Glencoe Science

Chapter Resources

Water

Includes:

Reproducible Student Pages

ASSESSMENT

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- ✔ Chapter Review

HANDS-ON ACTIVITIES

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Mc Graw Hill Glencoe

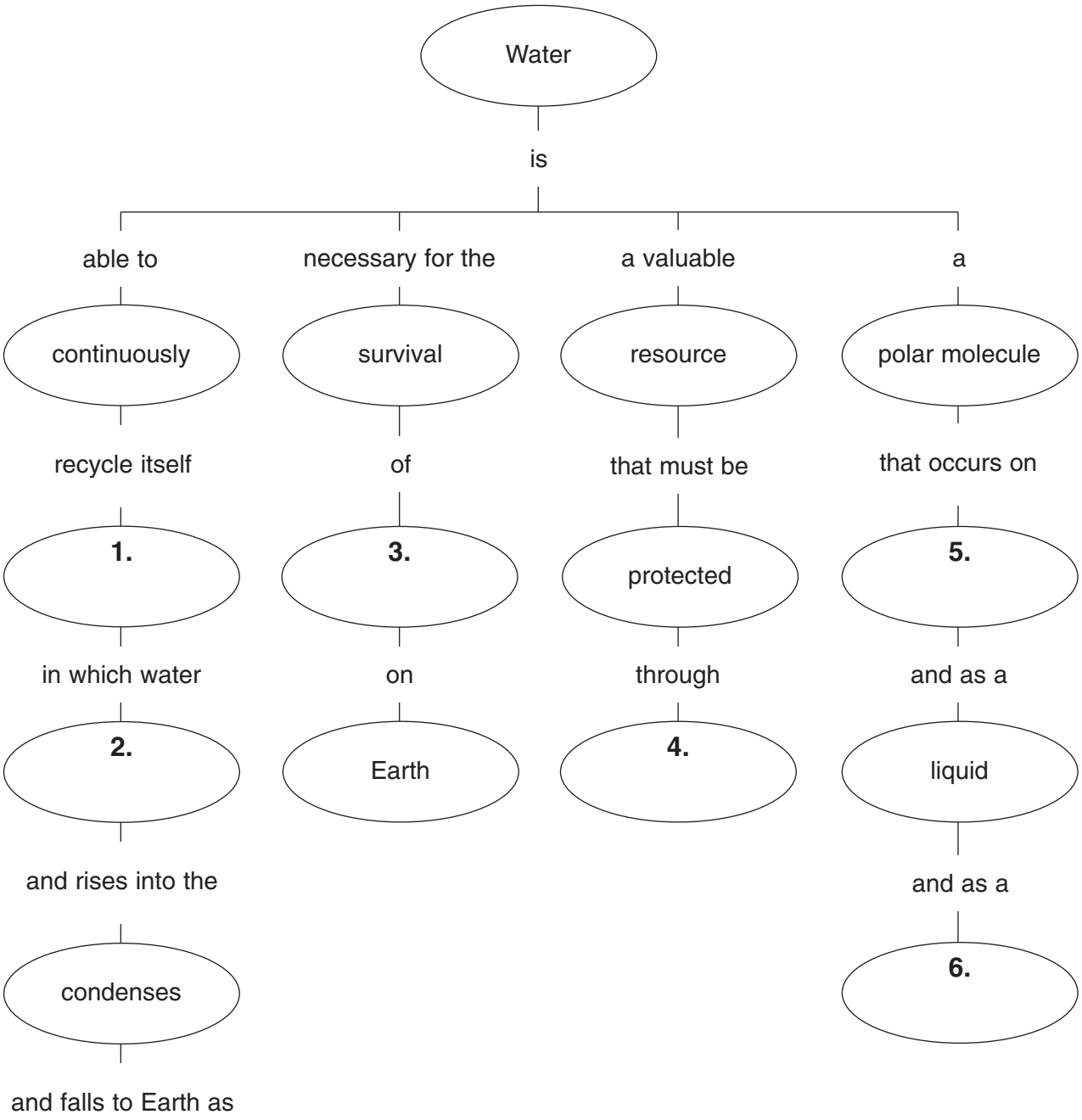
New York, New York Columbus, Ohio Chicago, Illinois Peoria, Illinois Woodland Hills, California

Directed Reading for Content Mastery

Overview Water

Directions: *Use the following terms to complete the concept map below.*

gas **evaporates** **life**
water cycle **conservation** **solid**



Name Date Class

Directed Reading for Content Mastery

Section 1 ▪ The Nature of Water

Directions: *Complete the following paragraphs using the terms listed below.*

vaporization	**cohesion**	**specific heat**
density	**polar molecule**	**fusion**

Water molecules are connected with weak bonds. Separating these bonds requires energy. The energy needed to change water from solid to liquid is called the latent heat of **1.** _____. The energy needed to change water from liquid to gas is the latent heat of **2.** _____.

These processes take time. Water won't freeze the instant it goes into the freezer, and ice won't melt immediately when you place an ice cube on the counter.

The **3.** _____ of water changes when materials such as salt are added. The water becomes denser. That is why freshwater, which has no salt, floats on salt water. Temperature also affects density. Heat provides energy to break the bonds connecting water molecules, the water molecules spread out, and the warm water becomes less dense than cold water.

The **4.** _____ of water is the attraction between molecules. It causes water to form drops on a window. Cohesion works because water is a **5.** _____. One of the water molecule's elements pulls harder on the shared electrons. Each water molecule acts as a tiny magnet, attracting other water molecules. The polarity of water allows it to dissolve other substances, such as sea salt. Another property of water is its high **6.** _____. This is the amount of energy that is needed to raise the temperature of 1 kg of a substance 1°C.

Meeting Individual Needs

Name Date Class

Directed Reading for Content Mastery

Section 2 ▪ Why is water necessary?
Section 3 ▪ Recycling Water

Directions: *Draw a line between each type of water use and its category.*

1. towns located near water sources	**a.** water and life
2. boating, scuba diving	**b.** water and society
3. passenger liners, freighters	**c.** water for production
4. moves nutrients through the body	**d.** water for transportation
5. industry and agriculture	**e.** water for recreation

Directions: *Write the letter of the term that correctly completes each sentence in the space at the left.*

_____ **6.** The careful use and protection of water is called water _____.
a. mulching **b.** conservation

_____ **7.** _____, which is trapped in soil openings, keeps plants and crops alive.
a. An aquifer **b.** Soil water

_____ **8.** Water held underground in rock layers is one type of _____.
a. groundwater **b.** surface water

_____ **9.** A layer of rock that has enough well-connected openings to allow water through is an _____.
a. aquifer **b.** emission

_____ **10.** Farmers can use better methods of _____ to conserve water.
a. vaporization **b.** irrigation

_____ **11.** Ice sheets and glaciers account for _____ of the freshwater on Earth.
a. 2 percent **b.** 77 percent

_____ **12.** Water vapor in Earth's atmosphere _____ to form the droplets in clouds.
a. evaporates **b.** condenses

Meeting Individual Needs

Name Date Class

Directed Reading for Content Mastery

Key Terms
Water

Directions: *Use the following terms to complete the sentences below.*

groundwater	**soil water**	**aquifer**
surface water	**irrigation**	**water conservation**
density	**cohesion**	**polar molecule**
states	**specific heat**	**freshwater**

1. You need to know mass and volume to find _____.
2. The attraction between molecules is called _____.
3. Farmers use _____ to water their crops.
4. Water is a(n) _____ that has many special properties.
5. _____ includes underground streams.
6. The careful use and protection of water is called _____.
7. Even when the Sun is shining on a body of water, the water is still cool because of its high _____.
8. Groundwater trapped in the soil is called _____.
9. A(n) _____ is a layer of rock or sediment with enough well-connected openings to allow groundwater to flow through it.
10. Streams, rivers, ponds, lakes, and reservoirs are types of _____.
11. The three _____, or forms, of water are solid, liquid, and gas.
12. Only three percent of Earth's water is _____.

Meeting Individual Needs

Name Date Class

SECTION 1 Reinforcement

The Nature of Water

Directions: *Write the term that matches each description below in the spaces provided. Write one letter in each space. Unscramble the letters in the boxes to find the answer to question 9.*

1. two atoms that bond with an oxygen atom to form a water molecule ☐ ___ ___ ___ ___ ___ ___ ___

2. caused by differences in density in ocean water ☐ ___ ___ ___ ___ ___ ___ ___

3. unit used to measure heat ___ ☐ ___ ___ ___

4. amount of mass in a unit of volume ___ ☐ ___ ___ ___ ___ ___

5. electrons in covalent bonds ☐ ___ ___ ___ ___ ___

6. property that enables water to dissolve other substances, such as sea salts ___ ☐ ___ ___ ___ ___ ___ ___

7. the amount of energy needed to raise the temperature of 1 kg of a substance 1°C ___ ___ ___ ___ ☐ ___ ___ ___ ___ ___ ___ ___

8. energy needed to change water from solid to liquid

___ ___ ___ ___ ☐ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

9. the attraction between water molecules ___ ___ ___ ___ ___ ___ ___ ___

Directions: *Answer the following questions on the lines provided.*

10. Name the three states of water.

_____

11. What are two factors that can change the density of water?

_____

_____

12. Why does ice float on water?

_____

_____

13. Does a high specific heat allow water to heat slowly, cool slowly, or to do both?

_____

Meeting Individual Needs

Name Date Class

SECTION 2 Reinforcement

Why is water necessary?

Directions: *Find the mistakes in the statements below. Rewrite each statement correctly on the lines provided.*

1. About 99 percent of Earth's total water supply is available for human use.

2. About ten percent of a person's body is water.

3. Water molecules are not attracted to other polar molecules.

4. Industry and transportation are the major users of water in the United States.

5. Conservation means piping in water from elsewhere and using it to grow crops.

6. Because interstate highways and airports are so important to modern society, big ships are seldom an economical way to move large freight.

7. Flooding the fields is a good way for farmers to conserve water.

8. The careful use and protection of water is called water recycling.

9. High-flow toilets are used to conserve water.

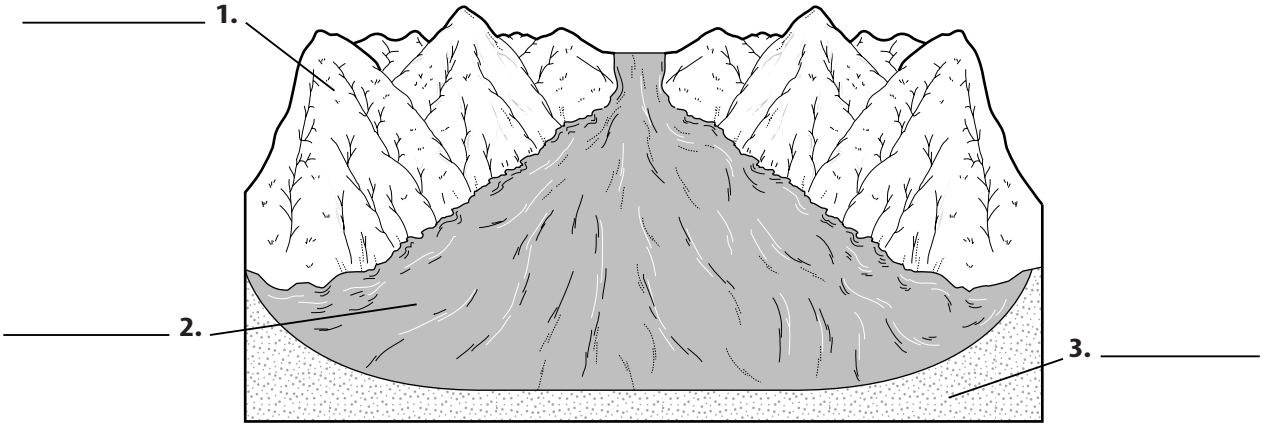
10. Water is not necessary in maintaining an ecological balance in nature.

SECTION 3 Reinforcement

Recycling Water

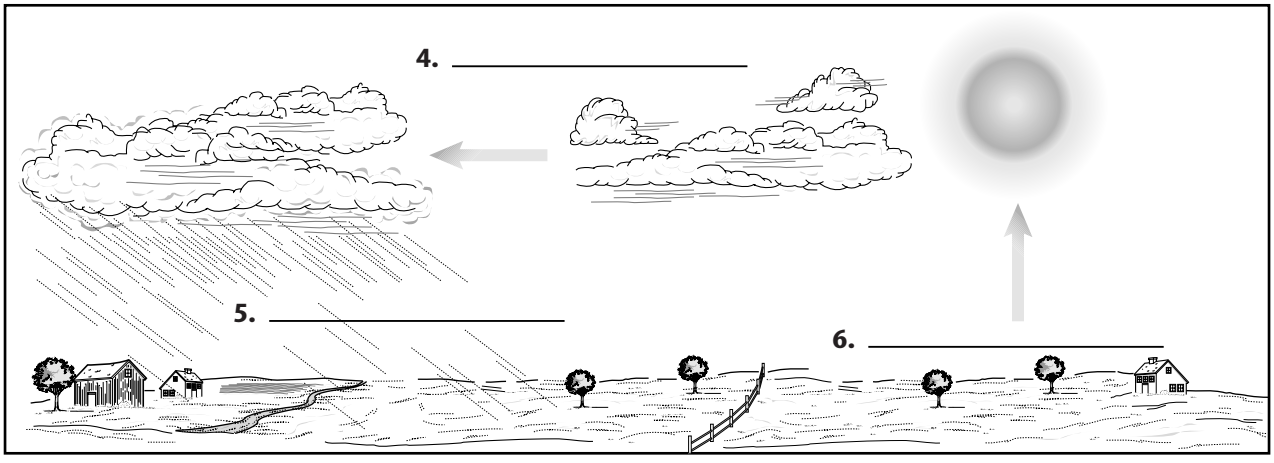
Directions: *Write the names of the different categories of water indicated on the cross section of land below.*

Figure 1



Directions: *Write the names of the three stages of the water cycle that occur above Earth's surface.*

Figure 2



Directions: *Use the illustrations above to answer the following questions on the lines provided.*

7. How is Figure 1 related to Figure 2?

8. In Figure 2, the water molecules that are falling from the cloud could be in which two of water's states? What determines the state of the water molecule?

SECTION 1 Enrichment

Snow Crystals: Miniature Masterpieces

"Under the microscope, I found that snowflakes were miracles of beauty, and it seemed a shame that this beauty should not be seen and appreciated by others. Every crystal was a masterpiece of design and no one design was ever repeated. When a snowflake melted, that design was forever lost. Just that much beauty was gone, without leaving any record behind." (Wilson A. Bentley)

Photographing Snowflakes

Wilson Bentley was only 15 when he first saw snowflakes (or snow crystals, to be more precise) under a microscope. He decided he would try to capture their beauty on film. That was well over 100 years ago, and the art of photography was not developed to the point it is today. It wasn't until 1885, after years of experimentation, that Bentley took the first picture of a single snow crystal. He did so by adapting a microscope to his camera. Eventually, he photographed more than 5,000 snow crystals. No two of them were alike.

Is it true that no two snow crystals have *ever* looked exactly alike? Without examining and comparing all the snow crystals that have ever fallen, there is no way to know for sure. However, it is a definite possibility.

The reason is in the way snow crystals form. It takes many millions of water molecules to make a snow crystal heavy enough to fall to the ground. The basic molecular structure of water—two hydrogen atoms to one oxygen atom—causes water to form into stable hexagonal, or six-sided, ice crystals. Millions of molecules can then become attached to this basic shape in countless billions of ways.

Crystal History

As crystals are blown this way and that and finally fall to Earth, changing temperatures and other conditions have different effects on crystal growth. In their short lives, snow crystals have histories as varied as human beings, and it is a crystal's chance history that determines its final design.

Science in Wilson Bentley's time could not explain exactly how snow crystals form. In fact, not all the answers are known even today. None of this has changed people's fascination with snow crystals or with Bentley's work. His original camera and many of his microphotographs are on display in a museum in Jericho, Vermont.

1. What causes ice crystals to form in hexagonal shapes?

2. What conditions make photographing snow crystals difficult?

3. Do you think that knowing the scientific explanation of how snow crystals form makes us appreciate their beauty more or less? Explain.

SECTION 2 Enrichment

Ideas for a Home

The term xeriscaping (ZEER uh skay pihng) comes from the Greek word *xeros*, meaning dry, and refers to landscaping with plants and methods that conserve water. Although it is often thought of in connection with dry climates, xeriscaping principles can be applied anywhere. The seven water-conserving principles are

- planning and design
- slow-growing and drought-tolerant plants
- appropriate turf
- soil preparation
- efficient irrigation methods
- use of mulch
- proper maintenance

Replacing the Lawn

Imagine that you have been asked to landscape the property around someone's home. The goal is to reduce water use by 30–50 percent. Devise a plan that follows the seven principles above. For example, you will probably want to replace lawn grass—which requires considerable water in order to stay healthy—with some other kind of ground cover. Possible choices include buffalo grass, shrubs, or a mulch such as bark chips or pine needles. You might want to loosen the soil and mix in compost or peat moss to help the soil retain water.

Better Irrigation

Choosing drought-resistant plants that are native to the area is another consideration. How the plants are placed in the yard also is important. Would it make sense to have the plants with the highest water needs near the house or far away? Grouping plants with similar water needs also will permit you to irrigate more efficiently. Two kinds of irrigation methods to consider are sprinkler irrigation and drip irrigation. The idea behind any irrigation method is not to wet the plants, but the soil, so that the water can be taken into the plant through the root system. For this purpose, a sprinkler is not always the most efficient method. Even a five-mile-per-hour wind can cause the water to be distributed unevenly. With low-pressure drip irrigation, perforated hoses apply water directly to the soil. As a result, little water is wasted through evaporation or runoff.

Directions: *Study the seven principles carefully. Then, on separate pieces of paper, complete the following steps in your landscape plan.*

1. Draw a layout of the yard you will xeriscape. Show the location of the house and any objects in the yard that are used for activities—a picnic table or a child's playhouse, for example.
2. Chart your plant choices for the various uses of the yard, showing the advantages of each plant choice. Use the library and other resources to determine your choices.
3. Indicate on your layout where you will place your plants and how you will irrigate them.

SECTION 3 Enrichment

Endangered Species of the Edwards Aquifer

In the San Antonio desert area of Texas, the Edwards aquifer provides water to almost two million residents and visitors.

Even though it is the largest artesian aquifer in the world, there are fears that it might not be able to provide for future needs. Threats to the aquifer include not only overuse, but agricultural and urban runoff that carries pollutants to the groundwater. The region's economy is based on water availability. Farmers, manufacturers, and land developers are concerned about limitations that may be imposed on them.

Endangered Species

Naturalists, on the other hand, are concerned about seven endangered species that are threatened with losing their natural habitats in the Edwards Aquifer region.

- One of these endangered species is the Texas blind salamander (*Typhlomolge rathbuni*), a sightless, white or pinkish salamander that lives in the aquifer's limestone caves. This salamander is particularly sensitive to groundwater pollutants.
- The fountain darter (*Etheostoma fonticola*) is a small, reddish-brown fish that dwells only in the San Marcos and Comal rivers. Drought eliminated the Comal River population in the 1950s, but a restocked population from the San Marcos River has survived.
- The San Marcos gambusia (*Gambusia georgei*) is a livebearing fish. Most aquatic biologists of the region believe that the San Marcos gambusia is already extinct.
- Texas wildrice (*Zizania texana*), an aquatic grass with leaves as long as 45 inches (1.14 meters), is considered endangered though it used to be abundant. As the city of San Marcos grows, groundwater in Edwards aquifer has been diverted, and water levels have decreased in the areas where the wildrice typically grows.
- The Comal Springs riffle beetle (*Heterelmis comalensis*) is a tiny, 1/8-inch-long (1/3 centimeter) aquatic beetle.
- Another species, the Comal Springs dryopid beetle (*Stygoparnus comalensis*), wasn't discovered until 1987. Very little is known about this species of beetle.
- The Peck's cave amphipod (*Stygobromus pecki*) is an unpigmented, eyeless, aquatic crustacean. The cave amphipod's primary habitat is deep within the aquifer.

By definition, an endangered species is a species in danger of disappearing forever if its situation is not improved. At this point the seven species described above are dependent for their survival on the success of water conservation efforts now underway in the Edwards aquifer region.

1. Name two threats to the health of the Edwards aquifer.

_____

2. Which types of agencies or groups would need to work together to find solutions to the overuse of the Edwards aquifer?

_____

_____

Note-taking Worksheet

Water

Section 1 The Nature of Water

A. Water, a molecule composed of two hydrogen atoms bonded to one _____ atom, is found on Earth in liquid, solid, and gaseous states.

1. To change water from solid to liquid, or from liquid to gas, _____ must be broken.

2. State changes, going from gas to liquid or from liquid to solid, requires _____.

B. _____—the heat energy needed to change water from solid to liquid

1. It takes _____ for water to change forms.

2. _____—the amount of heat needed to change water from liquid to gas

a. During latent heat of fusion and latent heat of vaporization, no increase or decrease in temperature occurs, just a change in _____.

3. Density—the amount of _____ in a unit of volume

a. Added _____, such as salt, change the density of water.

b. _____ also affects water density; warm water is less dense than cold water.

C. _____—attraction between water molecules that allows them to form drops and remain liquid at room temperature

1. Water is a **polar molecule** in which one element pulls on the shared _____ more than the other element.

a. The _____ of water makes it great for dissolving other substances.

2. _____—the amount of energy needed to raise the temperature of 1 kg of a substance 1°C

a. Water has one of the _____ values of specific heat.

Section 2 Why is water necessary?

A. _____ is essential for all life on Earth.

1. _____ percent of the human body is water.

2. Water provides habitats for _____ that live in and around it.

Meeting Individual Needs

Note-taking Worksheet (continued)

3. Cohesion allows for the _____ action that pulls water upward inside plant stems.

B. Industry uses water for producing manufactured goods; farmers use water for _____ of farmland.

1. Water is valuable for the _____ of people and freight down rivers and across oceans.
2. Water is a major source of _____, such as fishing, swimming, and boating.

C. Rivers, lakes, ponds, and oceans must be _____ to support the animals and plants that live within them.

1. _____, the careful use and protection of water, is important because less than _____ percent of Earth's water is available for human use.
   a. Much of the water used for agricultural irrigation is lost to _____.
   b. Companies can treat and _____ water used in industrial plants.
2. Everyone can _____ water.
   a. Turn off the water when soaping up in the _____.
   b. Turn off the faucet while brushing _____ or washing hands.
   c. Use a low-flow _____ system.

Section 3 Recycling Water

A. About 70 percent of Earth is covered by water, but less than one percent is available for _____ use.

1. Ocean water is plentiful, but too _____ for drinking, bathing, or irrigation.
2. _____ sheets and _____ account for 77 percent of Earth's freshwater.
3. **Groundwater**—water held underground in layers of _____ and _____
   a. Groundwater held within soil openings— _____
4. _____—layer of rock or sediment that allows groundwater to flow through it and is sometimes used as a water supply for towns and farms

Note-taking Worksheet (continued)

5. Lakes, rivers, ponds, streams, and reservoirs contain _____ water.
6. Water vapor is found in Earth's _____.
   a. The atmosphere uses the heating and cooling properties of water to move _____ around, causing wind and storms.
   b. Water vapor in the atmosphere absorbs energy and helps keep Earth _____.

B. Water on Earth constantly recycles itself through the _____.

1. Water _____ from oceans, lakes, and rivers and rises into Earth's atmosphere.
2. Water vapor _____ to form droplets in clouds.
3. Droplets fall back to Earth as _____, _____, or _____.
4. _____ runs off Earth's surface back to oceans, lakes, and rivers.