

# Grade Six

The sixth-grade standards continue to emphasize data analysis and experimentation. Methods are studied for testing the validity of predictions and conclusions. Scientific methodology, focusing on precision in stating hypotheses and defining dependent and independent variables, is strongly reinforced. The concept of change is explored through the study of transformations of energy and matter. The standards present an integrated focus on the role of the sun's energy in the Earth's systems, on water in the environment, on air and atmosphere, and on basic chemistry concepts. A more detailed understanding of the solar system and space exploration becomes a focus of instruction. Natural resource management, its relation to public policy, and cost/benefit tradeoffs in conservation policies are introduced.

The sixth-grade standards continue to focus on student growth in understanding the nature of science. This scientific view defines the idea that explanations of nature are developed and tested using observation, experimentation, models, evidence, and systematic processes. The nature of science includes the concepts that scientific explanations are based on logical thinking; are subject to rules of evidence; are consistent with observational, inferential, and experimental evidence; are open to rational critique; and are subject to refinement and change with the addition of new scientific evidence. The nature of science includes the concept that science can provide explanations about nature, can predict potential consequences of actions, but cannot be used to answer all questions.

## Scientific Investigation, Reasoning, and Logic

- 6.1 The student will plan and conduct investigations in which
- observations are made involving fine discrimination between similar objects and organisms;
  - a classification system is developed based on multiple attributes;
  - precise and approximate measurements are recorded;
  - scale models are used to estimate distance, volume, and quantity;
  - hypotheses are stated in ways that identify the independent (manipulated) and dependent (responding) variables;
  - a method is devised to test the validity of predictions and inferences;
  - one variable is manipulated over time, using many repeated trials;
  - data are collected, recorded, analyzed, and reported using appropriate metric measurements;
  - data are organized and communicated through graphical representation (graphs, charts, and diagrams);
  - models are designed to explain a sequence; and
  - an understanding of the nature of science is developed and reinforced.

## Force, Motion, and Energy

- 6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include
- potential and kinetic energy;
  - the role of the sun in the formation of most energy sources on Earth;
  - nonrenewable energy sources (fossil fuels including petroleum, natural gas, and coal);
  - renewable energy sources (wood, wind, hydro, geothermal, tidal, and solar); and
  - energy transformations (heat/light to mechanical, chemical, and electrical energy).

- 6.3 The student will investigate and understand the role of solar energy in driving most natural processes within the atmosphere, the hydrosphere, and on the Earth's surface. Key concepts include
- the Earth's energy budget;
  - the role of radiation and convection in the distribution of energy;
  - the motion of the atmosphere and the oceans;
  - cloud formation; and
  - the role of heat energy in weather-related phenomena including thunderstorms and hurricanes.

## **Matter**

- 6.4 The student will investigate and understand that all matter is made up of atoms. Key concepts include
- atoms are made up of electrons, protons, and neutrons;
  - atoms of any element are alike but are different from atoms of other elements;
  - elements may be represented by chemical symbols;
  - two or more atoms may be chemically combined;
  - compounds may be represented by chemical formulas;
  - chemical equations can be used to model chemical changes; and
  - a limited number of elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere.
- 6.5 The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include
- water as the universal solvent;
  - the properties of water in all three states;
  - the action of water in physical and chemical weathering;
  - the ability of large bodies of water to store heat and moderate climate;
  - the origin and occurrence of water on Earth;
  - the importance of water for agriculture, power generation, and public health; and
  - the importance of protecting and maintaining water resources.
- 6.6 The student will investigate and understand the properties of air and the structure and dynamics of the Earth's atmosphere. Key concepts include
- air as a mixture of gaseous elements and compounds;
  - air pressure, temperature, and humidity;
  - how the atmosphere changes with altitude;
  - natural and human-caused changes to the atmosphere;
  - the relationship of atmospheric measures and weather conditions;
  - basic information from weather maps including fronts, systems, and basic measurements; and
  - the importance of protecting and maintaining air quality.

## **Living Systems**

- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
- a) the health of ecosystems and the abiotic factors of a watershed;
  - b) the location and structure of Virginia's regional watershed systems;
  - c) divides, tributaries, river systems, and river and stream processes;
  - d) wetlands;
  - e) estuaries;
  - f) major conservation, health, and safety issues associated with watersheds; and
  - g) water monitoring and analysis using field equipment including hand-held technology.

## **Interrelationships in Earth/Space Systems**

- 6.8 The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it. Key concepts include
- a) the sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets;
  - b) relative size of and distance between planets;
  - c) the role of gravity;
  - d) revolution and rotation;
  - e) the mechanics of day and night and the phases of the moon;
  - f) the unique properties of Earth as a planet;
  - g) the relationship of the Earth's tilt and the seasons;
  - h) the cause of tides; and
  - i) the history and technology of space exploration.

## **Resources**

- 6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include
- a) management of renewable resources (water, air, soil, plant life, animal life);
  - b) management of nonrenewable resources (coal, oil, natural gas, nuclear power, mineral resources);
  - c) the mitigation of land-use and environmental hazards through preventive measures; and
  - d) cost/benefit tradeoffs in conservation policies.