

Grade Three Science Standards of Learning for Virginia Public Schools – 2010

Introduction

The *Science Standards of Learning* for Virginia Public Schools identify academic content for essential components of the science curriculum at different grade levels. Standards are identified for kindergarten through grade five, for middle school, and for a core set of high school courses — Earth Science, Biology, Chemistry, and Physics. Throughout a student's science schooling from kindergarten through grade six, content strands, or topics are included. The Standards of Learning in each strand progress in complexity as they are studied at various grade levels in grades K-6, and are represented indirectly throughout the high school courses. These strands are

- Scientific Investigation, Reasoning, and Logic;
- Force, Motion, and Energy;
- Matter;
- Life Processes;
- Living Systems;
- Interrelationships in Earth/Space Systems;
- Earth Patterns, Cycles, and Change; and
- Earth Resources.

Five key components of the science standards that are critical to implementation and necessary for student success in achieving science literacy are 1) Goals; 2) K-12 Safety; 3) Instructional Technology; 4) Investigate and Understand; and 5) Application. It is imperative to science instruction that the local curriculum consider and address how these components are incorporated in the design of the kindergarten through high school science program.

Goals

The purposes of scientific investigation and discovery are to satisfy humankind's quest for knowledge and understanding and to preserve and enhance the quality of the human experience. Therefore, as a result of science instruction, students will be able to achieve the following objectives:

1. Develop and use an experimental design in scientific inquiry.
2. Use the language of science to communicate understanding.
3. Investigate phenomena using technology.
4. Apply scientific concepts, skills, and processes to everyday experiences.

5. Experience the richness and excitement of scientific discovery of the natural world through the collaborative quest for knowledge and understanding.
6. Make informed decisions regarding contemporary issues, taking into account the following:
 - public policy and legislation;
 - economic costs/benefits;
 - validation from scientific data and the use of scientific reasoning and logic;
 - respect for living things;
 - personal responsibility; and
 - history of scientific discovery.
7. Develop scientific dispositions and habits of mind including:
 - curiosity;
 - demand for verification;
 - respect for logic and rational thinking;
 - consideration of premises and consequences;
 - respect for historical contributions;
 - attention to accuracy and precision; and
 - patience and persistence.
8. Develop an understanding of the interrelationship of science with technology, engineering and mathematics.
9. Explore science-related careers and interests.

K-12 Safety

In implementing the *Science Standards of Learning*, teachers must be certain that students know how to follow safety guidelines, demonstrate appropriate laboratory safety techniques, and use equipment safely while working individually and in groups.

Safety must be given the highest priority in implementing the K-12 instructional program for science. Correct and safe techniques, as well as wise selection of experiments, resources, materials, and field experiences appropriate to age levels, must be carefully considered with regard to the safety precautions for every instructional activity. Safe science classrooms require thorough planning, careful management, and constant monitoring of student activities. Class enrollment should not exceed the designed capacity of the room.

Teachers must be knowledgeable of the properties, use, and proper disposal of all chemicals that may be judged as hazardous prior to their use in an instructional activity. Such information is referenced through Materials Safety Data Sheets (MSDS). The identified precautions involving the use of goggles, gloves, aprons, and fume hoods must be followed as prescribed.

While no comprehensive list exists to cover all situations, the following should be reviewed to avoid potential safety problems. Appropriate safety procedures should be used in the following situations:

- observing wildlife; handling living and preserved organisms; and coming in contact with natural hazards, such as poison ivy, ticks, mushrooms, insects, spiders, and snakes;
- engaging in field activities in, near, or over bodies of water;
- handling glass tubing and other glassware, sharp objects, and labware;
- handling natural gas burners, Bunsen burners, and other sources of flame/heat;
- working in or with direct sunlight (sunburn and eye damage);
- using extreme temperatures and cryogenic materials;
- handling hazardous chemicals including toxins, carcinogens, and flammable and explosive materials;
- producing acid/base neutralization reactions/dilutions;
- producing toxic gases;
- generating/working with high pressures;
- working with biological cultures including their appropriate disposal and recombinant DNA;
- handling power equipment/motors;
- working with high voltage/exposed wiring; and
- working with laser beam, UV, and other radiation.

The use of human body fluids or tissues is generally prohibited for classroom lab activities. Further guidance from the following sources may be referenced:

- OSHA (Occupational Safety and Health Administration);
- ISEF (International Science and Engineering Fair) rules; and
- public health departments' and school divisions' protocols.

Instructional Technology

The use of current and emerging technologies is essential to the K-12 science instructional program. Specifically, technology must accomplish the following:

- Assist in improving every student's functional literacy. This includes improved communication through reading/information retrieval (the use of

telecommunications), writing (word processing), organization and analysis of data (databases, spreadsheets, and graphics programs), presentation of one's ideas (presentation software), and resource management (project management software).

- Be readily available and regularly used as an integral and ongoing part of the delivery and assessment of instruction.
- Include instrumentation oriented toward the instruction and learning of science concepts, skills, and processes. Technology, however, should not be limited to traditional instruments of science, such as microscopes, labware, and data-collecting apparatus, but should also include computers, robotics, video-microscopes, graphing calculators, probeware, geospatial technologies, online communication, software and appropriate hardware, as well as other emerging technologies.
- Be reflected in the “instructional strategies” generally developed at the school division level.

In most cases, the application of technology in science should remain “transparent” unless it is the actual focus of the instruction. One must expect students to “do as a scientist does” and not simply hear about science if they are truly expected to explore, explain, and apply scientific concepts, skills, and processes.

As computer/technology skills are essential components of every student's education, it is important that teaching these skills is a shared responsibility of teachers of all disciplines and grade levels.

Investigate and Understand

Many of the standards in the *Science Standards of Learning* begin with the phrase “Students will investigate and understand.” This phrase was chosen to communicate the range of rigorous science skills and knowledge levels embedded in each standard. Limiting a standard to one observable behavior, such as “describe” or “explain,” would have narrowed the interpretation of what was intended to be a rich, highly rigorous, and inclusive content standard.

“Investigate” refers to scientific methodology and implies systematic use of the following inquiry skills:

- observing;
- classifying and sequencing;
- communicating;
- measuring;
- predicting;
- hypothesizing;

- inferring;
- defining, controlling, and manipulating variables in experimentation;
- designing, constructing, and interpreting models; and
- interpreting, analyzing, and evaluating data.

“Understand” refers to various levels of knowledge application. In the *Science Standards of Learning*, these knowledge levels include the ability to:

- recall or recognize important information, key definitions, terminology, and facts;
- explain the information in one’s own words, comprehend how the information is related to other key facts, and suggest additional interpretations of its meaning or importance;
- apply the facts and principles to new problems or situations, recognizing what information is required for a particular situation, using the information to explain new phenomena, and determining when there are exceptions;
- analyze the underlying details of important facts and principles, recognizing the key relations and patterns that are not always readily visible;
- arrange and combine important facts, principles, and other information to produce a new idea, plan, procedure, or product; and
- make judgments about information in terms of its accuracy, precision, consistency, or effectiveness.

Therefore, the use of “investigate and understand” allows each content standard to become the basis for a broad range of teaching objectives, which the school division will develop and refine to meet the intent of the *Science Standards of Learning*.

Application

Science provides the key to understanding the natural world. The application of science to relevant topics provides a context for students to build their knowledge and make connections across content and subject areas. This includes applications of science among technology, engineering, and mathematics, as well as within other science disciplines. Various strategies can be used to facilitate these applications and to promote a better understanding of the interrelated nature of these four areas.

Grade Three

The third-grade standards place increasing emphasis on conducting investigations. Students are expected to be able to develop questions, formulate simple hypotheses, make predictions, gather data, and use the metric system with greater precision. Using information to make inferences and draw conclusions becomes more important. In the area of physical science, the standards focus on simple and compound machines, energy, and a basic understanding of matter. Behavioral and physical adaptations are examined in relation to the life needs of animals. The notion of living systems is further explored in aquatic and terrestrial food chains and diversity in ecosystems. Patterns in the natural world are demonstrated in terms of the phases of the moon, tides, seasonal changes, the water cycle, and animal and plant life cycles. Geological concepts are introduced through the investigation of the components of soil.

Scientific Investigation, Reasoning, and Logic

- 3.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- observations are made and are repeated to ensure accuracy;
 - predictions are formulated using a variety of sources of information;
 - objects with similar characteristics or properties are classified into at least two sets and two subsets;
 - natural events are sequenced chronologically;
 - length, volume, mass, and temperature are estimated and measured in metric and standard English units using proper tools and techniques;
 - time is measured to the nearest minute using proper tools and techniques;
 - questions are developed to formulate hypotheses;
 - data are gathered, charted, graphed, and analyzed;
 - unexpected or unusual quantitative data are recognized;
 - inferences are made and conclusions are drawn;
 - data are communicated;
 - models are designed and built; and
 - current applications are used to reinforce science concepts.

Force, Motion, and Energy

- 3.2 The student will investigate and understand simple machines and their uses. Key concepts include
- purpose and function of simple machines;
 - types of simple machines;
 - compound machines; and
 - examples of simple and compound machines found in the school, home, and work environments.

Matter

- 3.3 The student will investigate and understand that objects are made of materials that can be described by their physical properties. Key concepts include
- objects are made of one or more materials;
 - physical properties remain the same as the material is changed in visible size; and
 - visible physical changes are identified.

Life Processes

- 3.4 The student will investigate and understand that adaptations allow animals to satisfy life needs and respond to the environment. Key concepts include
- a) behavioral adaptations; and
 - b) physical adaptations.

Living Systems

- 3.5 The student will investigate and understand relationships among organisms in aquatic and terrestrial food chains. Key concepts include
- a) producer, consumer, decomposer;
 - b) herbivore, carnivore, omnivore; and
 - c) predator and prey.
- 3.6 The student will investigate and understand that ecosystems support a diversity of plants and animals that share limited resources. Key concepts include
- a) aquatic ecosystems;
 - b) terrestrial ecosystems;
 - c) populations and communities; and
 - d) the human role in conserving limited resources.

Interrelationships in Earth/Space Systems

- 3.7 The student will investigate and understand the major components of soil, its origin, and its importance to plants and animals including humans. Key concepts include
- a) soil provides the support and nutrients necessary for plant growth;
 - b) topsoil is a natural product of subsoil and bedrock;
 - c) rock, clay, silt, sand, and humus are components of soils; and
 - d) soil is a natural resource and should be conserved.

Earth Patterns, Cycles, and Change

- 3.8 The student will investigate and understand basic patterns and cycles occurring in nature. Key concepts include
- a) patterns of natural events such as day and night, seasonal changes, simple phases of the moon, and tides;
 - b) animal life cycles; and
 - c) plant life cycles.
- 3.9 The student will investigate and understand the water cycle and its relationship to life on Earth. Key concepts include
- a) there are many sources of water on Earth;
 - b) the energy from the sun drives the water cycle;
 - c) the water cycle involves several processes;
 - d) water is essential for living things; and
 - e) water on Earth is limited and needs to be conserved.

Earth Resources

- 3.10 The student will investigate and understand that natural events and human influences can affect the survival of species. Key concepts include
- a) the interdependency of plants and animals;
 - b) the effects of human activity on the quality of air, water, and habitat;
 - c) the effects of fire, flood, disease, and erosion on organisms; and
 - d) conservation and resource renewal.
- 3.11 The student will investigate and understand different sources of energy. Key concepts include
- a) energy from the sun;
 - b) sources of renewable energy; and
 - c) sources of nonrenewable energy.