

Scientific Method Review

Scientific Method Notes

Variable: anything that varies in an experiment

Independent Variable: What is being test or changed

Dependent Variable: The results from changing the Independent Variable. This is measurable

Constant: Anything that stays the same in the experiment

Control: standard situation without the Independent Variable

Trial: A repeated measurement in your experiment

Validity: How well a scientific experiment measures what is ets out to, or how well it represents reality.

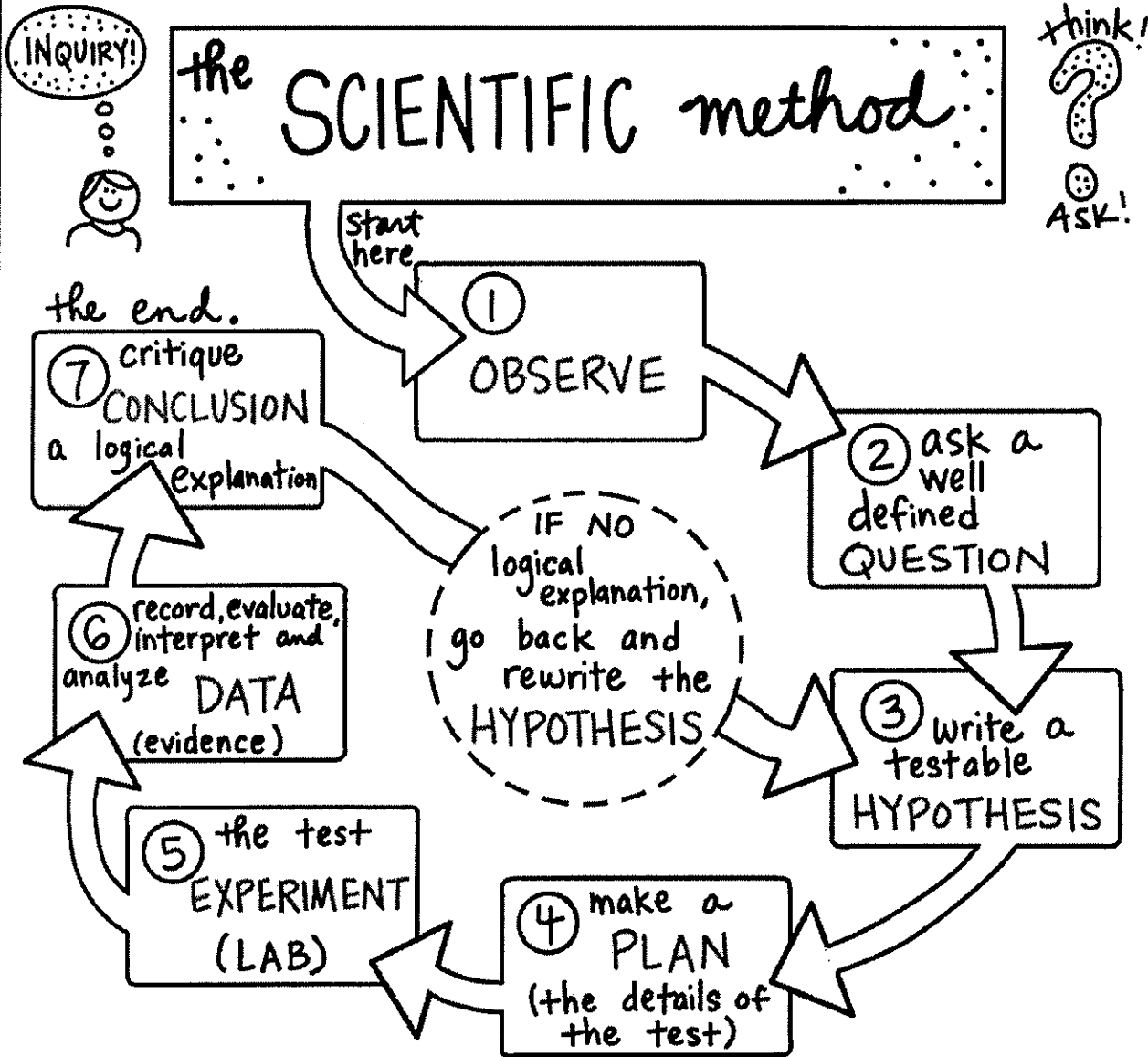
* the more trials you test & the better you control variable, the more valid your results will be *

Example: "A student wants to test how different colors of light affect the growth of a plant. She plans to grow plants in red, blue, green, and white light."

- **Independent Variable:** the color of the light
- **Dependent Variable:** Plant Growth
- **Constants:** type of plant, amount of light, amount of water, soil, ect.
- **Experimental Groups:** plants with colored light.
- **Control Group:** Plants with white light.

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Scientific Method



critical thinking-observing all parts before drawing a conclusion

hypothesis - an educated guess about the outcome of an investigation, testable

data - pieces of information

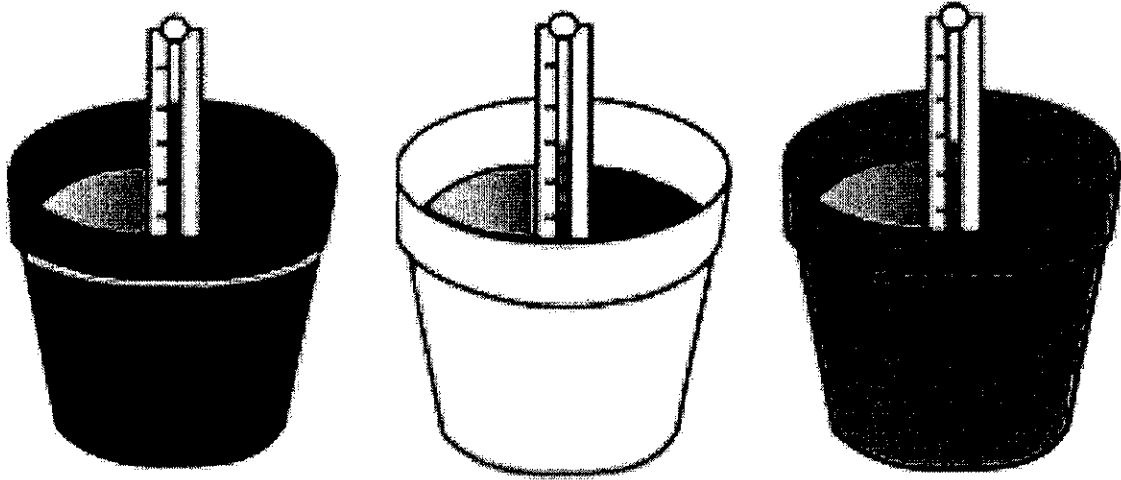
Critique - identify the problems and successes with an investigation

logical - expected to happen

explanation - reason, cause or an answer

Scientific Method Review

1. Zamirah wanted to find out if the color of a container would affect the temperature of the soil inside. She set up her experiment outdoors in direct sunlight as shown below



What is the independent variable in her experiment?

- a. The amount of sunshine
 - b. The size of the containers
 - c. The temperature of the soil
 - d. The color of the container
2. In a scientific experiment, the dependent variable is the:
 - a. variable that the scientist changes.
 - b. variable that is measured or observed and recorded.
 - c. possible answer to a scientific question.
 - d. variable that is kept the same.
 3. Read the hypothesis. What is the dependent variable in this experiment?

If coal is used to heat a school building, then the amount of air pollution around the building will increase.

- a. Type of pollution
- b. Type of resources
- c. Amount of air pollution
- d. Amount of coal used

Scientific Method Review

4. In the experiment shown, what represents the independent variable?

- a. the rate at which the plant will grow
- b. the amount of water each plant receives
- c. the amount of the fertilizer given to each plant
- d. the amount of light provided for each plant



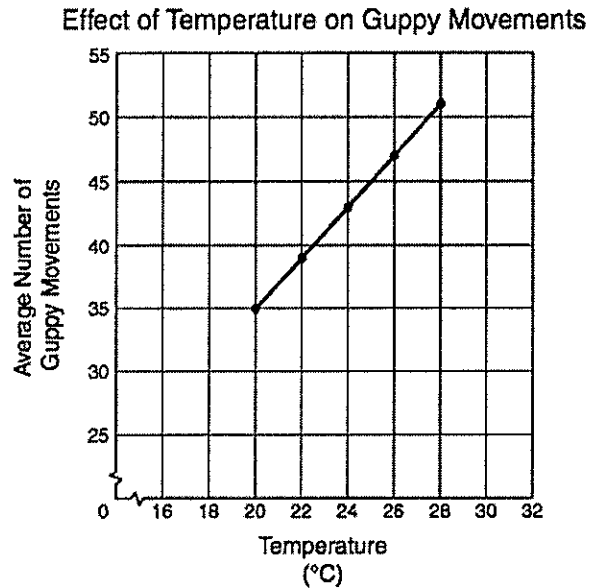
5. What inference can be drawn from the chart?

- a. Bluefin Tuna swim faster than Yellowfin Tuna.
- b. Yellowfin tuna swim faster than Bluefin Tuna.
- c. Yellowfin Tuna swim faster than Sailfish.
- d. All tuna fish in the ocean swim slowly

Fast Swimmers	
Fish	Speed (miles per hour)
Sailfish	60
Yellowfin Tuna	46
Bluefin Tuna	43
Flying Fish	40
Dolphin	37
Trout	15

6. According to the graph, about how many movements on average would the guppies most likely make at 30°C?

- a. 50
- b. 55
- c. 70
- d. 35



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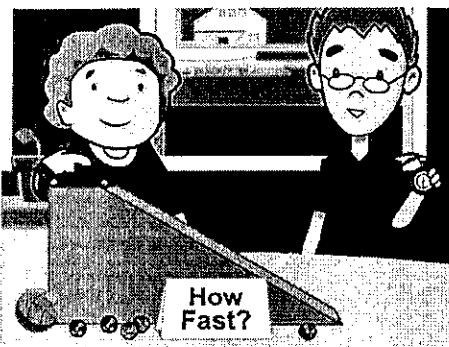
7. Henry conducted an experiment on plant growth over a five week time period. What is a correct prediction for plant growth during Week 6?

- a. 11 inches
- b. 19 inches
- c. 15.5 inches
- d. 17 inches

Henry's Plant Growth Data Table

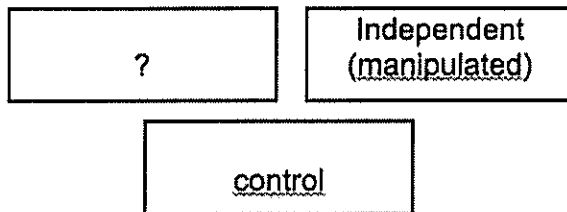
Week	Plant Growth
1	12 inches
2	14.5 inches
3	15 inches
4	17 inches
5	18.5 inches

8. Looking at the picture below, what would be considered an inference?



- a. There is a purple car at the top of the ramp.
- b. There are five marbles in front of the ramp.
- c. The boys are conducting an experiment.
- d. The boys are holding objects.

9. Which word helps describe the three types of variables in an experiment?



- a. variable
- b. observation
- c. Dependent (responding)
- d. Quantitative

10. Mia wanted to see if different brands of tires would make her model car go faster. She correctly set up an experiment to test 4 different brands of tires on her model car. She recorded her data in the data table. Why did Mia conduct three trials for each brand of tires?

- a. To classify each tire by tire tread
- b. To conclude that the hypothesis is correct
- c. To make a scaled down version of each tire
- d. To verify that all results are accurate

Brand of Tires Tested

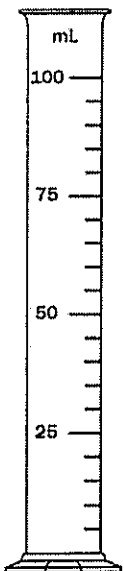
Brand of Tire	Trial 1 Time (sec)	Trial 2 Time (sec)	Trial 3 Time (sec)	Average Time (sec)
Brand A	26	25	25	25.3
Brand B	24	23	23	23.3
Brand C	28	27	25	26.7
Brand D	33	31	32	32.0

Scientific Method Review

11. The chart shows the data from an experiment. Which represents the controlled variable?

Light Amount	Water Amount	Growth Amount
8 hours	0 ml	0 in
8 hours	2 ml	2 in
8 hours	5 ml	3 in
8 hours	7 ml	6 in
8 hours	10 ml	3.5 in

- a. amount of water
 - b. growth amount
 - c. amount of plants
 - d. amount of light
12. After recording and analyzing data for an experiment a scientist must —
- a. state a conclusion
 - b. gather information
 - c. state the problem
 - d. form a hypothesis
13. What is the volume of liquid in the graduated cylinder? _____ mL

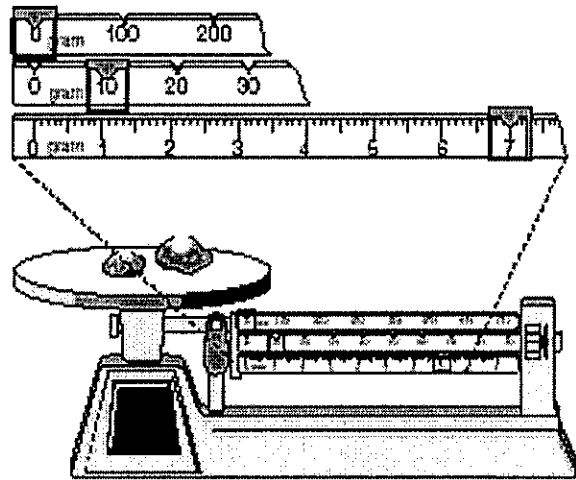


- a. 85
- b. 90
- c. 95
- d. 80

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14. What is the mass of the rocks on the balance?

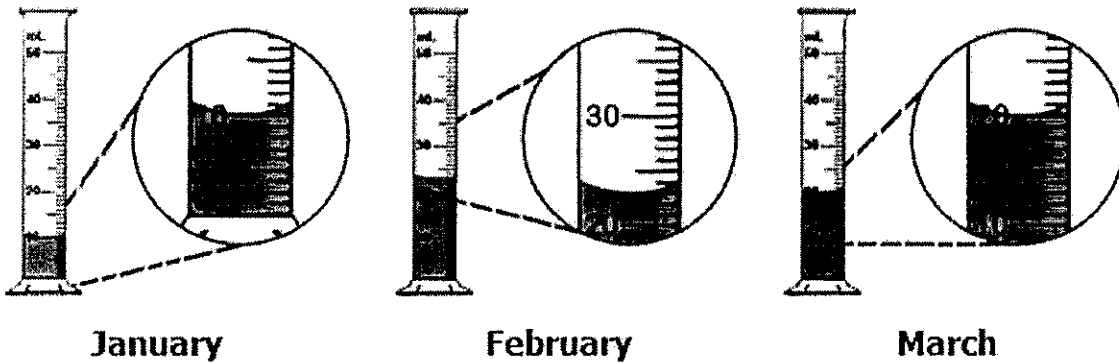
- a. 17 g
- b. 50 g
- c. 10 g
- d. 20 g



15. What is the last step in the scientific method?

- a. Record and analyze data
- b. Perform the experiment
- c. Form a hypothesis
- d. State a conclusion

16. A student took measurements in 100 milliliter graduated cylinders over three months and wrote them in his journal. Shade in all the correct volume measurements the student recorded.



19 mL	10 mL	11 mL
20 mL	23 mL	24 mL

Scientific Method Review

17. Which example is a quantitative observation?
- The classroom floor is dirty.
 - The classroom walls are white.
 - The classroom is decorated with many posters.
 - There are 26 students in the room.
18. The students conducted an experiment in science class to answer the question, “Which brand of paper towel absorbs the most water?” Which is NOT an example of a constant for this experiment?
- The measurement tool to calculate the amount of water absorbed
 - The amount of time the paper towel was held under the water
 - The container of water
 - The brand of paper towel
19. A constant in an experiment is —
- the factors that stay the same
 - the responding variable
 - the setup without the variable
 - the factor that gets tested
20. What is a hypothesis?
- the information you gather during an experiment
 - a decision you make based on reliable testing
 - a prediction you make about the outcome of the experiment
 - a question you ask before performing an experiment

Watershed Review

Match the term with the definition

_____ Watershed

_____ Tributaries

_____ Flood Plains

_____ Wetlands

_____ Estuaries

- A. the area of land that water flows across is it moves toward a stream, lake or other body of water.
- B. Smaller streams that join along the course of a river system
- C. Wide, flat border areas alongside a river into which water spills out at times of high flow
- D. Transitions zones between dry land and bodies of water are called.
- E. Fresh and saltwater meet and are mixed by the tides

Of all the water on Earth 97% of it is salt water (oceans) and the remaining 3% is freshwater. Freshwater is found in:

- ice caps and glaciers (69%)
- ground, aquifers. Soil, air (30%)
- the surface lakes, swamps, rivers (1%)

Directions: Write the percentage next to each type of water.		
Salt Water:	Fresh Water	Available Freshwater:

Directions: Shade each place where freshwater is found.

Streams	Atlantic Ocean	Air/atmosphere	soil
Rivers	Glaciers/ice caps	Pacific Ocean	Lakes

Where is the most freshwater located?

What is the percentage? _____ %

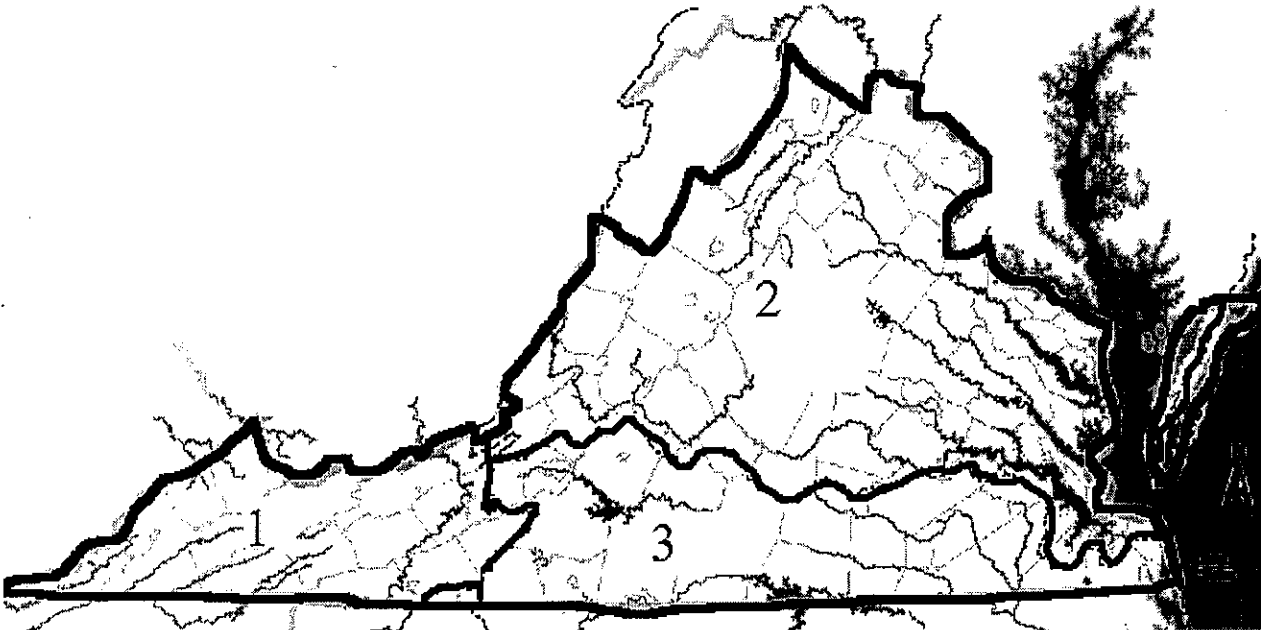
Watershed Review

Watersheds

A **watershed** is an area of land that water flows across on its way to a stream, lake, wetland, or other body of water. The three major regional watershed systems in Virginia *lead to* the **Chesapeake Bay**, the **North Carolina sounds** or the **Gulf of Mexico**. Areas of higher elevations, such as **ridgelines** and **divides**, separate watersheds from each other. Water on one side of a divide flows in a different direction than water on the other side of the divide.

1. What is a watershed?

2. How are watersheds separated?



The watershed labeled #1 in the map below is called the _____.

The watershed labeled #2 in the map below is called the _____.

The watershed labeled #3 in the map below is called the _____.

Watershed Review

Wetlands

Between the dry lands of a watershed and the bodies of water that flow through it are transition zones called **wetlands**. A wetland is an area of land that has saturated soil or is flooded by a shallow layer of water. Wetlands include such environments as swamps, marshes, and bogs. They can be **tidal**, influenced by the tides, or **non-tidal** and filled with fresh, brackish, or salt water.

Define wetland.

All wetlands perform important water quality functions. Some of these include maintaining water quality by filtering sediments, trapping nutrients, and breaking down pollutants; reducing erosion by slowing down runoff; regulating runoff by storing floodwaters; and recharging or replenishing groundwater. Wetlands also provide food and shelter for all kinds of wildlife and fish. They also provide migratory birds with nesting and resting areas.

Why are wetlands good? Why do you think they should be protected?

List 5 ways that wetlands are helpful and important (functions).

1. _____
2. _____
3. _____
4. _____
5. _____

Watershed Review

Wetlands

Three types of wetlands are swamps, marshes, and bogs, which are characterized primarily by their vegetation:

- **Swamps** are wetlands where the most common plant types are trees (cypresses, willows, oaks), vines (poison ivy), and shrubs. They occur in low-lying areas near slow-moving rivers and need a steady supply of water in order for trees to grow.

- **Marshes** are treeless wetlands sometimes called *wet meadows*. Grasses, reeds, cattails, and non-woody plants called *rushes* and *sedges* are common marsh plants. Marshes often form on floodplains where rivers overflow their banks.

- **Bogs** are characterized by low to medium-height woody plants. The only source of freshwater in a bog is rain. Since no streams carrying nutrients flow into bogs, plants, such as the Venus flytrap, get nutrients from insects. Because water does not drain from a bog, dead plant material builds up and sinks to the bottom. Eventually a substance called *peat* is formed. Gardeners use peat from a plant called *sphagnum moss*, which, when dried, can hold up to 20 times its weight in water.

What are the three main types of wetlands?

1.

2.

3.

Define

Define

Define

Directions: Compare and Contrast two of the wetlands above. Explain how they are similar and how they are different. Answer in two to three complete sentences.

Watershed Review

Estuaries

Estuaries are partially enclosed bodies of water where freshwater from streams and rivers meets salty ocean water. This mixture of water is called **brackish** water. Bays, lagoons, harbors, inlets, and sounds are examples of estuaries.

Estuaries perform important functions, such as

- provide habitat for many organisms
- serve as nurseries for their young (a very large number of fish return from the ocean to spawn in the protective waters of estuaries)
- provide a habitat for endangered and threatened birds

People depend on estuaries for trade, food, and shelter from violent open ocean water. Among other benefits, estuaries provide recreation in the form of swimming, boating, fishing, surfing, and bird watching. Estuaries act as a natural laboratory for scientists and students. The economy of many coastal communities is directly linked to the aesthetic beauty of the estuary nearby.

Like our rivers and streams, estuaries are in danger as a result of human activity. Much trash and sediment from up river are carried into the estuary. Chemical contamination in an estuary can linger for years and close down fishing in those areas. Silt and other sediment caused by erosion can suffocate bottom-dwelling plants and animals. Nutrients from upstream make their way into the estuary and cause over-enrichment of the water and oxygen depletion. Altering the natural water flow primarily by dredging and filling wetlands for development purposes has devastating effects on the estuary. Wetlands act as a buffer zone to the estuary by filtering and breaking down nutrients.

What is an estuary?

What are the functions of an estuary? (list at least 3)

1.

2.

3.

List three ways humans depend on estuaries.

1.

2.

3.

List two ways humans are harming estuaries.

1.

2.

What is the largest estuary in the United States?

What do wetlands do for estuaries?

Watershed Review

An **ecosystem** is made up of the living community and the nonliving factors that affect the organisms living in it. The nonliving, physical features of the environment are the **abiotic factors**, which determine ecosystem type and its distribution of plants and animals. Abiotic factors include water quality, topography, landforms, geology, climate, soil types, amount of sunlight, and air quality or oxygen availability. Living things in an ecosystem are called **biotic factors**. They include plants, animals, fungi, and bacteria. The health of an ecosystem is directly related to its water quality.

What is an ecosystem?

Abiotic	Biotic
Define	Define
Examples:	Examples:

Watershed Review

Human Impact	
<p>one thing that all watersheds have in common is people. Human activity can alter abiotic factors and thus accelerate or decelerate natural processes. Humans can increase the natural process of erosion by cutting down trees, plowing cropland, and building neighborhoods, shopping centers, and cities. Erosion occurs naturally when wind and water transport soil and sand. Trees capture, filter, and retain water; regulate flow of water, and contain sediment. If trees are removed, these healthy processes are not able to occur.</p>	<p>What are some negative effects of human activity?</p>
<p>Humans can also accelerate natural processes by destroying wetlands. Wetlands regulate runoff, reduce erosion, purify water by filtering it, and recharge ground water.</p>	<p>Brainstorm ways humans can decelerate (slow down) natural processes that positively impact our watershed. What are some positive effects of human activity?</p>
<p>Humans can accelerate natural processes by adding pollutants. Land-use changes upstream can cause runoff pollution problems for people, plants, and animals downstream that depend on clean, usable water. This form of pollution is called non-point-source pollution (NPS), because the pollution does not come from a single source, such as the discharge from a sewage treatment plant or a factory. NPS pollution is caused mainly by storm-water runoff. When it rains hard, water runs off farmland, city streets, construction sites, lawns, and driveways, carrying sediment, nutrients, pesticides, oil and gasoline, bacteria, and other pollutants with it. One of water's unique properties is its ability to dissolve a wide variety of compounds. Thus, water-soluble materials easily pollute water, which then carries these harmful substances into our waterways and other bodies of water.</p>	<p>What is non- point source pollution?</p> <p>Give an example of non- point source pollution</p> <p>What is point source pollution?</p> <p>Give an example of point source pollution</p>

Watershed Review

Water Quality Monitoring

The health of an ecosystem is directly related to its water quality.□

pH is the measure of how acidic or basic a water source is. A pH range of 6.0 to 9.0 has been found to support and protect freshwater aquatic life. High pH levels can damage the tissues of aquatic animals and cause death.

Temperatures can also affect the health of a water habitat. Changes outside of the normal seasonal changes can be detrimental. When human activities change water temperatures in rivers and streams, the death of aquatic life can result.

Salinity is the measure of dissolved salts in a water system. High levels of salt can damage floodplains and wetlands. Salinity levels also determine what plant and animal species can live in a water habitat.

Dissolved oxygen levels in a water system affect the growth and reproduction of aquatic animals. Low levels can kill vulnerable animals such as oysters, clams, and fish.

Turbidity has to do with the amount of suspended solids in a water system. The clearer the water is, the lower the turbidity. Increased turbidity can be caused by silt and clay from shoreline erosion as well as an increase in the numbers of microscopic plants called phytoplankton. High levels of turbidity can block sunlight, clog the gills of fish and smother aquatic nurseries.

The presence of certain **macro invertebrates** in a water system can indicate the health of the aquatic habitat. By looking at the types of organisms that are living in a water habitat, scientists can tell how healthy the water is. The water quality of a habitat is good when it is rich in oxygen and supports a variety of organisms. Water quality is fair when it has less oxygen and low levels of pollutants, and poor when it has high levels of pollutants. Some organisms can survive only in water of good quality while others can live in any quality of water. For example, if scientists find mayfly larvae, that indicates good water quality. This is because mayfly larvae are very sensitive to pollutants and changes in the other parameters. The presence of leeches, however, may indicate a problem. This is because leeches can live in any type of water. This monitoring also helps determine whether pollution control programs are working and helps direct pollution control efforts to areas where they are most needed.

Watershed Review

What is the health of an ecosystem related to?

What is water quality?

Why does it matter?

Define each of the following

pH	What happens when there are high levels of pH?
Salinity	What happens when the salinity is too high?
Turbidity	What happens when there is a high level of turbidity? How does turbidity increase?
Dissolved Oxygen	What happens if the dissolved oxygen is too low?

Macro invertebrates (define)

How can macroinvertebrates inform us of water quality?

Watershed Review

You walk up to a pond and you can immediately tell that the quality of the water is poor. List 3 things that you see.

1.

2.

3.

You walk up to a pond and you can immediately tell that the quality of the water is good. List 3 things that you see.

1.

2.

3.