



The Science Content Standards for Kindergarten Through Grade Five



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This chapter incorporates the *Science Content Standards*, providing an explanation of the science underlying the standards and outlining activities that are consistent with the objectives of the standards. The activities included in this chapter are examples of the ways in which the standards may be approached. They are not to be interpreted as requirements for the science classroom or for inclusion in instructional materials, thus explaining the frequent use of helping verbs, such as *can*, *may*, and *should*.

The science standards are set forth in terms of what students know. Therefore, mastery of an individual standard is achieved when students have actually learned the fact, skill, concept, principle, or theory specified. Mastery does not occur simply because students have received a particular explanation or participated in a particular activity.

The elementary school science program provides the foundational skills and knowledge students will need in middle school and high school. Students are introduced to facts, concepts, principles, and theories organized under the headings of physical, life, and earth sciences. They learn essential investigation and experimentation skills that will continue to be developed through high school. Elementary school students respond positively to

well-structured activities and expository reading materials that connect the world around them to the science content. Students raise questions, follow their curiosity, and learn to be analytical. They are encouraged to practice open and honest expression of ideas and observations; they learn to listen to and consider the ideas and observations of other students. Both teachers and students need to enjoy the adventure of science.

This enjoyable adventure includes the school library-media center as a natural partner in science teaching and learning. The books and other resources available in the school library enhance and expand an interest in and understanding of science. When the school library-media center is appropriately staffed with a credentialed library-media teacher, information literacy instruction can be integrated into regular science instruction.

Safety is always the foremost consideration in teacher modeling and the design of demonstrations, investigation and experimentation, and science projects, both at the school site and away from school. Teachers must become familiar with the *Science Safety Handbook for California Public Schools*.¹ It contains specific and useful information relevant to classroom teachers of science. School administrators, teachers,

parents/guardians, and students have a legal moral obligation to promote safety in science education. Safety must be taught. Scientists and engineers in universities and industries are

required to follow strict environmental health and safety regulations. Knowing and following safe practices in science are a part of understanding the nature of science and scientific enterprise.

Chapter 3
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Content
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Through
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Kindergarten

Science Content Standards

Science study provides children in kindergarten with a unique opportunity to explore the world around them. It is important to teach kindergarten students to be objective observers and to know the difference between an observation and an opinion. Students begin their study of science by observing and noting the similarities, differences, and component parts of materials, plants and animals, and the earth. They also observe processes and changes over time. Observational activities must always be designed with safety as a foremost consideration.

Students learn how to classify, compare, sort, and identify common objects. They expand their skills in descriptive language by learning to observe, measure, and predict the properties of materials. Activities related to freezing, melting, and evaporation can provide ways to stimulate classroom discussions. Studies of plants and animals, landforms, and weather allow students to recount personal stories and speak of familiar experiences and interests. In doing so they learn new vocabulary and have opportunities to practice mathematics. In the kindergarten curriculum, as students listen to stories, teachers may use important strategies for teaching comprehension by (1) using pictures and context to make predictions; (2) retelling familiar stories; and (3) answering and asking questions about essential elements.



STANDARD SET I. Physical Science

Standard Set 1 begins the study of the properties of matter and its transformations. While learning these standards, students build a foundation for making observations and measurements. The three standards call attention to the properties of common objects (most of which are solids) and to the properties of water. Teachers introduce the term *physical property* to students by asking them to observe the properties of a variety of objects. Students will be able to predict on the basis of some initial observations what will happen under different conditions rather than make random guesses.

I. Properties of materials can be observed, measured, and predicted. As a basis for understanding this concept:

- a. *Students know* objects can be described in terms of the materials they are made of (e.g., clay, cloth, paper) and their physical properties (e.g., color, size, shape, weight, texture, flexibility, attraction to magnets, floating, sinking).

Students learn how to compare objects on the basis of characteristics and physical properties, such as color, size, shape, weight, texture, flexibility, attraction to magnets, and floating and sinking in water. By working with objects and noting

their physical properties and characteristics, students develop their ability to make observations and use appropriate academic science language that is expressive and descriptive.

Teachers may provide a variety of objects that students can investigate by using the senses of sight, sound, and touch. Activities involving the sense of smell and taste should be done only at home under parental supervision. In the classroom students use sight, sound, and touch to sort objects according to their physical properties.

The next step is for students to sort objects according to properties that do not manifest themselves directly to those three senses. For example, they might test different objects for the ability to float or sink in a small container of water. The list might include wood blocks, sponges, solid rubber balls, metal washers, small rocks, and Styrofoam balls. Students can test a few of these objects by observing which ones sink or float, then test their predictions experimentally. They may be surprised to see that a heavy piece of wood will float, but a lighter metal washer will sink.

Those observations are important to discuss because the behavior of the object depends on its density and not its weight. Density is a topic that is covered formally in grade seven, but students need to get a “feel” for it in earlier grades. Similarly, the property of magnetism is discussed in some detail in grade four, but students in kindergarten may enjoy learning that magnets stick only to certain types of metal and that the most common magnetic metal is iron.

I. b. *Students know water can be a liquid or a solid and can be made to change back and forth from one form to the other.*

Observing the change from ice to liquid water and back to ice builds students’ understanding that a substance may have both solid and liquid forms. Freezing and then melting water shows students that the water is returned exactly to its original state. A teacher may consider reading a story about winter ice and snow to the class to help develop vocabulary and comprehension.

I. c. *Students know water left in an open container evaporates (goes into the air) but water in a closed container does not.*

Students can observe a cup of water covered or uncovered in the classroom during several days or weeks. The gradual evaporation of water offers an opportunity for students to record observations and develop vocabulary related to time periods that extend beyond a single day. The rate of evaporation will depend on the temperature and room humidity and on the type of container chosen. Stories in which it rains and then the water dries up may also provoke interesting discussions. When rain forms puddles on the ground, some of the water may evaporate and some of it may sink into the soil where it can be taken up by plants.

Students may observe evaporation in classroom demonstrations. Water vapor in the air may be condensed to liquid water and collected on a cold surface. For

example, a teacher might hold a hand-mirror over a container of hot tap water to show that the water vapor rises and fogs the mirror and that small droplets of water may form.



STANDARD SET 2. Life Sciences

Kindergarten students expand their observational skills and vocabulary by learning to describe the appearance and behavior of different animals and plants. They have the opportunity to discuss the principles of structure and function at a simple level. For example, most birds and many insects have wings and can fly, but birds have feathers and insects do not. There are many outstanding fictional stories that the teacher may select to read to the students, perhaps from the school library-media center. Students learn that stories may give plants and animals attributes that are funny but not real. Although authors may use anthropomorphism to engage the interest of young people and exercise their imagination, such a literary technique should not be confused with scientific procedures and fact. Teachers may use many expository texts to enrich the observation of plants and animals in a classroom.

2. Different types of plants and animals inhabit the earth. As a basis for understanding this concept:

- a.** *Students know how to observe and describe similarities and differences in the appearance and behavior of plants and animals (e.g., seed-bearing plants, birds, fish, insects).*

Teachers guide students to learn that all plants and animals need air, food, and water to grow and be healthy. Students also learn that most animals are able to move about from place to place, which helps them find food to eat. Terrestrial plants, on the other hand, are usually rooted in one place and must obtain their nutrients and energy from the surrounding air, soil, water, and sunlight.

- 2. b.** *Students know stories sometimes give plants and animals attributes they do not really have.*

Real plants and animals do not talk, wear clothing, or walk like humans. Scientific observation of plants and animals helps students in kindergarten to understand the difference between characteristics of the real world and of fantasy.

- 2. c.** *Students know how to identify major structures of common plants and animals (e.g., stems, leaves, roots, arms, wings, legs).*

Students increase the detail of their understanding of plants and animals as they learn about the major structural components of common plants and animals and their functions. For example, students might plant some seeds in pots, care for the plants that sprout, and note how the different structures (such as stems, leaves, and

roots) change during growth and development. A comparison of different leaves is also instructive. Leaves that are good to study have smooth or jagged edges; are wide or narrow; and are of a different color, odor, or texture. Keeping some small animals (such as goldfish and hamsters) in the classroom will provide opportunities for students to learn new vocabulary related to major structures. Students should also learn that scientists are responsible for the ethical care of laboratory animals and that classroom animals deserve no less care (*Education Code* Section 51540).



STANDARD SET 3. Earth Sciences

Mountains, valleys, plains, rivers, lakes, and oceans are all features of the surface of Earth. Forces within Earth uplift the land; and the actions of wind, water, and ice carve Earth's surface into topographic features. Contrasts between rivers and oceans, mountains and deserts, and hills

and valleys can become the natural settings for students to begin studying the earth sciences. Changing weather conditions (such as rain, wind, and temperature) provide students with opportunities to make observations and measurements. Recording changes in the weather provides a rich opportunity for class discussion and builds listening comprehension.

The materials that make up Earth's surface provide resources for human activities. Students learn that human consumption leads to waste that must be disposed of. This understanding will help them appreciate the importance of recycling and conserving Earth's resources.

3. Earth is composed of land, air, and water. As a basis for understanding this concept:

- a.** *Students know* characteristics of mountains, rivers, oceans, valleys, deserts, and local landforms.

Students can explore the variability of landforms by means of tangible experiences (such as making direct observations, hearing stories and seeing pictures, and making models on sand/water tables). They learn to identify the mountains, rivers, oceans, valleys, deserts, and other landforms in photographs or models. This activity will also help improve their vocabulary for describing things.

- 3. b.** *Students know* changes in weather occur from day to day and across seasons, affecting Earth and its inhabitants.

Students know that they do not wear the same clothes on a wet, windy day as they do on a hot, sunny day. They now need to extend their concept of the consequences of weather changes beyond their personal lives. Students make weather observations and note how the weather changes over a period of days, weeks, and months. They observe the generic effects of weather and seasons on the land and living organisms.

- 3. c.** *Students know how to identify resources from Earth that are used in everyday life and understand that many resources can be conserved.*

Students need to learn the connection between materials and the resources from which the materials were derived. Students learn the importance of science in understanding the need for good air to breathe and clean water to drink. Students may explore ways in which to conserve, recycle, and reuse materials, especially within the classroom and school site environment. It is important they learn that everything has an origin. For example, drinking water is derived from streams and lakes, wood and paper from trees, and bricks and metals from Earth.



STANDARD SET 4. Investigation and Experimentation

The ability to observe and describe common objects develops early and is enhanced by kindergarten instruction when students are introduced to the properties of solids and liquids, plants and animals, and landforms and weather conditions. Students can also be taught to compare and sort objects on the basis of the objects' properties and be encouraged to use mathematics to communicate some of their observations.

- 4. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:**

- a. Observe common objects by using the five senses. [*Caution: Observational activities associated with tasting and smelling should be conducted only under parental supervision at home.*]
- b. Describe the properties of common objects.
- c. Describe the relative position of objects using one reference (e.g., above or below).
- d. Compare and sort common objects by one physical attribute (e.g., color, shape, texture, size, weight).
- e. Communicate observations orally and through drawings.