Student Publication **Grade 4**

Water Matters!

Saving Your Water through Science

Southwest Florida
Water Management District

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Student Name

CONTENTS

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. But it isn't just people who need water. Animals and plants do, too. As a matter of fact, all living things need clean water. It's up to us to help keep it clean.

As you read this publication, you will learn about the three states of water and the power of the water cycle. You also will learn that water is a renewable but limited resource. Last, you will learn how plants and animals, including humans, affect the environment.

Section One:
Water's Ways

Water is amazing! We sometimes take water for granted because it is the most common substance on Earth. But we shouldn't! For one thing, nothing on Earth can live without water, and that's not the only reason why water is amazing.

You may have already learned that everything on Earth is made up of matter, and matter exists in three forms — liquid, solid and gas. But not everything on Earth exists naturally in all three forms. Only water does. Let's take a closer look at these three states of matter.

A ***solid*** doesn't flow like liquid. A solid keeps its shape no matter what container you put it in and even if it isn't in a container at all. Solids are everywhere. Just look around you. Desks, markers, walls, paper, windows, lunchboxes, your school building — these are all solids. When water is frozen, it becomes a solid called ice. Ice is used for cooling our drinks, ice skating and making a sprained ankle feel better. Polar bears and other North and South Pole animals live on ice.

A ***liquid*** flows when you pour it. It has no shape of its own, so it takes the shape of its container. When you pour liquid into a container, it fills the container from the bottom up. Liquid water covers ¾ of the Earth. People use liquid water for many things, but especially for drinking and cleaning.

Gases are all around us and include the air we breathe. Gases are often invisible and can fill a container of any size or shape no matter how big the container is. Gas bubbles also can be trapped in liquid — like the bubbles in a soda.

So now you know that water exists in three states — liquid, solid and gas. Did you also know that water is constantly changing from one state to another? To understand how this happens, you will first need to know that water is made up of molecules. In fact, everything 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 a fort, tiny molecules fit together to make up larger things like animals, stars, people and everything around us. Although you can easily see building blocks, molecules are so small that we can't see them with our own eyes.

Molecules are always moving. Temperature, heat or cold, changes the way molecules move. Think about heating a pan of water on the stove until it begins to boil. If you leave the pan boiling too long, all the water will eventually evaporate and the pan will be empty. Heat causes the molecules to move more quickly. As the heat increases, molecules speed up and spread farther apart. Some break away from the other water molecules and go up in the air as water vapor. This process is called ***evaporation***.

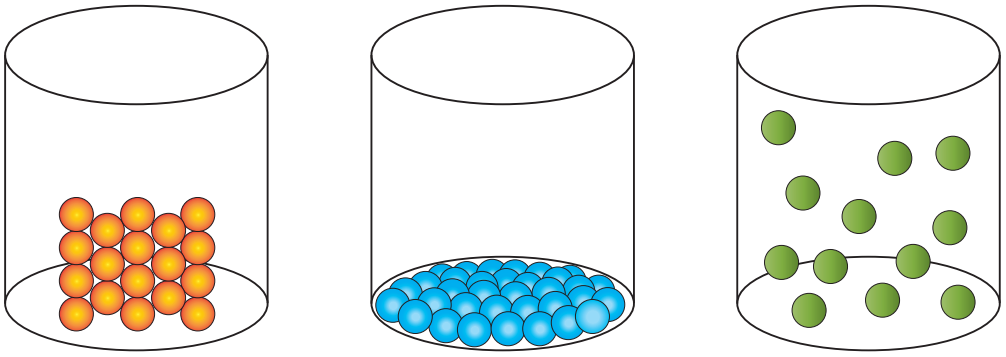
When water evaporates, it turns into a gas and seems to disappear. Another example of this is when a puddle forms on your driveway after it rains, but then disappears after the sun comes out. Even though you cannot see the water anymore, it still exists. It has evaporated, changing into an invisible gas called ***water vapor***.

Water vapor also can change to liquid water. Just as heat speeds molecules up, cold slows them down. When air gets cooler, the molecules in water vapor move more slowly and come closer together to form tiny droplets of liquid water. This is called ***condensation*** and explains why you see water drops on the outside of a drinking glass with ice in it. Water molecules in the air near your cold glass are cooling, slowing down, moving closer together and changing into liquid before your eyes.

Changing water from a liquid to a solid requires water to ***freeze***. As the liquid gets colder and colder, the molecules attach to each other and slow down so they are barely moving at all, just vibrating. At that point, water has turned to ice and has become a solid that holds its shape.

Heat also can change water from a solid to a liquid. 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, the ice ***melts*** and changes to liquid water.

Molecules in Solid, Liquid and Gas



Solid

A solid keeps its shape as molecules are held tightly together.

Liquid

In liquids, molecules are not as close together and move quickly, sometimes sliding by each other. This is why a liquid does not hold its own shape and must take the shape of its container.

Gas

Molecules in gases move the quickest and are farthest apart, filling the container.

Now that you know about molecules and how temperature affects them, you can understand how water changes from gas to liquid to solid.

Vocabulary Review

Write a Letter….Water Molecules Move!

Use the words on the right to fill in the blanks. Then draw molecules in the cylinders below. Look at page 4 for help.

Dear Friend,

I learned something amazing today — water is made of molecules and THEY MOVE!!! First, did you know that water, just like everything else around us, is made up of tiny _____ that are so small, we can't see them with our eyes.

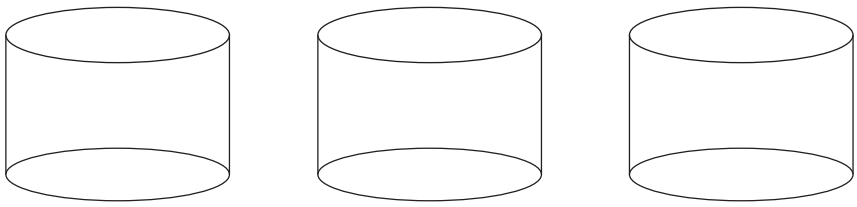
Second, _____ can change from liquid to solid to gas. Whether it is a liquid, a solid or a gas depends on temperature because temperature changes the way molecules _____.

When water is frozen, it is a _____ and it is called _____. As the water gets cold enough to _____, the molecules move very close together and slow down so much they hardly move at all.

When the _____ gets warmer, the molecules move _____ and aren't as close together. The ice _____ and the water becomes a _____.

In class, we saw water heated until it boiled. We learned that heat made the _____ move faster and spread farther apart. Some moved so fast that they broke away. The water seemed to disappear, but it really changed into a _____ called _____ _____. When this process happens, it is called _____.

Here is a picture showing how molecules look in solids, liquids and gases.



Solid **Liquid** **Gas**

Isn't science great?

Sincerely,

_____

gas

liquid

solid

melts

molecules

water

freeze

ice

temperature

water vapor

evaporation

faster

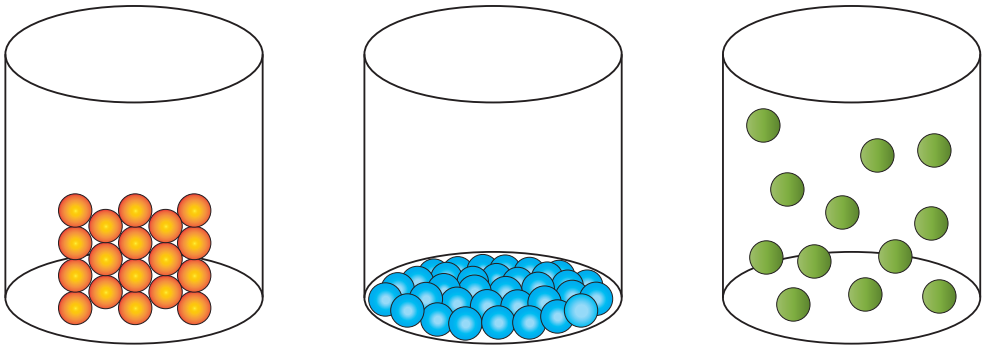
molecules

move

Questions:

On short answer questions, write your answers in complete sentences.

1. By looking at the picture of 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. Using the words "molecules" and "temperature," explain what is happening when water changes from a liquid to a solid?

_____

_____

_____

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

❑ true ❑ false

5. Water molecules are always moving, but temperature changes the way they move. True or false?

❑ true ❑ false

6. Explain what is really happening when a puddle seems to disappear on a sunny day.

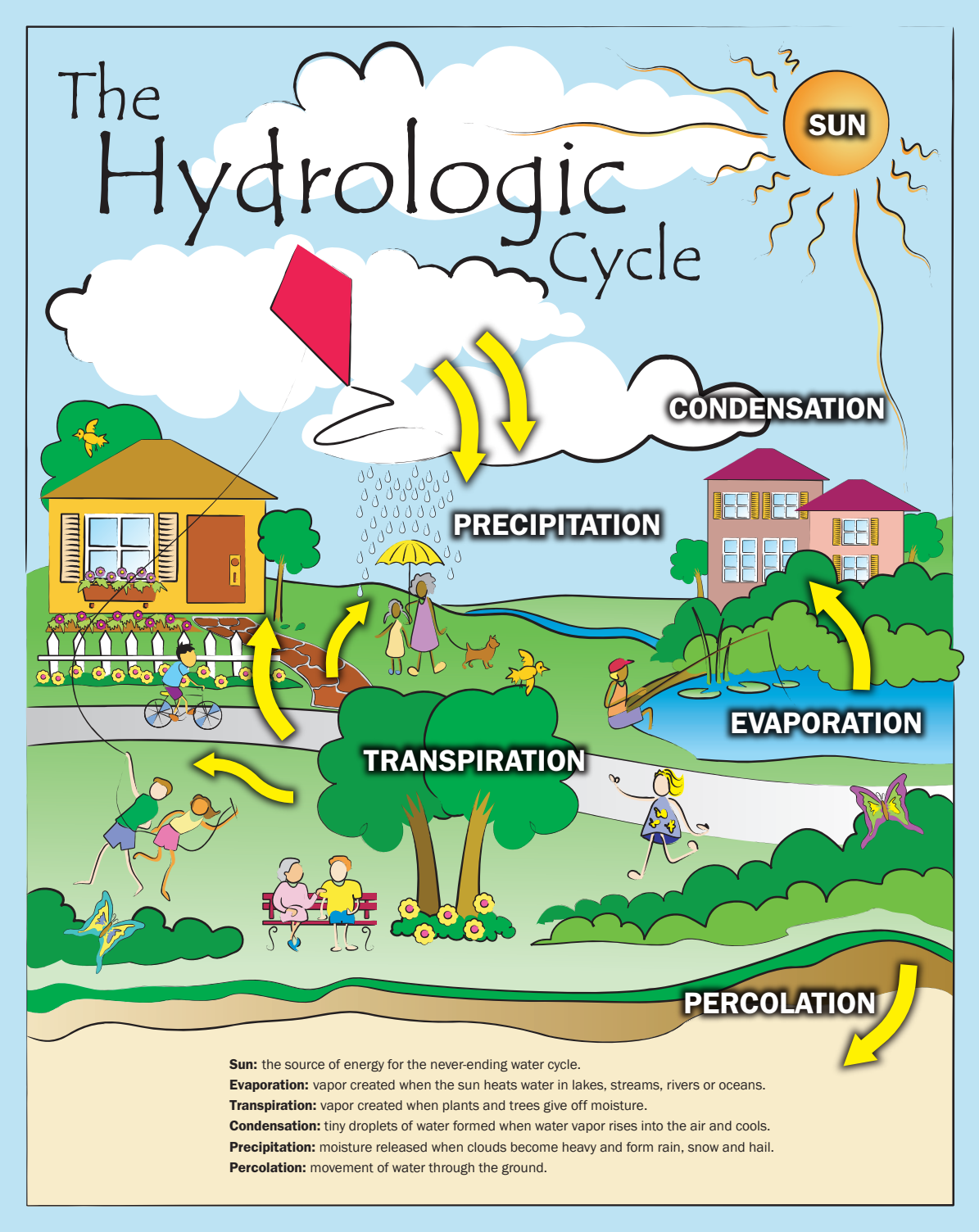
_____

_____

_____

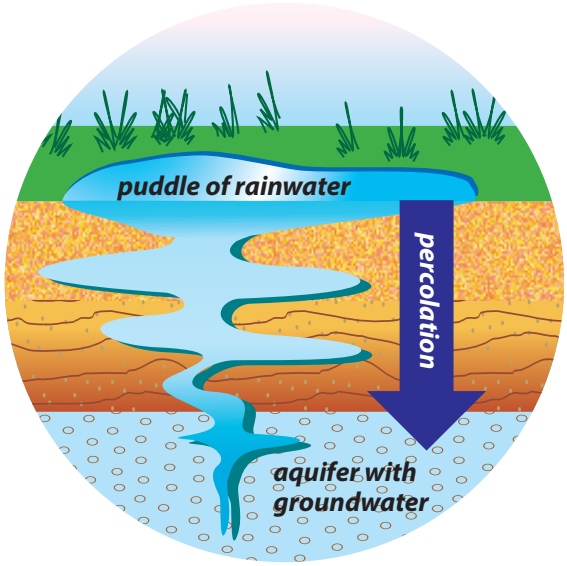
Section Two:
The Power of the Water Cycle

All the water on Earth continuously moves through a system in nature called the ***water cycle***. It is also called the ***hydrologic cycle***. Look at the illustration of the water cycle below:



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 from plants. This heat energy causes the water molecules to move faster and faster until they break away from each other. During this process, water evaporates, changing from liquid to water vapor, and seems to disappear 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. Droplets collect together in the clouds and grow heavier and heavier. When the droplets become too heavy to stay up in the clouds any longer, they fall to Earth as ***precipitation*** (rain, hail or snow).



Florida usually gets about 50 inches of rain during a year. That's a lot! Some of this rain evaporates before it even reaches the ground, some runs into lakes or rivers, and some ***percolates***, or soaks, into the ground. Once underground, some of this water trickles through the soil until it reaches the aquifer. An ***aquifer*** is an underground layer of spongelike rock that holds water. This water is called ***groundwater***, which is water beneath Earth's surface.

Some groundwater is absorbed through the roots of plants. After the plant uses the water it needs for photosynthesis, any leftover water is released back into the air through the leaves of the plant. This process is called ***transpiration***. Transpiration is similar to evaporation, but the water is evaporating from plants rather than from pavement, ponds, oceans and other surfaces.

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

Weathering and Erosion

Water is a powerful force of nature! Its movement can break down rock and reshape the land. Let's explore two processes: weathering and erosion.

Weathering is the breaking down of rock into smaller pieces. Weathering is caused by wind, water, heat and cold. For example, as ocean waves smash rocks against each other, the rocks are worn smooth and eventually turn into sand. This type of weathering is called physical weathering. With physical weathering, heat and cold also can cause minerals in rock to expand and shrink, creating cracks in the rock. Since water expands when it freezes, if water seeps into existing cracks and freezes, it can actually split rocks into smaller pieces.

Rainwater stuck in rock freezes in the winter. Over time, erosion happens and leaves behind stone arches like this one at the Arches National Park in Utah.

Another type of weathering is chemical weathering. This type of weathering is usually caused when rainfall picks up chemicals from the atmosphere and becomes acid rain. Over time these chemicals can dissolve rock and even cause the surface of buildings and statues to wear away.

Erosion is the movement of weathered material by gravity, wind and water. Erosion is what happens to material that has been loosened by weathering. Gravity, wind, rain, rivers, oceans and glaciers all cause erosion. Rain splashes down from the sky and loosens the weathered material. Rainfall also moves across the land, washing the pieces of rock and dirt into streams, rivers and oceans. Erosion can take a long time, such as when a mountain is worn down over millions of years. Or the change can be quick, like the damage from a flash flood or hurricane. For example, the beach is continuously being eroded. Each wave pulls loose sand back into the ocean.

Preventing soil erosion is important to our food supply, too. When soil used to grow plants for food is washed away, fewer crops can be grown. Since bare soil is much more likely to wash away, one of the ways to prevent erosion is to plant crops and trees, which will grow roots and hold soil in place.

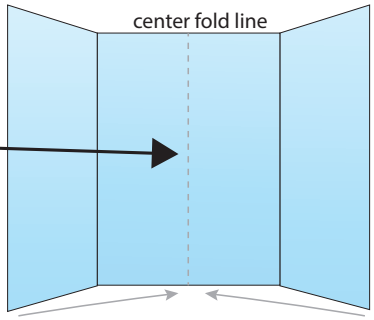
The Grand Canyon in Arizona was carved by erosion and shows how powerful water can be.

Vocabulary Review

The Water Cycle Foldable

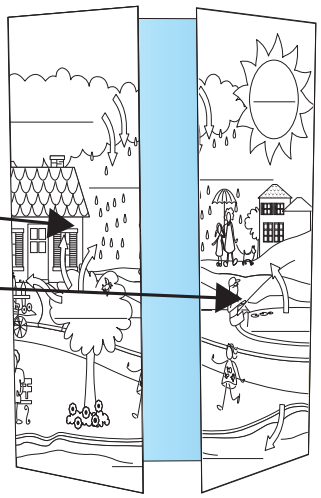
Instructions: Using the materials your teacher will give you, practice your water cycle words by making a water cycle foldable that looks like this:

1. Fold a piece of colored paper (blue, perhaps?) in half, horizontally.



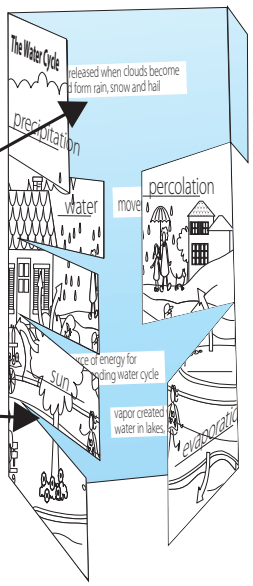
2. Open again and fold each side into the center fold line. Each "door" opens at the center.

3. Cut out the Water Cycle Diagram your teacher gives you. Fold in half vertically. Now cut in half. Glue the left half of the diagram on the left front "door" and the right half on the other "door."



4. Write "Water Cycle" all the way across the top. Then label each part of the Water Cycle on the lines of the "doors."

5. Cut out the definitions your teacher provides you, and glue each one on the inside under the matching part of the water cycle.



6. Cut the doors so that each part of the water cycle has a flap that reveals the correct definition underneath.

7. Then test how much you know about the water cycle by trying to define each word without lifting the flap.

Questions:

Write short answers in complete sentences.

1. Only part of all the water in the world is circulated in the water cycle. True or false?

   ❑ true ❑ false

2. Explain how the sun's energy powers the water cycle.

   _____

   _____

   _____

3. When you see clouds in the sky, you are seeing the part of the water cycle called percolation. True or false?

   ❑ true ❑ false

4. Explain where water can be found on Earth as a liquid, a solid and a gas by giving one example for each.

   Liquid: _____

   _____

   Solid:_____

   _____

   Gas:_____

   _____

5. Write a **W** in the blank before the examples of weathering, and write an **E** in the blank before the examples of erosion.

   _____ Beach sand being carried into the ocean by waves

   _____ Ocean waves smashing into rocks to create sand

   _____ Water getting into cracks in rocks, then freezing, causing the rock to break into smaller pieces

   _____ A canyon being carved out by a river

Section Three:
Renewable but Limited

Water is a ***natural resource***. A natural resource is any material on Earth that living things can use and that comes from nature. People do not make natural resources, but instead they gather them from Earth.

Resources can be either renewable or nonrenewable. ***Renewable resources*** are those that are replaced naturally over a short period of time and can be used again. For example, a new tree will grow to replace one that is cut down. ***Nonrenewable resources*** are limited and cannot be replaced once they are gone. For example, once all the oil on Earth is used, there will be no more.

Renewable Resources	Nonrenewable Resources
Solar Energy	Oil
Soil	Steel
Trees	Aluminum
Grass	Coal
Water	Phosphates

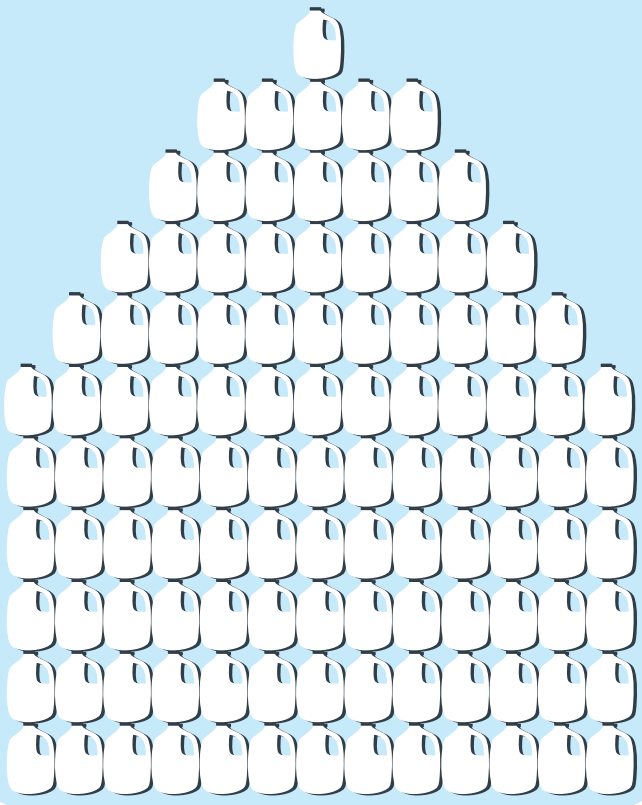
As you can see from the chart, water is a renewable resource. That's because all the water on Earth is recycled over and over again in the water cycle. Renewable does not mean unlimited. Remember that the water on Earth today is the same water that was here when Earth was formed. That means there is no new water, just the same water we have always had. Although both are renewable, water is different from trees because we cannot grow more of it. So water is renewable but the amount of water is limited.

How Much of the World's Water Can We Use?
Oceans cover nearly 3/4 of Earth's surface and hold nearly all of Earth's water. While oceans are important, they are filled with ***salt water***. People can't use salt water for drinking or for our daily needs.

The small portion of Earth's water that is not salty is called ***fresh water***. This is the kind of water people need, but not all of the Earth's fresh water is available for people. Most of it is frozen in ***glaciers***, which are very large and slow moving areas of ice. Only 1/100 of the all the water in the world is available for use by people, animals and plants. It is important for us to take good care of this water because we all depend on it to live.

How We Use Water
From brushing our teeth, to washing clothes and dishes, to flushing toilets, water is used many times a day.

If you filled 111 gallon jugs of milk with water, that's how much water the average person uses per day in our area. That's a lot of water!



Water also is used to grow or make the food we eat. Most fruits and vegetables are made up of more than 4/5 water. To make one loaf of bread requires 150 gallons of water, and to have one serving of chicken requires 400 gallons. To make many things other than food also require water. Making one car with tires uses 39,000 gallons of water!

You have learned that the amount of water on Earth doesn't change. As the number of people on Earth grows, there will be more people who need to share the water that is available. With such a small part of Earth's water available for people, animals and plants, it's important that we conserve our fresh water. To ***conserve*** means to use wisely and not waste.

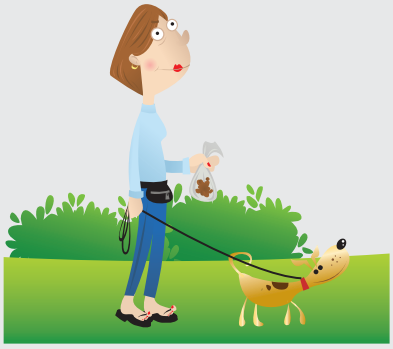
When you think about it, you and your family working together could save a lot of water by using water wisely every day. Watering your lawn only when necessary, using a nozzle on your garden hose and taking shorter showers are three easy ways to save. You can save up to eight gallons of water every day, just by turning off the tap while you brush your teeth in the morning and before bed. That adds up to more than 200 gallons a month!

Another smart thing we can do is to protect our fresh water from pollution. ***Water pollution*** is changing water in any way that makes it unclean or harmful to the living things that use it. Rain falling on our yards and streets washes fertilizer, pesticide, pet waste, litter, gas, oil and dirt into ponds, rivers and lakes. Water used in our homes also contains pollutants. This water must be cleaned before it can be used again.

The best way to protect our water is to avoid polluting it in the first place. Do your part to protect and conserve our water resources! Talk to your family about ways you all can help!

Protect Our Fresh Water From Water Pollution

Talk to parents about using fertilizers and pesticides sparingly.



Pick up after your pets.

Never dump anything down a storm drain.

Do NOT litter.

Vocabulary Review

Using what you learned in Section Four, make a card like the one shown below for four 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
nonrenewable resource
water pollution
natural resource
renewable resource
salt water

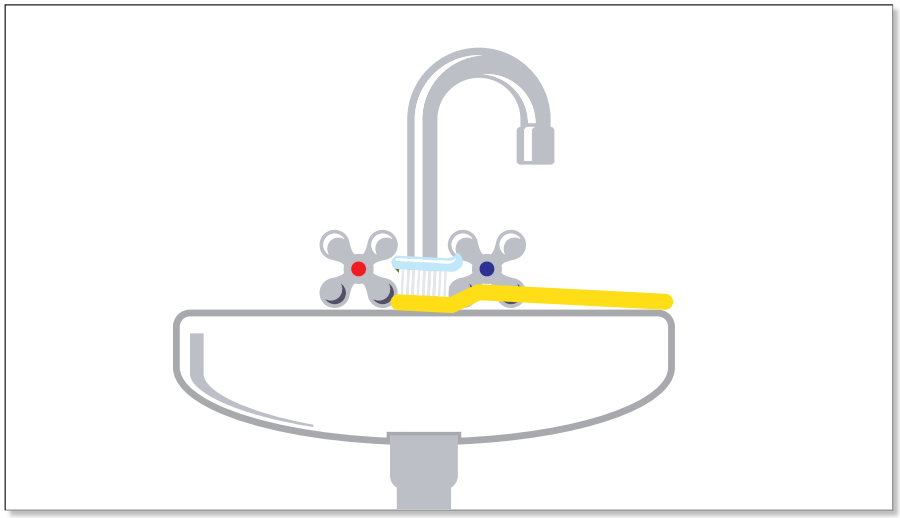
Conserve

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 answers in complete sentences.

1. Using what you've learned in Section Three, explain why water is a renewable resource.

_____

_____

_____

_____

2. Of all the water in the world, only a very small fraction is fresh water that we can use. True or false?

❑ true ❑ false

3. Explain why we need to conserve water if we have the same amount of water on Earth today that we have always had.

_____

_____

_____

_____

4. Write a short message to announce through your school's loudspeaker convincing students to save water. Include at least one reason why they should conserve water and at least one way they can conserve water.

_____

_____

_____

_____

5. Describe at least two ways water gets polluted.

_____

_____

_____

_____

Section Four:
Interdependence

You've learned that living things depend on water for life. In this section you will learn about ***interdependence***. Interdepencence is living things in a shared environment depending on each other to satisfy their basic needs.

One basic need is food. All living things need energy to live and grow. The energy we need comes from the food we eat, but how does the energy get into our food?

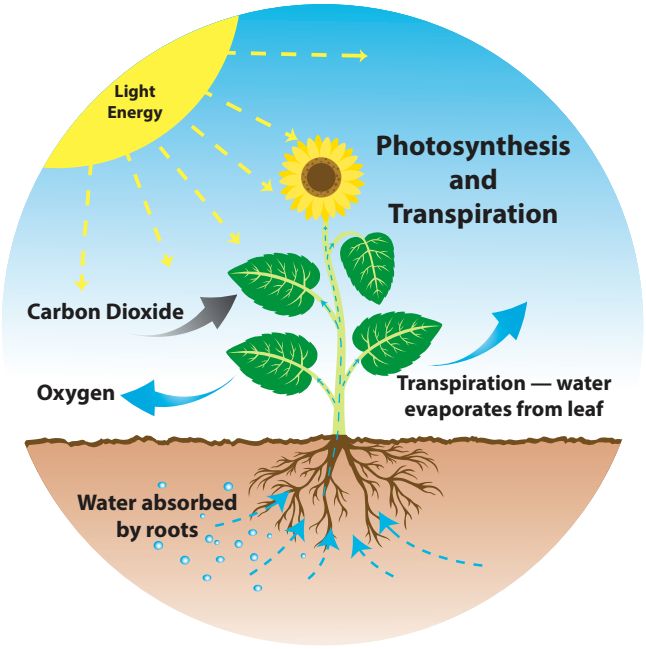
It starts with energy from the sun. We can see part of this energy as sunlight. A portion of the sun's energy goes into plants. Plants use this energy to make their own food through a process called ***photosynthesis***. In photosynthesis, plants take in carbon dioxide from the air. The air is combined with chlorophyll, the substance in plants that make them green. Then water from the soil is added to produce the food that gives plants energy. Photosynthesis takes place in the plant's leaf.

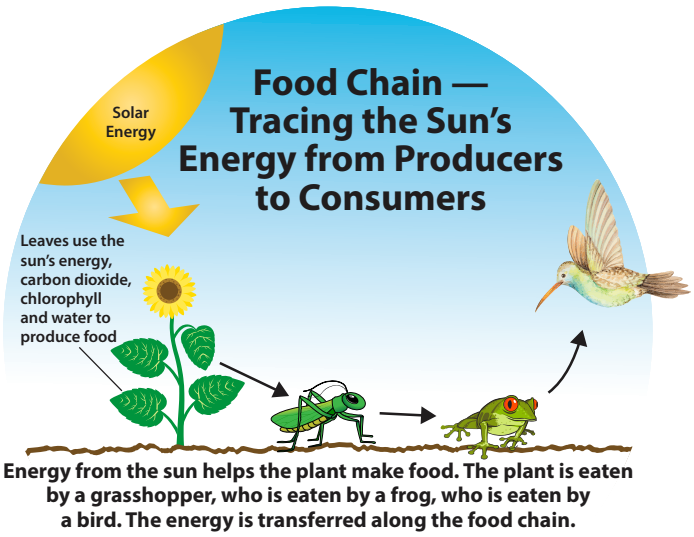
Transpiration is a process that takes place after photosynthesis. Extra water the plant doesn't use for photosynthesis is released through the plant's leaves to evaporate. This process of adding moisture to the air is called transpiration. Transpiration is part of the water cycle, and photosynthesis would not be possible without the water cycle. And without photosynthesis, the water cycle would not be possible!

Producers and Consumers Are Interdependent

Living things are considered either ***producers*** or ***consumers***. Plants are producers because they use the sun's energy to produce their own energy. Plants store extra energy in their roots, stems, leaves, flowers and seeds. When something eats the plant, it consumes the plant's extra energy.

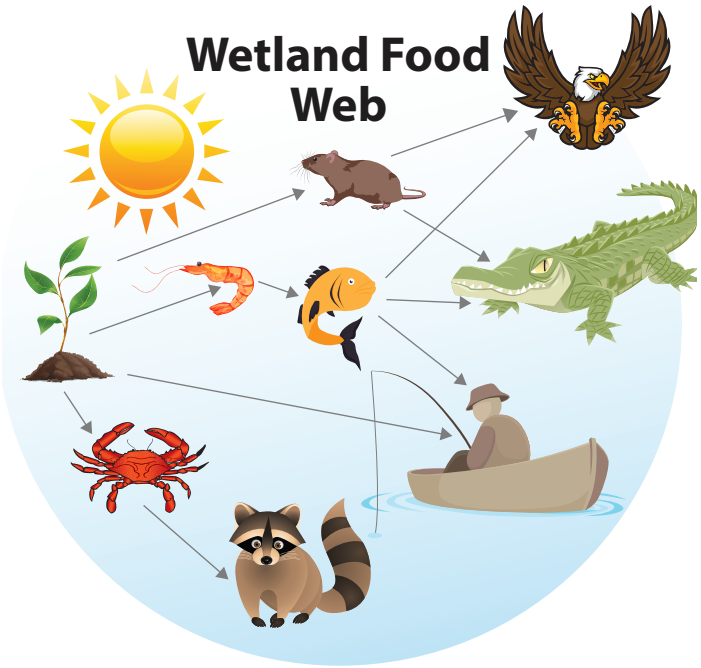
A consumer is an organism in the ecosystem that cannot produce its own food but instead must get its energy from eating. Consumers depend on producers for energy either by eating the producer or when they eat something that has eaten a producer. This process is called a ***food chain***. In a food chain, all energy comes from the sun. Food chains all start with a producer, and each food chain has only one producer. All food chains end in a consumer.





Energy from the sun helps the plant make food. The plant is eaten by a grasshopper, who is eaten by a frog, who is eaten by a bird. The energy is transferred along the food chain.

A food chain is one way to understand interdependence. In the illustration, the grasshopper depends on the plant for food, the frog depends on the grasshopper, the hummingbird depends on the frog and so forth. Living things need more to survive than just one food. That's why every living thing in nature lives in an ***ecosystem***. An ecosystem is a community of plants and animals that includes the surrounding environment. Within an ecosystem, a ***food web*** shows there are many food chains and they are all connected.



In the wetland food web illustration, you can see examples of interdependence. As always, the sun begins the food web by providing energy to the plant. When the shrimp eats the plant, it consumes energy. When the fish eats the shrimp, some of that energy is transferred to the fish. When the fish is eaten by the eagle, alligator or human, energy is once again consumed. In a food web, there are many connections.

Habitats

Within ecosystems there may be many habitats. A living thing's ***habitat*** is the place where it lives and must include everything necessary for it to survive. Habitats can exist within one another. For example, an ecosystem may be a very large forest. A black bear's habitat may be a portion of that forest, and within the black bear's habitat there could be a pond that is a frog's habitat. Plants and animals depend on their habitat to supply the things they need, such as sunlight, food, water and a suitable climate.

As more and more people have moved to Florida, the land has been changed to make it easier to use. In some cases, land has been cleared to grow food. Areas of land also have been paved over for roads, homes, stores and schools. These changes have caused the animals that lived there to lose their habitats.

Although human actions can harm habitats, humans also can protect and restore them. Here are some ways government agencies, groups and others have helped:

- Passed laws that protect water, air and land from pollution
- Purchased land to keep it natural and created preserves and parks where animals can live safely
- Restored habitats so they become healthy again
- Participated in volunteer cleanups to pick up litter, remove harmful plants and plant native species
- Educated people about ways to prevent pollution

Clam Bayou is Restored!

Clam Bayou is an example of a successful restoration. It is an ***estuary*** in central Florida. An estuary is where fresh water from rivers and streams flows into the ocean, mixing with salty seawater. Estuaries are safe places, for fish and other animals to raise their young. But, if the water is polluted, these young fish, shrimp and crabs will not survive.

Over the years, human activities had changed Clam Bayou's habitats. Because of these changes, native species moved out and harmful species moved in. Another serious problem was that heavy rains washed trash, dirt and other pollutants into Clam Bayou.

Several government agencies and other partners have worked together for the last 20 years to help clean Clam Bayou. They have stopped litter and other pollution from draining into Clam Bayou.

Clam Bayou's restoration has been so successful that many native species have returned including:

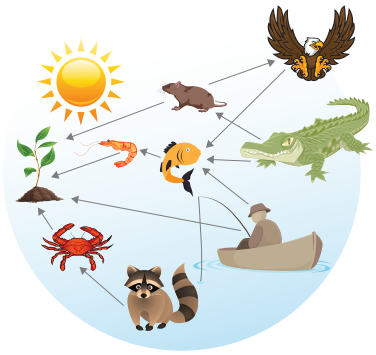
- Fish: redfish, snook, spotted sea trout, red drum and striped mullet
- Birds: bald eagle osprey, red-tailed hawk, great blue heron, wood stork, white ibis, pileated woodpecker, roseate spoonbill and many others
- Animals: manatees, otter, dolphin, bobcat, alligator, snakes, turtles and blue crab

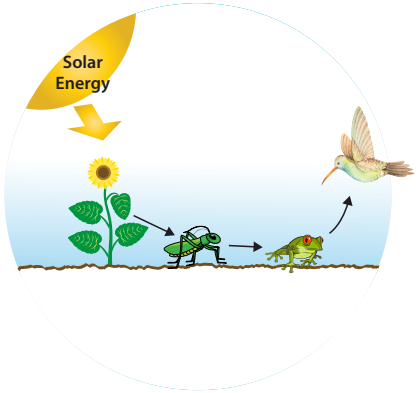
Restorations like Clam Bayou show that people can help make habitats healthy again so that native species return to their "home." The return of these species to Clam Bayou shows that everything in nature is connected. Now that the water is cleaner and the habitat is healthier, the native species have returned.

Vocabulary Review

Consumers	Ecosystem	Estuary
Food chain	Food web	Habitat
Interdependence	Photosynthesis	Producers

1. Label the images a "food chain" or "food web."





a._____ b. _____

What is the difference?

c. _____

_____

2. Label the correct image either a "producer" or "consumer."

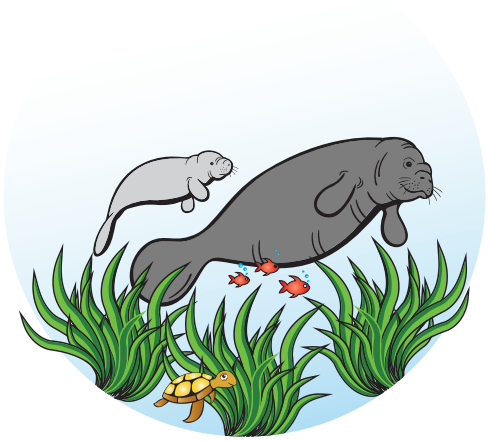
a._____ b. _____

What is the difference?

c. _____

_____

3. Label the correct image either a "habitat" or an "ecosystem."



a._____ b. _____

What is the difference?

c. _____

_____

Write the three words from the word list on the previous page that were not used in the pairs above. Write a definition for each word.

4. Word: _____ Definition: _____

_____

_____

5. Word: _____ Definition: _____

_____

_____

6. Word: _____ Definition: _____

_____

_____

Questions:

Write short answers in complete sentences.

1. Which is more important to human life — transpiration or photosynthesis? Explain why you chose that answer.

2. List three ways you and your family could help prevent water pollution.

3. Draw and label a food chain showing one example of how you get energy. In addition to naming the item you are drawing, also label each item either "producer" or "consumer."

4. Using what you learned in this section, list at least two ways humans harm habitats and at least two ways humans help habitats and the species that live in them.