



Water Matters!

Saving Your Water through Science



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Introduction



Water is one of the most common but important substances on Earth. People need water to live. Water is found in three forms: solid, liquid and gas.

No matter how old we are or where we live, we need clean, fresh water to keep us alive and healthy. Since water is all around us, we sometimes forget that our water supply is limited. The amount of water on the Earth always stays the same. With more and more people in the world needing water, we must use it very carefully.

As you read this publication, you will learn about the three states of water and the amazing water cycle. You also will learn how plants fit into the water cycle. Last, you will learn how precious water is to every living thing — including you!

Section One:

Water Three Ways

From the time you get up in the morning to the time you go to bed at night, you use water in many ways. Can you think of some ways you use water every day?

You use water in the morning by flushing the toilet, washing your hands and brushing your teeth. During the day, water is used to cook your meals and wash your clothes and dishes. Whenever you are thirsty, you can easily have water to drink right from your faucet. Sometimes you might help your parents by watering a plant or giving a pet some water. Before bed, you use water when you take a bath or shower.

All these examples are ways we use water when it is a **liquid**. Other examples of liquids are orange juice, milk and shampoo. A liquid flows when you pour it. It also has no shape of its own so it takes the shape of its container. It may surprise you to know that water isn't always in a liquid state. It also can be a solid or a gas.



A **solid** holds its shape and doesn't flow like a liquid. A solid can be hard like a rock, soft like a kitten's fur, big like a car or small like grains of sand. A solid keeps its shape no matter what container you put it in and even if it isn't in any container at all. For water to change from a liquid to a solid, energy is used to cool the water until it **freezes**. When water is in a solid state, it is called ice.

Energy also can change water from a solid to a liquid or from a liquid to a gas. This change happens when energy is added in the form of heat. Think about taking an ice cube out of the freezer and setting it in a bowl on the counter. What will happen to

the ice? As the air warms the ice cube, it starts **melting** and gradually changes from solid ice to liquid water.

Heat also can change liquid water into a **gas**. When water is a gas, it is called **water vapor**.

Gases are like the air around us. They are often invisible and can fill a container of any size or shape no matter how big the container is. When water turns to a gas, it seems to be magic when the water disappears. Your hair is wet after you wash it, but after awhile, it is dry. You may have seen a puddle of water after a rain. A little while after the sun comes out, the puddle disappears. *Where did the water go?*

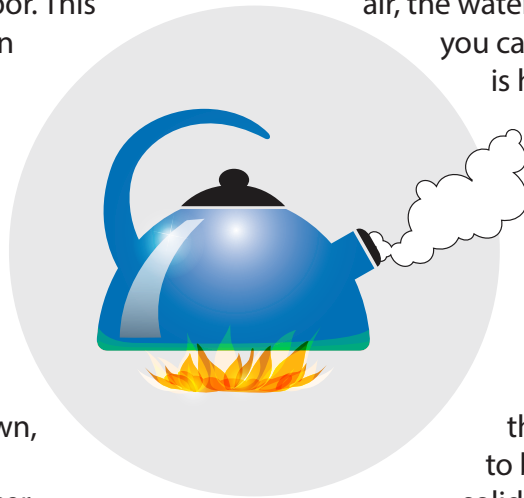
To answer this question, you need to understand that water is made up of molecules. **Molecules** are tiny objects that fit together to form larger things. In the same way you might fit together building blocks to make a castle or fort, tiny molecules fit together to make up larger things like animals and stars and people and everything around us. While you can easily see building blocks, molecules are so small we can't see them with our eyes.

Now that you know about molecules, you can understand what is really going on when water changes from solid to liquid to gas. These changes depend on temperature. Molecules are always moving, but heat or cold change the way they move.



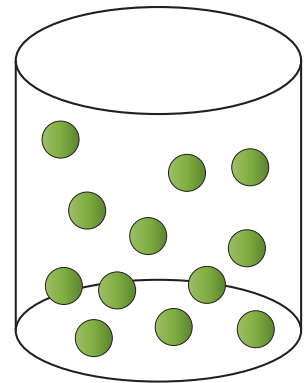
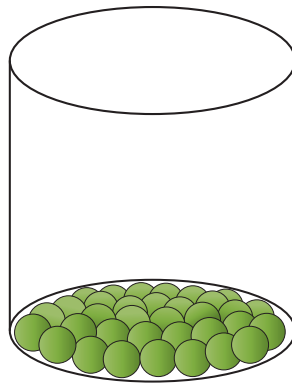
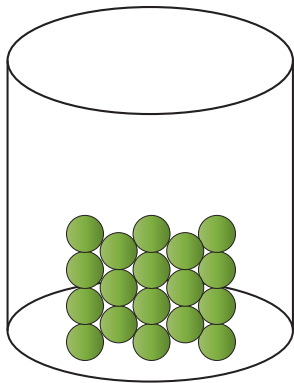
Heat energy causes the molecules to move more quickly and spread farther apart. Some move so fast that they break away from other water molecules and go up into the air as water vapor. This process is called **evaporation**. Even though you can't see the water anymore, it still exists. It has changed into an invisible gas called water vapor. Evaporation is what makes the water in puddles or the water in your hair seem to disappear.

Have you ever been outside on a cool morning and been able to see your breath? The gas you exhale contains water vapor. When it hits cooler air, the water vapor condenses into a mist you can actually see! This also is what is happening when you see water droplets form on the outside of a cold glass with ice in it. During condensation, water molecules in the air are cooling, moving closer together and changing into liquid.



So, how does water vapor become liquid water again? As air cools down, the molecules in water vapor slow down so much that they come closer together to form tiny droplets of liquid water. This process is called **condensation**.

When water cools even more, the molecules slow down enough to become a solid. Whether water is solid, liquid or gas, it is necessary for all living things.



Molecules in

Solid

A **solid** keeps its shape as molecules move very slowly and are packed together.

Liquid

In **liquids**, molecules move more and are not as close together, so the liquid cannot hold its own shape and takes the shape of the container.

Gas

Molecules in **gases** move the quickest and spread out to fill the container.

Vocabulary Review

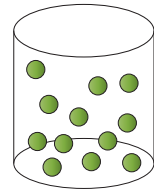
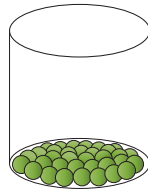
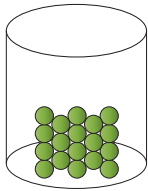
Review the bolded vocabulary words and definitions in Section One to fill in the blanks below:

Vocabulary Word	Definition
	As air cools down, the molecules in water vapor slow so much that they come closer together to form tiny droplets of liquid water.
	When heat causes the water molecules to move so fast they break away and go up in the air as water vapor.
Freezing	
	Molecules in this state are often invisible and can fill a container of any size or shape. Water molecules in this state are also called water vapor.
Liquid	
Melting	
	Tiny objects so small we can't see them but they fit together to form everything around us.
Solid	

Questions:

Write your answers in complete sentences.

1. Look at the molecules in each cup. Decide which cup holds a **gas**, a **solid** or a **liquid**. Write the correct word under each cup.



2. Everything around us is made up of molecules. True or false?

true false

3. What are two ways to make water evaporate?

4. Heat changes liquid water to solid. True or false?

true false

5. Temperature changes the way molecules move. True or false?

true false

6. Explain what is really happening when a puddle disappears on a sunny day.

How I Changed

Fill in the blanks using the word bank.

Directions:

air	gas	melting
liquid	hot	moving
evaporated	ice	solid
freezing	liquid	colder

I am a water drop and my name is **Aqua**. I have lived in the ocean a long time and I love to see the pretty fish all around me. But last week that changed when something very strange happened.



The sky was blue and the sun was shining brightly on me as I floated along on top of a wave. As the sun shined on me, I started to get very, very _____. All of a sudden, I was lifted up into the _____. I looked down at myself and was surprised that I was invisible. I knew then that I had _____. I had changed from a liquid to a _____. I felt like I was flying! Wee! I flew for many miles.

As I went higher and higher into the sky, the temperature began to get _____. I started going slower and began to feel heavier. I knew then that I was turning back into a _____. I started to get so heavy that I fell down out of the sky a long, long way. Finally I landed. I looked around and everything was completely different.



The warm ocean was gone! Instead I saw white stuff all around



me and it was very cold. I found that I was _____ very slowly now, hardly at all. I was getting colder and colder. That's when I realized I was _____! I looked down and saw that I was no longer a liquid, but now a _____. I had changed to _____. It was not much fun just being stuck there. Boring!

I was so glad when the sun came out and I started _____. Once I became _____ again, I began to flow into a stream and had so much fun going faster and faster down the mountain. I even made new fish friends. What do you think what will happen to me next?

Section Two:

The Amazing Water Cycle

A cycle is a pattern that happens over and over again, like the wheels on your bicycle going round and round. But there are other kinds of cycles, too. On school days, for example, your schedule follows a cycle of getting up, going to school, coming home, doing your homework, eating dinner and going to bed. This cycle is repeated every regular school day. In this section you will learn about another kind of cycle — the **water cycle**.

All the water on Earth is part of a wonderful system in nature called the water cycle. Sometimes you will hear it called the **hydrologic cycle**.

The sun's energy makes the water cycle work. Heat from the sun warms water on the surface of lakes, rivers and oceans, as well as from the land and even plants. This heat energy causes the water molecules to move faster and faster until they break away. During this process called **evaporation**, water changes from liquid to vapor and goes up into the air.

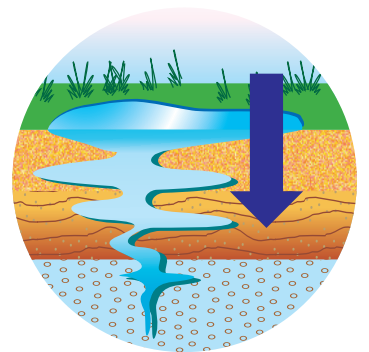
When the water vapor rises and meets cold air, the water molecules slow down and move closer together. This process, called **condensation**, creates what we see as clouds. Signs of condensation also can be seen in your home. Have you ever noticed a steamy bathroom mirror after a shower? When water vapor in the air comes in contact with the cool mirror, the molecules cool and become slower while growing closer together. Tiny water droplets begin to form on the mirror. As the droplets become

heavier and heavier, they run down the mirror. What was once an invisible gas is now liquid.

Something similar happens to water vapor in clouds. These droplets collect together in the clouds and grow heavier and heavier. When the droplets become too heavy to stay up in the clouds, they fall to Earth as **precipitation**. Precipitation can be in the form of rain, hail, sleet or snow.



On average, Florida gets about 50 inches of rain each year. That's a lot! Some of this rain evaporates before it even reaches the ground, some runs into a lake or river, and some soaks into the ground in a process called **percolation**. Water that percolates into the ground remains underground for many years. It may some day be used by people or come out of a natural opening in the ground, called a spring. The water also may be taken up by the roots of plants. Water the plant doesn't need is released back into the air through the plants leaves in a process called **transpiration**. You will learn more about this process in the next section.



As you can see, evaporation, condensation, precipitation, percolation and transpiration are going on around you all the time. All of the planet's water continuously circulates through the water cycle. That means the same water all around us has been here since the Earth began. The water we drink today is the same water that dinosaurs drank!

The Hydrologic Cycle

SUN

CONDENSATION

PRECIPITATION

EVAPORATION

TRANSPIRATION

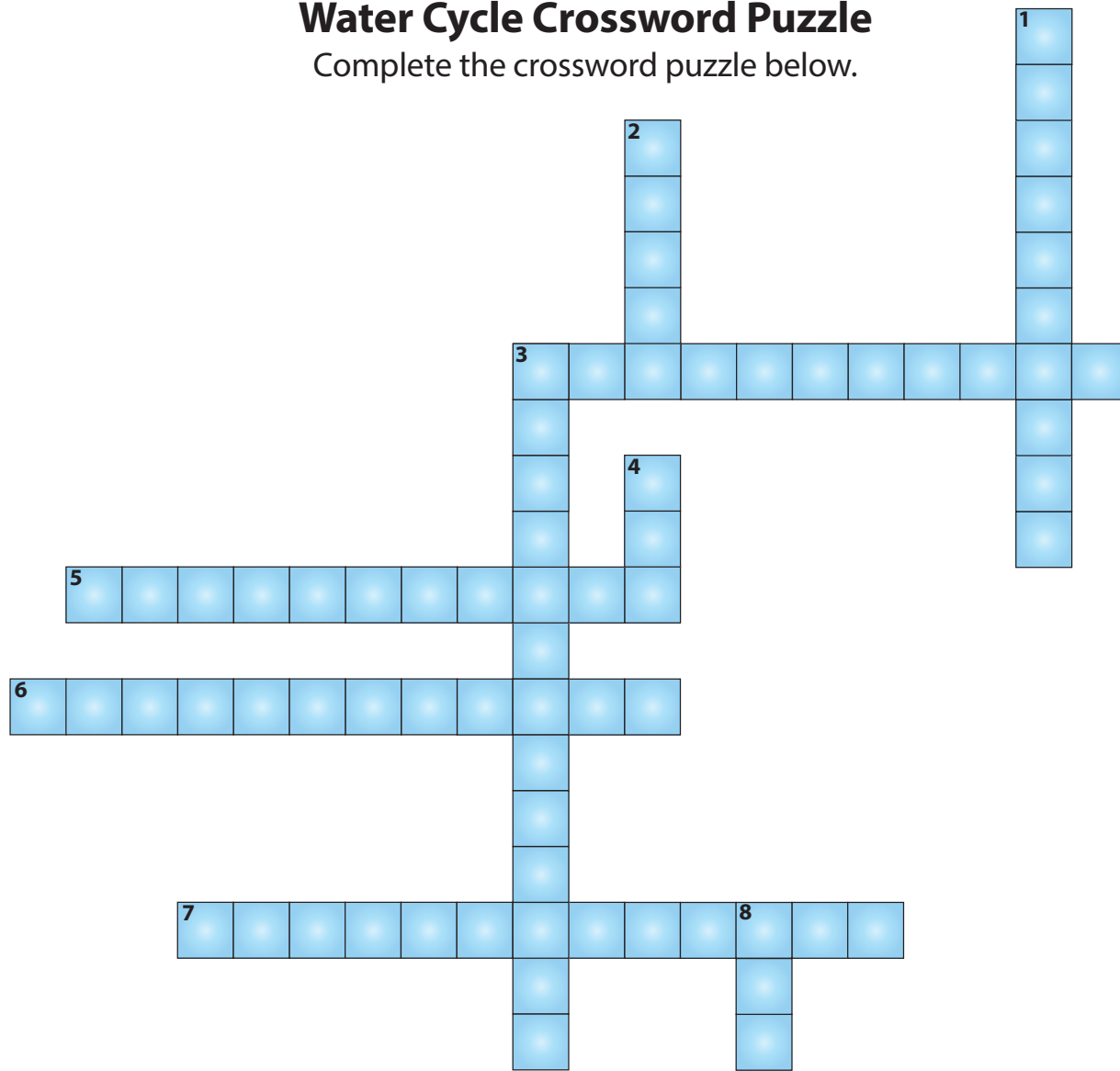
PERCOLATION

- Sun:** the source of energy for the never-ending water cycle
- Evaporation:** vapor created when the sun heats water in lakes, streams, rivers or oceans
- Transpiration:** vapor created when plants and trees give off moisture
- Condensation:** tiny droplets of water formed when water vapor rises into the air and cools
- Precipitation:** moisture released when clouds become heavy and form rain, snow and hail
- Percolation:** movement of water through the ground

Vocabulary Review

Water Cycle Crossword Puzzle

Complete the crossword puzzle below.



- | | | | | | |
|-------------|---------------|-------------|---------------|-----|-------|
| percolation | transpiration | sun | precipitation | ice | water |
| hydrologic | condensation | evaporation | | | |

Horizontal

- Water soaking into the ground is called _____.
- _____ happens when the sun heats water until it changes to a gas.
- Tiny droplets of water that form when water vapor cools is called _____.
- _____ happens when water evaporates from plants and trees.

Vertical

- All the water on Earth continuously moves through a natural system called the _____ cycle.
- People, plants and animals need _____ to live.
- Rain or snow falling from the sky is called _____.
- The _____ provides energy for the never-ending water cycle.
- A solid form of water is called _____.

Questions:

Write short answers in complete sentences.

1. Only part of the world's water circulates in the water cycle. True or false?

 true false

2. Circle the best answer:

Earth has the same amount of water now as it did millions of years ago. How is this possible?

- a. Because we have many lakes, rivers and streams
- b. Because plants and trees give off moisture
- c. Because water keeps moving through the water cycle
- d. Because it rains a lot

3. Clouds in the sky are part of percolation in the water cycle. True or false?

 true false

4. What is the sun's part in the water cycle?

5. The water cycle is a very important process for life on Earth. Why is it called a cycle?

Section Three:

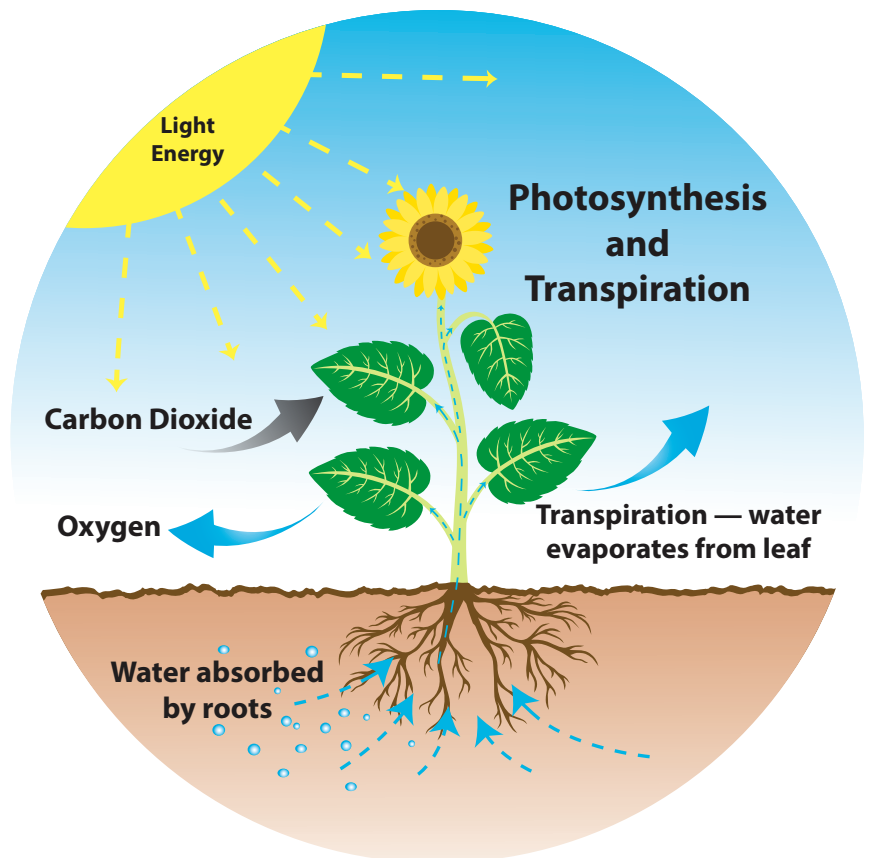
Plants' Place in the Water Cycle

So far, you've learned about the stages of the water cycle — precipitation, percolation, condensation, evaporation and transpiration. Remember the water cycle is a never-ending process that recycles all of the world's water. In this section you will learn more about transpiration and how plants fit into the water cycle.

Plants help people. You probably already know that many of the foods we eat like carrots, potatoes, bananas, apples or strawberries, come from plants. In addition, plants provide grains we use for making cereal, bread, cookies and other treats. Plants also are food for animals so we can eat meats like chicken or hamburger. Are you surprised to learn plants also make oxygen and they clean our water? You may be wondering what all this has to do with the water cycle.

To understand plants' place in the water cycle, you need to first understand how plants work. Plants not only provide many of the foods people eat, but they actually make their own food through a process called **photosynthesis**. Plants use energy from the sun to make their own food and feed themselves.

As part of photosynthesis, plants help us breathe. Plants use carbon dioxide to create oxygen that people breathe in. Plants need sunlight, carbon dioxide and water for **photosynthesis**. Plants take in water from soil to create food in their leaves. Water is taken in through plants' roots and moves up the **stem** to get to the leaves. Photosynthesis mostly takes place in the leaves.



Water the plant didn't need to make food during photosynthesis evaporates through the leaves. This is the process of **transpiration**. Transpiration occurs again and again. As water evaporates off the leaves and into the air, more water travels up through a plant's roots and stem to replace the evaporated water. This constant process is another example of a cycle.

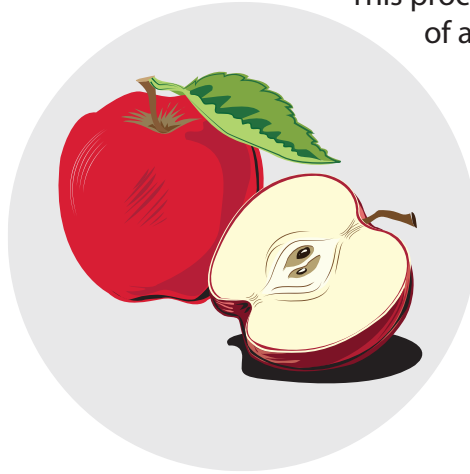
Remember we learned that plants actually help clean our water? Even when plants take in dirty water through their roots, they clean the water as it moves through their stems and leaves. By the time the extra water the plant doesn't need is transpired through its leaves, that water has been cleaned! This is a wonderful benefit of plants' place in the water cycle.

The water plants take in and the food it creates during photosynthesis help the plant grow and produce flowers, fruit and seeds.

Flowers, fruit and seeds are the way plants reproduce. **Flowers** produce seeds so that new plants can grow. They also add a lot of beauty to the world and provide food to butterflies, bees, bats and birds. Fruit not only provides food,

but also contains and protects seeds. These seeds fall to the ground and new plants grow from them.

This process is another cycle — the life cycle of a plant.



The water cycle doesn't work without plants. Plants can't live without the water cycle. The two work together and are both necessary for life on Earth.

Vocabulary Review

1. Select all correct answers.

Photosynthesis

_____ is how plants make their own food

_____ requires energy from the sun

_____ is the opposite of transpiration

_____ uses water

_____ can be done by animals

2. Using your own words, write a definition of photosynthesis and transpiration.

Photosynthesis _____

Transpiration _____

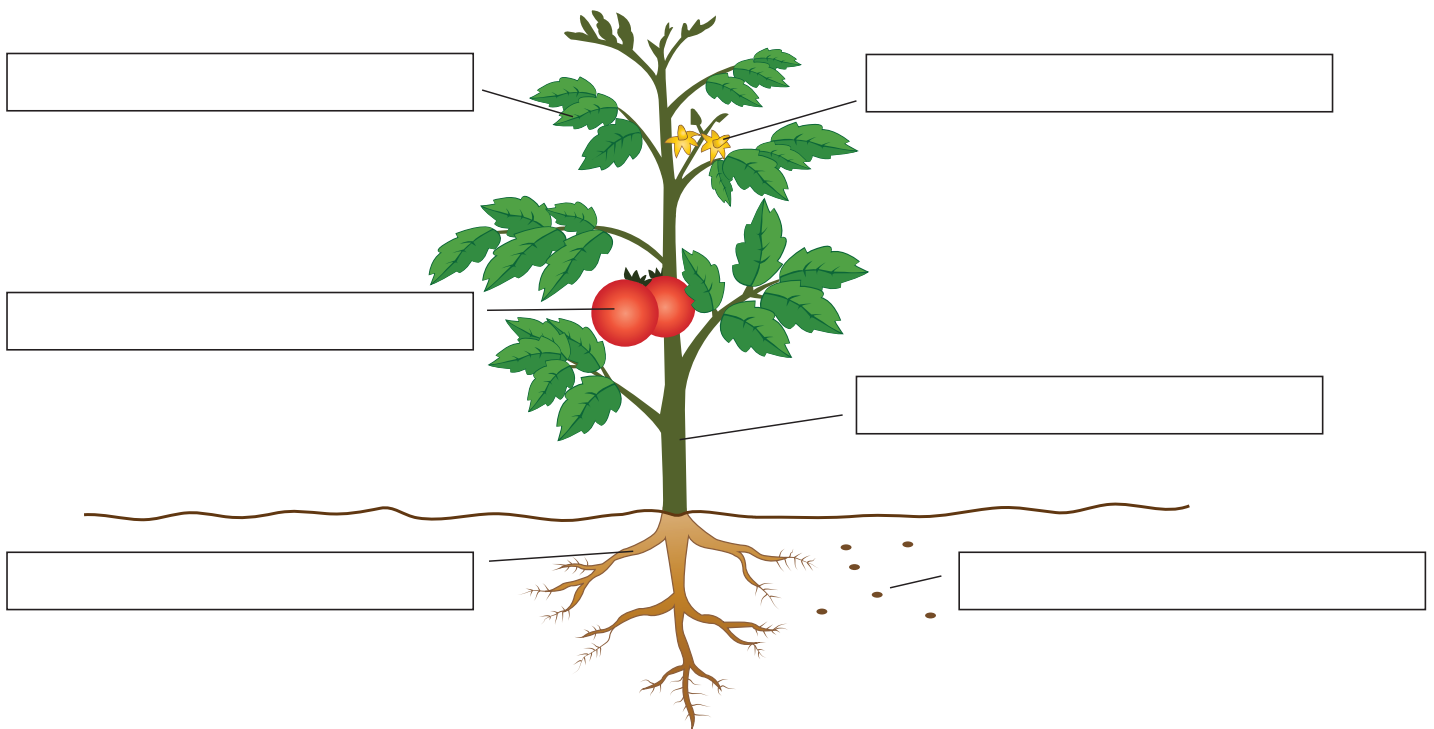
3. Write a sentence using the word photosynthesis and a sentence using the word transpiration.

Photosynthesis _____

Transpiration _____

4. Label the parts of a plant and draw a line from the part of the plant to its purpose.

Parts of a Plant



Produces seeds so new plants can grow and provides food for insects, birds and bats

Supports the plant and carries water to all the parts of the plant

Contains new plants and helps plants reproduce

Uses sunlight, water and carbon dioxide to make food through photosynthesis and provides water for transpiration

Absorbs water from the soil

Protects the seed and provides food

Questions

Write answers in complete sentences.

1. What part do plants play in the hydrologic cycle?

2. Why are plants good for people?

3. Which order should these steps be placed in? Put a number 1 in the blank next to the first step, a number 2 in the blank next to the second step and so on.

- ___ The plant takes in water through its roots.
- ___ Water that the plant doesn't need is transpired out of the leaf and evaporates.
- ___ Plants use carbon dioxide, sunlight and water to create their own food.
- ___ Water travels up from the roots to the leaves through the stem.

4. What is alike about evaporation and transpiration? What is different about them?

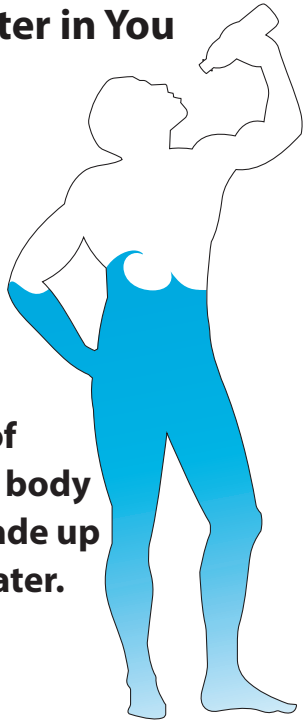
Section Four:

Water and You

Who needs water? You do! What does it feel like to be thirsty? That feeling of being thirsty is your body's way of making sure you drink the water you need. Did you know that you can live almost 30 days without food, but only three or four days without water? You may be surprised to learn that more than 2/3 of your body is made up of water. Water in your body helps your blood flow, heart pump, food digest, eyes and mouth stay moist, and your body to stay cool and strong.

Water in You

2/3 of your body is made up of water.



But it is not just people who need water. Every living thing on Earth — people, animals, plants, insects — everything that is alive needs water.

Where does all this water come from? When we look at a picture of Earth from space, we see why it is sometimes called “The Blue Planet.” All the blue you see in the picture is water on the surface of Earth, also called **surface water**.

Surface water is the water found in Earth's rivers, ponds, lakes, streams and oceans.

We learned earlier that all the water in the world is part of the water cycle. This water is continuously moving from the sky to land and to the oceans. Oceans are made up of **salt water** and cover nearly 3/4 of the Earth's surface. The water in the oceans is too salty for us to drink or use for our daily needs like bathing or brushing our teeth.

People need **fresh water**. Only a small amount of Earth's water is freshwater. People need fresh water. Some fresh water is called **groundwater** since it is underground. But most of Earth's fresh water is frozen in **glaciers**. Glaciers are very large, slow moving areas of ice. We cannot use the fresh water in glaciers because it would be too hard to get.

Only 1/100 of all the water in the world is available to people, animals and plants. Let's think about how much is 1/100 of something. If your friend had 100 raisins and gave you only one, you would get $\frac{1}{100}$ of the raisins. You wouldn't have much to eat, would you? So 1/100 is a very small amount.

We have learned the amount of water on Earth doesn't change. But the number of people on Earth grows, which means more people need water. With such a small part of Earth's water available for people, animals and plants, it is important to conserve our fresh water.

To **conserve** means to use our water wisely and not waste it. To learn about how you can help conserve water, read the tips on the next page. You can save up to eight gallons of water a day just by turning off the faucet while you brush your teeth. That adds up to more than 200 gallons a month! When you think about it, you and your family working together can save a lot of water by using it wisely every day.

Water-Saving Tips!



Garbage Disposal

A garbage disposal requires a lot of water to operate properly. Use a disposal only when necessary.

Dishwasher

Use your automatic dishwasher only for full loads.



Toilet Flushing

Avoid using your toilet as a wastebasket. Tissues, insects and other things belong in a trash can, not the toilet.



Bathing

Take only shallow baths.

Yard Watering

Water efficiently.

Brushing Teeth

Turn off the water while brushing your teeth.



Laundry

Run only full loads in the washing machine. Running the machine when it's full will save you time, energy and water.



Shower

Limit the time water runs while you're taking a shower. Install a low-flow showerhead.

Washing Hands

Don't let the water run while you are washing your hands.



Washing Dishes by Hand

When washing dishes by hand, fill one sink or basin with soapy water and fill the rinsing sink to one-third or one-half full — avoid letting the water run continuously in the rinsing sink.



Vocabulary Review

Using what you learned in Section Four, make a card like the one shown below for three of the words listed in blue.

- Write the vocabulary word at the top of the card.
- Write a definition in your own words.
- Write a sentence using the word.
- On the back of the card, draw a picture that shows what the word means.

conserve fresh water glaciers groundwater salt water surface water

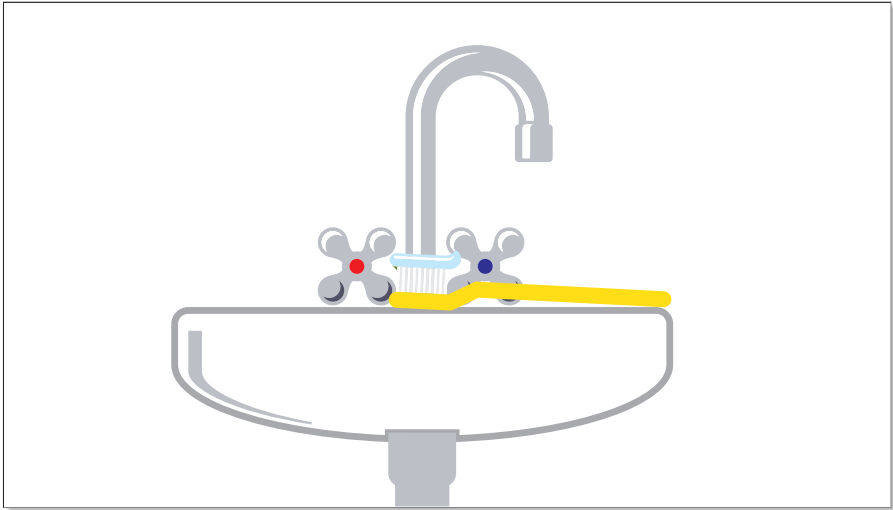
Conserve _____

Definition: _____

To use wisely, don't waste, save. _____

Sentence: _____

I will conserve water by turning off the sink when I brush _____
my teeth. _____



Questions

Write your answers in complete sentences.

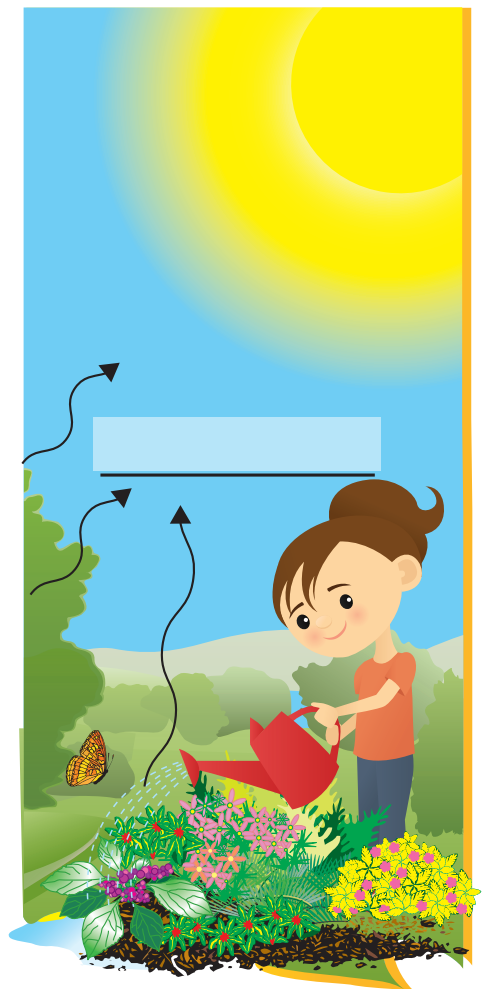
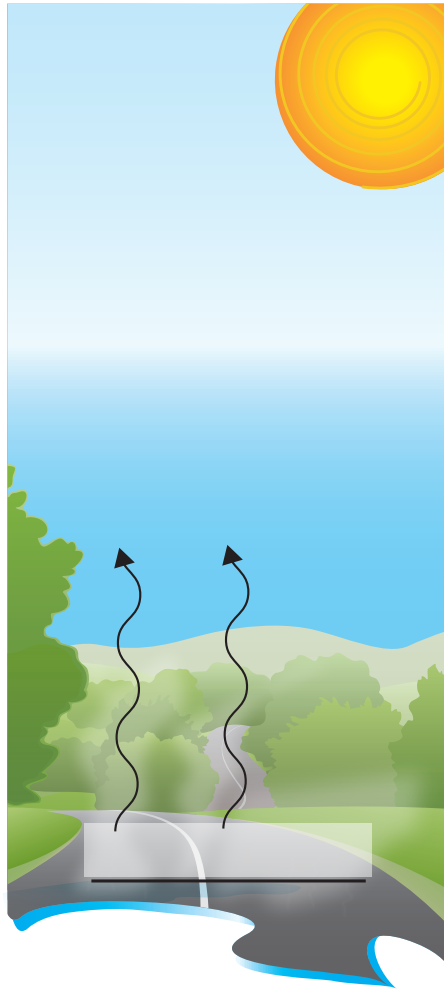
1. People can drink salt water in oceans. True or False?
2. Write a short message convincing other students to save water. Include at least one reason why people should conserve water and one example of how to save water.

3. Fresh water in glaciers is water in a solid form. True or False?
4. It's time to conserve water! Develop a water conservation plan for your home by listing three ways you and your family can save water at home.

Extension Activities

1. Look at these pictures. Label all the places the water cycle is taking place by writing the correct water cycle word in each box. Choose from these words:

condensation precipitation percolation evaporation transpiration



2. In your opinion, what part of the water cycle is most important? Give your reasons in complete sentences.

3. Using these vocabulary words from all four sections, answer the following questions.

All	Conserve	Evaporation	Fresh water
Hydrologic	Water	Oxygen	Sun
Part	Percolation	Precipitation	
Roots	Plants	Stem	Sun
Salt water	Solid	Temperature	
Water vapor	Water	Molecules	

- a. A _____ is a substance that holds its shape and doesn't flow like a liquid.
- b. When water is boiling, its _____ are moving faster and faster until they break off and go into the air in a process called _____.
- c. Our bodies are about 2/3 _____.
- d. When water is a gas, it is called _____.
- e. When you see rain, which part of the water cycle are you seeing? _____
- f. When rain soaks into the ground, what part of the water cycle is it? _____
- g. The _____ changes how fast or slow molecules move.
- h. The _____ provides the energy that powers the _____ cycle.
- i. How much of Earth's water circulates over and over again in the water cycle? _____
- j. Without _____ there would be no transpiration.
- k. Water is taken in by a plant's _____ and travels up through its _____.
- l. _____ takes place when water evaporates from a tree or plant's leaf.
- m. Plants help people by producing _____ to help us breathe.
- n. Every living thing on Earth needs _____.
- o. Nearly all the water on Earth's surface is _____.
- p. To _____ water means to never waste it.