

Life Science & Biology SOL

THE SOL FOR GRADE 6

SOL 6.7, in the Living Systems SOL strand, deals with “the natural processes and human interactions that affect watersheds systems.” One of the key concepts for SOL 6.7 is “water monitoring and analysis using field equipment including hand-held technology.” SOL 6.1 describes science process skills to be developed and practiced by students in Grade 6. It should be noted that SOL 6.7 further develops a third grade SOL, 3.6, also in the Living Systems strand, which

deals with different environments including water-related environments.

Other water-related SOL for Grade 6 are covered elsewhere in this curriculum packet. SOL 6.5, which deals with “the unique properties and characteristics of water and its roles in the natural and human-made environment,” is covered in the previous section “How Can We Help Maintain Our Water Supply?” SOL 6.9, which deals with “public policy decisions relating to the environment,” is covered in the section “How Can We Help Protect Our Water Resources?”

— WATER-RELATED LIFE SCIENCE & BIOLOGY SOL FOR GRADE 6 —

| SUBJECT OF SOL | STANDARDS OF LEARNING |
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| Process Skills <i>6.1</i> | The student will plan and conduct investigations in which <ol style="list-style-type: none">observations are made involving fine discrimination between similar objects and organisms;a classification system is developed based on multiple attributes;precise and approximate measures 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 with many repeated trials;data are collected, recorded, analyzed, and reported using appropriate metric measurement;data are organized and communicated through graphical representation (graphs, charts, and diagrams);models are designed to explain a sequence; andthe nature of science is developed and reinforced. |

HOW HEALTHY ARE OUR WATERWAYS?

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| Watersheds 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. |
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LIFE SCIENCE SOL FOR GRADE 7

Students are usually taught the Life Science SOL in Grade 7. Seventh grade life science draws together and further develops concepts introduced across Grades K–6 in the Life Processes and Living Systems SOL strands. “The Life Science standards emphasize a more complex understanding of change, cycles, patterns, and relationships in the living world.” There is a heavy emphasis on ecosystems, including aquatic ecosystems, changes in ecosystems, and the impacts of human activity. The science process skills continue to be emphasized at the seventh grade level. “Inquiry skills at this level include organization and mathematical analysis of data, manipulating variables in experimentation, and identifying sources of experimental error.”

The specific Life Science SOL that are water-related include LS.7, LS.11, and LS.12. SOL LS.7 deals with the dependence of organisms within an ecosystem “on one another and on nonliving components of the environment.” Specific concepts include the water cycle and “relationships within terrestrial, freshwater, and marine ecosystems.” SOL LS.11 covers the dynamic and changing nature of ecosystems. Some specific concepts covered by this SOL include “factors that increase or decrease population size,” eutrophication, and “catastrophic disturbances.” Finally, SOL LS.12 covers “the relationships between ecosystem dynamics and human activity.” Concepts include “change in habitat size, quality, and structure” and “population disturbances and factors that threaten and enhance species survival.”

HOW HEALTHY ARE OUR WATERWAYS?

—WATER-RELATED LIFE SCIENCE SOL—

| SUBJECT OF SOL | STANDARDS OF LEARNING |
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| Process Skills <i>LS.1</i> | The student will plan and conduct investigations in which a) data are organized into tables showing repeated trials and means; b) variables are defined; c) SI (metric) units are used; d) models are constructed 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) continuous line graphs are constructed, interpreted, and used to make predictions; i) interpretations from the same set of data are evaluated and defended; and j) the nature of science is developed and reinforced. |
| Ecosystems <i>LS.7</i> | 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. |
| Changes in Ecosystems <i>LS.11</i> | The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time (daily, seasonal, and longterm). Key concepts include a) phototropism, hibernation, and dormancy; b) factors that increase or decrease population size; and c) eutrophication, climate change, and catastrophic disturbances. |
| Ecosystems and Human Activity <i>LS.12</i> | 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, and structure; c) change in species competition; d) population disturbances and factors that threaten and enhance species survival; and e) environmental issues (water supply, air quality, energy production, and waste management). |

HOW HEALTHY ARE OUR WATERWAYS?

BIOLOGY SOL FOR GRADE 10

Students are usually taught the Biology SOL in Grade 10. SOL BIO.9, covering “dynamic equilibria within populations, communities, and ecosystems,” includes three concepts that are related to water resources in Virginia. Students study “the effects of natural events and human influences on ecosystems,” “the complexity of the Chesapeake Bay and its watershed,” and “local ecosystems, including flora, fauna, and microorganisms.” The introduction to the Biology SOL also iterates

the importance of students continuing to develop and practice the science process skills.

“Emphasis continues to be placed on the skills necessary to examine alternative scientific explanations, actively conduct controlled experiments, analyze and communicate information, and acquire and use scientific literature....The importance of scientific research that validates or challenges ideas is emphasized at this level.” (Standards of Learning for Virginia Public Schools, Virginia Board of Education, 1995 – Revised 2003)

—WATER-RELATED BIOLOGY SOL—

| SUBJECT OF SOL | STANDARDS OF LEARNING |
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| Process Skills <i>BIO.1</i> | The student will plan and conduct investigations in which a) observations of living organisms are recorded in the lab and in the field; b) hypotheses are formulated based on direct observations and information from the scientific literature; c) variables are defined and investigations are designed to test hypotheses; d) graphing and arithmetic calculations are used as tools in data analysis; e) conclusions are formed based on recorded quantitative and qualitative data; f) sources of error inherent in experimental design are identified and discussed; g) validity of data is determined; h) alternative explanations and models are recognized and analyzed; i) appropriate technology, including computers, graphing calculators, and probeware, is used for gathering and analyzing data and communicating results; j) research scientific literature; k) differentiation is made between a scientific hypothesis and theory; l) a scientific viewpoint is constructed and defended; and m) chemicals and equipment are used in a safe manner. |

HOW HEALTHY ARE OUR WATERWAYS?

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| <p>Populations, Communities, and Ecosystems</p> <p><i>BIO.9</i></p> | <p>The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include</p> <ul style="list-style-type: none">a) interactions within and among populations including carrying capacities, limiting factors, and growth curves;b) nutrient cycling with energy flow through ecosystems;c) succession patterns in ecosystems;d) the effects of natural events and human influences on ecosystems;e) the complexity of the Chesapeake Bay and its watershed; andf) analysis of local ecosystems, including flora, fauna, and microorganisms. |
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USING THIS PACKET

This section of the curriculum packet contains two content chapters and three lessons, all written as resources for middle school or high school teachers. The main focus of the section is water quality monitoring. The section also includes a lesson describing how middle school students can carry out a stream restoration project. The two content chapters “Chemical and Physical Measures” and “Bacteria, Submerged Aquatic Vegetation, and Other Organisms” provide background on different water quality indicators.

The first lesson, “Lesson 5 – Evaluating a Stream,” is intended for the sixth grade level and suggests a variety of water quality monitoring procedures appropriate for Grade 6. This lesson specifically targets SOL 6.7, and also supports the seventh grade Life Science SOL LS.7, LS.11, and LS.12. The second lesson, “Lesson 6 – Restoring a Stream,” is written for seventh grade Life Science and supports SOL 6.7 and LS.12. The third lesson, “Lesson 7 – Optical Brighteners and Water Quality,” is an additional water quality monitoring lesson written for tenth grade Biology and supporting SOL BIO.9.

