Name _____ Date _____ Class _____

*Due Date _____

Water on Earth

*Please annotate each summary.
*Answer questions on the back in complete sentences

Guide for Reading

- How do people and other living things use water?
- How is Earth's water distributed?
- How does Earth's water move through the water cycle?

Earth is unique among the planets in the solar system because its surface is nearly covered with liquid water. The water on Earth is essential to life. **All living things need water in order to carry out their body processes. In addition, many living things use water for shelter.** One of the body processes that needs water is **photosynthesis.** This is the process by which plants use water, carbon dioxide, and energy from the sun to make their food. Animals and other living things depend on food made by plants. Bodies of water also provide many organisms with **habitats,** or places to live and obtain what is necessary to survive.

Most of the Earth's water—roughly 97 percent—is found in salty oceans. Only 3 percent is fresh water. The huge expanses of ice near the North and South Poles account for about three quarters of that 3 percent. The oceans—actually, a single world ocean—cover nearly 71 percent of Earth's surface. The fresh water that is available for humans to use includes the water in lakes and rivers. But far more fresh water is located underground. **Groundwater** is water that fills the cracks and spaces in underground soil and rock layers.

Water on Earth is naturally recycled through the **water cycle. Water moves from bodies of water, land, and living things on Earth's surface to the atmosphere and back to Earth's surface.** The sun is the source of energy that drives the water cycle.

The water cycle has no beginning or end. It includes evaporation, condensation, and precipitation. Large amounts of water continually evaporate from oceans and lakes. More water vapor is given off through the leaves of plants in a process called **transpiration.**

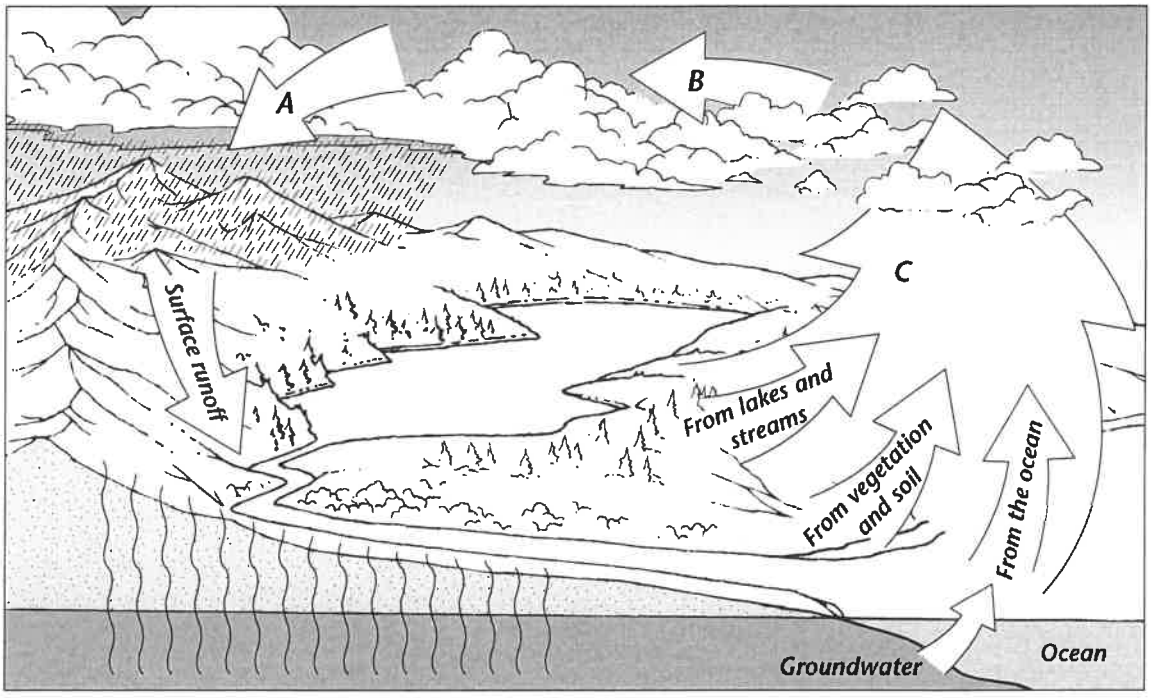
As warm air carries water vapor upward, the air cools. Cold air holds less water vapor than warm air, so the water condenses into droplets, which clump around dust particles and form clouds. As the droplets grow bigger and heavier, they fall back to Earth as rain, snow, sleet, or hail, also called **precipitation.**

Most precipitation falls directly into the oceans. Some water that falls on land evaporates immediately. Some runs off the surface into rivers, lakes, or oceans, or trickles down into the ground. The total amount of water on Earth has remained fairly constant for millions of years. In the world as a whole, the rates of evaporation and precipitation are balanced.

Name _____ Date _____ Class _____

Earth: The Water Planet ▪ *Review and Reinforce*

Water on Earth



Study the illustration, and then answer the questions on a separate sheet of paper.

1. Give this illustration a title by writing the name of the continuous process it shows.
2. What three processes does this illustration show at points A, B, and C?
3. What is the source of energy that drives the continuous process shown in the illustration?
4. Name and describe the process by which water moves from plants to the atmosphere.
5. Describe how clouds form in the continuous process shown.
6. What role does the ocean play in the continuous process shown?

Name _____ Date _____ Class _____

The Properties of Water

Guide for Reading

- How does the chemical structure of water molecules cause them to stick together?
- What are some of water's unusual properties?
- What are the three states in which water exists on Earth?

A water molecule is made up of two hydrogen atoms bonded to an oxygen atom. Each end of a water molecule has a slight electric charge. A molecule that has electrically charged areas is called a **polar molecule. The positive hydrogen ends of one water molecule attract the negative oxygen ends of nearby water molecules. As a result, the water molecules tend to stick together.**

Many of water's unusual properties occur because of the attraction among its polar molecules. **The properties of water include capillary action, surface tension, the ability to dissolve many substances, and high specific heat. Capillary action** is the combined force of attraction among water molecules and with the molecules of surrounding materials. **Surface tension** is the tightness across the surface of water that is caused by polar molecules pulling on each other.

A **solution** is a mixture that forms when one substance dissolves another. The substance that does the dissolving is called the **solvent.** Many substances dissolve in water because water is polar. The charged ends of the water molecule attract the molecules of other polar substances.

Specific heat is the amount of heat needed to increase the temperature of a certain amount of a substance. Compared to other substances, water requires a lot of heat to increase its temperature.

Water exists in three **states,** or forms: solid, liquid, and gas. **Ice is a solid, the familiar form of water is a liquid, and water vapor in the air is a gas.** Change of state is related to temperature, which is a measurement of the average speed of molecules. When the temperature reaches 0°C, the solid ice melts and becomes liquid water. At 100°C, liquid water boils and the molecules have enough energy to escape the liquid and become water vapor. Liquid water also becomes a gas through **evaporation,** which is the process by which molecules at the surface of a liquid absorb enough energy to change to the gaseous state.

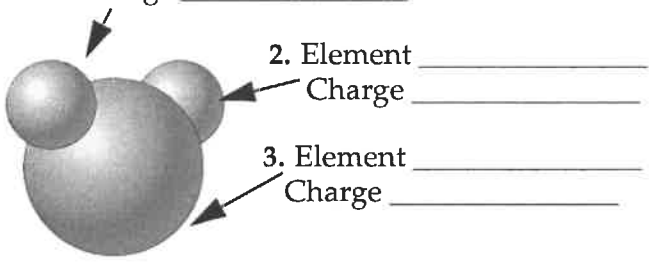
The process by which a gas changes to a liquid is called **condensation.** As the temperature of the gas cools down to 100°C, the molecules slow down and begin to change back to the liquid state. When water cools below 4°C, the molecules line up in a crystal structure. Water molecules take up more space in this crystal structure than as a liquid. This means that ice is less dense than liquid water, and thus floats on liquid water.

Name _____ Date _____ Class _____

The Properties of Water

Understanding Main Ideas

Label the parts of this water molecule by writing the name of the element and the electrical charge in items 1 through 3.



Answer the following questions on a separate sheet of paper.

4. Why is water considered a polar substance?
5. Which state of water allows fish to remain in a lake when winter temperatures are below 0°C? Explain.
6. What happens to the molecules of water vapor when the temperature of the gas cools to 100°C?
7. Why is water often called the "universal solvent"?

Building Vocabulary

Match each term with its definition by writing the letter of the correct definition in the right column on the line beside the term in the left column.

____ 8. capillary action	a. a mixture that forms when one substance dissolves another
____ 9. condensation	b. form of a substance, including solid, liquid, or gas
____ 10. evaporation	c. the tightness across the surface of water caused by the polar molecules pulling on each other
____ 11. specific heat	d. the process by which molecules at the surface of a liquid absorb enough energy to change to the gaseous state
____ 12. solution	e. the combined force of attraction among water molecules and with the molecules of surrounding materials
____ 13. solvent	f. the process by which a gas changes to a liquid
____ 14. state	g. a substance that dissolves another substance
____ 15. surface tension	h. the amount of heat needed to increase the temperature of a certain amount of a substance by 1°C

Name _____ Date _____ Class _____

Floating and Sinking

Key Concepts

- What is the effect of the buoyant force?
- How can you use density to determine whether an object will float or sink in a fluid?

Objects under water feel lighter than in air. The water exerts an upward force, called the **buoyant force,** on the object, so it feels lighter. **The buoyant force acts in the direction opposite to the force of gravity, so it makes an object feel lighter.**

Any object submerged in a fluid displaces, or takes the place of, a volume of fluid equal to its own volume. For an object floating on the surface, the volume of fluid displaced is equal to the volume of the part of the floating object that is submerged. **Archimedes' principle** states that the buoyant force on an object is equal to the weight of the fluid displaced by the object.

If the weight of an object submerged in a fluid is greater than the buoyant force, the net force will be downward and the object will sink. If the weight of a submerged object is less than the buoyant force, the object will rise. If the weight is exactly equal to the buoyant force, an object submerged in a fluid will remain suspended at some level within the fluid.

The **density** of a substance is its mass per unit volume.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

By comparing densities, you can predict whether an object will float or sink in a fluid. An object that is more dense than the fluid in which it is immersed sinks. An object that is less dense than the fluid in which it is immersed rises or floats on the surface. And if the density of an object is equal to the density of the fluid in which it is immersed, the object neither rises nor sinks, but remains suspended at some level within the fluid.

Air is also a fluid. Objects rise in air if their densities are less than the density of air. A helium balloon rises because helium is less dense than air.

Changing the density of an object can make it rise or sink. The density of a submarine is changed by pumping water into or out of the flotation tanks. As the mass changes, the density changes, and the submarine rises or falls.

Another way to change density is to change volume. A solid steel block will sink in water. But the same steel made into the curved hull of a boat will float. The shape of the hull causes it to displace a greater volume of water than a solid block of steel of the same mass. The greater the volume of water displaced, the greater the buoyant force.

Name _____ Date _____ Class _____

Floating and Sinking

Understanding Main Ideas

Answer the following questions in the spaces provided. Use the back of this sheet or a separate sheet of paper if you need more room.

1. Explain why an object underwater feels lighter than when it is in air.

2. If an object that floats on the surface displaces 10 cm^3 of water, how much does that object weigh? Explain how you know.

Fill in the table below.

Observation of object in fluid	Density of object compared to the density of the fluid
Object sinks.	3.
Object rises or floats on surface.	4.
Object floats at constant level.	5.

Building Vocabulary

Define each of the following in the spaces provided.

6. Archimedes' principle

7. density

8. buoyant force

Name_____

Date_____pd_____

River Basins and Watersheds

Carefully read the details about your ecological address and the river basins in North Carolina. Highlight and annotate! Complete the Post Reading Questions on the back.

Your ecological address is the river basin you live in so if you live in all but the southwest of Wake County you are in the ***Neuse River*** basin. There are ***17*** river basins in North Carolina. Some drain into the Atlantic Ocean as they flow west to east. Some of our rivers drain into the Gulf of Mexico as they flow southwest or west. The coastal plain transitions to the Piedmont region along the "***fall line",*** a line which marks the elevation at which waterfalls first appear on streams and rivers. The fall line is what separates the direction river basins flow.

Most of Raleigh and other towns in Wake County get their city drinking water from Falls Lake. The ***headwaters*** of the Neuse were where the Eno and Flat Rivers joined. It flows freely through eastern North Carolina until you reach New Bern where it dumps into the Pamlico Sound. The ***248 mile long Neuse River*** basin is the 3rd largest in N.C and serves a very large population for the land area it drains. It is one of only 4 river basins that lie totally within the state's boundaries. The ***Albemarle- Pamlico Sound system*** is the birthplace of 90% of the commercial seafood that is caught off the N.C. coast. That is why estuarine environments are often called the ***Nursery of the Sea.***

The Neuse is one of the most ***polluted rivers*** in the nation. One of the major causes is nutrient pollution from non point sources along the river. ***Nutrient pollution is caused by high levels of nitrogen*** (which is a main ingredient in fertilizer and animal waste) and phosphorus (found in fertilizer). These nutrients can cause a body of water to grow ***too much algae*** leading to stagnant water and very ***low levels of dissolved oxygen***. Another major cause of water pollution in N.C. is ***sediment pollution***. This has been caused by clear cutting of forests as land has been developed. The runoff from rain brings lots of sediment into the rivers causing the water to become turbid or cloudy and burying the benthic species. Cloudy water does not allow as much sunlight to penetrate. This is called by ***turbidity.***

If you live in southwestern Wake County, your ecological address is the Cape Fear River Basin. Your city drinking water in Cary is drawn from Jordan Lake. The headwaters of the Cape Fear are where the Deep and Haw Rivers meet. The Cape Fear's 200 miles of river is also entirely located in N.C. boundaries. The Cape Fear flows southeast and dumps into the sound off the coast of Wilmington, N.C. The Cape Fear is deep enough for large ships and barges to come into ***port*** at Wilmington. North Carolina only has two major ports- Wilmington and Morehead City. This is unusual as NC has many miles of coastline but our estuaries are very shallow.

The largest watershed in the United States is the ***Mississippi River*** watershed. It is made of up of many rivers which drain into the mighty Mississippi. These include the Red, Arkansas, Missouri, and Ohio rivers. The Mississippi' headwater s is in Minnesota and it dumps into the Gulf of Mexico near New Orleans. The ***Amazon River*** in Brazil, South America is the largest river basin in the world.

Post Reading Questions

1) What river basin do most people in Wake County live in?_____

2) How many river basins are in North Carolina? _____

3) What is the fall line?

4) So if the Neuse River and Cape Fear river both ultimately end up in the Atlantic Ocean, what direction do they flow?

_____

5) How many of N.C.'s 17 river basins are within the boundaries of the state? ***(Use your notes to help you.)***

6) What are the two main sources of pollution on the Neuse River Basin?

7) Why is the Cape Fear important to North Carolina's economy?

8) What is the largest watershed in the United States and where does it begin and end?

9) What is the largest in the world?

10) Why estuaries are often referred to as the ***nursery of the sea***?

Name _____ Date _____ Class _____

Water Underground

Guide for Reading

- How does water move through underground layers of soil and rock?
- How do people obtain water from an aquifer?

Underground water comes from precipitation that soaks into the ground. **The water underground trickles down between particles of soil and through cracks and spaces in layers of rock.**

Different types of rock and soil have different-sized spaces, or pores, between their particles. Materials that allow water to pass through easily are called **permeable.** Materials that do not allow water to pass through easily are called **impermeable.**

When water soaks down into the ground, it passes through permeable materials. Eventually it reaches an impermeable layer. There, it stops trickling down and begins to fill the spaces in the permeable layer above it. The permeable layer that becomes filled with water is called the **saturated zone.** The level of the top of the water in the saturated zone is called the **water table.** The layer of rocks and soil above the water table is called the **unsaturated zone.**

An **aquifer** is an underground layer of rock or sediment where water has collected. The water in an aquifer seeps through the permeable rock layers where it is stored. **With mechanical equipment people can obtain groundwater from an aquifer by drilling a well below the water table.** Pumping water out of an aquifer lowers the water level near the well. The aquifer refills when new water from the surface, called recharge, enters the aquifer.

In some aquifers, the water that has collected between impermeable layers is under great pressure. If a hole is drilled in the impermeable layer above it, the water flows out of the aquifer without being pumped. A well in which water rises because of pressure within the aquifer is called an **artesian well.**

A spring is a place where groundwater bubbles or flows out of cracks in the rock. The water in some springs is warm or even hot. The water is heated by hot rocks deep underground. A geyser is a hot spring in which the water is under pressure. From time to time, the pressure causes the hot water and steam to erupt into the air.

Name _____ Date _____ Class _____

Water Underground

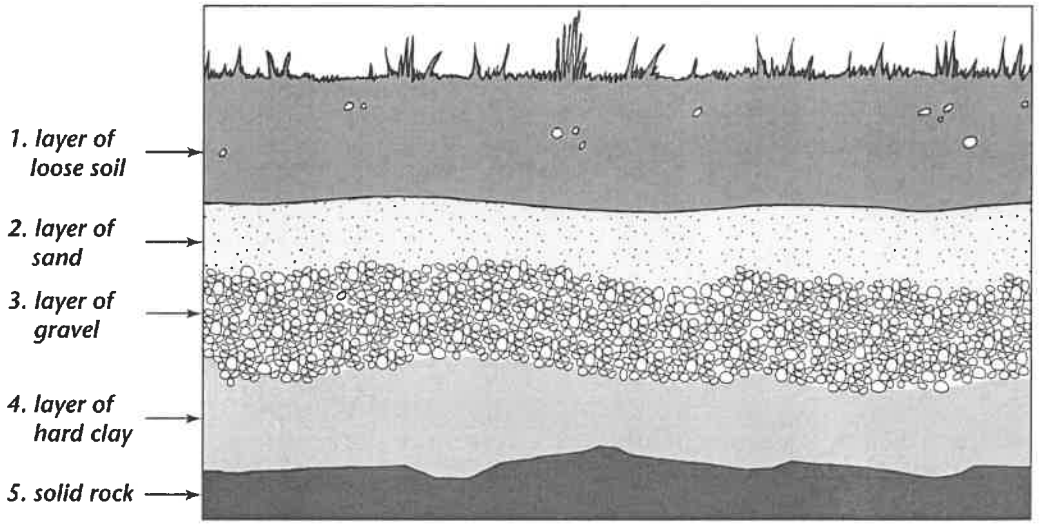
Understanding Main Ideas

Answer the following questions on a separate sheet of paper.

1. What two factors determine how easily water moves through a material?
2. Why doesn't water have to be pumped out of an artesian well?
3. What might cause a well to run dry?

Building Vocabulary

Look carefully at this diagram. Then answer the questions below.



4. Which layers are permeable?

_____

_____

5. Which layers are impermeable?

_____

_____

6. What is an underground layer that holds water called?

_____

_____

7. Use a blue pencil or marker to add groundwater to the diagram. You may choose how much groundwater you add, but make sure you put the groundwater in a logical place on the diagram. Then add the following labels: saturated zone, water table, unsaturated zone.