

# **Estuaries 101 Middle School Curriculum Activities with Corresponding Virginia SOL's**

## *Activity 1 – Where Rivers Meet the Sea*

- 6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- h) data are analyzed and communicated through graphical representation;
  - i) models and simulations are designed and used to illustrate and explain phenomena and systems;
  - j) current applications are used to reinforce science concepts.
- 6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include
- e) energy transformations.
- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
- c) divides, tributaries, river systems, and river and stream processes;
  - d) wetlands;
  - e) estuaries.
- PS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- j) valid conclusions are made after analyzing data;
  - k) research methods are used to investigate practical problems and questions;
  - m) models and simulations are constructed and used to illustrate and explain phenomena;
  - n) current applications of physical science concepts are used.

## *Activity 2 – Seasonal Swings*

- 6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- h) data are analyzed and communicated through graphical representation;

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

j) current applications are used to reinforce science concepts.

6.6 The student will investigate and understand the properties of air and the structure and dynamics of Earth's atmosphere. Key concepts include

e) the relationship of atmospheric measures and weather conditions;

f) basic information from weather maps, including fronts, systems, and basic measurements.

6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include

d) wetlands;

e) estuaries.

PS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

j) valid conclusions are made after analyzing data;

k) research methods are used to investigate practical problems and questions;

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

n) current applications of physical science concepts are used.

### *Activity 3 – Water Going Up, Water Going Down*

6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

h) data are analyzed and communicated through graphical representation;

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

j) current applications are used to reinforce science concepts.

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

e) energy transformations.

- 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.
- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include  
d) wetlands;  
e) estuaries.
- 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  
c) the role of gravity;  
e) the mechanics of day and night and the phases of the moon;  
h) the cause of tides.
- LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which  
d) models and simulations are constructed and used to illustrate and explain phenomena;  
i) patterns are identified in data and are interpreted and evaluated;  
j) current applications are used to reinforce life science concepts.
- 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  
a) photosynthesis as the foundation of virtually all food webs.
- 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  
b) factors that increase or decrease population size;  
c) climate changes, and catastrophic disturbances.
- PS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which  
j) valid conclusions are made after analyzing data;  
k) research methods are used to investigate practical problems and questions;

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

n) current applications of physical science concepts are used.

#### *Activity 4 – Estuary Food Pyramid*

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;

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

j) current applications are used to reinforce science concepts.

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;

e) energy transformations.

6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include

d) wetlands;

e) estuaries.

LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

d) models and simulations are constructed and used to illustrate and explain phenomena;

j) current applications are used to reinforce life science concepts.

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

a) energy transfer between sunlight and chlorophyll;

b) transformation of water and carbon dioxide into sugar and oxygen;

c) photosynthesis as the foundation of virtually all food webs.

- 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;
  - d) energy flow in food webs and energy pyramids.
- 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;
  - b) the relationship between predators and prey.
- 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.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
- b) factors that increase or decrease population size;
  - c) climate changes, and catastrophic disturbances.
- LS.11 The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include
- e) environmental issues.

### *Activity 5 – Planet Plankton*

- 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;
  - j) current applications are used to reinforce science concepts.

- 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;
  - e) energy transformations.
- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
- d) wetlands;
  - e) estuaries.
- 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
- a) energy transfer between sunlight and chlorophyll;
  - b) transformation of water and carbon dioxide into sugar and oxygen;
  - c) photosynthesis as the foundation of virtually all food webs.
- 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;
  - d) energy flow in food webs and energy pyramids.
- LS.9 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;
  - c) adaptations that enable organisms to survive within a specific ecosystem.
- LS.12 The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key concepts include
- d) characteristics that can and cannot be inherited.

- LS.13 The student will investigate and understand that populations of organisms change over time. Key concepts include
- c) how environmental influences, as well as genetic variation, can lead to diversity of organisms.

*Activity 6 – An Ode to the Oyster*

- 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.
- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
- d) wetlands;
  - e) estuaries;
  - f) major conservation, health, and safety issues associated with watersheds.
- 6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include
- a) management of renewable resources.
- 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;
  - b) patterns of cellular organization and their relationship to life processes in living things.
- 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.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
- b) factors that increase or decrease population size;
  - c) climate changes, and catastrophic disturbances.

- LS.11 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;
  - d) population disturbances and factors that threaten or enhance species survival;
  - e) environmental issues.

### *Activity 7 – Hooray for Horseshoe Crabs*

- 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.
- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
- d) wetlands;
  - e) estuaries.
- 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;
  - 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
- d) the characteristics that define a species.
- 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 8 – Sharks in the Estuary*

- 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.

- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
- d) wetlands;
  - e) estuaries.
- 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;
  - 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
- d) the characteristics that define a species.
- LS.8 The student will investigate and understand interactions among populations in a biological community. Key concepts include
- b) the relationship between predators and prey;
  - e) niches.
- 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.13 The student will investigate and understand that populations of organisms change over time. Key concepts include
- c) how environmental influences, as well as genetic variation, can lead to diversity of organisms.

### *Activity 9 – Bountiful Birds*

- 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.

- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
- d) wetlands;
  - e) estuaries.
- LS.4 The student will investigate and understand how organisms can be classified. Key concepts include
- d) the characteristics that define a species.
- LS.7 The student will investigate and understand that interactions exist among members of a population. Key concepts include
- b) influence of behavior on a population.
- LS.8 The student will investigate and understand interactions among populations in a biological community. Key concepts include
- b) the relationship between predators and prey;
  - c) competition and cooperation;
  - e) niches.
- LS.9 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;
  - c) adaptations that enable organisms to survive within a specific ecosystem.
- LS.13 The student will investigate and understand that populations of organisms change over time. Key concepts include
- c) how environmental influences, as well as genetic variation, can lead to diversity of organisms.

### *Activity 10 – The Jubilee Phenomenon*

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

j) current applications are used to reinforce science concepts.

6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include

d) wetlands;

e) estuaries.

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

e) the mechanics of day and night and the phases of the moon;

h) the cause of tides.

LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

d) models and simulations are constructed and used to illustrate and explain phenomena;

h) data are organized, interpreted, and used to make predictions;

i) patterns are identified in data and are interpreted and evaluated;

j) current applications are used to reinforce life science concepts.

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

c) complex relationships within terrestrial, freshwater, and marine ecosystems.

PS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

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;

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

n) current applications of physical science concepts are used.

### *Activity 11 – The Great Oyster Mystery*

- 6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- h) data are analyzed and communicated through graphical representation;
  - j) current applications are used to reinforce science concepts.
- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
- d) wetlands;
  - e) estuaries.
- LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- h) data are organized, interpreted, and used to make predictions;
  - i) patterns are identified in data and are interpreted and evaluated;
  - j) current applications are used to reinforce life science concepts.
- 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
- c) complex relationships within terrestrial, freshwater, and marine ecosystems.
- LS.8 The student will investigate and understand interactions among populations in a biological community. Key concepts include
- b) the relationship between predators and prey.
- 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.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
- b) factors that increase or decrease population size.
- PS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- 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;
- m) models and simulations are constructed and used to illustrate and explain phenomena;
- n) current applications of physical science concepts are used.

### *Activity 12 – Migrating Mangroves and Marshes*

- 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;
  - h) data are analyzed and communicated through graphical representation;
  - j) current applications are used to reinforce science concepts.
- 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) temperature;
  - d) natural and human-caused changes to the atmosphere;
  - e) the relationship of atmospheric measures and weather conditions.
- 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
  - d) wetlands;
  - e) estuaries.
- LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
  - i) patterns are identified in data and are interpreted and evaluated;
  - j) current applications are used to reinforce life science concepts.

- 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
- 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
- a) differences between ecosystems and biomes;
  - b) characteristics of land, marine, and freshwater ecosystems;
  - c) 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
- b) factors that increase or decrease population size;
  - c) climate change and catastrophic disturbances.
- 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.
- PS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- j) valid conclusions are made after analyzing data;
  - k) research methods are used to investigate practical problems and questions;
  - n) current applications of physical science concepts are used.

*Activity 13 – Port to Port*

- 6.6 The student will investigate and understand the properties of air and the structure and dynamics of Earth's atmosphere. Key concepts include
- d) natural and human-caused changes to the atmosphere;
  - e) the relationship of atmospheric measures and weather conditions.

- 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;
  - d) wetlands;
  - e) estuaries;
  - f) major conservation, health, and safety issues associated with watersheds.
- 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;
  - d) cost/benefit tradeoffs in conservation policies.
- 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
- b) factors that increase or decrease population size;
  - c) climate change and catastrophic disturbances.
- LS.11 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;
  - d) population disturbances and factors that threaten or enhance species survival;
  - e) environmental issues.

*Activity 14 – Oil Spill: The Rest of the Story*

- 6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- i) models and simulations are designed and used to illustrate and explain phenomena and systems;

j) current applications are used to reinforce science concepts.

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  
e) the importance of water for agriculture, power generation, and public health;

f) the importance of protecting and maintaining water resources.

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;

c) divides, tributaries, river systems, and river and stream processes;

d) wetlands;

e) estuaries;

f) major conservation, health, and safety issues associated with watersheds.

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;

d) cost/benefit tradeoffs in conservation policies.

LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

d) models and simulations are constructed and used to illustrate and explain phenomena;

j) current applications are used to reinforce life science concepts.

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 water cycle;

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

b) factors that increase or decrease population size;

c) eutrophication, climate change, and catastrophic disturbances.

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 15 – Score One for the Estuaries*

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

e) the importance of water for agriculture, power generation, and public health;

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

d) natural and human-caused changes to the atmosphere.

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;

d) wetlands;

e) estuaries;

f) major conservation, health, and safety issues associated with watersheds.

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;

d) cost/benefit tradeoffs in conservation policies.

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

b) factors that increase or decrease population size;

c) eutrophication, climate change, and catastrophic disturbances.

LS.11 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;

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

e) environmental issues.