

SCIENCE STANDARD ARTICULATED BY GRADE LEVEL

GRADE 5

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. Formulate a relevant question through observations that can be tested by an investigation.
(See M05-S2C1-01)*

PO 2. Formulate predictions in the realm of science based on observed cause and effect relationships.

*PO 3. Locate information (e.g., book, article, website) related to an investigation.
(See W05-S3C6-01 and R05-S3C1-05)*

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

PO 3. Conduct simple investigations (e.g., related to forces and motion, Earth processes) based on student-developed questions 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 M05-S4C4-01)*

*PO 5. Record data in an organized and appropriate format (e.g., t-chart, table, list, written log).
(See W05-S3C2-01 and W05-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 and form conclusions.
(See M05-S2C1-03)

PO 2. Analyze whether the data is consistent with the proposed explanation that motivated the investigation.

PO 3. Evaluate the reasonableness of the outcome of an investigation.

PO 4. Develop new investigations and predictions based on questions that arise from the findings of an investigation.

PO 5. Identify possible relationships between variables in simple investigations (e.g., time and distance; incline and mass of object).

Concept 4: Communication

Communicate results of investigations.

PO 1. *Communicate verbally or in writing the results of an inquiry.*
(See W05-S3C3-01)

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

- *bar graph*
- *line graph*
- *Venn diagram*
- *model*

(See M05-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, 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., Percy Lavon Julian [scientist], supports Strand 4; Niels Bohr [scientist], supports Strand 5; Edwin Hubble [scientist], supports Strand 6).

Concept 2: Nature of Scientific Knowledge

Understand how science is a process for generating knowledge.

PO 1. Provide examples that support the premise that science is an ongoing process that changes in response to new information and discoveries (e.g., space exploration, medical advances).

PO 2. Explain the cycle by which new scientific knowledge generates new scientific inquiry.

PO 3. Describe how scientific knowledge is subject to modification and/or change as new information/technology challenges prevailing theories.

PO 4. Compare collaborative approaches that scientists use for investigations (e.g., teams, individual with peer review).

PO 5. Describe qualities of the scientists' habits of mind (e.g., openness, skepticism, integrity, tolerance).

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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. Explain the impacts of natural hazards on habitats (e.g., global warming, floods, asteroid or large meteor impacts).
- PO 2. Propose a solution, resource, or product that addresses a specific human, animal, or habitat need.
- PO 3. Evaluate the possible strengths and weaknesses of a proposed solution to a specific problem relevant to human, animal, or habitat needs.

Concept 2: Science and Technology in Society

Develop viable solutions to a need or problem.

- PO 1. Describe the relationship between science and technology.
- PO 2. Explain how scientific knowledge, skills, and technological capabilities are integral to a variety of careers.
- 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: Structure and Function in Living Systems

Understand the relationships between structures and functions of organisms.

PO 1. Identify the functions and parts of the skeletal system:

- protection – rib cage, cranium
- support – vertebrae
- movement – pelvis, femur, hip

PO 2. Identify the following types of muscles:

- cardiac – heart
- smooth – stomach
- skeletal – biceps

PO 3. Identify the functions and parts of the nervous system:

- control center – brain
- relay mechanism – spinal cord
- transport messages – nerves

PO 4. Distinguish between voluntary and involuntary responses.

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.

No performance objectives at this grade level

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.

PO 1. Identify that matter is made of smaller units called:

- molecules (e.g., H₂O, CO₂)
- atoms (e.g., H, N, Na)

PO 2. Distinguish between mixtures and compounds.

PO 3. Describe changes of matter:

- physical – cutting wood, ripping paper, freezing water
- chemical – burning of wood, rusting of iron, milk turning sour

Concept 2: Motion and Forces

Understand the relationship between force and motion.

PO 1. Describe the following forces:

- gravity
- friction

PO 2. Describe the various effects forces can have on an object (e.g., cause motion, halt motion, change direction of motion, cause deformation).

PO 3. Examine forces and motion through investigations using simple machines (e.g., wedge, plane, wheel and axle, pulley, lever).

PO 4. Demonstrate effects of variables on an object's motion (e.g., incline angle, friction, applied forces).

Concept 3: Transfer of Energy

Understand that energy can be stored and transferred.

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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.

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. Describe how the Moon's appearance changes during a four-week lunar cycle.

PO 2. Describe how Earth's rotation results in day and night at any particular location.

PO 3. Distinguish between revolution and rotation.

PO 4. Describe the role of gravity as an attractive force between celestial objects.

Concept 3: Earth in the Solar System

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

PO 1. Identify the known planets of the solar system.

PO 2. Describe the distinguishing characteristics of the known planets in the solar system.

PO 3. Describe various objects in the sky (e.g., asteroids, comets, stars, meteors/shooting stars).

PO 4. Describe the change in position and motion of the following objects in the sky over time:

- real motion – Moon, planets
- apparent motion (due to the motion of the Earth) – Sun, Moon, stars

PO 5. Explain the apparent motion of the Sun and stars.

PO 6. Describe efforts to explore space (e.g., Apollo missions, space shuttles, Hubble space telescope, space probes).

(See Strand 2)

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