

Virginia

Standards of Learning Assessments

Test Blueprint
Grade 8 Science
2018 Science
Standards of Learning

This test blueprint will be effective with the administration of the spring 2023 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 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 6.4a, the sun is important in the formation of most energy sources on Earth, is assigned to the reporting category *Earth and Space Systems* in the Grade 8 Science SOL test. However, 6.4c, radiation, conduction, and convection distribute energy, is assigned to the reporting category *Force, Motion, Energy, and Matter*.


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. Every 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 6, Life Science, and Physical Science Standards of Learning, amplified by the Curriculum Frameworks, define the essential understandings, knowledge, and skills that are measured by the Standards of Learning tests. The Curriculum Frameworks identify essential understandings, define essential content knowledge, and describe essential skills 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
Force, Motion, Energy, and Matter	6.4 c, d 6.5 a-g 6.6 a-f		PS.2 a-c PS.3 a-d PS.4 a-b PS.5 a-c PS.6 a-d PS.7 a-b PS.8 a-b PS.9 a-f	19
Living Systems and Ecosystems	6.8 a-d	LS.2 a-e LS.3 a-c LS.4 a-b LS.5 a-c LS.6 a-d LS.7 a-b LS.8 a-c LS.9 a-c LS.10 a-c LS.11 a-c		15
Earth and Space Systems	6.2 a-d 6.3 a-e 6.4 a, b 6.7 a-f 6.9 a-f			11
Number of Operational Items				45
Number of Field-Test Items*				10
Total Number of Items on Test				55

 The Scientific and Engineering Practices are embedded into test items to varying degrees.

*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.

Grade 8 Science Expanded Test Blueprint

Scientific and Engineering Practices

- 6.1 The student will demonstrate an understanding of scientific and engineering practices by
- a) asking questions and defining problems
 - ask questions to determine relationships between independent and dependent variables
 - develop hypotheses and identify independent and dependent variables
 - offer simple solutions to design problems
 - b) planning and carrying out investigations
 - independently and collaboratively plan and conduct observational and experimental investigations; identify variables, constants, and controls where appropriate, and include the safe use of chemicals and equipment
 - evaluate the accuracy of various methods for collecting data
 - take metric measurements using appropriate tools
 - use tools and materials to design and/or build a device to solve a specific problem
 - c) interpreting, analyzing, and evaluating data
 - organize data sets to reveal patterns that suggest relationships
 - construct, analyze, and interpret graphical displays of data
 - compare and contrast data collected by different groups and discuss similarities and differences in findings
 - use data to evaluate and refine design solutions
 - d) constructing and critiquing conclusions and explanations
 - construct explanations that include qualitative or quantitative relationships between variables
 - construct scientific explanations based on valid and reliable evidence obtained from sources (including the students' investigations)
 - generate and compare multiple solutions to problems based on how well they meet the criteria and constraints
 - e) developing and using models
 - use scale models to represent and estimate distance
 - use, develop, and revise models to predict and explain phenomena
 - evaluate limitations of models
 - f) obtaining, evaluating, and communicating information
 - read scientific texts, including those adapted for classroom use, to obtain scientific and/or technical information
 - gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication
 - construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning

- LS.1 The student will demonstrate an understanding of scientific and engineering practices by
- a) asking questions and defining problems
 - ask questions and develop hypotheses to determine relationships between independent and dependent variables
 - offer simple solutions to design problems
 - b) planning and carrying out investigations
 - independently and collaboratively plan and conduct observational and experimental investigations; identify variables, constants, and controls where appropriate and include the safe use of chemicals and equipment
 - evaluate the accuracy of various methods for collecting data
 - take metric measurements using appropriate tools and technologies including the use of microscopes
 - c) interpreting, analyzing, and evaluating data
 - identify, interpret, and evaluate patterns in data
 - construct, analyze, and interpret graphical displays of data
 - compare and contrast data collected by different groups and discuss similarities and differences in their findings
 - consider limitations of data analysis and/or seek to improve precision and accuracy of data
 - use data to evaluate and refine design solutions
 - d) constructing and critiquing conclusions and explanations
 - construct explanations that include qualitative or quantitative relationships between variables
 - construct scientific explanations based on valid and reliable evidence obtained from sources (including the students' investigations)
 - differentiate between a scientific hypothesis and theory
 - e) developing and using models
 - construct and use models and simulations to illustrate, predict, and/or explain observable and unobservable phenomena, life processes, or mechanisms
 - evaluate limitations of models
 - f) obtaining, evaluating, and communicating information
 - read scientific texts, including those adapted for classroom use, to obtain scientific and/or technical information
 - gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication
 - construct, use, and/or present an argument supported by empirical evidence and scientific reasoning
- PS.1 The student will demonstrate an understanding of scientific and engineering practices by
- a) asking questions and defining problems
 - ask questions that require empirical evidence to answer
 - develop hypotheses indicating relationships between independent and dependent variables
 - offer simple solutions to design problems
 - b) planning and carrying out investigations

This revised test blueprint will be effective beginning with the spring 2023 test administration.

- independently and collaboratively plan and conduct observational and experimental investigations; identify variables, constants, and controls where appropriate and include the safe use of chemicals and equipment
 - evaluate the accuracy of various methods for collecting data
 - take metric measurements using appropriate tools and technologies
 - apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system
- c) interpreting, analyzing, and evaluating data
- construct and interpret data tables showing independent and dependent variables, repeated trials, and means
 - construct, analyze, and interpret graphical displays of data and consider limitations of data analysis
 - apply mathematical concepts and processes to scientific questions
 - use data to evaluate and refine design solutions to best meet criteria
- d) constructing and critiquing conclusions and explanations
- construct scientific explanations based on valid and reliable evidence obtained from sources (including the students' own investigations)
 - construct arguments supported by empirical evidence and scientific reasoning
 - generate and compare multiple solutions to problems based on how well they meet the criteria and constraints
 - differentiate between a scientific hypothesis, theory, and law
- e) developing and using models
- construct, develop, and use models and simulations to illustrate and/or explain observable and unobservable phenomena
 - evaluate limitations of models
- f) obtaining, evaluating, and communicating information
- read scientific texts, including those adapted for classroom use, to determine the central idea and/or obtain scientific and/or technical information
 - gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication
 - construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning

Reporting Category: Force, Motion, Energy, and Matter

Number of Items: 19

Standards of Learning:

- 6.4 The student will investigate and understand that there are basic sources of energy and that energy can be transformed. Key ideas include
- c) radiation, conduction, and convection distribute energy; and
 - d) energy transformations are important in energy usage.
- 6.5 The student will investigate and understand that all matter is composed of atoms. Key ideas include
- a) atoms consist of particles, including electrons, protons, and neutrons;

- b) atoms of a particular element are similar but differ from atoms of other elements;
 - c) elements may be represented by chemical symbols;
 - d) two or more atoms interact to form new substances, which are held together by electrical forces (bonds);
 - e) compounds may be represented by chemical formulas;
 - f) chemical equations can be used to model chemical changes; and
 - g) a few elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere.
- 6.6 The student will investigate and understand that water has unique physical properties and has a role in the natural and human-made environment. Key ideas include
- a) water is referred to as the universal solvent;
 - b) water has specific properties;
 - c) thermal energy has a role in phase changes;
 - d) water has a role in weathering;
 - e) large bodies of water moderate climate; and
 - f) water is important for agriculture, power generation, and public health.
- PS.2 The student will investigate and understand that matter is composed of atoms. Key ideas include
- a) our understanding of atoms has developed over time;
 - b) the periodic table can be used to predict the chemical and physical properties of matter; and
 - c) the kinetic molecular theory is used to predict and explain matter interactions.
- PS.3 The student will investigate and understand that matter has properties and is conserved in chemical and physical processes. Key ideas include
- a) pure substances can be identified based on their chemical and physical properties;
 - b) pure substances can undergo physical and chemical changes that may result in a change of properties;
 - c) compounds form through ionic and covalent bonding; and
 - d) balanced chemical equations model the conservation of matter.
- PS.4 The student will investigate and understand that the periodic table is a model used to organize elements based on their atomic structure. Key uses include
- a) symbols, atomic numbers, atomic mass, chemical groups (families), and periods are identified on the periodic table; and
 - b) elements are classified as metals, metalloids, and nonmetals.
- PS.5 The student will investigate and understand that energy is conserved. Key ideas include
- a) energy can be stored in different ways;
 - b) energy is transferred and transformed; and
 - c) energy can be transformed to meet societal needs.

- PS.6 The student will investigate and understand that waves are important in the movement of energy. Key ideas include
- energy may be transferred in the form of longitudinal and transverse waves;
 - mechanical waves need a medium to transfer energy;
 - waves can interact; and
 - energy associated with waves has many applications.
- PS.7 The student will investigate and understand that electromagnetic radiation has characteristics. Key ideas include
- electromagnetic radiation, including visible light, has wave characteristics and behavior; and
 - regions of the electromagnetic spectrum have specific characteristics and uses.
- PS.8 The student will investigate and understand that work, force, and motion are related. Key ideas include
- motion can be described using position and time; and
 - motion is described by Newton's laws.
- PS.9 The student will investigate and understand that there are basic principles of electricity and magnetism. Key ideas include
- an imbalance of charge generates static electricity;
 - materials have different conductive properties;
 - electric circuits transfer energy;
 - magnetic fields cause the magnetic effects of certain materials;
 - electric current and magnetic fields are related; and
 - many technologies use electricity and magnetism.

Reporting Category: Life Systems and Ecosystems

Number of Items: 15

Standards of Learning:

- 6.8 The student will investigate and understand that land and water have roles in watershed systems. Key ideas include
- a watershed is composed of the land that drains into a body of water;
 - Virginia is composed of multiple watershed systems which have specific features;
 - the Chesapeake Bay is an estuary that has many important functions; and
 - natural processes, human activities, and biotic and abiotic factors influence the health of a watershed system.
- LS.2 The student will investigate and understand that all living things are composed of one or more cells that support life processes, as described by the cell theory. Key ideas include
- the development of the cell theory demonstrates the nature of science;
 - cell structure and organelles support life processes;
 - similarities and differences between plant and animal cells determine how they support life processes;

- d) cell division is the mechanism for growth and reproduction; and
 - e) cellular transport (osmosis and diffusion) is important for life processes.
- LS.3 The student will investigate and understand that there are levels of structural organization in living things. Key ideas include
- a) patterns of cellular organization support life processes;
 - b) unicellular and multicellular organisms have comparative structures; and
 - c) similar characteristics determine the classification of organisms.
- LS.4 The student will investigate and understand that there are chemical processes of energy transfer which are important for life. Key ideas include
- a) photosynthesis is the foundation of virtually all food webs; and
 - b) photosynthesis and cellular respiration support life processes.
- LS.5 The student will investigate and understand that biotic and abiotic factors affect an ecosystem. Key ideas include
- a) matter moves through ecosystems via the carbon, water, and nitrogen cycles;
 - b) energy flow is represented by food webs and energy pyramids; and
 - c) relationships exist among producers, consumers, and decomposers.
- LS.6 The student will investigate and understand that populations in a biological community interact and are interdependent. Key ideas include
- a) relationships exist between predators and prey and these relationships are modeled in food webs;
 - b) the availability and use of resources may lead to competition and cooperation;
 - c) symbiotic relationships support the survival of different species; and
 - d) the niche of each organism supports survival.
- LS.7 The student will investigate and understand that adaptations support an organism's survival in an ecosystem. Key ideas include
- a) biotic and abiotic factors define land, marine, and freshwater ecosystems; and
 - b) physical and behavioral characteristics enable organisms to survive within a specific ecosystem.
- LS.8 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time. Key ideas include
- a) organisms respond to daily, seasonal, and long-term changes;
 - b) changes in the environment may increase or decrease population size; and
 - c) large-scale changes such as eutrophication, climate changes, and catastrophic disturbances affect ecosystems.
- LS.9 The student will investigate and understand that relationships exist between ecosystem dynamics and human activity. Key ideas include
- a) changes in habitat can disturb populations;
 - b) disruptions in ecosystems can change species competition; and
 - c) variations in biotic and abiotic factors can change ecosystems.

- LS.10 The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key ideas include
- DNA has a role in making proteins that determine organism traits;
 - the role of meiosis is to transfer traits to the next generation; and
 - Punnett squares are mathematical models used to predict the probability of traits in offspring.
- LS.11 The student will investigate and understand that populations of organisms can change over time. Key ideas include
- mutation, adaptation, natural selection, and extinction change populations;
 - the fossil record, genetic information, and anatomical comparisons provide evidence for evolution; and
 - environmental factors and genetic variation, influence survivability and diversity of organisms..

Reporting Category: Earth and Space Systems

Number of Items: 11

Standards of Learning:

- 6.2 The student will investigate and understand that the solar system is organized and the various bodies in the solar system interact. Key ideas include
- matter is distributed throughout the solar system;
 - planets have different sizes and orbit at different distances from the sun;
 - gravity contributes to orbital motion; and
 - the understanding of the solar system has developed over time.
- 6.3 The student will investigate and understand that there is a relationship between the sun, Earth, and the moon. Key ideas include
- Earth has unique properties;
 - the rotation of Earth in relationship to the sun causes day and night;
 - the movement of Earth and the moon in relationship to the sun causes phases of the moon;
 - Earth's tilt as it revolves around the sun causes the seasons; and
 - the relationship between Earth and the moon is the primary cause of tides.
- 6.4 The student will investigate and understand that there are basic sources of energy and that energy can be transformed. Key ideas include
- the sun is important in the formation of most energy sources on Earth; and
 - Earth's energy budget relates to living systems and Earth's processes.
- 6.7 The student will investigate and understand that air has properties and that Earth's atmosphere has structure and is dynamic. Key ideas include
- air is a mixture of gaseous elements and compounds;
 - the atmosphere has physical characteristics;
 - properties of the atmosphere change with altitude;

- d) there is a relationship between air movement, thermal energy, and weather conditions;
- e) atmospheric measures are used to predict weather conditions; and
- f) weather maps give basic information about fronts, systems, and weather measurements.

6.9 The student will investigate and understand that humans impact the environment and individuals can influence public policy decisions related to energy and the environment. Key ideas include

- a) natural resources are important to protect and maintain;
- b) renewable and nonrenewable resources can be managed;
- c) major health and safety issues are associated with air and water quality;
- d) major health and safety issues are related to different forms of energy;
- e) preventive measures can protect land-use and reduce environmental hazards; and
- f) there are cost/benefit tradeoffs in conservation policies.