Fifth 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 5th Grade Students:

- **Physical Science:** Recognize that matter is made of particles that are too small to be seen; describe how new substances can be formed when chemical reactions occur, explain how Earth's gravitational force exerts force on objects.
- **Life Science:** Understand that plants acquire their material from growth chiefly from air and water, and that matter flows in cycles between air, soil, plants, animals, and microbes as these organisms live and die.
- **Earth and Space Science:** Understand that the Earth and sun provide many renewable and nonrenewable resources; recognize that Earth's surface changes constantly; understand how the uneven heating of Earth's surface (by the sun) affects weather.

Throughout 5th Grade You May Find Students:

- Conducting an investigation to determine whether the mixing of two or more substances results in new substances.
- Developing a model to describe the movement of matter among plants, animals, decomposers, and the environment.
- Developing models to describe the ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- Using data and graphs to describe the amounts and percentages of saltwater and freshwater in various reservoirs to provide evidence about the distribution of water on Earth.
- Obtaining information about ways individual communities use science ideas to protect the Earth's resources and environment.

Basic Questions

Physical Science

1. **How do particles combine to form the variety of matter one observes?**
2. **How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?**
3. **What underlying forces explain the variety of interactions observed?**
4. **How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used?**

Life Science

5. **How do organisms obtain and use the matter and energy they need to live and grow?**
6. **How do organisms interact with the living and nonliving environments to obtain matter and energy? How do matter and energy move through an ecosystem?**

Earth and Space Science

7. **What is the universe, and what goes on in stars?**
8. **What are the predictable patterns caused by Earth's movement in the solar system?**
9. **How do Earth's major systems interact? How do the properties and movements of water shape Earth's surface and affect its systems?**
10. **How do the properties and movements of water shape Earth's surface and affect its systems?**
11. **How do humans change the planet?**

Specific Principles and Skills

Physical Science

1. **Basic Question: How do particles combine to form the variety of matter one observes?**

   *Scientific Principles

   a. Structure and Properties of Matter: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. Measurements of a variety of properties can be used to identify materials.
   b. Students understand that matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.

   *Scientific Practices

   a. Develop a model to describe that matter is made of particles too small to be seen. *(Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water and evaporating salt water. Does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.)*
   b. Make observations and measurements to identify materials based on their properties. *(Examples of materials to be identified could include baking soda and other powders, metals, minerals and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and*

solubility; density is not intended as an identifiable property. Does not include density or distinguishing mass and weight.)

2. **Basic Questions: How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?**

*Scientific Principles

a. Chemical Reactions: No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary Statement: Mass and weight are not distinguished at this grade level.) When two or more different substances are mixed, a new substance with different properties may be formed.
b. Students understand that chemical reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.

*Scientific Practices

a. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. *(Examples of reactions or changes could include phase changes, dissolving and mixing that form new substances. Does not include distinguishing mass and weight.)*
b. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
c. Cause and Effect: Cause - and - effect relationships are routinely identified, tested and used to explain change.

3. **Basic Question: What underlying forces explain the variety of interactions observed?**

*Scientific Principles

a. Types of Interactions: The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

*Scientific Practices

a. Support an argument that the gravitational force exerted by Earth on objects is directed down. *("Down" is a local description of the direction that points toward the center of the spherical Earth. Does not include mathematical representation of gravitational force).*

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 energy released from food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).
b. Students understand that the energy released from food was once energy from the sun.

*Scientific Practices

a. Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun. *(Examples of models could include diagrams and flowcharts.)*

Life Science

5. **Basic Question: How do organisms obtain and use the matter and energy they need to live and grow?**

   *Scientific Principles

   a. Organization for Matter and Energy Flow in Organisms: Plants acquire their material for growth chiefly from air and water.

   *Scientific Practices

   a. Support an argument that plants get the materials they need for growth chiefly from air and water. *(Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.)*

6. **Basic Questions: How do organisms interact with the living and nonliving environments to obtain matter and energy? How do matter and energy move through an ecosystem?**

   *Scientific Principles

   a. Interdependent Relationships in Ecosystems: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.
   b. Cycles of Matter and Energy Transfer in Ecosystems: Matter cycles between the air and soil and among plants, animals and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid or solid) back into the environment.
   c. Systems and System Models: A system can be described in terms of its components and their interactions.
   d. Students understand that matter cycles between air and soil and among plants, animals and microbes as these organisms live and die.

   *Scientific Practices

   a. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. *(Emphasis is on the idea that matter that is not food [air, water, decomposed materials in soil] is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.)*

Earth and Space Science

7. **Basic Question: What is the universe, and what goes on in stars?**

   *Scientific Principles

   a. The Universe and its Stars: The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.

b. Students understand that stars range greatly in size and distance from Earth, and this can explain their relative brightness.

*Scientific Practices

a. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth. *(Limited to relative distances, not sizes, of stars. Does not include other factors that affect apparent brightness [such as stellar masses, age and stage].)*

8. Basic Question: What are the predictable patterns caused by Earth's movement in the solar system?

*Scientific Principles

a. Earth and the Solar System: The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.
b. Students understand that Earth's orbit and rotation and the orbit of the moon around earth cause observable patterns.

*Scientific Practices

a. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. *(Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months. Does not include causes of seasons.)*

9. Basic Questions: How do Earth's major systems interact? How do the properties and movements of water shape Earth's surface and affect its systems?

*Scientific Principles

a. Earth Materials and Systems: Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.
b. Students understand that Earth's major systems interact in multiple ways to affect Earth's surface materials and processes.

*Scientific Practices

a. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere and/or atmosphere interact. *(Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system. Limited to the interactions of two systems at a time.)*

10. **Basic Question: How do the properties and movements of water shape Earth's surface and affect its systems?**

    *Scientific Principles

    a. The Roles of Water in Earth's Surface Processes: Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.
    b. Students understand that Most of Earth's water is in the ocean and much of Earth's freshwater in glaciers or underground.

    *Scientific Practices

    a. Describe and graph the amounts and percentages of saltwater and freshwater in various reservoirs to provide evidence about the distribution of water on Earth. *(Limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps; does not include the atmosphere.)*

11. **Basic Question: How do humans change the planet?**

    *Scientific Principles

    a. Human Impacts on Earth Systems: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.
    b. Students understand that societal activities have had major effects on land, ocean, atmosphere, and even outer space

    *Scientific Practices

    a. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.