The main intent of science instruction in Utah is that students will value and use science as a process of obtaining knowledge based upon observable evidence.

By the end of third grade students will be able to:

1. Use Science Process and Thinking Skills

- a. Observe simple objects and patterns and report their observations.
- b. Sort and sequence data according to a given criterion.
- c. Make simple predictions and inferences based upon observations.
- d. Compare things and events.
- e. Use instruments to measure length, temperature, volume, and weight using appropriate units.
- f. Conduct a simple investigation when given directions.
- g. Develop and use simple classification systems.
- h. Use observations to construct a reasonable explanation.

2. Manifest Scientific Attitudes and Interests

- a. Demonstrate a sense of curiosity about nature.
- b. Voluntarily read or look at books and other materials about science.
- c. Pose questions about objects, events, and processes.

3. Understand Science Concepts and Principles

- a. Know science information specified for their grade level.
- b. Distinguish between examples and non-examples of science concepts taught.
- c. Explain science concepts and principles using their own words and explanations.

4. Communicate Effectively Using Science Language and Reasoning

- a. Record data accurately when given the appropriate form and format (e.g., table, graph, chart).
- b. Report observation with pictures, sentences, and models.
- c. Use scientific language appropriate to grade level in oral and written communication.
- d. Use available reference sources to obtain information.

Science Benchmark

Earth orbits around the sun, and the moon orbits around Earth. Earth is spherical in shape and rotates on its axis to produce the night and day cycle. To people on Earth, this turning of the planet makes it appear as though the sun, moon, planets, and stars are moving across the sky once a day. However, this is only a perception as viewed from Earth.

STANDARD I: Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.

Objective 1: Describe the appearance of Earth and the moon.

- a. Describe the shape of Earth and the moon as spherical.
- b. Explain that the sun is the source of light that lights the moon.
- c. List the differences in the physical appearance of Earth and the moon as viewed from space.

Objective 2: Describe the movement of Earth and the moon and the apparent movement of other bodies through the sky.

- a. Describe the motions of Earth (i.e., the rotation [spinning] of Earth on its axis, the revolution [orbit] of Earth around the sun).
- b. Use a chart to show that the moon orbits Earth approximately every 28 days.
- c. Use a model of Earth to demonstrate that Earth rotates on its axis once every 24 hours to produce the night and day cycle.
- d. Use a model to demonstrate why it seems to a person on Earth that the sun, planets, and stars appear to move across the sky.

Science language
students should use:

model, orbit, sphere, moon, axis, rotation, revolution, appearance

Science Benchmark

For any particular environment, some types of plants and animals survive well, some survive less well and some cannot survive at all. Organisms in an environment interact with their environment. Models can be used to investigate these interactions.
--

STANDARD II: Students will understand that organisms depend on living and nonliving things within their environment.

Objective 1: Classify living and nonliving things in an environment.

- a. Identify characteristics of living things (i.e., growth, movement, reproduction).
- b. Identify characteristics of nonliving things.
- c. Classify living and nonliving things in an environment.

Objective 2: Describe the interactions between living and nonliving things in a small environment.

- a. Identify living and nonliving things in a small environment (e.g., terrarium, aquarium, flowerbed) composed of living and nonliving things.
- b. Predict the effects of changes in the environment (e.g., temperature, light, moisture) on a living organism.
- c. Observe and record the effect of changes (e.g., temperature, amount of water, light) upon the living organisms and nonliving things in a small-scale environment.
- d. Compare a small-scale environment to a larger environment (e.g., aquarium to a pond, terrarium to a forest).
- e. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Science language students should use:	environment, interaction, living, nonliving, organism, survive, observe, terrarium, aquarium, temperature, moisture, small-scale
---------------------------------------	--

Science Benchmark

Forces cause changes in the speed or direction of the motion of an object. The greater the force placed on an object, the greater the change in motion. The more massive an object is, the less effect a given force will have upon the motion of the object. Earth's gravity pulls objects toward it without touching them.

STANDARD III: Students will understand the relationship between the force applied to an object and resulting motion of the object.

Objective 1: Demonstrate how forces cause changes in speed or direction of objects.

- a. Show that objects at rest will not move unless a force is applied to them.
- b. Compare the forces of pushing and pulling.
- c. Investigate how forces applied through simple machines affect the direction and/or amount of resulting force.

Objective 2: Demonstrate that the greater the force applied to an object, the greater the change in speed or direction of the object.

- a. Predict and observe what happens when a force is applied to an object (e.g., wind, flowing water).
- b. Compare and chart the relative effects of a force of the same strength on objects of different weight (e.g., the breeze from a fan will move a piece of paper but may not move a piece of cardboard).
- c. Compare the relative effects of forces of different strengths on an object (e.g., strong wind affects an object differently than a breeze).
- d. Conduct a simple investigation to show what happens when objects of various weights collide with one another (e.g., marbles, balls).
- e. Show how these concepts apply to various activities (e.g., batting a ball, kicking a ball, hitting a golf ball with a golf club) in terms of force, motion, speed, direction, and distance (e.g. slow, fast, hit hard, hit soft).

STANDARD IV: Students will understand that objects near Earth are pulled toward Earth by gravity.

Objective 1: Demonstrate that gravity is a force.

- a. Demonstrate that a force is required to overcome gravity.
- b. Use measurement to demonstrate that heavier objects require more force than lighter ones to overcome gravity.

Objective 2: Describe the effects of gravity on the motion of an object.

- a. Compare how the motion of an object rolling up or down a hill changes with the incline of the hill.
- b. Observe, record, and compare the effect of gravity on several objects in motion (e.g., a thrown ball and a dropped ball falling to Earth).
- c. Pose questions about gravity and forces.

Science language students should use:	distance, force, gravity, weight, motion, speed, direction, simple machine
---------------------------------------	--

Science Benchmark

Light is produced by the sun and observed on Earth. Living organisms use heat and light from the sun. Heat is also produced from motion when one thing rubs against another. Things that give off heat often give off light. While operating, mechanical and electrical machines produce heat and/or light.

STANDARD V: Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Objective 1: Provide evidence showing that the sun is the source of heat and light for Earth.

- a. Compare temperatures in sunny and shady places.
- b. Observe and report how sunlight affects plant growth.
- c. Provide examples of how sunlight affects people and animals by providing heat and light.
- d. Identify and discuss as a class some misconceptions about heat sources (e.g., clothes do not produce heat, ice cubes do not give off cold).

Objective 2: Demonstrate that mechanical and electrical machines produce heat and sometimes light.

- a. Identify and classify mechanical and electrical sources of heat.
- b. List examples of mechanical or electrical devices that produce light.
- c. Predict, measure, and graph the temperature changes produced by a variety of mechanical machines and electrical devices while they are operating.

Objective 3: Demonstrate that heat may be produced when objects are rubbed against one another.

- a. Identify several examples of how rubbing one object against another produces heat.
- b. Compare relative differences in the amount of heat given off or force required to move an object over lubricated/non-lubricated surfaces and smooth/rough surfaces (e.g., waterslide with and without water, hands rubbing together with and without lotion).

Science language students should use:	mechanical, electrical, temperature, degrees, lubricated, misconception, heat source, machine
---------------------------------------	---

Fourth Grade Science Core Curriculum

The theme for the fourth grade Science Core curriculum is **Utah natural history**. Students will learn about Utah environments including; weather, water cycle, rocks, fossils, soils, plants and animals. Understanding the concepts of **cycles** is an essential component of science literacy and is introduced at this grade level. Emphasis should be placed on skills to classify many things. Students should come to value and use science as a process of obtaining knowledge based on observable evidence, and their curiosity should be encouraged and sustained as they develop the abilities associated with inquiry in science.

Good science instruction requires that attention be paid to providing students with hands–on science investigations in which student inquiry is an important goal. Their curiosity should be encouraged and sustained. Teachers should provide opportunities for all students to experience many things. Fourth graders should feel the excitement of a rainstorm, hunt for fossils in rocks, observe the patterns in a spider web, and teach their parents to recognize the song of the lark. They should have many opportunities to observe and predict, to infer and to classify. They should come to enjoy science as a process of learning about their world.

Science Core concepts should be integrated with concepts and skills from other curriculum areas. Reading, writing and mathematics skills should be emphasized as integral to the instruction of science. Technology issues and the nature of science are significant components of this Core. Personal relevance of science in students’ lives is always an important part of helping students to value science and should be emphasized at this grade-level.

This Core was designed using the American Association for the Advancement of Science’s Project 2061: Benchmarks For Science Literacy and the National Academy of Science’s National Science Education Standards as guides to determine appropriate content and skills.

The fourth grade Science Core has three online resources designed to help with classroom instruction; they include Teacher Resource Book –a set of lesson plans, assessment items and science information specific to fourth grade; the Sci-ber Text –an electronic science text book specific to the Utah Core; and the science test item pool. This pool includes multiple-choice questions, performance tasks, and interpretive items aligned to the standards and objectives of the fourth grade Science Core. These resources are all available on the Utah Science Home Page. <http://schools.utah.gov/curr/science/>

SAFETY PRECAUTIONS:

The hands–on nature of this science curriculum increases the need for teachers to use appropriate precautions in the classroom and field. Teachers must adhere to the published guidelines for the proper use of animals, equipment, and chemicals in the classroom. These guidelines are available on the Utah Science Home Page.

Intended Learning Outcomes for Fourth Grade Science

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of science instruction. They are an essential part of the Science Core Curriculum and provide teachers with a standard for evaluation of student learning in science. Instruction should include significant science experiences that lead to student understanding using the ILOs.

The main intent of science instruction in Utah is that students will value and use science as a process of obtaining knowledge based upon observable evidence.

By the end of fourth grade students will be able to:

1. Use Science Process and Thinking Skills

- a. Observe simple objects and patterns and report their observations.
- b. Sort and sequence data according to a given criterion.
- c. Make simple predictions and inferences based upon observations.
- d. Compare things and events.
- e. Use instruments to measure length, temperature, volume, and weight using appropriate units.
- f. Conduct a simple investigation when given directions.
- g. Develop and use simple classification systems.
- h. Use observations to construct a reasonable explanation.

2. Manifest Scientific Attitudes and Interests

- a. Demonstrate a sense of curiosity about nature.
- b. Voluntarily read or look at books and other materials about science.
- c. Pose questions about objects, events, and processes.

3. Understand Science Concepts and Principles

- a. Know science information specified for their grade level.
- b. Distinguish between examples and non-examples of science concepts taught.
- c. Explain science concepts and principles using their own words and explanations.

4. Communicate Effectively Using Science Language and Reasoning

- a. Record data accurately when given the appropriate form and format (e.g., table, graph, chart).
- b. Report observation with pictures, sentences, and models.
- c. Use scientific language appropriate to grade level in oral and written communication.
- d. Use available reference sources to obtain information.

Science Benchmark

Matter on Earth cycles from one form to another. The cycling of matter on Earth requires energy. The cycling of water is an example of this process. The sun is the source of energy for the water cycle. Water changes state as it cycles between the atmosphere, land, and bodies of water on Earth.

STANDARD I: Students will understand that water changes state as it moves through the water cycle.

Objective 1: Describe the relationship between heat energy, evaporation and condensation of water on Earth.

- a. Identify the relative amount and kind of water found in various locations on Earth (e.g., oceans have most of the water, glaciers and snowfields contain most fresh water).
- b. Identify the sun as the source of energy that evaporates water from the surface of Earth.
- c. Compare the processes of evaporation and condensation of water.
- d. Investigate and record temperature data to show the effects of heat energy on changing the states of water.

Objective 2: Describe the water cycle.

- a. Locate examples of evaporation and condensation in the water cycle (e.g., water evaporates when heated and clouds or dew forms when vapor is cooled).
- b. Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle.
- c. Identify locations that hold water as it passes through the water cycle (e.g., oceans, atmosphere, fresh surface water, snow, ice, and ground water).
- d. Construct a model or diagram to show how water continuously moves through the water cycle over time.
- e. Describe how the water cycle relates to the water supply in your community.

Science language
students should use:

vapor, precipitation, evaporation, clouds, dew, condensation,
temperature, water cycle

Science Benchmark

Weather describes conditions in the atmosphere at a certain place and time. Water, energy from the sun, and wind create a cycle of changing weather. The sun's energy warms the oceans and lands at Earth's surface, creating changes in the atmosphere that cause the weather. The temperature and movement of air can be observed and measured to determine the effect on cloud formation and precipitation. Recording weather observations provides data that can be used to predict future weather conditions and establish patterns over time. Weather affects many aspects of people's lives.

STANDARD II: Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

Objective 1: Observe, measure, and record the basic elements of weather.

- a. Identify basic cloud types (i.e., cumulus, cirrus, stratus clouds).
- b. Observe, measure, and record data on the basic elements of weather over a period of time (i.e., precipitation, air temperature, wind speed and direction, and air pressure).
- c. Investigate evidence that air is a substance (e.g., takes up space, moves as wind, temperature can be measured).
- d. Compare the components of severe weather phenomena to normal weather conditions (e.g., thunderstorm with lightning and high winds compared to rainstorm with rain showers and breezes).

Objective 2: Interpret recorded weather data for simple patterns.

- a. Observe and record effects of air temperature on precipitation (e.g., below freezing results in snow, above freezing results in rain).
- b. Graph recorded data to show daily and seasonal patterns in weather.
- c. Infer relationships between wind and weather change (e.g., windy days often precede changes in the weather; south winds in Utah often precede a cold front coming from the north).

Objective 3: Evaluate weather predictions based upon observational data.

- a. Identify and use the tools of a meteorologist (e.g., measure rainfall using rain gauge, measure air pressure using barometer, measure temperature using a thermometer).
- b. Describe how weather and forecasts affect people's lives.
- c. Predict weather and justify prediction with observable evidence.
- d. Evaluate the accuracy of student and professional weather forecasts.
- e. Relate weather forecast accuracy to evidence or tools used to make the forecast (e.g., feels like rain vs. barometer is dropping).

Science language students should use:	atmosphere, meteorologist, freezing, cumulus, stratus, cirrus, air pressure, thermometer, air temperature, wind speed, forecast, severe, phenomena, precipitation, seasonal, accuracy, barometer, rain gauge, components
---------------------------------------	--

Science Benchmark

Earth materials include rocks, soils, water, and gases. Rock is composed of minerals. Earth materials change over time from one form to another. These changes require energy. Erosion is the movement of materials and weathering is the breakage of bedrock and larger rocks into smaller rocks and soil materials. Soil is continually being formed from weathered rock and plant remains. Soil contains many living organisms. Plants generally get water and minerals from soil.

STANDARD III: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 1: Identify basic properties of minerals and rocks.

- a. Describe the differences between minerals and rocks.
- b. Observe rocks using a magnifying glass and draw shapes and colors of the minerals.
- c. Sort rocks by appearance according to the three basic types: sedimentary, igneous and metamorphic (e.g., sedimentary—rounded-appearing mineral and rock particles that are cemented together, often in layers; igneous—with or without observable crystals that are not in layers or with or without air holes or glasslike; metamorphic —crystals/minerals, often in layers).
- d. Classify common rocks found in Utah as sedimentary (i.e., sandstone, conglomerate, shale), igneous (i.e., basalt, granite, obsidian, pumice) and metamorphic (i.e., marble, gneiss, schist).

Objective 2: Explain how the processes of weathering and erosion change and move materials that become soil.

- a. Identify the processes of physical weathering that break down rocks at Earth's surface (i.e., water movement, freezing, plant growth, wind).
- b. Distinguish between weathering (i.e., wearing down and breaking of rock surfaces) and erosion (i.e., the movement of materials).
- c. Model erosion of Earth materials and collection of these materials as part of the process that leads to soil (e.g., water moving sand in a playground area and depositing this sand in another area).
- d. Investigate layers of soil in the local area and predict the sources of the sand and rocks in the soil.

Objective 3: Observe the basic components of soil and relate the components to plant growth.

- a. Observe and list the components of soil (i.e., minerals, rocks, air, water, living and dead organisms) and distinguish between the living, nonliving, and once living components of soil.
- b. Diagram or model a soil profile showing topsoil, subsoil, and bedrock, and how the layers differ in composition.
- c. Relate the components of soils to the growth of plants in soil (e.g., mineral nutrients, water).
- d. Explain how plants may help control the erosion of soil.
- e. Research and investigate ways to provide mineral nutrients for plants to grow without soil (e.g., grow plants in wet towels, grow plants in wet gravel, grow plants in water).

Science language students should use:

mineral, weathering, erosion, sedimentary, igneous, metamorphic, topsoil, subsoil, bedrock, organism, freeze, thaw, profile, nonliving, structural support, nutrients

Science Benchmark

Fossils are evidence of living organisms from the past and are usually preserved in sedimentary rocks. A fossil may be an impression left in sediments, the preserved remains of an organism, or a trace mark showing that an organism once existed. Fossils are usually made from the hard parts of an organism because soft parts decay quickly. Fossils provide clues to Earth's history. They provide evidence that can be used to make inferences about past environments. Fossils can be compared to one another, to living organisms, and to organisms that lived long ago.

STANDARD IV: Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

Objective 1: Describe Utah fossils and explain how they were formed.

- a. Identify features of fossils that can be used to compare them to living organisms that are familiar (e.g., shape, size and structure of skeleton, patterns of leaves).
- b. Describe three ways fossils are formed in sedimentary rock (i.e., preserved organisms, mineral replacement of organisms, impressions or tracks).
- c. Research locations where fossils are found in Utah and construct a simple fossil map.

Objective 2: Explain how fossils can be used to make inferences about past life, climate, geology, and environments.

- a. Explain why fossils are usually found in sedimentary rock.
- b. Based on the fossils found in various locations, infer how Utah environments have changed over time (e.g., trilobite fossils indicate that Millard County was once covered by a large shallow ocean; dinosaur fossils and coal indicate that Emery and Uintah County were once tropical and swampy).
- c. Research information on two scientific explanations for the extinction of dinosaurs and other prehistoric organisms.
- d. Formulate questions that can be answered using information gathered on the extinction of dinosaurs.

Science language students should use:	infer, environments, climate, dinosaur, preserved, extinct, extinction, impression, fossil, prehistoric, mineral, organism, replacement, trilobite, sedimentary, tropical
---------------------------------------	---

Science Benchmark

Utah has diverse plant and animal life that is adapted to and interacts in areas that can be described as wetlands, forests, and deserts. The characteristics of the wetlands, forests, and deserts influence which plants and animals survive best there. Living and nonliving things in these areas are classified based on physical features.

STANDARD V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 1: Describe the physical characteristics of Utah's wetlands, forests, and deserts.

- a. Compare the physical characteristics (e.g., precipitation, temperature, and surface terrain) of Utah's wetlands, forests, and deserts.
- b. Describe Utah's wetlands (e.g., river, lake, stream, and marsh areas where water is a major feature of the environment) forests (e.g., oak, pine, aspen, juniper areas where trees are a major feature of the environment), and deserts (e.g., areas where the lack of water provided an environment where plants needing little water are a major feature of the environment).
- c. Locate examples of areas that have characteristics of wetlands, forests, or deserts in Utah.
- d. Based upon information gathered, classify areas of Utah that are generally identified as wetlands, forests, or deserts.
- e. Create models of wetlands, forests, and deserts.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

- a. Identify common plants and animals that inhabit Utah's forests, wetlands, and deserts.
- b. Cite examples of physical features that allow particular plants and animals to live in specific environments (e.g., duck has webbed feet, cactus has waxy coating).
- c. Describe some of the interactions between animals and plants of a given environment (e.g., woodpecker eats insects that live on trees of a forest, brine shrimp of the Great Salt Lake eat algae and birds feed on brine shrimp).
- d. Identify the effect elevation has on types of plants and animals that live in a specific wetland, forest, or desert.
- e. Find examples of endangered Utah plants and animals and describe steps being taken to protect them.

Objective 3: Use a simple scheme to classify Utah plants and animals.

- a. Explain how scientists use classification schemes.
- b. Use a simple classification system to classify unfamiliar Utah plants or animals (e.g., fish/amphibians/reptile/bird/mammal, invertebrate/vertebrate, tree/shrub/grass, deciduous/conifers).

Objective 4: Observe and record the behavior of Utah animals.

- a. Observe and record the behavior of birds (e.g., caring for young, obtaining food, surviving winter).
- b. Describe how the behavior and adaptations of Utah mammals help them survive winter (e.g., obtaining food, building homes, hibernation, migration).
- c. Research and report on the behavior of a species of Utah fish (e.g., feeding on the bottom or surface, time of year and movement of fish to spawn, types of food and how it is obtained).
- d. Compare the structure and behavior of Utah amphibians and reptiles.
- e. Use simple classification schemes to sort Utah's common insects and spiders.

Fourth Grade Science Core Curriculum

Science language students should use:	wetland, forest, desert, adaptation, deciduous, coniferous, invertebrate, vertebrate, bird, amphibian, reptile, fish, mammal, insect, hibernation, migration
Common plants:	sagebrush, pinyon pine, Utah juniper, spruce, fir, oak brush, quaking aspen, cottonwood, cattail, bulrush, prickly pear cactus
Common animals:	jackrabbit, cottontail rabbit, red fox, coyote, mule deer, elk, moose, cougar, bobcat, deer mouse, kangaroo rat, muskrat, beaver, gopher snake, rattlesnake, lizard, tortoise, frog, salamander, red-tailed hawk, barn owl, lark, robin, pinyon jay, magpie, crow, trout, catfish, carp, grasshopper, ant, moth, butterfly, housefly, bee, wasp, pill bug, millipede

Fifth Grade Science Core

In the Fifth Grade students begin to understanding concepts of **Change and Cause and Effect**. Students will learn about the constantly changing Earth's surface. They will investigate physical and chemical changes in matter. They will begin to relate causes for changes with their effects. Students will have opportunity to investigate the effects of various forces, such as magnetism and electricity upon materials. They will begin to learn how traits passed from parent organisms to their offspring effect their survival.

Students should learn to value the scientific processes as means of obtaining knowledge. They should be encouraged to maintain an open and questioning mind and should be helped and encouraged to pose their own questions about objects, events, processes and results. Fifth graders should have the opportunity to plan and conduct their own experiments and come to their own conclusions as they read, observe, compare, describe, infer and draw conclusions.

Good science instruction requires hands-on science investigations in which student inquiry is an important goal. Teachers should provide opportunities for all students to explore many things. Fifth graders should have sufficient understanding of Earth Science to point out an interesting landform to others and hypothesize its origin; feel the success of connecting batteries and wire to make the lights come on; learn about chemical change as they mix baking soda and vinegar and test changes in acidity of liquids using the juice of red cabbage leaves. They should come to enjoy science as a process of learning about their world.

Science Core concepts should be integrated with concepts and skills from other curriculum areas. Reading, writing and mathematics skills should be emphasized as integral to the instruction of science. Technology issues and the nature of science are significant components of this Core. Personal relevance of science in students' lives is always an important part of helping students to value science and should be emphasized at this grade level.

This Core was designed using the American Association for the Advancement of Science's Project 2061: Benchmarks For Science Literacy and the National Academy of Science's National Science Education Standards as guides to determine appropriate content and skills.

The fifth grade Science Core has three online resources designed to help with classroom instruction; they include Teacher Resource Book –a set of lesson plans, assessment items and science information specific to fifth grade; Sci-ber Text –an electronic science textbook specific to the Utah Core, and the science test item pool. This pool includes multiple-choice questions, performance tasks, and interpretive items aligned to the standards and objectives of the fifth grade Science Core. These resources are all available on the Utah Science Home Page at: <http://schools.utah.gov/curr/science/>

SAFETY PRECAUTIONS:

The hands-on nature of this science curriculum increases the need for teachers to use appropriate precautions in the classroom and field. Teachers must adhere to the published guidelines for the proper use of animals, equipment, and chemicals in the classroom. These guidelines are available on the Utah Science Home Page.

Intended Learning Outcomes for Fifth Grade Science

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of science instruction. They are an essential part of the Science Core Curriculum and provide teachers with a standard for evaluation of student learning in science. Instruction should include significant science experiences that lead to student understanding using the ILOs.

The main intent of science instruction in Utah is that students will value and use science as a process of obtaining knowledge based upon observable evidence.

By the end of fifth grade students will be able to:

1. Use Science Process and Thinking Skills

- a. Observe simple objects, patterns, and events and report their observations.
- b. Sort and sequence data according to criteria given.
- c. Given the appropriate instrument, measure length, temperature, volume, and mass in metric units as specified.
- d. Compare things, processes, and events.
- e. Use classification systems.
- f. Plan and conduct simple experiments.
- g. Formulate simple research questions.
- h. Predict results of investigations based on prior data.
- i. Use data to construct a reasonable conclusion.

2. Manifest Scientific Attitudes and Interests

- a. Demonstrate a sense of curiosity about nature.
- b. Voluntarily read and look at books and other materials about science.
- c. Pose science questions about objects, events, and processes.
- d. Maintain an open and questioning mind toward new ideas and alternative points of view.
- e. Seek and weigh evidence before drawing conclusions.
- f. Accept and use scientific evidence to help resolve ecological problems.

3. Understand Science Concepts and Principles

- a. Know and explain science information specified for the grade level.
- b. Distinguish between examples and non-examples of concepts that have been taught.
- c. Solve problems appropriate to grade level by applying science principles and procedures.

4. Communicate Effectively Using Science Language and Reasoning

- a. Record data accurately when given the appropriate form (e.g., table, graph, chart).
- b. Describe or explain observations carefully and report with pictures, sentences, and models.
- c. Use scientific language in oral and written communication.
- d. Use reference sources to obtain information and cite the source.
- e. Use mathematical reasoning to communicate information.

5. Demonstrate Awareness of Social and Historical Aspects of Science

- a. Cite examples of how science affects life.
- b. Understand the cumulative nature of science knowledge.

6. Understand the Nature of Science

- a. Science is a way of knowing that is used by many people not just scientists.
- b. Understand that science investigations use a variety of methods and do not always use the same set of procedures; understand that there is not just one "scientific method."
- c. Science findings are based upon evidence.

Science Benchmark

The weight of an object is always equal to the sum of its parts, regardless of how it is assembled. In a chemical reaction or physical change matter is neither created nor destroyed. When two or more materials are combined, either a chemical reaction or physical change may occur. Chemical reactions are often indicated when materials give off heat or cool as they take in heat, give off light, give off gas, or change colors. In a chemical reaction, materials are changed into new substances. In a physical change a new substance is not formed.

STANDARD I: Students will understand that chemical and physical changes occur in matter.

Objective 1: Describe that matter is neither created nor destroyed even though it may undergo change.

- a. Compare the total weight of an object to the weight of its individual parts after being disassembled.
- b. Compare the weight of a specified quantity of matter before and after it undergoes melting or freezing.
- c. Investigate the results of the combined weights of a liquid and a solid after the solid has been dissolved and then recovered from the liquid (e.g., salt dissolved in water then water evaporated).
- d. Investigate chemical reactions in which the total weight of the materials before and after reaction is the same (e.g., cream and vinegar before and after mixing, borax and glue mixed to make a new substance).

Objective 2: Evaluate evidence that indicates a physical change has occurred.

- a. Identify the physical properties of matter (e.g., hard, soft, solid, liquid, gas).
- b. Compare changes in substances that indicate a physical change has occurred.
- c. Describe the appearance of a substance before and after a physical change.

Objective 3: Investigate evidence for changes in matter that occur during a chemical reaction.

- a. Identify observable evidence of a chemical reaction (e.g., color change, heat or light given off, heat absorbed, gas given off).
- b. Explain why the measured weight of a remaining product is less than its reactants when a gas is produced.
- c. Cite examples of chemical reactions in daily life.
- d. Compare a physical change to a chemical change.
- e. Hypothesize how changing one of the materials in a chemical reaction will change the results.

Science language students should use:

heat, substance, chemical change, dissolve, physical change, matter, product, reactants, solid, liquid, weight

Science Benchmark

The Earth's surface is constantly changing. Some changes happen very slowly over long periods of time, such as weathering, erosion, and uplift. Other changes happen abruptly, such as landslides, volcanic eruptions, and earthquakes. All around us, we see the visible effects of the building up and breaking down of the Earth's surface.

STANDARD II: Students will understand that volcanoes, earthquakes, uplift, weathering, and erosion reshape Earth's surface.

Objective 1: Describe how weathering and erosion change Earth's surface.

- a. Identify the objects, processes, or forces that weather and erode Earth's surface (e.g., ice, plants, animals, abrasion, gravity, water, wind).
- b. Describe how geological features (e.g., valleys, canyons, buttes, arches) are changed through erosion (e.g., waves, wind, glaciers, gravity, running water).
- c. Explain the relationship between time and specific geological changes.

Objective 2: Explain how volcanoes, earthquakes, and uplift affect Earth's surface.

- a. Identify specific geological features created by volcanoes, earthquakes, and uplift.
- b. Give examples of different landforms that are formed by volcanoes, earthquakes, and uplift (e.g., mountains, valleys, new lakes, canyons).
- c. Describe how volcanoes, earthquakes, and uplift change landforms.
- d. Cite examples of how technology is used to predict volcanoes and earthquakes.

Objective 3: Relate the building up and breaking down of Earth's surface over time to the various physical land features.

- a. Explain how layers of exposed rock, such as those observed in the Grand Canyon, are the result of natural processes acting over long periods of time.
- b. Describe the role of deposition in the processes that change Earth's surface.
- c. Use a time line to identify the sequence and time required for building and breaking down of geologic features on Earth.
- d. Describe and justify how the surface of Earth would appear if there were no mountain uplift, weathering, or erosion.

Science language students should use:	earthquakes, erode, erosion, faults, uplift, volcanoes, weathering, buttes, arches, glaciers, geological, deposition
---------------------------------------	--

Science Benchmark

Earth and some earth materials have magnetic properties. Without touching them, a magnet attracts things made of iron and either pushes or pulls on other magnets. Electricity is a form of energy. Current electricity can be generated and transmitted through pathways. Some materials are capable of carrying electricity more effectively than other materials. Static electricity is a result of objects being electrically charged. Without touching them, materials that are electrically charged may either push or pull other charged materials.

STANDARD III: Students will understand that magnetism can be observed when there is an interaction between the magnetic fields of magnets or between a magnet and materials made of iron.

Objective 1: Investigate and compare the behavior of magnetism using magnets.

- a. Compare various types of magnets (e.g., permanent, temporary, and natural magnets) and their abilities to push or pull iron objects they are not touching.
- b. Investigate how magnets will both attract and repel other magnets.
- c. Compare permanent magnets and electromagnets.
- d. Research and report the use of magnets that is supported by sound scientific principles.

Objective 2: Describe how the magnetic field of Earth and a magnet are similar.

- a. Compare the magnetic fields of various types of magnets (e.g., bar magnet, disk magnet, horseshoe magnet).
- b. Compare Earth's magnetic field to the magnetic field of a magnet.
- c. Construct a compass and explain how it works.
- d. Investigate the effects of magnets on the needle of a compass and compare this to the effects of Earth's magnetic field on the needle of a compass (e.g., magnets effect the needle only at close distances, Earth's magnetic field affects the needle at great distances, magnets close to a compass overrides the Earth's effect on the needle).

STANDARD IV: Students will understand features of static and current electricity.

Objective 1: Describe the behavior of static electricity as observed in nature and everyday occurrences.

- a. List several occurrences of static electricity that happen in everyday life.
- b. Describe the relationship between static electricity and lightning.
- c. Describe the behavior of objects charged with static electricity in attracting or repelling without touching.
- d. Compare the amount of static charge produced by rubbing various materials together (e.g., rubbing fur on a glass rod produces a greater charge than rubbing the fur with a metal rod, the static charge produced when a balloon is rubbed on hair is greater than when a plastic bag is rubbed on hair).
- e. Investigate how various materials react differently to statically charged objects.

Objective 2: Analyze the behavior of current electricity.

- a. Draw and label the components of a complete electrical circuit that includes switches and loads (e.g., light bulb, bell, speaker, motor).
- b. Predict the effect of changing one or more of the components (e.g., battery, load, wires) in an electric circuit.
- c. Generalize the properties of materials that carry the flow of electricity using data by testing different materials.
- d. Investigate materials that prevent the flow of electricity.
- e. Make a working model of a complete circuit using a power source, switch, bell or light, and a conductor for a pathway.

Science language students should use:	battery, complete circuit, incomplete circuit, current, conductor, insulator, pathway, power source, attract, compass, electromagnetism, magnetic force, magnetic field, natural magnet, permanent magnet, properties, repel, static electricity, temporary magnet, switch, load
---------------------------------------	--

Science Benchmark

All living things inherit a set of characteristics or traits from their parents. Members of any given species transfer traits from one generation to the next. The passing of traits from parent to offspring is called heredity and causes the offspring to resemble the parent. Some traits differ among members of a population, and these variations may help a particular species to survive better in a given environment in getting food, finding shelter, protecting itself, and reproducing. These variations give the individual a survival advantage over other individuals of the same species.

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

Objective 1: Using supporting evidence, show that traits are transferred from a parent organism to its offspring.

- a. Make a chart and collect data identifying various traits among a given population (e.g., the hand span of students in the classroom, the color and texture of different apples, the number of petals of a given flower).
- b. Identify similar physical traits of a parent organism and its offspring (e.g., trees and saplings, leopards and cubs, chickens and chicks).
- c. Compare various examples of offspring that do not initially resemble the parent organism but mature to become similar to the parent organism (e.g., mealworms and darkling beetles, tadpoles and frogs, seedlings and vegetables, caterpillars and butterflies).
- d. Contrast inherited traits with traits and behaviors that are not inherited but may be learned or induced by environmental factors (e.g., cat purring to cat meowing to be let out of the house; the round shape of a willow is inherited, while leaning away from the prevailing wind is induced).
- e. Investigate variations and similarities in plants grown from seeds of a parent plant (e.g., how seeds from the same plant species can produce different colored flowers or identical flowers).

Objective 2: Describe how some characteristics could give a species a survival advantage in a particular environment.

- a. Compare the traits of similar species for physical abilities, instinctual behaviors, and specialized body structures that increase the survival of one species in a specific environment over another species (e.g., difference between the feet of snowshoe hare and cottontail rabbit, differences in leaves of plants growing at different altitudes, differences between the feathers of an owl and a hummingbird, differences in parental behavior among various fish).
- b. Identify that some environments give one species a survival advantage over another (e.g., warm water favors fish such as carp, cold water favors fish such as trout, environments that burn regularly favor grasses, environments that do not often burn favor trees).
- c. Describe how a particular physical attribute may provide an advantage for survival in one environment but not in another (e.g., heavy fur in arctic climates keep animals warm whereas in hot desert climates it would cause overheating; flippers on such animals as sea lions and seals provide excellent swimming structures in the water but become clumsy and awkward on land; cacti retain the right amount of water in arid regions but would develop root rot in a more temperate region; fish gills have the ability to absorb oxygen in water but not on land).
- d. Research a specific plant or animal and report how specific physical attributes provide an advantage for survival in a specific environment.

Science language students should use:	inherited, environment, species, offspring, traits, variations, survival, instincts, population, specialized structure, organism, life cycle, parent organism, learned behavior
---------------------------------------	---