

Virginia

Standards of Learning Assessments

Test Blueprint

Grade 8 Science

**2010 Science
Standards of Learning**

This revised test blueprint will be effective with the administration of the 2012-2013 Science Standards of Learning (SOL) tests.

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Grade 8 Science Standards of Learning

Test Blueprint

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General Test Information

Test Blueprint

Much like the blueprint for a building, a test blueprint serves as a guide for test construction. The blueprint indicates the content areas that will be addressed by the test and the number of items that will be included by content area and for the test as a whole. There is a blueprint for each test (e.g., grade 3 reading, grade 5 mathematics, grade 8 science, Virginia and United States History).

Reporting Categories

Each test covers a number of Standards of Learning (SOL). In the test blueprint, the SOL are grouped into categories that address related content and skills. These categories are labeled as reporting categories. For example, a reporting category for the Grade 8 Science Standards of Learning 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 for each reporting category and as a total test score.

Assignment of Standards of Learning to Reporting Category

Different parts of a Standard of Learning may be assigned to different reporting categories. For example, Grade 6 Science SOL 6.2a, which covers potential and kinetic energy, is assigned to the reporting category *Force, Motion, Energy, and Matter* in the Grade 8 Science SOL test. However, 6.2b, which involves the role of the sun in the formation of most energy sources on Earth, is assigned to the reporting category *Earth and Space Systems*.

Standards of Learning Excluded from Testing

In some content areas, there are SOL that do not lend themselves to assessment within the current format of the SOL tests. The SOL not tested are listed as “Excluded from Testing” at the end of the blueprint for each test. In Grade 8 Science there are no SOL that are excluded within the current format of the SOL tests.

Coverage of Standards of Learning

Due to the large number of SOL in each grade level content area, *every* Standard of Learning will not be assessed on every version (form) of an SOL test. By necessity, to keep the length of a test reasonable, each version will sample from the SOL within a reporting category. All SOL in the blueprint will be tested within a three year period, and *all of these* SOL are eligible for inclusion on each version of an SOL test.

Use of the Curriculum Framework

The Grade 8 Science Standards of Learning, amplified by the Curriculum Framework, define the essential understandings, knowledge, and skills that are measured by the Standards of Learning tests. The Curriculum Framework enhances understanding of the SOL, defines essential content knowledge, and describes essential skills and processes students need to master.

**Grade 8 Science
Test Blueprint Summary Table**

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

*Field test items are being tried out with students for potential use on subsequent tests and will not be used to compute students' scores on the test.

This revised test blueprint will be effective with the administration of the 2012-2013 Science Standards of Learning tests.

Grade 8 Science Expanded Test Blueprint

Assessed with Other Science Standards of Learning

The following skill-based standards will be assessed through the reporting categories by applying them to other Standards of Learning content:

Grade 6 Standards of Learning

- 6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- j) current applications are used to reinforce science concepts.

Life Science Standards of Learning

- LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- j) current applications are used to reinforce life science concepts.

Physical Science Standards of Learning

- PS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- n) current applications of physical science concepts are used.

Reporting Category: Scientific Investigation

Number of Items: 10

Standards of Learning:

Grade 6 Standards of Learning

- 6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- a) observations are made involving fine discrimination between similar objects and organisms;
 - b) precise and approximate measurements are recorded;
 - c) scale models are used to estimate distance, volume, and quantity;
 - d) hypotheses are stated in ways that identify the independent and dependent variables;
 - e) a method is devised to test the validity of predictions and inferences;
 - f) one variable is manipulated over time, using many repeated trials;
 - g) data are collected, recorded, analyzed, and reported using metric measurements and tools;
 - h) data are analyzed and communicated through graphical representation; and

- i) models and simulations are designed and used to illustrate and explain phenomena and systems.

Life Science Standards of Learning

- LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- a) data are organized into tables showing repeated trials and means;
 - b) a classification system is developed based on multiple attributes;
 - c) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and probeware are used to gather data;
 - d) models and simulations are constructed and used to illustrate and explain phenomena;
 - e) sources of experimental error are identified;
 - f) dependent variables, independent variables, and constants are identified;
 - g) variables are controlled to test hypotheses, and trials are repeated;
 - h) data are organized, communicated through graphical representation, interpreted, and used to make predictions; and
 - i) patterns are identified in data and are interpreted and evaluated.

Physical Science Standards of Learning

- PS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- a) chemicals and equipment are used safely;
 - b) length, mass, volume, density, temperature, weight, and force are accurately measured;
 - c) conversions are made among metric units, applying appropriate prefixes;
 - d) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, probeware, and spring scales are used to gather data;
 - e) numbers are expressed in scientific notation where appropriate;
 - f) independent and dependent variables, constants, controls, and repeated trials are identified;
 - g) data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted;
 - h) 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;
 - i) frequency distributions, scatterplots, line plots, and histograms are constructed and interpreted;
 - j) valid conclusions are made after analyzing data;
 - k) research methods are used to investigate practical problems and questions;
 - l) experimental results are presented in appropriate written form; and

- m) models and simulations are constructed and used to illustrate and explain phenomena.

Reporting Category: Force, Motion, Energy, and Matter**Number of Items: 15****Standards of Learning:**Grade 6 Standards of Learning

- 6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include
- potential and kinetic energy; and
 - energy transformations.
- 6.4 The student will investigate and understand that all matter is made up of atoms. Key concepts include
- atoms consist of particles, including electrons, protons, and neutrons;
 - atoms of a particular element are alike but are different from atoms of other elements;
 - elements may be represented by chemical symbols;
 - two or more atoms interact to form new substances, which are held together by electrical forces (bonds);
 - 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; and
 - the properties of water in all three phases.
- 6.6 The student will investigate and understand the properties of air and the structure and dynamics of Earth's atmosphere. Key concepts include
- air as a mixture of gaseous elements and compounds.

Physical Science Standards of Learning

- PS.2 The student will investigate and understand the nature of matter. Key concepts include
- the particle theory of matter;
 - elements, compounds, mixtures, acids, bases, and salts;
 - solids, liquids, and gases;
 - physical properties;
 - chemical properties; and

- f) characteristics of types of matter based on physical and chemical properties.
- 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 numbers, atomic mass, chemical families (groups), and periods;
 - classification of elements as metals, metalloids, and nonmetals; and
 - formation of compounds through ionic and covalent 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;
 - chemical changes; and
 - nuclear reactions.
- PS.6 The student will investigate and understand forms of energy and how energy is transferred and transformed. Key concepts include
- potential and kinetic energy; and
 - mechanical, chemical, electrical, thermal, radiant, and nuclear energy.
- PS.7 The student will investigate and understand temperature scales, heat, and thermal energy transfer. Key concepts include
- Celsius and Kelvin temperature scales and absolute zero;
 - phase change, freezing point, melting point, boiling point, vaporization, and condensation;
 - conduction, convection, and radiation; and
 - applications of thermal energy transfer.
- PS.8 The student will investigate and understand the characteristics of sound waves. Key concepts include
- wavelength, frequency, speed, amplitude, rarefaction, and compression;
 - resonance;
 - the nature of compression waves; and
 - technological applications of sound.
- PS.9 The student will investigate and understand the characteristics of transverse waves. Key concepts include
- wavelength, frequency, speed, amplitude, crest, and trough;
 - the wave behavior of light;

- c) images formed by lenses and mirrors;
 - d) the electromagnetic spectrum; and
 - e) technological applications of light.
- PS.10 The student will investigate and understand the scientific principles 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) technological applications of work, force, and motion.
- 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) relationship between a magnetic field and an electric current;
 - c) electromagnets, motors, and generators and their uses; and
 - d) conductors, semiconductors, and insulators.

Reporting Category: Life Systems

Number of Items: 7

Standards of Learning:

Life Science Standards of Learning

- LS.2 The student will investigate and understand that all living things are composed of cells. Key concepts include
- a) cell structure and organelles;
 - b) similarities and differences between plant and animal cells;
 - c) development of cell theory; and
 - d) cell division.
- 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) patterns of cellular organization and their relationship to life processes in living things.
- LS.4 The student will investigate and understand how organisms can be classified. Key concepts include
- a) the distinguishing characteristics of domains of organisms;
 - b) the distinguishing characteristics of kingdoms of organisms;
 - c) the distinguishing characteristics of major animal phyla and plant divisions; and
 - d) the characteristics that define a species.

- LS.5 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
- energy transfer between sunlight and chlorophyll;
 - transformation of water and carbon dioxide into sugar and oxygen; and
 - photosynthesis as the foundation of virtually all food webs.
- LS.12 The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key concepts include
- the structure and role of DNA;
 - the function of genes and chromosomes;
 - genotypes and phenotypes;
 - characteristics that can and cannot be inherited;
 - genetic engineering and its applications; and
 - historical contributions and significance of discoveries related to genetics.
- LS.13 The student will investigate and understand that populations of organisms change over time. Key concepts include
- the relationships of mutation, adaptation, natural selection, and extinction.

Reporting Category: Ecosystems**Number of Items: 7****Standards of Learning:****Grade 6 Standards of Learning**

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

Life Science Standards of Learning

- LS.6 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
- the carbon, water, and nitrogen cycles;
 - interactions resulting in a flow of energy and matter throughout the system;
 - complex relationships within terrestrial, freshwater, and marine ecosystems; and

- d) energy flow in food webs and energy pyramids.
- LS.7 The student will investigate and understand that interactions exist among members of a population. Key concepts include
- competition, cooperation, social hierarchy, territorial imperative; and
 - influence of behavior on a population.
- LS.8 The student will investigate and understand interactions among populations in a biological community. Key concepts include
- the relationships among producers, consumers, and decomposers in food webs;
 - the relationship between predators and prey;
 - competition and cooperation;
 - symbiotic relationships; and
 - niches.
- LS.9 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include
- differences between ecosystems and biomes;
 - characteristics of land, marine, and freshwater ecosystems; and
 - adaptations that enable organisms to survive within a specific ecosystem.
- LS.10 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic, change over time, and respond to daily, seasonal, and long-term changes in their environment. Key concepts include
- phototropism, hibernation, and dormancy;
 - factors that increase or decrease population size; and
 - eutrophication, climate changes, and catastrophic disturbances.
- LS.11 The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include
- food production and harvest;
 - change in habitat size, quality, or structure;
 - change in species competition;
 - population disturbances and factors that threaten or enhance species survival; and
 - environmental issues.

Reporting Category: Earth and Space Systems**Number of Items: 11****Standards of Learning:**Grade 6 Standards of Learning

- 6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include
- the role of the sun in the formation of most energy sources on Earth;

- c) nonrenewable energy sources; and
 - d) renewable energy sources.
- 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 Earth's surface. Key concepts include
- a) 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 thermal 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 thermal energy and moderate climate;
 - e) the importance of water for agriculture, power generation, and public health; and
 - f) 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 Earth's atmosphere. Key concepts include
- b) pressure, temperature, and humidity;
 - c) atmospheric changes with altitude;
 - d) natural and human-caused changes to the atmosphere and the importance of protecting and maintaining air quality;
 - e) the relationship of atmospheric measures and weather conditions; and
 - f) basic information from weather maps including fronts, systems, and basic measurements.
- 6.8 The student will investigate and understand the organization of the solar system and the interactions among the various bodies that comprise it. Key concepts include
- a) the sun, moon, Earth, other planets and their moons, dwarf planets, 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 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;
 - b) management of nonrenewable resources;
 - c) the mitigation of land-use and environmental hazards through preventive measures; and
 - d) cost/benefit tradeoffs in conservation policies.

Life Science Standards of Learning

- LS.13 The student will investigate and understand that populations of 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.