

# Sample Content Standards

## National Science Standards:

Science Content Standards: 9-12

### Science as Inquiry

CONTENT STANDARD A: As a result of activities in grades 9-12, all students should develop  
Abilities necessary to do scientific inquiry  
Understandings about scientific inquiry

#### ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY

**IDENTIFY QUESTIONS AND CONCEPTS THAT GUIDE SCIENTIFIC INVESTIGATIONS.** Students should formulate a testable hypothesis and demonstrate the logical connections between the scientific concepts guiding a hypothesis and the design of an experiment. They should demonstrate appropriate procedures, a knowledge base, and conceptual understanding of scientific investigations.

**DESIGN AND CONDUCT SCIENTIFIC INVESTIGATIONS.** Designing and conducting a scientific investigation requires introduction to the major concepts in the area being investigated, proper equipment, safety precautions, assistance with methodological problems, recommendations for use of technologies, clarification of ideas that guide the inquiry, and scientific knowledge obtained from sources other than the actual investigation. The investigation may also require student clarification of the question, method, controls, and variables; student organization and display of data; student revision of methods and explanations; and a public presentation of the results with a critical response from peers. Regardless of the scientific investigation performed, students must use evidence, apply logic, and construct an argument for their proposed explanations.

**USE TECHNOLOGY AND MATHEMATICS TO IMPROVE INVESTIGATIONS AND COMMUNICATIONS.** A variety of technologies, such as hand tools, measuring instruments, and calculators, should be an integral component of scientific investigations. The use of computers for the collection, analysis, and display of data is also a part of this standard. Mathematics plays an essential role in all aspects of an inquiry. For example, measurement is used for posing questions, formulas are used for developing explanations, and charts and graphs are used for communicating results.

**COMMUNICATE AND DEFEND A SCIENTIFIC ARGUMENT.** Students in school science programs should develop the abilities associated with accurate and effective communication. These include writing and following procedures, expressing concepts, reviewing information, summarizing data, using language appropriately, developing diagrams and charts, explaining statistical analysis, speaking clearly and logically, constructing a reasoned argument, and responding appropriately to critical comments.

#### UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY

Scientists usually inquire about how physical, living, or designed systems function. Conceptual principles and knowledge guide scientific inquiries. Historical and current scientific knowledge influence the design and interpretation of investigations and the evaluation of proposed explanations made by other scientists.

Scientists conduct investigations for a wide variety of reasons. For example, they may wish to discover new as-

pects of the natural world, explain recently observed phenomena, or test the conclusions of prior investigations or the predictions of current theories.

Scientists rely on technology to enhance the gathering and manipulation of data. New techniques and tools provide new evidence to guide inquiry and new methods to gather data, thereby contributing to the advance of science. The accuracy and precision of the data, and therefore the quality of the exploration, depends on the technology used.

Mathematics is essential in scientific inquiry. Mathematical tools and models guide and improve the posing of questions, gathering data, constructing explanations and communicating results

## Unifying Concepts and Processes

**STANDARD:** As a result of activities in grades K-12, all students should develop understanding and abilities aligned with the following concepts and processes:

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement
- Evolution and equilibrium
- Form and function

### PROGRAM STANDARD C:

The science program should be coordinated with the mathematics program to enhance student use and understanding of mathematics in the study of science and to improve student understanding of mathematics.

Science requires the use of mathematics in the collection and treatment of data and in the reasoning used to develop concepts, laws, and theories. School science and mathematics programs should be coordinated so that students learn the necessary mathematical skills and concepts before and during their use in the science program.

# California State Standards:

## **7th Grade:**

### **Science:**

#### Investigation and Experimentation

7. Scientific progress is made by asking meaningful questions and conducting careful investigations. Students will:

- a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
- c. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.
- d. Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge (e.g., motion of Earth's plates and cell structure).
- e. Communicate the steps and results from an investigation in written reports and oral presentations.

### **Math:**

#### Measurement and Geometry

1.0 Students choose appropriate units of measure and use ratios to convert within and between measurement systems to solve problems:

1.1 Compare weights, capacities, geometric measures, times, and temperatures within and between measurement systems (e.g., miles per hour and feet per second, cubic inches to cubic centimeters).

1.2 Construct and read drawings and models made to scale.

2.0 Students compute the perimeter, area, and volume of common geometric objects and use the results to find measures of less common objects. They know how perimeter, area, and volume are affected by changes of scale:

2.1 Use formulas routinely for finding the perimeter and area of basic two-dimensional figures and the surface area and volume of basic three-dimensional figures, including rectangles, parallelograms, trapezoids, squares, triangles, circles, prisms, and cylinders.

#### Mathematical Reasoning

1.0 Students make decisions about how to approach problems:

1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.

1.2 Formulate and justify mathematical conjectures based on a general description of the mathematical question or problem posed.

1.3 Determine when and how to break a problem into simpler parts.

2.0 Students use strategies, skills, and concepts in finding solutions:

2.1 Use estimation to verify the reasonableness of calculated results.

2.2 Apply strategies and results from simpler problems to more complex problems.

2.7 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

3.0 Students determine a solution is complete and move beyond a particular problem by generalizing to other situations:

3.1 Evaluate the reasonableness of the solution in the context of the original situation.

3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.

3.3 Develop generalizations of the results obtained and the strategies used and apply them to new problem situations.

## **8th Grade**

### **Science**

9. Scientific progress is made by asking meaningful questions and conducting careful investigations.. Students will:

a. Plan and conduct a scientific investigation to test a hypothesis.

b. Evaluate the accuracy and reproducibility of data.

c. Distinguish between variable and controlled parameters in a test.

### **Math:**

#### Geometry

8.0 Students know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.

11.0 Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids.

## 9th – 12th Grade

### Writing:

2.6 Write technical documents (e.g., a manual on rules of behavior for conflict resolution, procedures for conducting a meeting, minutes of a meeting):

- a. Report information and convey ideas logically and correctly.
- b. Offer detailed and accurate specifications.

### Science:

Investigation & Experimentation - Grades 9 to 12

1. 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 four strands, students should develop their own questions and perform investigations. Students will:

- a. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- b. Identify and communicate sources of unavoidable experimental error.
- c. Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- d. Formulate explanations by using logic and evidence.

1. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

### Math:

Geometry

8.0 Students know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.

11.0 Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids.