

SCIENCE STANDARD ARTICULATED BY GRADE LEVEL

GRADE 4

The goal in the development of the standard was to assure that the six strands and five unifying concepts are interwoven into a fabric of science that represents the true nature of science. Students have the opportunity to develop both the skills and content knowledge necessary to be scientifically literate members of the community.

Strands 1, 2, and 3 are designed to be explicitly taught *and* embedded *within* each of the content Strands 4, 5, and 6, and are not intended to be taught in isolation. The processes, skills, and content of the first three strands are designed to “umbrella” and complement the content of Life Science, Physical Science, and Earth and Space Science.

Strand 1: Inquiry Process

Inquiry Process establishes the basis for students’ learning in science. Students use scientific processes: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, and communicating results.

Concept 1: Observations, Questions, and Hypotheses

Observe, ask questions, and make predictions.

PO 1. Differentiate inferences from observations.

PO 2. Formulate a relevant question through observations that can be tested by an investigation.
(See M04-S2C1-01)

PO 3. Formulate predictions in the realm of science based on observed cause and effect relationships.

PO 4. Locate information (e.g., book, article, website) related to an investigation.
(See W04-S3C6-01 and R04-S3C1-05)

Concept 2: Scientific Testing (Investigating and Modeling)

Participate in planning and conducting investigations, and recording data.

PO 1. Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry.

PO 2. Plan a simple investigation that identifies the variables to be controlled.

PO 3. Conduct controlled investigations (e.g., related to erosion, plant life cycles, weather, magnetism) in life, physical, and Earth and space sciences.

PO 4. Measure using appropriate tools (e.g., ruler, scale, balance) and units of measure (i.e., metric, U.S. customary).
(See M04-S4C4-03 and M04-S4C4-07)

PO 5. Record data in an organized and appropriate format (e.g., t-chart, table, list, written log).
(See W04-S3C2-01 and W04-S3C3-01)

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Concept 3: Analysis and Conclusions

Organize and analyze data; compare to predictions.

PO 1. Analyze data obtained in a scientific investigation to identify trends.
(See M04-S2C1-03)

PO 2. Formulate conclusions based upon identified trends in data.
(See M04-S2C1-03)

PO 3. Determine that data collected is consistent with the formulated question.

PO 4. Determine whether the data supports the prediction for an investigation.

PO 5. Develop new questions and predictions based upon the data collected in the investigation.

Concept 4: Communication

Communicate results of investigations.

PO 1. Communicate verbally or in writing the results of an inquiry.
(See W04-S3C3-01)

PO 2. Choose an appropriate graphic representation for collected data:

- bar graph
- line graph
- Venn diagram
- model

(See M04-S2C1-02)

PO 3. Communicate with other groups or individuals to compare the results of a common investigation.

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Strand 2: History and Nature of Science

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

Concept 1: History of Science as a Human Endeavor

Identify individual and cultural contributions to scientific knowledge.

PO 1. Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations (e.g., Margaret Mead [anthropologist], supports Strand 4; Nikola Tesla [engineer, inventor] supports Strand 5; Michael Faraday [scientist], supports Strand 5; Benjamin Franklin [scientist], supports Strand 5).

PO 2. Describe science-related career opportunities.

Concept 2: Nature of Scientific Knowledge

Understand how science is a process for generating knowledge.

PO 1. Explain the role of experimentation in scientific inquiry.

PO 2. Describe the interaction of components in a system (e.g., flashlight, radio).

PO 3. Explain various ways scientists generate ideas (e.g., observation, experiment, collaboration, theoretical and mathematical models).

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Strand 3: Science in Personal and Social Perspectives

Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world – as living creatures, consumers, decision makers, problem solvers, managers, and planners.

Concept 1: Changes in Environments

Describe the interactions between human populations, natural hazards, and the environment.

PO 1. Describe how natural events and human activities have positive and negative impacts on environments (e.g., fire, floods, pollution, dams).

PO 2. Evaluate the consequences of environmental occurrences that happen either rapidly (e.g., fire, flood, tornado) or over a long period of time (e.g., drought, melting ice caps, the greenhouse effect, erosion).

Concept 2: Science and Technology in Society

Understand the impact of technology.

PO 1. Describe how science and technology (e.g., computers, air conditioning, medicine) have improved the lives of many people.

PO 2. Describe benefits (e.g., easy communications, rapid transportation) and risks (e.g., pollution, destruction of natural resources) related to the use of technology.

PO 3. Design and construct a technological solution to a common problem or need using common materials.

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Strand 4: Life Science

Life Science expands students' biological understanding of life by focusing on the characteristics of living things, the diversity of life, and how organisms and populations change over time in terms of biological adaptation and genetics. This understanding includes the relationship of structures to their functions and life cycles, interrelationships of matter and energy in living organisms, and the interactions of living organisms with their environment.

Concept 1: Characteristics of Organisms

Understand that basic structures in plants and animals serve a function.

PO 1. Compare structures in plants (e.g., roots, stems, leaves, flowers) and animals (e.g., muscles, bones, nerves) that serve different functions in growth and survival.

PO 2. Classify animals by identifiable group characteristics:

- vertebrates – mammals, birds, fish, reptiles, amphibians
- invertebrates – insects, arachnids

Concept 2: Life Cycles

Understand the life cycles of plants and animals.

No performance objectives at this grade level

Concept 3: Organisms and Environments

Understand the relationships among various organisms and their environment.

PO 1. Describe ways various resources (e.g., air, water, plants, animals, soil) are utilized to meet the needs of a population.

PO 2. Differentiate renewable resources from nonrenewable resources.

PO 3. Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment.

PO 4. Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes).

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Concept 4: Diversity, Adaptation, and Behavior

Identify plant and animal adaptations.

PO 1. Recognize that successful characteristics of populations are inherited traits that are favorable in a particular environment.

PO 2. Give examples of adaptations that allow plants and animals to survive.

- camouflage – horned lizards, coyotes
- mimicry – Monarch and Viceroy butterflies
- physical – cactus spines
- mutualism – species of acacia that harbor ants, which repel other harmful insects

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Strand 5: Physical Science

Physical Science affords students the opportunity to increase their understanding of the characteristics of objects and materials they encounter daily. Students gain an understanding of the nature of matter and energy, including their forms, the changes they undergo, and their interactions. By studying objects and the forces that act upon them, students develop an understanding of the fundamental laws of motion, knowledge of the various ways energy is stored in a system, and the processes by which energy is transferred between systems and surroundings.

Concept 1: Properties of Objects and Materials

Classify objects and materials by their observable properties.

No performance objectives at this grade level

Concept 2: Position and Motion of Objects

Understand spatial relationships and the way objects move.

No performance objectives at this grade level

Concept 3: Energy and Magnetism

Investigate different forms of energy.

PO 1. Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects.

PO 2. Construct series and parallel electric circuits.

PO 3. Explain the purpose of conductors and insulators in various practical applications.

PO 4. Investigate the characteristics of magnets (e.g., opposite poles attract, like poles repel, the force between two magnet poles depends on the distance between them).

PO 5. State cause and effect relationships between magnets and circuitry.

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Strand 6: Earth and Space Science

Earth and Space Science provides the foundation for students to develop an understanding of the Earth, its history, composition, and formative processes, and an understanding of the solar system and the universe. Students study the regularities of the interrelated systems of the natural world. In doing so, they develop understandings of the basic laws, theories, and models that explain the world (NSES, 1995). By studying the Earth from both a historical and current time frame, students can make informed decisions about issues affecting the planet on which they live.

Concept 1: Properties of Earth Materials

Identify the basic properties of Earth materials.

No performance objectives at this grade level

Concept 2: Earth's Processes and Systems

Understand the processes acting on the Earth and their interaction with the Earth systems.

PO 1. Identify the Earth processes that cause erosion.

PO 2. Describe how currents and wind cause erosion and land changes.

PO 3. Describe the role that water plays in the following processes that alter the Earth's surface features:

- erosion
- deposition
- weathering

PO 4. Compare rapid and slow processes that change the Earth's surface, including:

- rapid – earthquakes, volcanoes, floods
- slow – wind, weathering

PO 5. Identify the Earth events that cause changes in atmospheric conditions (e.g., volcanic eruptions, forest fires).

PO 6. Analyze evidence that indicates life and environmental conditions have changed (e.g., tree rings, fish fossils in desert regions, ice cores).

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Concept 3: Changes in the Earth and Sky

Understand characteristics of weather conditions and climate.

- PO 1. Identify the sources of water within an environment (e.g., ground water, surface water, atmospheric water, glaciers).
- PO 2. Describe the distribution of water on the Earth's surface.
- PO 3. Differentiate between weather and climate as they relate to the southwestern United States.
- PO 4. Measure changes in weather (e.g., precipitation, wind speed, barometric pressure).
- PO 5. Interpret the symbols on a weather map or chart to identify the following:
- temperatures
 - fronts
 - precipitation
- PO 6. Compare weather conditions in various locations (e.g., regions of Arizona, various U.S. cities, coastal vs. interior geographical regions).

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