

## Overview

Fourth-graders possess some solid foundations in science and are developing the ability to work independently. The fourth-grade science standards provide opportunities for them to build upon their existing knowledge by formulating their own questions and predictions and conducting investigations.

Grade-four students are expected to learn both the content and process of science. Effective science programs reflect a balanced, comprehensive approach that includes the teaching of investigation and experimentation skills along with direct instruction. Key elements of a balanced science program include explicit teaching of science content and concepts, identifying students' prior knowledge, and addressing student misconceptions. Investigation skills should also be highlighted, with students encouraged to find answers or reach conclusions by using their own experiences or observations. High-quality science instruction should also develop students' command of the academic language of science and use standards-based connections with other core subjects to reinforce science learning.

Safety should always be the foremost consideration in teacher modeling, the design of demonstrations, investigation and experiments, and science projects. Safety must be taught. Knowing and following safe practices in science are a part of understanding the nature of science and scientific enterprise. Everyone involved in science education should become familiar with the *Science Safety Handbook for California Public Schools*, which is posted on the CDE Web page at <http://www.cde.ca.gov/pd/ca/sc/documents/scisafebk.pdf>. The publication contains specific and useful information relevant to teachers, administrators, parents/guardians, and students.

## What Fourth-Grade Students Should Know

Students who have mastered the science content standards for kindergarten through grade three have already had some formal, introductory experiences with fourth-grade science topics. They studied energy, including electricity, in third grade and worked with magnets in both kindergarten and second grade. In preparation for the fourth-grade life sciences standards, students have already learned about types of plants and animals that inhabit different biomes and have a simple understanding of adaptation from their studies in grades one and three. They know that organisms in an ecosystem interact.

Students entering fourth grade learned basic information about rocks, minerals, and the processes of erosion in grade two. They are able to observe patterns and make simple predictions. They have steadily developed their observation, measurement, and recordkeeping skills, including creating graphs and making drawings to record, organize, interpret, and display data. Students entering fourth grade know how to use a variety of simple tools and understand that asking meaningful questions and conducting careful investigations are central to making scientific progress.

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October 2011 Edition **What Students Learn in Fourth Grade**

During fourth grade, students learn to formulate and justify predictions based on cause-and-effect relationships, differentiate observation from inference, and conduct multiple trials to test their predictions. In

collecting data during investigative activities, they learn to follow a written set of instructions and continue to build their skills in expressing measurements in metric system units. Students develop their own questions, conduct scientific investigations, and communicate their findings in writing.

In physical science, students in grade four enhance their understandings of electricity and magnetism and consider the practical applications of these effects, building simple circuits, compasses and electromagnets. In their study of life sciences, students extend their knowledge of ecology by learning about food chains and webs and exploring the relationships between producers, consumers, and decomposers. They consider all components of an ecosystem, living and nonliving, and are introduced to microorganisms.

In earth science, fourth-graders learn about rocks, minerals, and the rock cycle. They learn how to differentiate rocks on the basis of their properties and how to identify common minerals. Students also study the processes of erosion and weathering and learn about the role of water in shaping the surface of Earth. In addition, students learn about rapid processes that change Earth's land surface: landslides, volcanic eruptions, and earthquakes.

Grade-four science topics are organized into six standard sets: Physical Sciences, two sets of standards in Life Sciences, two sets of standards in Earth Sciences (Rocks and Minerals and Waves, Wind, Water, and Ice), and Investigation and Experimentation. As students learn the content defined by the standards in the Life, Earth, and Physical Sciences strands, they are also practicing investigation and experimentation skills. That is, the investigation and experimentation standards should be infused throughout science instruction.

### **Physical Sciences**

The grade-four standards for the physical sciences enhance student understanding of electricity and magnetism. Students learn that electricity and magnetism are related effects that have many useful applications in everyday life. They design and build simple electrical circuits and experiment with wires, batteries, and bulbs. They learn that electric currents produce magnetic fields, they construct basic electromagnets, and they study how electromagnets work in simple devices. Students learn that magnets have two poles and that like poles repel, while unlike poles attract each other. They observe that electrically charged objects may either attract or repel one another and that electrical energy can be converted into heat, light, and motion.

### **Life Sciences (Standard Set 2)**

Students in grade four expand their knowledge of food chains and food webs to include not only the producers and consumers that they previously discussed but also the decomposers of plant and animal remains, such as insects, fungi, and bacteria. The idea that all organisms need energy and matter to live and grow is reinforced. Students learn that plants are the primary source of matter and energy entering most food chains. They study the relationships between producers and consumers in food chains and webs and understand that decomposers recycle matter from dead plants and animals.

**Students develop their own questions, conduct scientific investigations, and communicate their findings in writing.**

### **Life Sciences (Standard Set 3)**

The grade-four life sciences standards further develop the concept that organisms in an ecosystem interact and that living organisms depend on one another and their environment for survival. Students learn that ecosystems can be characterized by their living and nonliving components. The concept of adaptation is deepened as students learn that in any particular environment, some plants and animals survive well, some survive less well, and some cannot survive at all. Students study ecological relationships, such as animals using plants for shelter or nesting and plants using animals for pollination and seed dispersal. Fourth-graders also learn about the vital role and benefits of microorganisms in the environment. Common misconceptions that these organisms are responsible only for diseases and decomposition may be addressed and dispelled.

### **Earth Sciences (Rocks and Minerals)**

Students learn that the properties of rocks and minerals reflect the processes that form them. They study the rock cycle and learn to differentiate among igneous, sedimentary, and metamorphic rocks by referring to their properties and methods of formation. Fourth-graders also learn how to describe, sort, and classify minerals using the properties of hardness, cleavage, color, and streak and develop the ability to use a table of diagnostic properties to identify common rock-forming minerals and ore minerals.

### **Earth Sciences (Waves, Wind, Water, and Ice)**

Fourth-graders study the processes of weathering and erosion and learn that these processes continually form sediments that form new rocks as a part of the constant recycling of Earth's crust. They learn that waves, wind, water, and ice shape and reshape Earth's land surface and that moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places. Students learn that natural processes, such as freezing, thawing, and the growth of roots, cause rocks to break into smaller pieces and that some changes in the earth are due to slow processes such as erosion. Other changes are due to rapid processes such as landslides, volcanic eruptions, and earthquakes.