

SCIENCE STANDARD ARTICULATED BY GRADE LEVEL

GRADE 6

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

Formulate predictions, questions, or hypotheses based on observations. Locate appropriate resources.

PO 1. Differentiate among a question, hypothesis, and prediction.

PO 2. Formulate questions based on observations that lead to the development of a hypothesis.
(See M06-S2C1-01)

PO 3. Locate research information, not limited to a single source, for use in the design of a controlled investigation.
(See W06-S3C6-01, R06-S3C1-06, and R06-S3C2-03)

Concept 2: Scientific Testing (Investigating and Modeling)

Design and conduct controlled investigations.

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

PO 2. Design an investigation to test individual variables using scientific processes.

PO 3. Conduct a controlled investigation using scientific processes.

PO 4. Perform measurements using appropriate scientific tools (e.g., balances, microscopes, probes, micrometers).
(See M06-S4C4-02)

PO 5. Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs.
(See W06-S3C2-01 and W06-S3C3-01)

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Concept 3: Analysis and Conclusions

Analyze and interpret data to explain correlations and results; formulate new questions.

PO 1. Analyze data obtained in a scientific investigation to identify trends.
(See M06-S2C1-03)

PO 2. Form a logical argument about a correlation between variables or sequence of events (e.g., construct a cause-and-effect chain that explains a sequence of events).

PO 3. Evaluate the observations and data reported by others.

PO 4. Interpret simple tables and graphs produced by others.

PO 5. Analyze the results from previous and/or similar investigations to verify the results of the current investigation.

PO 6. Formulate new questions based on the results of a completed investigation.

Concept 4: Communication

Communicate results of investigations.

PO 1. Choose an appropriate graphic representation for collected data:

- line graph
- double bar graph
- stem and leaf plot
- histogram

(See M06-S2C1-02)

PO 2. Display data collected from a controlled investigation.

(See M06-S2C1-02)

PO 3. Communicate the results of an investigation with appropriate use of qualitative and quantitative information.

(See W06-S3C2-01)

PO 4. Create a list of instructions that others can follow in carrying out a procedure (without the use of personal pronouns).

(See W06-S3C3-01)

PO 5. Communicate the results and conclusion of the investigation.

(See W06-S3C6-02)

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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, cultural, and technological 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., Jacques Cousteau [inventor, marine explorer], supports Strand 4; William Beebe [scientist], supports Strand 4; Thor Heyerdahl [anthropologist], supports Strand 6).*
- PO 2. Describe how a major milestone in science or technology has revolutionized the thinking of the time (e.g., Cell Theory, sonar, SCUBA, underwater robotics).
- PO 3. Analyze the impact of a major scientific development occurring within the past decade.
- PO 4. Describe the use of technology in science-related careers.

Concept 2: Nature of Scientific Knowledge

Understand how science is a process for generating knowledge.

- PO 1. Describe how science is an ongoing process that changes in response to new information and discoveries.
- PO 2. Describe how scientific knowledge is subject to change as new information and/or technology challenges prevailing theories.
- PO 3. Apply the following scientific processes to other problem solving or decision making situations:
- observing
 - questioning
 - communicating
 - comparing
 - measuring
 - classifying
 - predicting
 - organizing data
 - inferring
 - generating hypotheses
 - identifying variables

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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. Evaluate the effects of the following natural hazards:

- sandstorm
- hurricane
- tornado
- ultraviolet light
- lightning-caused fire

PO 2. Describe how people plan for, and respond to, the following natural disasters:

- drought
- flooding
- tornadoes

Concept 2: Science and Technology in Society

Develop viable solutions to a need or problem.

PO 1. Propose viable methods of responding to an identified need or problem.

PO 2. Compare possible solutions to best address an identified need or problem.

PO 3. Design and construct a solution to an identified need or problem using simple classroom materials.

PO 4. Describe a technological discovery that influences science.

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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: Structure and Function in Living Systems

Understand the relationships between structures and functions of organisms.

PO 1. Explain the importance of water to organisms.

PO 2. Describe the basic structure of a cell, including:

- cell wall
- cell membrane
- nucleus

PO 3. Describe the function of each of the following cell parts:

- cell wall
- cell membrane
- nucleus

PO 4. Differentiate between plant and animal cells.

PO 5. Explain the hierarchy of cells, tissues, organs, and systems.

PO 6. Relate the following structures of living organisms to their functions:

Animals

- respiration – gills, lungs
- digestion – stomach, intestines
- circulation – heart, veins, arteries, capillaries
- locomotion – muscles, skeleton

Plants

- transpiration – stomata, roots, xylem, phloem
- absorption – roots, xylem, phloem
- response to stimulus (phototropism, hydrotropism, geotropism) – roots, xylem, phloem

PO 7. Describe how the various systems of living organisms work together to perform a vital function:

- respiratory and circulatory
- muscular and skeletal
- digestive and excretory

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Concept 2: Reproduction and Heredity

Understand the basic principles of heredity.

No performance objectives at this grade level

Concept 3: Populations of Organisms in an Ecosystem

Analyze the relationships among various organisms and their environment.

PO 1. Explain that sunlight is the major source of energy for most ecosystems.
(See Strand 5 Concept 3 and Strand 6 Concept 2)

PO 2. Describe how the following environmental conditions affect the quality of life:

- water quality
- climate
- population density
- smog

Concept 4: Diversity, Adaptation, and Behavior

Identify structural and behavioral adaptations.

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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 and Changes of Properties in Matter

Understand physical and chemical properties of matter.

No performance objectives at this grade level

Concept 2: Motion and Forces

Understand the relationship between force and motion.

No performance objectives at this grade level

Concept 3: Transfer of Energy

Understand that energy can be stored and transferred.

PO 1. Identify various ways in which electrical energy is generated using renewable and nonrenewable resources (e.g., wind, dams, fossil fuels, nuclear reactions).

PO 2. Identify several ways in which energy may be stored.

PO 3. Compare the following ways in which energy may be transformed:

- mechanical to electrical
- electrical to thermal

PO 4. Explain how thermal energy (heat energy) can be transferred by:

- conduction
- convection
- radiation

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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: Structure of the Earth

Describe the composition and interactions between the structure of the Earth and its atmosphere.

PO 1. Describe the properties and the composition of the layers of the atmosphere.

PO 2. Explain the composition, properties, and structure of the Earth's lakes and rivers.

PO 3. Explain the composition, properties, and structures of the oceans' zones and layers.

PO 4. Analyze the interactions between the Earth's atmosphere and the Earth's bodies of water (water cycle).

PO 5. Describe ways scientists explore the Earth's atmosphere and bodies of water.
(See Strand 2 Concept 1)

Concept 2: Earth's Processes and Systems

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

PO 1. Explain how water is cycled in nature.

PO 2. Identify the distribution of water within or among the following:

- atmosphere
- lithosphere
- hydrosphere

PO 3. Analyze the effects that bodies of water have on the climate of a region.

PO 4. Analyze the following factors that affect climate:

- ocean currents
- elevation
- location

PO 5. Analyze the impact of large-scale weather systems on the local weather.

PO 6. Create a weather system model that includes:

- the Sun
- the atmosphere
- bodies of water

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Concept 3: Earth in the Solar System

Understand the relationships of the Earth and other objects in the solar system.

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