



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. 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 water cycle and how it affects weather. You also will learn about the ways Florida's extreme weather affects the environment and you.

Section One: The Water Cycle

One of the first things each of us does every morning when we wake up is use water. We use water to brush our teeth, wash our faces, flush toilets and clean up after breakfast.

You probably already know that your body needs water to survive. About two-thirds of your body is water, and the water you drink keeps your blood flowing and your body working. While we need water to live, we also use it for fun activities like boating, swimming or fishing. In addition, water

provides jobs for fishermen, ship captains, farmers, scientists, engineers and many others. Humans aren't the only ones who need water. Animals and plants also need it to survive. Both humans and the environment depend on water.

Do you know where the water you use every day comes from? All of the water in our environment recycles itself over and over again with no beginning and no end. This endless system is called the water cycle, also known as the hydrologic cycle.

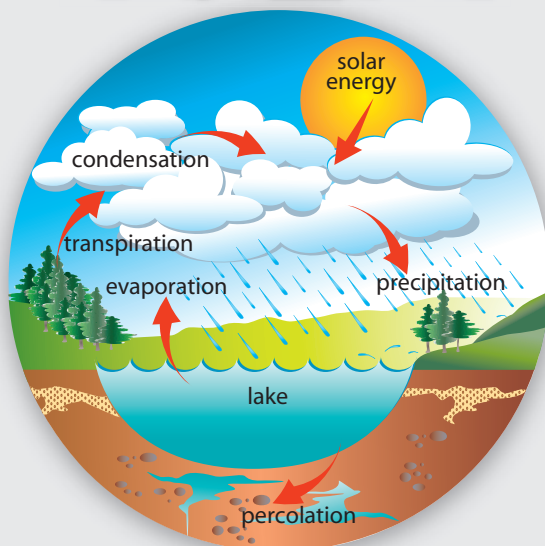
The water cycle works because water can change back and forth from being a liquid, a solid or a gas. Water in its liquid state is seen all around us. It fills rivers, lakes and the oceans, as well as our water glasses and bathtubs. But we also can see liquid water disappearing right before our eyes — puddles dry up, dishes dry on a dish rack and our own bodies can dry off after swimming without using a towel. Where do you think the water goes? Even though you cannot see the water anymore, it still exists.

Water, like everything else, is made up of tiny molecules, too small to see. Water molecules are constantly moving. Some move so fast they break away from other water molecules and change from a liquid into an invisible gas called **water vapor**. This is the process of **evaporation**. In the water cycle, heat from the sun, or solar energy, warms surface waters in rivers, lakes and oceans, causing some of the water to evaporate. This water is released into the air and takes the form of vapor. In a similar way, water is released into the air by plants through **transpiration**.

Temperature changes how quickly water evaporates. Since heat makes water molecules move faster, water evaporates more quickly on hot days. On cooler days, water molecules move more slowly, causing the rate of evaporation to slow down.

When water vapor rises and meets the colder air higher in the sky, the water molecules slow

The Hydrologic Cycle



Evaporation

vapor created when the sun heats water in lakes, streams, rivers, oceans, puddles and other bodies of water

Transpiration

vapor created when plants and trees give off moisture through their leaves

Condensation

tiny droplets of water formed when the water vapor rises into the air and cools, forming clouds

Precipitation

moisture released from clouds in the form of rain, snow, sleet or hail

Percolation

downward movement of water through the ground

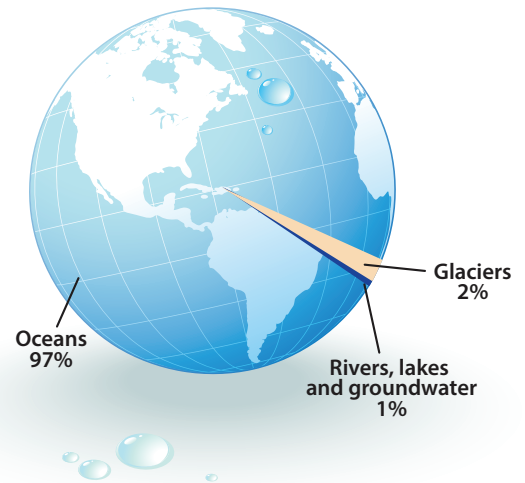
down and form water drops. In this process, called **condensation**, water changes back from gas to liquid. These water drops stick together to make clouds. When clouds become full and heavy, water falls back to Earth as **precipitation**. In Florida, precipitation is most often in the form of rain, but precipitation also can be snow, sleet or hail. As precipitation returns water to the Earth, some of it may end up in oceans, rivers and lakes. Some may be absorbed by plants, or soak into the ground in a process called **percolation**. Water that percolates into the ground is called groundwater. Most people who live in our area of Florida get our drinking water from groundwater.

In cold climates where temperatures stay at or below freezing, liquid water changes to a solid. Water as a solid is called ice. Some places on Earth are so cold that the ice stays frozen in very large masses called glaciers. Most of Earth's fresh water is frozen in glaciers and polar ice caps like those shown in this picture.



The amount of water traveling through the water cycle always stays the same. At any time, 97 percent of the water on Earth is salt water in oceans. Three percent of all the water on Earth is fresh water, and most of this is frozen. That leaves one percent of the world's water that is fresh water people and nature can use.

The World's Water



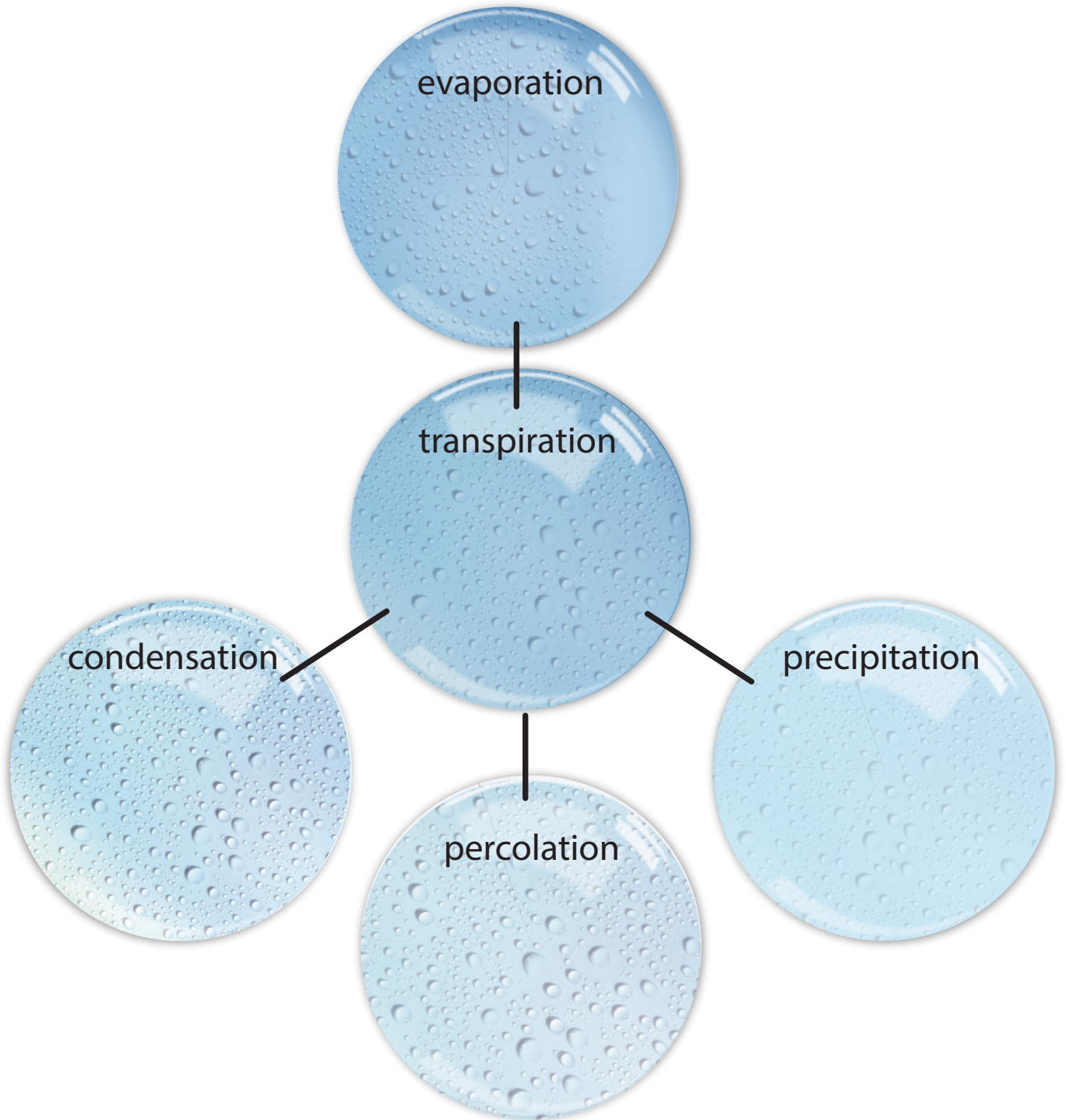
Holding almost all of the world's water, oceans play a very important role in the water cycle. Since nearly three-fourths of Earth's surface is covered by oceans, most of the water that evaporates from Earth's surface evaporates from oceans. Knowing that oceans are full of salt water, you may be wondering why isn't rainfall salty? Rainfalls are fresh water because the minerals that make oceans salty are left behind during evaporation. The minerals don't evaporate with the water molecules. So when the water molecules fall back to the Earth as precipitation, we get fresh water. That is a very good thing since all living things depend on fresh water to live!

Vocabulary Review

Water Cycle Concept Map

Directions:

Create five concept maps, one for each of the water cycle words — *evaporation*, *transpiration*, *condensation*, *precipitation* and *percolation*. Fill out the spokes with a definition, a sentence and a synonym. Under the concept map, draw a picture representing the word.



Questions:

Write your answers in complete sentences.

1. Explain in your own words how the water cycle works.

2. Is evaporation affected by a cloudy day? Why or why not?

3. What part do the oceans play in the water cycle?

Section Two:

Precipitation

You've learned how the water cycle works, but did you know that it plays an important role in **weather**? Weather is how the air and atmosphere are outside on any day at any moment. Florida has some wild weather with heavy rain showers, hurricanes, tornadoes, waterspouts and more!

Rain showers are an example of precipitation, a part of the water cycle. There are four types of precipitation: rain, sleet, hail and snow. As the sun heats Earth's surface, water evaporates into the air. The sky remains clear as long as the air can hold the water vapor. But, as the water vapor cools, it turns into droplets that combine to form a cloud. A cloud is made of millions of droplets of water.

Clouds may be close to or miles above the earth's surface. In fact, fog is a special type of cloud near the ground. You have already noticed that not all clouds look the same. Some are small and fluffy, some are thin and wispy, and others are big and towering. But, no matter what their shape or size, all clouds begin the same way in the water cycle, which is through condensation. Eventually, as clouds become heavier, some form of precipitation falls, which returns water to the Earth.

Depending on the weather at the time, there are four types of precipitation that may form: rain, sleet, hail and snow.

Rain

Rain is the most common form of precipitation, especially in Florida. Rain is water in its liquid form that falls from the sky as precipitation. Rain forms when the water molecules in the colder temperatures high in the sky condense around a tiny piece of dust or other particle and join with other molecules until the drops are heavy enough to fall to the ground. Since rain drops bring those dust particles to Earth, rainfall actually cleans the air. Raindrops are much

smaller than we think! They actually range from 1/100 inch (.0254 centimeter) to 1/4 inch (.635 centimeter) in diameter. A rain gauge is used to measure rainfall.

Sleet

Sleet starts as falling snow but melts into rain as it goes through a warm layer of air on its way down. It then goes through a layer of air below freezing just above the surface of the Earth and refreezes into ice pellets. Sleet falls as ice pellets that you may see bouncing off your windshield, roof or the ground. If a lot of sleet falls and temperatures stay freezing, it may accumulate and look like snow.

Hail

Hailstones, also called **hail**, are like very small rocks made of ice. Hail also requires freezing temperatures. Hail is created during storms when water drops freeze and combine with dirt or dust. Wind blows the hailstones back up into the cloud where more water freezes around them, making them bigger. Hailstones are usually about the size of a pea or a marble, but the largest hailstone found in the United States was 8 inches across and weighed almost 2 pounds. It was found July 23, 2010, in Vivian, South Dakota.



Hail is like small rocks made of ice.

Snow

Snow is different from hail. While hailstones are just balls of ice, snow falls in the form of ice crystals. The ice crystals are formed individually in clouds, but when they fall, they stick together to form snowflakes. No two snowflakes are alike and how they are formed depends on the temperature and humidity. Snow is rare in Florida because it can't form unless temperatures on the ground are near or below freezing — less than 32 degrees Fahrenheit (0 degrees Celsius).



Snow covering the trees and ground



Snow is ice crystals that stick together to form snowflakes.

Too Little and Too Much — Droughts and Floods

An average of 53 inches of rainfall occurs each year in Florida. However, the amount of rain can be quite different between seasons. It's normal for more than half of our rainfall for the year to fall between June and September. This is sometimes called "the rainy season." That means the rest of year normally gets less rain and is called "the dry season." If there is no rain or less rain than normal during a period of time, it can cause extremely dry conditions. This is called a **drought**. Droughts can happen at any time and can last a long time, sometimes years.

Droughts can cause a lot of problems. Plants, crops and wildlife can die. In extremely dry conditions, forest fires can start easily and spread quickly. Rivers and lakes can dry up so that recreational activities such as fishing and boating may be limited. Groundwater supplies may get so low that people can no longer pump out enough water for their needs. When droughts continue too long, people must cut back on activities like washing cars and watering lawns to make sure there is enough water for drinking and other necessary uses.

Although a drought may seem to be over when it starts to rain again, this is not always the case. When the rain does fall, especially in hot weather, much of it evaporates. For droughts to be over, enough rain must fall to refill our rivers, lakes, streams and groundwater supplies. During droughts, it is especially important that people use water wisely.

Floods are the opposite of droughts and happen when too much rain falls too quickly. When rain falls normally, some of it evaporates, some absorbs into the ground and some runs off into water bodies like ponds, rivers and lakes. Heavy rains, can cause the ground to become saturated and water bodies to overflow. When this happens, rainwater has nowhere to go and floods streets, yards and homes. Florida is more likely to have floods than some other states, especially in the rainy summer months. This is because it has so many water bodies and it gets most of its rain in a short period of time. Heavy rains that come with hurricanes also can cause flooding.

Floods can be extremely dangerous. People and cars can be swept away, especially in fast-moving flood waters. Homes, vehicles, roads and other property can be damaged, too. Water supply and electricity are disrupted, roads are closed, and people struggle and suffer as a result. In addition to this, flood waters can bring a lot of diseases and infections. Like droughts, floods can ruin crops and damage ecosystems. Flooding can last from several hours to months at a time. Floodwaters usually evaporate or soak into the ground in a matter of days, weeks and sometimes months after the rains stop. It can take years to repair damage from floods.



Floods occur when too much rain falls too quickly.

Vocabulary Review

Select all correct answers for each of the vocabulary words:

Weather

- includes rain showers, hurricanes, tornadoes and more.
- is how the air and atmosphere are outside at any day at any moment.
- is what it's like outside over a long period of time.
- is not affected by the water cycle.
- does not affect rain, sleet, hail and snow.

Droughts

- occur over a short period of time.
- include extremely dry conditions.
- are caused by no rain at all for long periods of time or less rain than normal.
- happen when too much rain falls over time.
- can last a long time, sometimes years.

Floods

- happen when not enough rain falls over a period of time.
- happen when too much rain falls too quickly.
- are more likely to happen in Florida than some other states.
- are not dangerous.
- can last for several hours to months at a time.

Rain

- is a form of transpiration.
- is a form of precipitation.
- is water in solid form.
- is measured using a barometer.

Sleet

- is not a form of precipitation.
- hits Earth's surface as ice pellets.
- starts falling as snow.
- hits Earth's surface as water in liquid form.

Hail

- is very small rocks made of ice.
- is water in solid form.
- is a form of evaporation.
- does not require freezing temperatures to form.

Snow

- All snowflakes are alike.
- falls in the form of ice crystals.
- forms when temperatures on the ground are more than 32 degrees Fahrenheit.
- is a form of precipitation.

Questions:

Write short answers in complete sentences.

1. How are sleet, hail and snow alike? How are they different?

2. Why is rain the most common form of precipitation in Florida?

3. Explain a drought. What are three ways droughts can cause problems for Florida's residents?

4. Why is Florida more likely to have floods than some other states?

Section Three:

Weather — Mild to Wild

Many people like to visit and live in Florida because of our weather. We learned in Section Two, weather is how the air and atmosphere are outside on any day at any moment. Some words people use to describe the weather are sunny, cloudy, stormy, humid, dry, hot, cold, etc. Florida is known for its sunny days and mild winters. However, weather can change quickly, so it's a good idea to check the weather report when making plans. It's easy to find the latest weather forecasts on TV, the radio, the Internet and cell phones, and in the newspapers.

Forecasting the Weather

Weather in a particular time and place is determined by air temperature, air pressure, humidity, precipitation, wind speed and direction. To forecast the weather, scientists called **meteorologists** measure these elements by using special instruments. Let's learn more about the factors used to forecast the weather:

Air temperature is how hot or cold the air is.

Air pressure is the weight of the air over a certain area. We don't often think about the fact that we live under air, and the weight of this air presses down on us. Temperature also affects air pressure. Warm air rises and that causes lower air pressure. Cold air sinks causing high pressure.

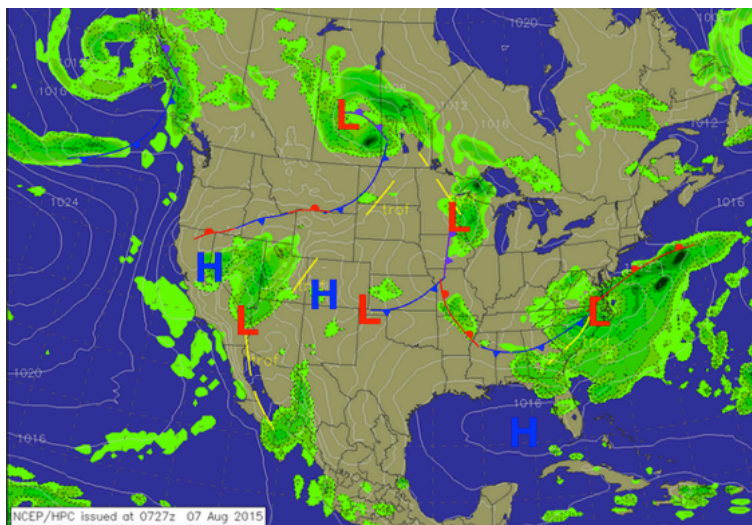
Humidity is the amount of water vapor in the air. The amount of water vapor the air can hold depends on the temperature of the air. Warm air can hold more water vapor, while cold air holds less.

Wind speed is how fast the wind is blowing.

Wind direction is the direction from which the wind is blowing.

By looking at a weather map, you will see curving lines with bumps. These lines represent fronts. A **front** is a boundary between two different air masses, usually one is warm and one is cold. While warm and cold fronts can both bring storms, cold fronts usually have more affect. A cold front pushes or lifts the warmer air it's replacing more quickly than a warm front does. The rapid rise of air helps produce heavy downpours and the gusty winds that can lead to strong or severe weather. On weather maps, blue lines are cold fronts and red lines are warm fronts.

As you look at a weather map, you also will notice the letters "H" and "L." These letters stand for high and low pressure. High pressure is usually calm, sunny weather. Low pressure, on the other hand, most often brings stormy weather.



Wild Weather

In Florida, we experience some of the wildest weather in the world! Although snow would be very unlikely, Florida does have hurricanes, tornadoes, heavy rain showers and a lot of lightning strikes.

Our area gets so much thunder and lightning that Florida is considered the **thunderstorm** capital of North America! If you see lightning and hear thunder, you know it is a thunderstorm. All thunderstorms produce lightning and are very dangerous. These storms are formed when warm, moist air becomes very heavy with water vapor and forms clouds. Eventually the cloud can hold no more water so the rain must fall.



Lightning is a bright flash of electricity produced within a thundercloud high in the sky when many small bits of frozen raindrops bump into each other as they move around in the air. Thunder is the sound lightning makes as it suddenly heats the air. Did you know that you can determine how far away a storm is by counting the seconds between seeing a flash of lightning and hearing the thunder? For every five seconds counted, a storm is one mile away. By counting this way, you may have enough warning to head for cover in a storm. If you are outside and you hear thunder, then you are in danger— get inside a building or into a car.

Tornadoes are another form of extreme weather that Florida can experience during thunderstorms or hurricanes. Tornadoes form when warm, moist air from the Gulf of Mexico and cool, dry air from Canada meet. Changes in wind speed and direction cause the wind to spin and be pushed up to form

a funnel. Tornadoes don't last long — most Florida tornadoes last less than 10 minutes — but they can do a lot of damage. Wind speeds can be as high as 300 miles per hour. They can uproot trees, tear down buildings and even destroy entire towns.

People who live in Florida also are familiar with **tropical storms** and **hurricanes**. During our hurricane season (June–November), small storms can develop and gather strength over warm tropical waters. Florida is almost completely surrounded by warm water, which makes it especially vulnerable to hurricanes. In fact, more hurricanes have hit Florida than any other state.



A Hurricane Forming.

Meteorologists use technology to track storms. Weather satellites fly high above the Earth and send images of a hurricane forming. It looks like a spinning pinwheel shape, with bands of clouds rotating around a dark, calm spot known as the eye of the hurricane. Another important tool is radar, which scientists use to watch hurricanes form and track their paths. The weather updates that we receive on our cell phones, computers, radios and televisions are accurate and up to date because of powerful advances in technology.

Meteorologists also study air pressure and wind speed when tracking hurricanes. During a hurricane, the air pressure falls and wind speeds increase. Wind speeds determine whether a storm is a tropical depression, a tropical storm or a hurricane. A tropical depression has winds of 23–36 miles per hour (mph). A tropical storm has winds speeds of 36–74 mph. When wind speeds are higher than 74 mph, the storm is considered to be a hurricane. Hurricane winds can get as high as 200 mph. Hurricanes usually last about a week but gradually weaken once they begin to move over land.

Category	Wind Speed (mph)	Damage at Landfall
1	74-95	Minimal
2	96-110	Moderate
3	111-130	Extensive
4	131-155	Extreme
5	Over 155	Catastrophic

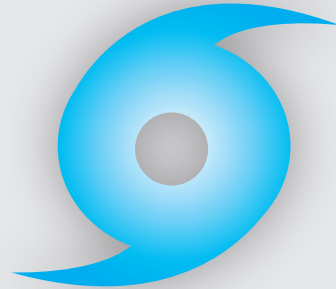
Numbered categories are used to describe the power of a hurricane.

Hurricanes are assigned names based on six lists of alphabetical names that are rotated each year. Since more than one hurricane can form at a time, assigning a name to each hurricane helps avoid confusion about which storm is being discussed.

Hurricane winds cause a lot of damage, and unfortunately, hurricanes also bring **storm surges**, floods and tornadoes. Storm surges are caused when a hurricane's winds push a mound of water onto land at the coast. This causes major flooding and destruction of homes, trees, roads, bridges, piers and other property. Flooding also can be caused by the heavy rainfall brought by hurricanes.

Thankfully, meteorologists can predict when a hurricane is brewing. Their warnings give people plenty of time to leave or prepare for an approaching hurricane.

2016 Hurricane Names



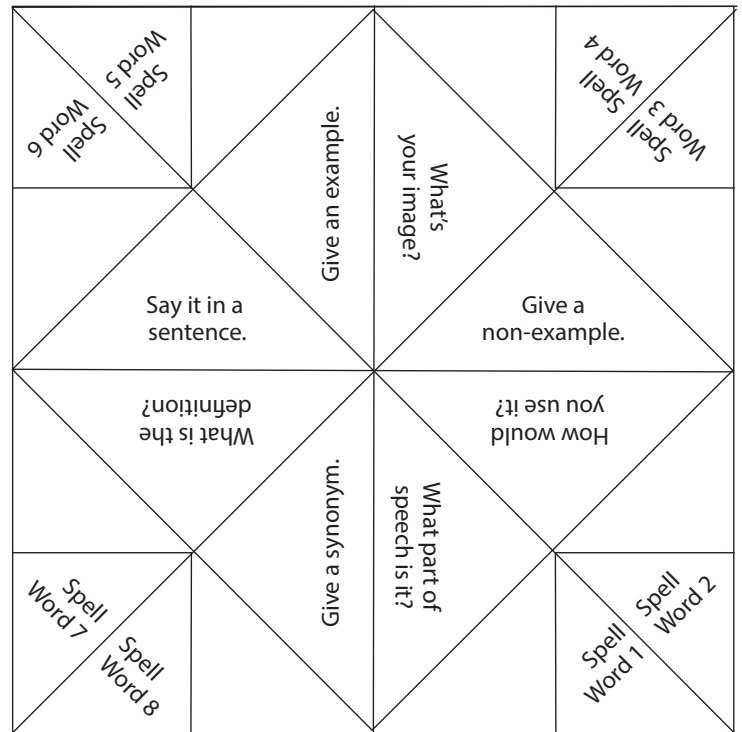
Alex
Bonnie
Colin
Danielle
Earl
Fiona
Gaston
Hermine
Ian
Julia
Karl
Lisa
Matthew
Nicole
Otto
Paula
Richard
Shary
Tobias
Virginie
Walter

Weather — Mild to Wild Cootie Catcher Vocabulary Review

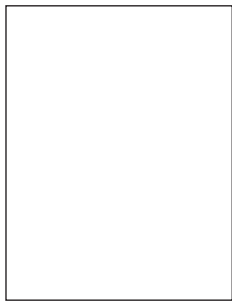
Vocabulary Cootie Catcher

Follow the folding instructions below to make a cootie catcher. Then use the template to the right to complete your cootie catcher and learn more about the vocabulary words from Section Three. Pick any eight of these vocabulary words:

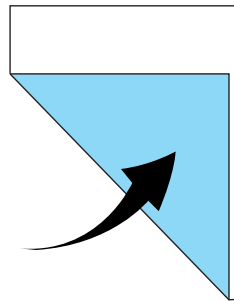
- | | |
|-----------------|----------------|
| Air pressure | Storm surge |
| Air temperature | Thunderstorm |
| Front | Tropical storm |
| Humidity | Tornado |
| Hurricane | Weather |
| Lightning | Wind direction |
| Meteorologist | Wind speed |



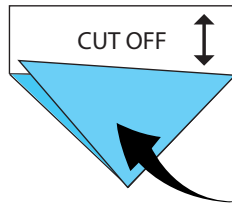
Cootie Catcher Folding Instructions



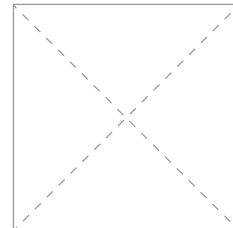
Use an 8.5" x 11" sheet of paper.



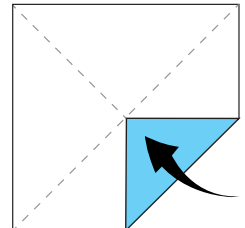
Fold corner up till it meets the side of the paper.



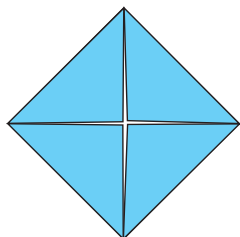
Fold the other corner up till it meets the other side – then cut off the the rectangle at the top.



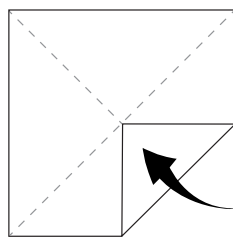
Unfold and you should now have an 8.5" x 8.5" piece.



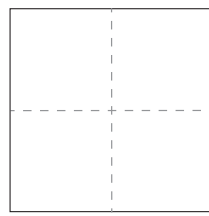
Fold up all four corners so that the points meet in the middle.



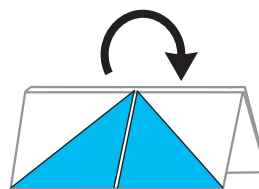
This is what it should look like.



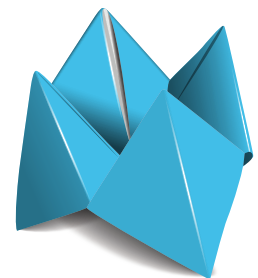
Flip it over. Fold up all four corners so that the points meet in the middle.



It should look like this now.



Now fold the top back.



Work your fingers into the four corners from the fold side. Work the creases to form the four points.

Questions

Write answers in complete sentences.

1. What factors do meteorologists study to predict the weather?

2. Why are meteorologists important to people? List two reasons based on what you learned about weather in Florida.

3. How are tornadoes and hurricanes alike and different?

4. How can you tell how close a thunderstorm is to you? What should you do if a thunderstorm is near?
