Fourth Grade Standards: SCIENCE

*Note: This information has been adapted from the 2020 Colorado State Standards as presented on the Colorado Department of Education (CDE) website. It is *not* an exhaustive or detailed list. All standards mentioned represent skills grade-level students should have mastered by the end of the grade-level year. If you desire further information, please visit the Standards page on the CDE website: https://www.cde.state.co.us/standardsandinstruction/standards

This document provides support in addressing the academic standards in four categories: a general **Overview** of expectations and scientific behaviors, **Basic Questions** (a "fly by" glance of concepts a student masters throughout the school year), **Scientific Principles** (principles that students can begin to understand), and **Scientific Practices** (general ideas for how to introduce and teach the principles). As you consider the learning objectives for each grade level, use the "Basic Questions" checklist to help you plan out your year. Start with the end in mind: If my child needs to know how to _____ by the end of the school year, what learning activities can be implemented to introduce and then reinforce the concepts? Think next about smaller steps in learning that your child needs to master in order to reach that end goal. While science units tend to be taught thematically, certain basic skills can (and should) be practiced in every unit (i.e. observing, predicting, experimenting, reading graphs, etc.). We understand that science is often a subject area where parents choose a curriculum that aligns with a family's personal values and worldview. Know that any of the standards can be addressed according to a family's personal beliefs. If you are using a reputable and research-based curriculum, then your child will most likely be working his/her way through these learning objectives in a well-paced and consistent manner. (A brief sampling of solid curriculum options can be found on the CSP website under "Homeschool Resources.")

Overview

Expectations for 4th Grade Students:

- **Physical Science:** Recognize that energy comes in many forms such as light, heat, sound, magnetic, chemical, and electrical and can move from place to place; understand collisions between objects can impact motion; recognize that waves have regular patterns of motion, and that patterns can be used to encode, send, receive, and decode information, explain how an object can be seen.
- **Life Science:** Recognize that organisms have both internal and external structures that serve various functions and describe how animals receive and process information through senses.
- **Earth and Space Science:** Understand how Earth has changed over time, how energy and fuels that humans use are derived from natural sources, and how their uses affect the environment.

Throughout 4th Grade You May Find Students:

- Using evidence to construct an explanation relating to the speed of an object, and ask questions about the changes in energy that occur when objects collide.
- Making observations to provide evidence that energy can be transferred from place to place.
- Developing models to describe the properties of waves or to describe how we see objects.
- Constructing an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- Using models to describe that animals receive and process information through their senses.
- Analyzing and interpreting data from maps to describe patterns of Earth's features.
- Identifying evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
- Obtaining and combining information to describe that energy and fuels are derived from natural resources, and their uses affect the environment

Basic Questions

Physical Science

1. **What is energy?**
2. **What is meant by conservation of energy? How is energy transferred between objects or systems?**
3. **How are forces related to energy?**
4. **How do food and fuel provide energy? If energy is conserved, why is it also produced or used?**
5. **What are the characteristic properties and behaviors of waves?**
6. **What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?**
7. **How are instruments that transmit and detect waves used to extend human senses?**

Life Science

8. **How do internal and external structures support the survival, growth, behavior and reproduction of plants and animals?**

Earth and Space Science

9. **How can water, ice, wind and vegetation change the land?**
10. **What patterns of Earth's features can be determined with the use of maps? How do living organisms alter Earth's processes and structures?**
11. **Why do the continents move, and what causes earthquakes and volcanoes?**
12. **How do humans depend on Earth's resources?**
13. **How do natural hazards affect individuals and societies?**

Specific Principles and Skills

Physical Science

1. **Basic Question: What is energy?**

   *Scientific Principles

   a. Definitions of Energy: The faster a given object is moving, the more energy it possesses. Energy can be moved from place to place by moving objects or through sound, light or electric currents.
   b. Students understand that the faster an object moves the more energy it has.

   *Scientific Practices

   a. Use evidence to construct an explanation relating the speed of an object to the energy of that object. *(Examples of evidence relating speed and energy could include change of shape on impact or other results of collisions.)*

2. **Basic Questions: What is meant by conservation of energy? How is energy transferred between objects or systems?**

   *Scientific Principles

   a. Conservation of Energy and Energy Transfer: Energy is present whenever there are moving objects, sound, light or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is

produced. Light also transfers energy from place to place. Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.

b. Students understand that energy can be moved from place to place.

*Scientific Practices

a. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat and electric currents.

3. Basic Question: How are forces related to energy?

*Scientific Principles

a. Relationships Between Energy and Forces: When objects collide, the contact forces transfer energy so as to change the objects' motions.

b. Students understand that when objects collide, contact forces transfer so as to change objects' motion.

*Scientific Practices

a. Ask questions and predict outcomes about the changes in energy that occur when objects collide. *(Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.)*

4. Basic Questions: How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used?

*Scientific Principles

a. Energy in Chemical Processes and Everyday Life: The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.

b. Students understand that energy can be produced, used or released by converting stored energy.

*Scientific Practices

a. Apply scientific ideas to design, test and refine a device that converts energy from one form to another. *(Examples of evidence relating speed and energy could include change of shape on impact or other results of collisions.)*

5. Basic Question: What are the characteristic properties and behaviors of waves?

*Scientific Principles

a. Wave Properties: Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets the beach. Waves of the same type can differ in amplitude (height of waves) and wavelength (spacing between wave peaks).

b. Students understand that waves are regular patterns of motion.

*Scientific Practices

a. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. *(Examples of models could include diagrams, analogies and physical models using wire to illustrate wavelength and amplitude of waves.)*

6. **Basic Questions: What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?**

*Scientific Principles

a. Electromagnetic Radiation: An object can be seen when light reflected from its surface enters the eyes.
b. Students understand that an object can be seen when light reflected from its surface enters the eyes.

*Scientific Practices

a. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

7. **Basic Question: How are instruments that transmit and detect waves used to extend human senses?**

*Scientific Principles

a. Information Technologies and Instrumentation: Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information – convert it from digitized form to voice – and vice versa.
b. Students understand that patterns can encode, send, receive and decode information.

*Scientific Practices

a. Generate and compare multiple solutions that use patterns to transfer information. *(Examples of solutions could include drums sending coded information through sound waves, using a grid of 1s and 0s representing black and white to send information about a picture and using Morse code to send text.)*

8. **Basic Question: How do internal and external structures support the survival, growth, behavior and reproduction of plants and animals?**

*Scientific Principles

a. Structure and Function: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior and reproduction.
b. Information Processing: Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.
c. Students understand that organisms have both internal and external structures that serve various functions.

*Scientific Practices

a. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction. *(Examples of structures*

could include thorns, stems, roots, colored petals, heart, stomach, lungs, brain and skin. Stress at this level is on understanding the macroscale systems and their functions, not the microscopic scale.)

b. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. *(Emphasis is on systems information transfer. Does not include the mechanisms by which the brain stores and recalls information or the mechanism of how sensory receptors function.)*

9. How can water, ice, wind and vegetation change the land?

*Scientific Principles

a. The History of the Planet Earth: Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers.
b. Students understand that the Earth has changed over time.

*Scientific Practices

a. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. *(Examples of evidence from patterns could include rock layers with shell fossils above rock layers with plant fossils and no shells, indicating a change from water to land over time; and a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.)*

10. What patterns of Earth's features can be determined with the use of maps? How do living organisms alter Earth's processes and structures?

*Scientific Principles

a. Earth Materials and Systems: Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms and gravity break rocks, soils and sediments into smaller particles and move them around.
b. Biogeology: Living things affect the physical characteristics of their regions.
c. Students understand that there are four major earth systems interact.

*Scientific Practices

a. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. *(Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling and volume of water flow. Limited to a single form of weathering or erosion.)*

11. Why do the continents move, and what causes earthquakes and volcanoes?

*Scientific Principles

a. Plate Tectonics and Large-Scale System Interactions: The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.
b. Students understand that the Earth's physical features occur in patterns.

*Scientific Practices

a. Analyze and interpret data from maps to describe patterns of Earth's features. *(Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes and earthquakes.)*

12. How do humans depend on Earth's resources?

*Scientific Principles

a. Natural Resources: Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.
b. Students understand that energy and fuels are derived from natural sources and their use affects the environment.

*Scientific Practices

a. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. *(Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.)*

13. Basic Question: How do natural hazards affect individuals and societies?

*Scientific Principles

a. Natural Hazards: A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.
b. Students understand that a variety of hazards result from natural process.

*Scientific Practices

a. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. *(Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity. Limited to earthquakes, floods, tsunamis, and volcanic eruptions.)*