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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 questions based on observations that lead to the development of a hypothesis.
(See M08-S2C1-01)

PO 2. Use appropriate research information, not limited to a single source, to use in the development of a testable hypothesis.
(See W08-S3C6-01, R08-S3C1-06, and R08-S3C2-03)

PO 3. Generate a hypothesis that can be tested.

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 a controlled investigation to support or reject a hypothesis.

PO 3. Conduct a controlled investigation to support or reject a hypothesis.

PO 4. Perform measurements using appropriate scientific tools (e.g., balances, microscopes, probes, micrometers).

PO 5. Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs.
(See W08-S3C2-01 and W08-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 M08-S2C1-08)

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. Interpret data that show a variety of possible relationships between two variables, including:
- positive relationship
- negative relationship
- no relationship

PO 4. Formulate a future investigation based on the data collected.

PO 5. Explain how evidence supports the validity and reliability of a conclusion.

PO 6. Identify the potential investigational error that may occur (e.g., flawed investigational design, inaccurate measurement, computational errors, unethical reporting).

PO 7. Critique scientific reports from periodicals, television, or other media.

PO 8. Formulate new questions based on the results of a previous investigation.

Concept 4: Communication
Communicate results of investigations.

PO 1. Communicate the results of an investigation.

PO 2. Choose an appropriate graphic representation for collected data:
- *line graph*
- *double bar graph*
- *stem and leaf plot*
- *histogram*

(See M08-S2C1-03)

PO 3. Present analyses and conclusions in clear, concise formats.
(See W08-S3C6-02)

PO 4. Write clear, step-by-step instructions for conducting investigations or operating equipment (without the use of personal pronouns).
(See W08-S3C3-01)

PO 5. Communicate the results and conclusion of the investigation.
(See W08-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., Watson and Crick [scientists], support Strand 4; Rosalind Franklin [scientist], supports Strand 4; Charles Darwin [scientist], supports Strand 4; George Washington Carver [scientist, inventor], supports Strand 4; Joseph Priestley [scientist], supports Strand 5; Sir Frances Bacon [philosopher], supports Strand 5; Isaac Newton [scientist], supports Strand 5).

PO 2. Evaluate the effects of the following major scientific milestones on society:

- Mendelian Genetics
- Newton's Laws

PO 3. Evaluate the impact of a major scientific development occurring within the past decade.

PO 4. Evaluate career opportunities related to life and physical sciences.

Concept 2: Nature of Scientific Knowledge

Understand how science is a process for generating knowledge.

PO 1. 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*

PO 2. Describe how scientific knowledge is subject to change as new information and/or technology challenges prevailing theories.

PO 3. Defend the principle that accurate record keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.

PO 4. Explain why scientific claims may be questionable if based on very small samples of data, biased samples, or samples for which there was no control.

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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. Analyze the risk factors associated with natural, human induced, and/or biological hazards, including:
- waste disposal of industrial chemicals
- greenhouse gases

PO 2. Analyze possible solutions to address the environmental risks associated with chemicals and biological systems.

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 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. Compare risks and benefits of the following technological advances:
- radiation treatments
- genetic engineering (See Strand 4 Concept 2)
- airbags (See Strand 5 Concept 2)

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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.
No performance objectives at this grade level

Concept 2: Reproduction and Heredity Understand the basic principles of heredity.
PO 1. Explain the purposes of cell division: • growth and repair • reproduction PO 2. Explain the basic principles of heredity using the human examples of: • eye color • widow's peak • blood type PO 3. Distinguish between the nature of dominant and recessive traits in humans.

Concept 3: Populations of Organisms in an Ecosystem Analyze the relationships among various organisms and their environment.
No performance objectives at this grade level

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Concept 4: Diversity, Adaptation, and Behavior
Identify structural and behavioral adaptations.

PO 1. Explain how an organism's behavior allows it to survive in an environment.

PO 2. Describe how an organism can maintain a stable internal environment while living in a constantly changing external environment.

PO 3. Determine characteristics of organisms that could change over several generations.

PO 4. Compare the symbiotic and competitive relationships in organisms within an ecosystem (e.g., lichen, mistletoe/tree, clownfish/sea anemone, native/non-native species).

PO 5. Analyze the following behavioral cycles of organisms:
- hibernation
- migration
- dormancy (plants)

PO 6. Describe the following factors that allow for the survival of living organisms:
- protective coloration
- beak design
- seed dispersal
- pollination

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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 different kinds of matter based on the following physical properties:
- states
- density
- boiling point
- melting point
- solubility

PO 2. Identify different kinds of matter based on the following chemical properties:
- reactivity
- pH
- oxidation (corrosion)

PO 3. Identify the following types of evidence that a chemical reaction has occurred:
- formation of a precipitate
- generation of gas
- color change
- absorption or release of heat

PO 4. Classify matter in terms of elements, compounds, or mixtures.

PO 5. Classify mixtures as being homogeneous or heterogeneous.

PO 6. Explain the systematic organization of the periodic table.

PO 7. Investigate how the transfer of energy can affect the physical and chemical properties of matter.

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Concept 2: Motion and Forces
Understand the relationship between force and motion.

PO 1. Demonstrate velocity as the rate of change of position over time.

PO 2. Identify the conditions under which an object will continue in its state of motion (Newton's 1st Law of Motion).

PO 3. Describe how the acceleration of a body is dependent on its mass and the net applied force (Newton's 2nd Law of Motion).

PO 4. Describe forces as interactions between bodies (Newton's 3rd Law of Motion).

PO 5. Create a graph devised from measurements of moving objects and their interactions, including:
- position-time graphs
- velocity-time graphs

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.
No performance objectives at this grade level

Concept 3: Earth in the Solar System Understand the relationships of the Earth and other objects in the solar system.
No performance objectives at this grade level

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