

Virginia

Standards of Learning Assessments

Blueprint

Grade 8

Science Test

for the

2003 Science Standards of Learning

The revised blueprint will be effective with the 2007-2008 administration of the Standards of Learning Tests.

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Grade 8 Science Blueprint

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Standards of Learning (SOL) Test Blueprint

Introduction

What is a test blueprint?

A test blueprint is a guide for test construction and use. The Standards of Learning (SOL) test blueprints serve a number of purposes. They serve as a guide to test developers as they write test questions and construct the SOL tests. These blueprints also serve as a guide to educators, parents, and students in that they show:

- (a) the SOL covered by the test and which, if any, have been excluded;
- (b) which SOL are assigned to each reporting category;
- (c) the number of test items in each reporting category and on the total test;
- (d) general information about how the test questions were constructed; and
- (e) the materials that students are allowed to use while taking the test.

How is the test blueprint organized?

The blueprint contains the following information:

1. **Test Development Guidelines**: guidelines used by the testing contractor and the members of the Content Committees in developing the SOL tests. This section contains two parts:
 - A. **General Considerations** — lists general considerations that were used in developing the test as well as considerations specific to a particular content area.
 - B. **Ancillary Materials** — lists any materials that students are allowed to use while taking the test.
2. **Blueprint Summary Table**: a summary of the blueprint which displays the following information:
 - reporting categories for the test;
 - Standards of Learning (SOL) included in each reporting category; SOL are identified by numbers and letters that correspond to the original SOL document;
 - number of test items in each reporting category;
 - total number of operational items on the test;
 - total number of field items on the test;
 - total number of items (operational and field test items) on the test; and
 - SOL which are excluded from the SOL test.
3. **Expanded Blueprint**: provides the same information as the **Blueprint Summary Table** except that the full text of each SOL is included.

What is a reporting category?

Each test accesses a number of SOL. In the test blueprint SOL are grouped into categories that represent related content or skills. These categories are labeled *Reporting Categories*. For example, a reporting category for the Grade 8 Science test is “Force, Motion, Energy, and Matter.” Each of the SOL in this reporting category addresses a skill involved in investigating or understanding the concepts of force, motion, energy, or matter. When the results of the SOL tests are reported, the scores will be presented in terms of scores for each reporting category and a total test score.

Are some SOL assigned to more than one reporting category?

Letters under a particular SOL are sometimes coded to different reporting categories. For example, the SOL LS.14a which deals with relationships of mutation, adaptation, etc. is assigned to the reporting category “Life Systems.” However, SOL LS.14b which deals evidence of evolution in fossil records is assigned to the reporting category “Earth and Space Systems.” Each lettered SOL is assigned to only one reporting category.

Will all SOL listed in the blueprint be assessed each time the SOL tests are given?

Each SOL will not be assessed on every SOL test form. To keep the length of a test reasonable, the test will measure a selection of the SOL within a reporting category. However, every SOL that is not excluded in the blueprint is eligible for inclusion on each form of an SOL test. Over time all SOL in a reporting category will be assessed.

Grade 8 Science Test Development Guidelines

A. General Considerations

1. All items included in this test will address the knowledge and skills specified in the 2003 Virginia Standards of Learning in Science for grades 6-8.
2. Items will be examined for any content or context that stereotypes, offends, or unfairly penalizes students based on age, gender, economic status, race, ethnicity, religion, or geographic region.
3. The test will be untimed.
4. There is no penalty for guessing. Students will be scored on the number of correct answers out of the total number of operational items on the test.
5. The questions will be appropriate in terms of understandings and experiences that accompany an active science program.
6. Information will be presented through written text or through visual materials such as graphs, tables, models, or other illustrations.
7. Questions will require students to apply previously acquired knowledge and/or to use information that is provided in the question itself.
8. Measurements will be given in SI (metric), or English units where appropriate.
9. Students are permitted to use 4-function or scientific calculators during the test.
10. Students will be permitted to use standard (e.g., inches) and metric rulers during the test.
11. Students will be permitted scratch paper at any time during the test.

B. Ancillary Materials

Refer to the current examiner's manual or the Department of Education's Web site for ancillary materials that may be used.

Grade Eight Science Test Blueprint Summary Table

Reporting Categories	Number of Items	Grade Six SOL	Life Science SOL	Physical Science SOL
Scientific Investigation	10	6.1a-k	LS.1a-j	PS.1a-n
Force, Motion, Energy, and Matter	15	6.2a, e 6.4a-g 6.5a, b 6.6a		PS.2a-f PS.3 a, b PS.4a-c PS.5a-c PS.6a-c PS.7a-d PS.8a-d PS.9a-c PS.10a-d PS.11a-c
Life Systems*	7		LS.2a-d LS.3a, b LS.4a-c LS.5a-c LS.6a-c LS.13a-g LS.14a	
Ecosystems	7	6.7a-g	LS.7a-d LS.8a, b LS.9a-e LS.10a-c LS.11a-c LS.12a-e	
Earth and Space Systems*	11	6.2b-d 6.3a-e 6.5c-g 6.6b-g 6.8a-i 6.9a-d	LS.14b, c	
SOL Excluded From This Test		None		
Total Number of Operational Items	50			
Field Test Items**	10			
Total Number of Items	60			

*Standards from the Resources strand are incorporated in this Reporting Category.

**These field test items will *not* be used to compute students' scores on the test.

Expanded Blueprint

Reporting Category: Scientific Investigation Number of Items: 10

Grade Six SOL in This Reporting Category:

- 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.

Life Science SOL in This Reporting Category:

- LS.1 The student will plan and conduct investigations in which
- data are organized into tables showing repeated trials and means;
 - variables are defined;
 - metric units (SI—International System of Units) are used;
 - models are constructed to illustrate and explain phenomena;
 - sources of experimental error are identified;
 - dependent variables, independent variables, and constants are identified;
 - variables are controlled to test hypotheses, and trials are repeated;
 - continuous line graphs are constructed, interpreted, and used to make predictions;
 - interpretations from a set of data are evaluated and defended; and
 - an understanding of the nature of science is developed and reinforced.

Physical Science SOL in This Reporting Category:

- PS.1 The student will plan and conduct investigations in which
- chemicals and equipment are used safely;
 - length, mass, volume, density, temperature, weight, and force are accurately measured and reported using metric units (SI—International System of Units);

- c) conversions are made among metric units, applying appropriate prefixes;
- d) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and spring scales are used to gather data;
- e) numbers are expressed in scientific notation where appropriate;
- f) research skills are utilized using a variety of resources;
- g) independent and dependent variables, constants, controls, and repeated trials are identified;
- h) data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted;
- i) data tables for descriptive statistics showing specific measures of central tendency, the range of the data set, and the number of repeated trials are constructed and interpreted;
- j) frequency distributions, scattergrams, line plots, and histograms are constructed and interpreted;
- k) valid conclusions are made after analyzing data;
- l) research methods are used to investigate practical problems and questions;
- m) experimental results are presented in appropriate written form; and
- n) an understanding of the nature of science is developed and reinforced.

Reporting Category: Force, Motion, Energy, and Matter
Number of Items: 15

Grade 6 SOL in This Reporting Category

- 6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include
- a) potential and kinetic energy; and
 - e) energy transformations (heat/light to mechanical, chemical, and electrical energy).
- 6.4 The student will investigate and understand that all matter is made up of atoms. Key concepts include
- a) atoms are made up of electrons, protons, and neutrons;
 - b) atoms of any element are alike but are different from atoms of other elements;
 - c) elements may be represented by chemical symbols;
 - d) two or more atoms may be chemically combined;
 - e) compounds may be represented by chemical formulas;
 - f) chemical equations can be used to model chemical changes; and
 - g) 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
- a) water as the universal solvent;
 - b) the properties of water in all three states;

- 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;

Physical Science SOL in This Reporting Category

- PS.2 The student will investigate and understand the basic nature of matter. Key concepts include
- the particle theory of matter;
 - elements, compounds, mixtures, acids, bases, and salts;
 - solids, liquids, and gases;
 - characteristics of types of matter based on physical and chemical properties;
 - physical properties (shape, density, solubility, odor, melting point, boiling point, color); and
 - chemical properties (acidity, basicity, combustibility, reactivity).
- PS.3 The student will investigate and understand the modern and historical models of atomic structure. Key concepts include
- the contributions of Dalton, Thomson, Rutherford, and Bohr in understanding the atom; and
 - the modern model of atomic structure.
- PS.4 The student will investigate and understand the organization and use of the periodic table of elements to obtain information. Key concepts include
- symbols, atomic number, atomic mass, chemical families (groups), and periods;
 - classification of elements as metals, metalloids, and nonmetals; and
 - simple compounds (formulas and the nature of bonding).
- PS.5 The student will investigate and understand changes in matter and the relationship of these changes to the Law of Conservation of Matter and Energy. Key concepts include
- physical changes;
 - nuclear reactions (products of fusion and fission and the effect of these products on humans and the environment); and
 - chemical changes (types of reactions, reactants, and products; and balanced equations).
- PS.6 The student will investigate and understand states and forms of energy and how energy is transferred and transformed. Key concepts include
- potential and kinetic energy;
 - mechanical, chemical, and electrical energy; and
 - heat, light, and sound.
- PS.7 The student will investigate and understand temperature scales, heat, and heat transfer. Key concepts include
- Celsius and Kelvin temperature scales and absolute zero;

- b) phase change, freezing point, melting point, boiling point, vaporization, and condensation;
 - c) conduction, convection, and radiation; and
 - d) applications of heat transfer (heat engines, thermostats, refrigeration, and heat pumps).
- PS.8 The student will investigate and understand characteristics of sound and technological applications of sound waves. Key concepts include
- a) wavelength, frequency, speed, and amplitude;
 - b) resonance;
 - c) the nature of mechanical waves; and
 - d) technological applications of sound.
- PS.9 The student will investigate and understand the nature and technological applications of light. Key concepts include
- a) the wave behavior of light (reflection, refraction, diffraction, and interference);
 - b) images formed by lenses and mirrors; and
 - c) the electromagnetic spectrum.
- PS.10 The student will investigate and understand scientific principles and technological applications of work, force, and motion. Key concepts include
- a) speed, velocity, and acceleration;
 - b) Newton’s laws of motion;
 - c) work, force, mechanical advantage, efficiency, and power; and
 - d) applications (simple machines, compound machines, powered vehicles, rockets, and restraining devices).
- PS.11 The student will investigate and understand basic principles of electricity and magnetism. Key concepts include
- a) static electricity, current electricity, and circuits;
 - b) magnetic fields and electromagnets; and
 - c) motors and generators.

<p>Reporting Category: Life Systems (Standards from the Resources strand are incorporated in this Reporting Category.)</p> <p>Number of Items: 7</p>
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Life Science SOL in This Reporting Category:

- LS.2 The student will investigate and understand that all living things are composed of cells. Key concepts include
- a) cell structure and organelles (cell membrane, cell wall, cytoplasm, vacuole, mitochondrion, endoplasmic reticulum, nucleus, and chloroplast);
 - b) similarities and differences between plant and animal cells;
 - c) development of cell theory; and

- d) cell division (mitosis and meiosis).
- LS.3 The student will investigate and understand that living things show patterns of cellular organization. Key concepts include
- a) cells, tissues, organs, and systems; and
 - b) life functions and processes of cells, tissues, organs, and systems (respiration, removal of wastes, growth, reproduction, digestion, and cellular transport).
- LS.4 The student will investigate and understand that the basic needs of organisms must be met in order to carry out life processes. Key concepts include
- a) plant needs (light, water, gases, and nutrients);
 - b) animal needs (food, water, gases, shelter, space); and
 - c) factors that influence life processes.
- LS.5 The student will investigate and understand how organisms can be classified. Key concepts include
- a) the distinguishing characteristics of kingdoms of organisms;
 - b) the distinguishing characteristics of major animal and plant phyla; and
 - c) the characteristics of the species.
- LS.6 The student will investigate and understand the basic physical and chemical processes of photosynthesis and its importance to plant and animal life. Key concepts include
- a) energy transfer between sunlight and chlorophyll;
 - b) transformation of water and carbon dioxide into sugar and oxygen; and
 - c) photosynthesis as the foundation of virtually all food webs.
- LS.13 The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key concepts include
- a) the role of DNA;
 - b) the function of genes and chromosomes;
 - c) genotypes and phenotypes;
 - d) factors affecting the expression of traits;
 - e) characteristics that can and cannot be inherited;
 - f) genetic engineering and its applications; and
 - g) historical contributions and significance of discoveries related to genetics.
- LS.14 The student will investigate and understand that organisms change over time. Key concepts include
- a) the relationships of mutation, adaptation, natural selection, and extinction.

Reporting Category: Ecosystems

Number of Items: 7

Grade 6 SOL in This Reporting Category

- 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.
- LS.7 The student will investigate and understand that organisms within an ecosystem are dependent on one another and on nonliving components of the environment. Key concepts include
- a) the carbon, water, and nitrogen cycles;
 - b) interactions resulting in a flow of energy and matter throughout the system;
 - c) complex relationships within terrestrial, freshwater, and marine ecosystems; and
 - d) energy flow in food webs and energy pyramids.
- LS.8 The student will investigate and understand that interactions exist among members of a population. Key concepts include
- a) competition, cooperation, social hierarchy, territorial imperative; and
 - b) influence of behavior on a population.
- LS.9 The student will investigate and understand interactions among populations in a biological community. Key concepts include
- a) the relationships among producers, consumers, and decomposers in food webs;
 - b) the relationship between predators and prey;
 - c) competition and cooperation;
 - d) symbiotic relationships; and
 - e) niches.
- LS.10 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include
- a) differences between ecosystems and biomes;
 - b) characteristics of land, marine, and freshwater ecosystems; and
 - c) adaptations that enable organisms to survive within a specific ecosystem.
- LS.11 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time (daily, seasonal, and long term). Key concepts include

- a) phototropism, hibernation, and dormancy;
- b) factors that increase or decrease population size; and
- c) eutrophication, climate changes, and catastrophic disturbances.

LS.12 The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include

- a) food production and harvest;
- b) change in habitat size, quality, or structure;
- c) change in species competition;
- d) population disturbances and factors that threaten or enhance species survival.
- e) environmental issues (water supply, air quality, energy production, and waste management).

Reporting Category: Earth and Space Systems (Standards from the Resources strand are incorporated in this Reporting Category.)

Number of Items: 11

Grade 6 SOL in This Reporting Category

6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include

- b) the role of the sun in the formation of most energy sources on Earth;
- c) nonrenewable energy sources (fossil fuels including petroleum, natural gas, and coal);
- d) renewable energy sources (wood, wind, hydro, geothermal, tidal, and solar).

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

- a) the Earth's energy budget;
- b) the role of radiation and convection in the distribution of energy;
- c) the motion of the atmosphere and the oceans;
- d) cloud formation; and
- e) the role of heat energy in weather-related phenomena including thunderstorms and hurricanes.

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

- c) the action of water in physical and chemical weathering;
- d) the ability of large bodies of water to store heat and moderate climate;
- e) the origin and occurrence of water on Earth;
- f) the importance of water for agriculture, power generation, and public health; and
- g) 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

- b) air pressure, temperature, and humidity;
- c) how the atmosphere changes with altitude;
- d) natural and human-caused changes to the atmosphere;
- e) the relationship of atmospheric measures and weather conditions;
- f) basic information from weather maps including fronts, systems, and basic measurements; and the importance of protecting and maintaining air quality.
- g) the importance of protecting and maintaining water resources.

Reporting Category: Earth and Space Systems (Standards from the Resources strand are incorporated in this Reporting Category.)

Number of Items: 11

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.

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.

Life Science SOL in This Reporting Category

LS.14 The student will investigate and understand that organisms change over time. Key concepts include

- b) evidence of evolution of different species in the fossil record; and
- c) how environmental influences, as well as genetic variation, can lead to diversity of organisms.