

Estuaries 101 High School Curriculum

Activities with Corresponding Virginia SOL's

Earth Science

Activity 1 - Observing Estuaries

- ES. 1 The student will plan and conduct investigations in which
- b) technologies including computers, probe ware and geospatial technologies, are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions;
 - d) maps and globes are read and interpreted, including location by latitude and longitude;
 - f) current applications are used to reinforce Earth science concepts.
- ES. 8 The student will investigate and understand how freshwater resources are influenced by geological processes and the activities of humans. Key concepts include
- d) identification of sources of fresh water including rivers, springs, and aquifers, with reference to the hydrologic cycle.
- ES. 10 The student will investigate and understand that oceans are complex, interactive, physical, chemical, and biological systems and are subject to long- and short-term variations. Key concepts include
- a) physical and chemical changes related to tides, waves, currents, sea level and ice cap variations, upwelling and salinity variations;
 - b) importance of environmental and geological implications;
 - c) system interactions.

Activity 2 - Salinity and Tides in York River

- ES. 1 The student will plan and conduct investigations in which
- b) technologies including computers, probe ware and geospatial technologies, are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions;
 - d) maps and globes are read and interpreted, including location by latitude and longitude;
 - f) current applications are used to reinforce Earth science concepts.

- ES. 2 The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include
- a) science explains and predicts the interactions and dynamics of complex Earth systems;
 - b) evidence is required to evaluate hypotheses and explanations;
 - c) observation and logic are essential for reaching a conclusion;
 - d) evidence is evaluated for scientific theories.
- ES. 3 The student will investigate and understand the characteristics of Earth and the solar system. Key concepts include
- b) sun-Earth-moon relationships (seasons, tides, and eclipses).
- ES. 8 The student will investigate and understand how freshwater resources are influenced by geological processes and the activities of humans. Key concepts include
- d) identification of sources of fresh water including rivers, springs, and aquifers, with reference to the hydrologic cycle;
 - f) identification of the major watershed systems in Virginia, including the Chesapeake Bay and its tributaries.
- ES. 10 The student will investigate and understand that oceans are complex, interactive, physical, chemical, and biological systems and are subject to long- and short-term variations. Key concepts include
- a) physical and chemical changes related to tides, waves, currents, sea level and ice cap variations, upwelling and salinity variations;
 - b) importance of environmental and geological implications;
 - c) system interactions.

Activity 3 - Estuary and Watershed

- BIO. 2 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include
- a) water chemistry and its impact on life processes.
- ES. 1 The student will plan and conduct investigations in which
- b) technologies including computers, probe ware and geospatial technologies, are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions;

d) maps and globes are read and interpreted, including location by latitude and longitude;

f) current applications are used to reinforce Earth science concepts.

ES. 8 The student will investigate and understand how freshwater resources are influenced by geological processes and the activities of humans. Key concepts include

d) identification of sources of fresh water including rivers, springs, and aquifers, with reference to the hydrologic cycle;

e) dependence on freshwater resources and the effects of human usage on water quality;

f) identification of the major watershed systems in Virginia, including the Chesapeake Bay and its tributaries.

LS. 11 The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include

b) change in habitat size, quality, or structure;

d) population disturbances and factors that threaten or enhance species survival;

e) environmental issues.

Activity 4 - Extreme Weather and Estuaries

BIO. 2 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include

a) water chemistry and its impact on life processes.

ES. 1 The student will plan and conduct investigations in which

b) technologies including computers, probe ware and geospatial technologies, are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions;

d) maps and globes are read and interpreted, including location by latitude and longitude;

f) current applications are used to reinforce Earth science concepts.

ES. 2 The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include

a) science explains and predicts the interactions and dynamics of complex Earth systems;

- b) evidence is required to evaluate hypotheses and explanations;
- c) observation and logic are essential for reaching a conclusion;
- d) evidence is evaluated for scientific theories

ES. 12 The student will investigate and understand that energy transfer between the sun and Earth and its atmosphere drives weather and climate on Earth. Key concepts include

- c) severe weather occurrences, such as tornadoes, hurricanes, and major storms

Life Science

Activity 1 - Survival in an Estuary

- BIO. 1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- b) hypotheses are formulated based on direct observations and information from scientific literature;
 - d) graphing and arithmetic calculations are used as tools in data analysis;
 - e) conclusions are formed based on recorded quantitative and qualitative data;
 - i) appropriate technology including computers, graphing calculators, and probe ware, is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions.
- BIO. 2 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include
- a) water chemistry and its impact on life processes.
- LS. 9 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include
- b) characteristics of land, marine, and freshwater ecosystems;
 - c) adaptations that enable organisms to survive within a specific ecosystem.

Activity 2 - Nutrients in an Estuary

- BIO. 1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- b) hypotheses are formulated based on direct observations and information from scientific literature;

d) graphing and arithmetic calculations are used as tools in data analysis;

e) conclusions are formed based on recorded quantitative and qualitative data;

i) appropriate technology including computers, graphing calculators, and probe ware, is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions.

BIO. 2 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include

a) water chemistry and its impact on life processes;

d) the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

BIO. 8 The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include

b) nutrient cycling with energy flow through ecosystems;

d) the effects of natural events and human activities on ecosystems.

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

a) the carbon, water and nitrogen cycles;

b) interactions resulting in a flow of energy and matter throughout the system

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

c) eutrophication, climate changes and catastrophic disturbances

Activity 3 - Biodiversity in an Estuary

BIO. 8 The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include

d) the effects of natural events and human activities on ecosystems;

e) analysis of the flora, fauna, and microorganisms of Virginia ecosystems.

- ES. 1 The student will plan and conduct investigations in which
- b) technologies including computers, probe ware and geospatial technologies, are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions;
 - d) maps and globes are read and interpreted, including location by latitude and longitude;
 - f) current applications are used to reinforce Earth science concepts.
- LS. 8 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
- LS. 9 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include
- b) characteristics of land, marine, and freshwater ecosystems;
 - c) adaptations that enable organisms to survive within a specific ecosystem

Physical Science

Activity 1 - Chemistry in an Estuary

- BIO. 2 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include
- a) water chemistry and its impact on life processes.
- BIO. 8 The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include
- d) the effects of natural events and human activities on ecosystems.
- ES. 2 The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include
- a) science explains and predicts the interactions and dynamics of complex Earth systems;
 - b) evidence is required to evaluate hypotheses and explanations;
 - c) observation and logic are essential for reaching a conclusion;
 - d) evidence is evaluated for scientific theories

- ES. 10 The student will investigate and understand that oceans are complex, interactive physical, chemical and biological systems and are subject to long- and short-term variations. Key concepts include
- a) physical and chemical changes related to tides, waves, currents, sea level and ice cap variations, upwelling, and salinity variations;
 - b) importance of environmental and geological implications;
 - c) system interactions

Activity 2 - Dissolved Oxygen in an Estuary

- BIO. 2 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include
- a) water chemistry and its impact on life processes.
 - d) the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

- ES. 2 The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include
- a) science explains and predicts the interactions and dynamics of complex Earth systems;
 - b) evidence is required to evaluate hypotheses and explanations;
 - c) observation and logic are essential for reaching a conclusion;
 - d) evidence is evaluated for scientific theories

- ES. 10 The student will investigate and understand that oceans are complex, interactive physical, chemical and biological systems and are subject to long- and short-term variations. Key concepts include
- b) importance of environmental and geological implications;
 - c) system interactions.

- 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
- b) interactions resulting in a flow of energy and matter throughout the system;
 - c) complex relationships within terrestrial, freshwater and marine ecosystems.

- 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
- c) eutrophication, climate changes and catastrophic disturbances.

Activity 3 - Human Impact on Estuaries: A Terrible Spill in Grand Bay

- BIO. 1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- b) hypotheses are formulated based on direct observations and information from scientific literature;
 - c) variables are designed 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;
 - h) chemicals and equipment are used in a safe manner;
 - i) appropriate technology including computers, graphing calculators, and probe ware, is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions.
 - m) current applications of biological concepts are used.
- BIO. 2 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include
- a) water chemistry and its impact on life processes.
- BIO. 8 The students will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include
- b) nutrient cycling with energy flow through ecosystems;
 - d) the effects of natural events and human activities on ecosystems.
- ES. 10 The student will investigate and understand that oceans are complex, interactive physical, chemical and biological systems and are subject to long- and short-term variations. Key concepts include
- b) importance of environmental and geological implications;
 - c) system interactions

- 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
- b) interactions resulting in a flow of energy and matter throughout the system;
 - c) complex relationships within terrestrial, freshwater and marine ecosystems.
- LS. 9 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include
- b) characteristics of land, marine, and freshwater ecosystems;
 - c) adaptations that enable organisms to survive within a specific ecosystem.
- LS. 11 The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include
- b) change in habitat size, quality, or structure;
 - d) population disturbances and factors that threaten or enhance species survival;
 - e) environmental issues