

The background of the page is light blue with stylized rain clouds and falling raindrops. On the left side, there are three cartoon children playing in the rain. The top child is a blonde girl in a pink dress holding a blue umbrella. The middle child is a girl with dark curly hair in a purple dress holding an orange and yellow umbrella. The bottom child is a girl with orange hair in a blue dress holding a pink umbrella. They are all smiling and jumping in puddles.

# All About Weather

Science Journal

Name

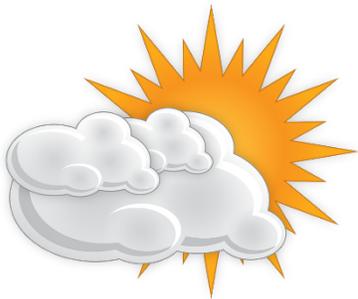
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# All About Weather Unit



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Lesson/Day	Lesson Title
1	Weather! Weather! Weather!
2	How Does Water Freeze?
3	Evaporation: How Does Water Turn Into a Gas?
4	All About Air: Why Does Hot Air Rise and Cool Air Sink?
5	All About Clouds
6	Celsius and Fahrenheit: A Look at Temperature
7	Stormy Weather
8	Lightening Strikes: All About Thunderstorms
9	The Arch After the Storm: All About Rainbows
10	The Howling Wind
11	All About the Four Seasons
12	What is Climate?



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# Vocabulary



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<b>Below Freezing</b>	Any temperature that is below 0° C / 32° F.
<b>Blizzard</b>	A storm that is snowy and windy.
<b>Breeze</b>	Lightly blowing wind.
<b>Celsius</b>	Measurement of temperature. Freezing = 0° Boiling = 100°
<b>Cold Spell</b>	A period of cold weather.
<b>Degrees</b>	How temperature is measured.
<b>Drizzle</b>	Light rain.
<b>Drought</b>	A period with no rainfall.
<b>Fahrenheit</b>	Measurement of temperature. Freezing = 32° Boiling = 212°
<b>Flood</b>	An overflowing amount of rain.
<b>Flurries</b>	Very light snowfall.
<b>Fog</b>	A thick cloud of vapor that reduces visibility.
<b>Forecast</b>	The weather that is expected for the future.
<b>Frost</b>	Ice crystals that form on a frozen surface.
<b>Hail</b>	Small ice pieces that usually fall during a storm.
<b>Heatwave</b>	A period with extremely hot weather.
<b>Humid</b>	Water vapor in the air.
<b>Hurricane</b>	A tropical storm with rain and very high winds.
<b>Icy</b>	Covered with or consisting of ice.

<b>Lightning</b>	An electric current / flash that occurs between a cloud and the ground.
<b>Meteorologist</b>	A person who studies weather / weather patterns.
<b>Meteorology</b>	The study of weather / weather patterns.
<b>Overcast</b>	A cloudy sky with no visible sunlight.
<b>Precipitation</b>	Rain or snow that falls from the sky.
<b>Rain</b>	Water that falls from the sky.
<b>Raindrop</b>	A single drop of rain.
<b>Rainbow</b>	An arch of colors that form in the sky following a rainstorm.
<b>Season</b>	One of the four divisions of the year marked by a change in weather and daylight hours.
<b>Shower</b>	A light and fast fall of rain, snow, hail, or sleet.
<b>Sleet</b>	A form of precipitation consisting of ice, mixed with rain and snow.
<b>Smog</b>	Fog or haze combined with smoke and pollutants in the atmosphere.
<b>Snow</b>	Frozen water vapor that falls from the sky and lands as white flakes.
<b>Temperature</b>	The degree of heat present.
<b>Thermometer</b>	An instrument for measuring the temperature.
<b>Thunder</b>	Loud noise caused by lightning.
<b>Tornado</b>	Vortex of violently rotating wind.
<b>Ultraviolet Rays</b>	The rays from the Sun that can cause damage.
<b>Wind</b>	Blowing air.



# What is Weather?

- Weather is the state of the atmosphere at a specific time and location.
- Weather includes: rain, snow, sunshine, clouds, wind, sleet, etc.
- Weather occurs in the troposphere—the lowest layer of Earth's atmosphere.
- Weather is influenced by many factors.
- Differences in air pressure, moisture, and temperature between two locations are the major reasons why weather occurs.
- Weather plays a big role in our daily lives.



Image by GDJ on Openclipart

## Think About It!

**What is your favorite type of weather and why?**

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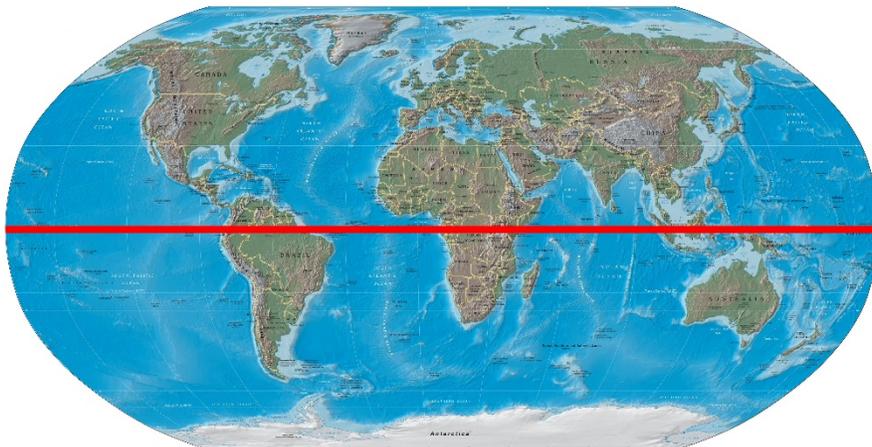
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# How Does Weather Change?

- Weather varies from location to location. It can be snowy and  $-20^{\circ}$  in Juneau, Alaska but sunny and  $95^{\circ}$  in San Juan, Puerto Rico.
- The factors that influence weather include:
  - Temperature
  - Air pressure
  - Wind
  - Moisture in the air (humidity)
  - Elevation
  - Latitude → distance a place is, north or south, from the Equator
  - Ocean currents
  - Distance from the sea
  - Wind
- Latitude is the distance a place is, north or south, from the Equator.
- The Equator is an imaginary line drawn around the Earth equally distant from both poles, dividing the Earth into northern and southern hemispheres and constituting the parallel of latitude  $0^{\circ}$ .
- Places closer to the Equator will experience warmer climate and longer days than places further away.



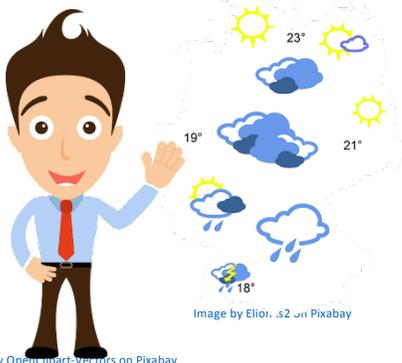
# Types of Weather

Weather Type	Description	Picture
<p><b>Clouds</b></p>	<p>a visible mass of condensed water vapor floating in the atmosphere, typically high above the ground.</p>	 <p><small>Image by WolfBlur on Pixabay</small></p>
<p><b>Dust Storm</b></p>	<p>a strong, turbulent wind that carries clouds of fine dust, soil, and sand over a large area.</p>	 <p><small>Image by NOAA George E. Marsh on Wikimedia Commons</small></p>
<p><b>Fog</b></p>	<p>a thick cloud of tiny water droplets suspended in the atmosphere at or near the Earth's surface that obscures or restricts visibility.</p>	 <p><small>Image by Beyond My Ken on Wikimedia Commons</small></p>
<p><b>Freezing Rain</b></p>	<p>rain that freezes when it lands on an object, such as trees, grass, power lines, buildings, etc.</p>	 <p><small>Image by Laslovarga on Wikimedia Commons</small></p>
<p><b>Hail</b></p>	<p>pellets of frozen rain that fall in showers from cumulonimbus clouds.</p>	 <p><small>Image by rohspatz on Pixabay</small></p>
<p><b>Hurricane</b></p>	<p>a storm with a violent wind, in particular a tropical cyclone in the Caribbean.</p>	 <p><small>Image by NOAA on Wikimedia Commons</small></p>
<p><b>Lightning</b></p>	<p>discharge of electricity that occurs in the atmosphere.</p>	 <p><small>Image by oompa123 on Wikimedia Commons</small></p>

Weather Type	Description	Picture
<b>Rain</b>	moisture condensed from the atmosphere that falls visibly in separate drops.	 <small>Image by akshay_r13 on Pixabay</small>
<b>Sleet</b>	a form of precipitation consisting of ice pellets, often mixed with rain or snow.	 <small>Image by mike epp on Wikimedia Commons</small>
<b>Snow</b>	atmospheric water vapor frozen into ice crystals and falling in light white flakes or lying on the ground as a white layer.	 <small>Image by Ralph Hockens on Wikimedia Commons</small>
<b>Sunshine</b>	direct sunlight unbroken by cloud, especially over a comparatively large area.	 <small>Image by ForestWander on Wikimedia Commons</small>
<b>Thunderstorm</b>	a storm with thunder and lightning and typically also heavy rain or hail.	 <small>Image by skeeze on Pixabay</small>
<b>Tornado</b>	a mobile, destructive vortex of violently rotating winds having the appearance of a funnel-shaped cloud and advancing beneath a large storm system.	 <small>Image by Justin Hobson on Wikimedia Commons</small>
<b>Wind</b>	the perceptible natural movement of the air, especially in the form of a current of air blowing from a particular direction.	 <small>Image by JuliaSchSch on Pixabay</small>

# Meteorology

- Meteorology is the study of the Earth's atmosphere.
- A person who studies meteorology is called a meteorologist.
- A meteorologist studies the Earth's atmosphere and carefully watches the weather. A meteorologist has the ability to predict the weather forecast—an estimate of future events.
- There are many factors that go into predicting the weather, which is why forecasts aren't 100% accurate.
- Meteorologists use many different tools to measure and predict the weather. *We will learn about these tools on the next page!*



## Think About It!

**Do you think being a meteorologist is a hard job? Why or why not?  
Would you like to be a meteorologist? Why or why not?**

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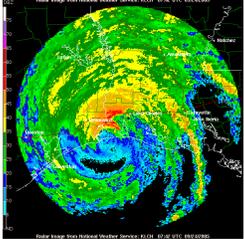
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# How Do We Measure and Predict the Weather?

Tool	Description	Picture
<p><b>Doppler Radar</b></p>	<p>determines the rate of precipitation as well as wind speed and direction. The Doppler Radar helps the meteorologist determine if a storm warning needs to be issued.</p>	 <p><small>Image by NOAA on Wikimedia Commons</small></p>
<p><b>Satellite</b></p>	<p>used to view cloud formations over a specific area.</p>	 <p><small>Image by NOAA on Wikimedia Commons</small></p>
<p><b>Rain Gauge</b></p>	<p>used to measure the amount of rainfall.</p>	 <p><small>Image by Bidgee on Wikimedia Commons</small></p>
<p><b>Anemometer</b></p>	<p>used to measure the speed of wind.</p>	 <p><small>Image by Alex Borland on Public Domain Pictures</small></p>
<p><b>Barometer</b></p>	<p>used to measure the air pressure to see if it is rising or falling.</p>	 <p><small>Image by Agnelous on Wikimedia Commons</small></p>
<p><b>Thermometer</b></p>	<p>used to measure the temperature outside.</p>	 <p><small>Image by Cruccone on Wikimedia Commons</small></p>
<p><b>Computer Model</b></p>	<p>Different models can view many different areas to allow meteorologists to see how the weather is changing.</p>	 <p><small>Image by Famartin on Wikimedia Commons</small></p>

# The Three Forms of Water

- Water is colorless, odorless, and tasteless substance.
- Water exists in three states:
  - Solid
  - Liquid
  - Gas

Water as a Solid	Water as a Liquid	Water as a Gas
Ice <i>Ice is formed at 0°C and 32° F</i>	Wet and Fluid	Vapor or Steam <i>Steam is formed at 100° C / 212° F</i>

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## Identify the Three Forms of Water!

Write solid, liquid, or gas on the line under each picture.



Image by raphaelb on Openclipart



Image by OpenClipart-Vectors on Pixabay

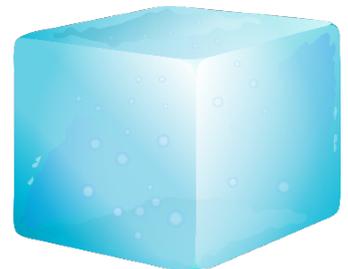


Image by lekamie on Openclipart

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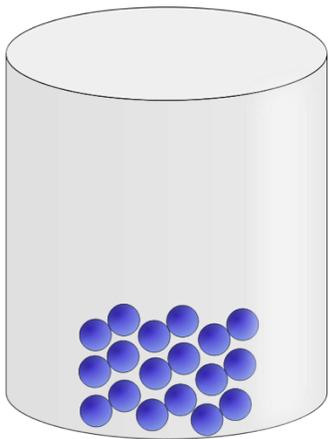
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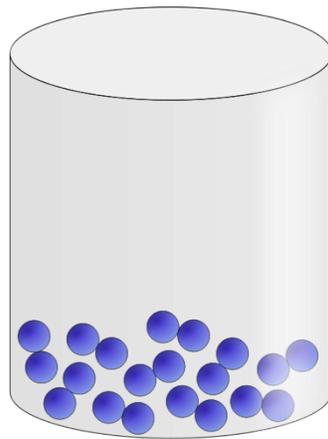
# Water Molecules

- A molecule is a group of atoms that are bonded together.
- A molecule represents the smallest fundamental unit of a chemical compound.
- Water molecules look different for each of the three forms of water.

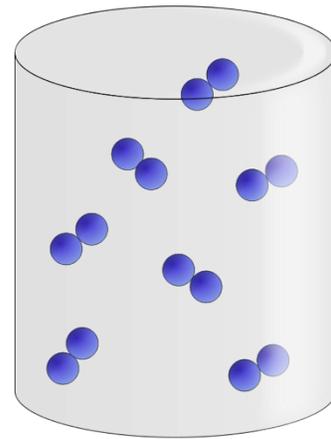
Solid	Liquid	Gas
Molecules do not assume the shape of the container. The molecules are fixed into one position and do not move freely. There is also not a lot of space between the molecules.	Molecules assume the shape of the container. The molecules move freely, but there is not a lot of space between them.	Molecules assume the shape of the container. The molecules move freely and there is a lot of space between them.



**Solid**



**Liquid**



**Gas**

Image by Yelod on Wikimedia Commons

## How Does Water Freeze?

- Freezing is the process of liquid water turning into a solid.
- When something freezes, it means that heat has been lost.
- Water freezes at 0°C / 32°F
- As the temperature drops, the water molecules begin to slow down / lose energy.
- Once the molecules slow down, it is easier for them to attach to each other. When molecules are attached, they share electrons.
- As the molecules attach to each other and lock together, they begin to form a hexagon-shaped pattern.
- Once the molecules are attached and locked together, and the pattern is formed, it is hard to move them.
- Solid water, or ice, takes up about 9% more room than its liquid form.
- Solid water takes up more room because the molecules are not freely bouncing around.

***Think about your classmates. If you all stood up and huddled together, you wouldn't take up as much room as if you stood up with your arms extended touching each other's shoulders.***

- Oceans do not freeze as quickly as freshwater because they contain salt. The salt molecules protect the water molecules by creating little “fences” around them.
- If the temperature drops below  $-2^{\circ}\text{C}$  /  $28.5^{\circ}\text{F}$ , the ocean will freeze.
- When a solid melts, it means that it is turning back into a liquid.
- Melting means that the temperature has increased.
- Once the molecules have enough heat, their energy will return and they will break free.
- Once the molecules break free, they will begin to bounce freely.



Image by Juliancolton on Wikimedia Commons



Image by peltierclem on Pixabay



Image by refotech on Pixabay

# Ice: Environmental Effects

- Rain that falls and freezes on contact is called freezing rain.
- Sleet is a combination of ice, rain, and snow.
- Ice can make walking and driving very dangerous.
- When roads become icy, the chances of getting into a car accident or falling increase.
- When trees / tree limbs become heavy with ice, they can break.
- When power lines become heavy with ice, they can fall or break, causing power outages.
- When the roads are icy, it is best to stay indoors to avoid injuries.
- Special salt is usually thrown onto the roads to melt the ice and to prevent more ice from freezing onto the road.



# The Water Cycle

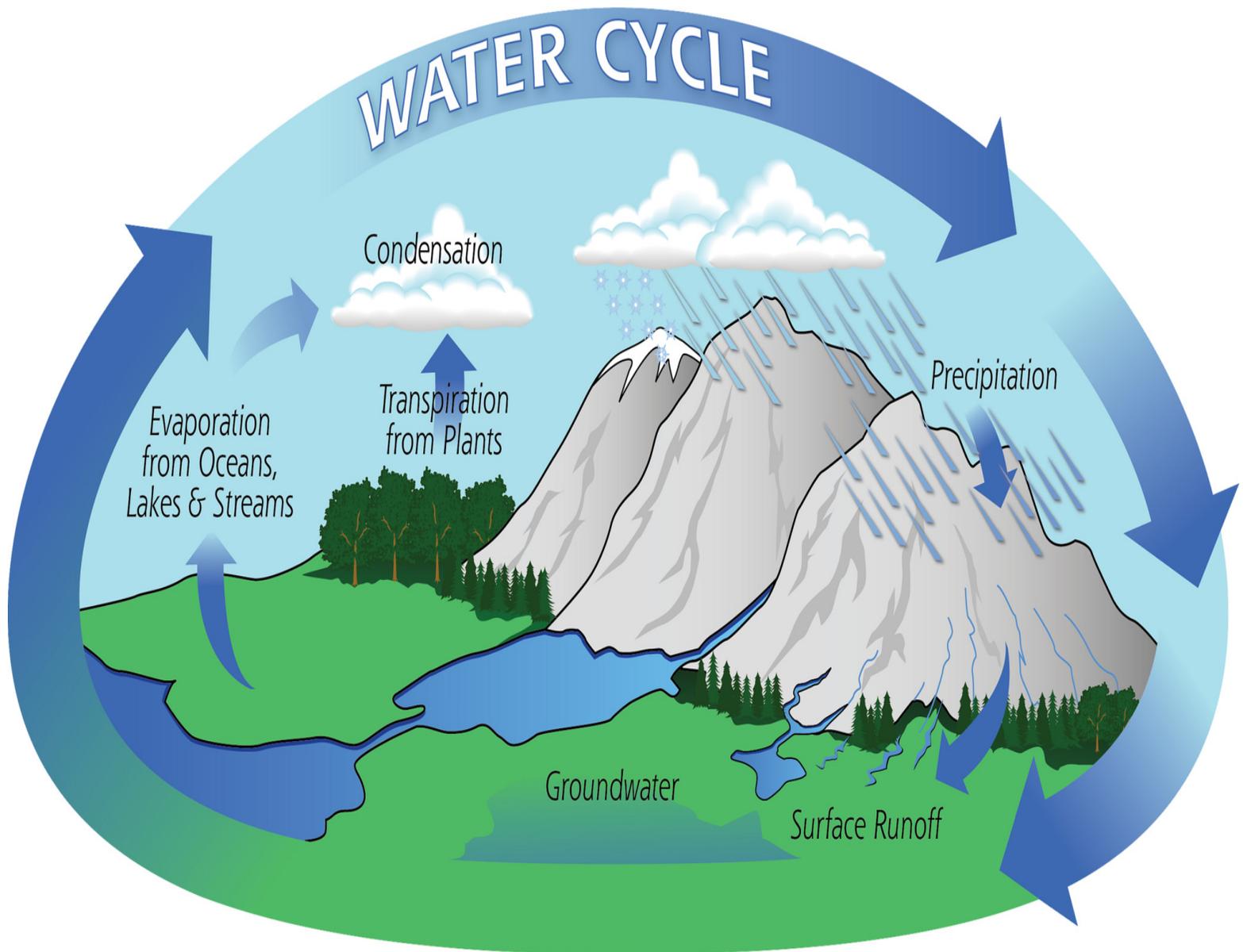


Image by NASA on Flickr

# Evaporation and Condensation

- Evaporation is the process in which a liquid turns into a vapor.
- Water molecules leave the surface of the Earth and enter the atmosphere.
- Evaporation occurs when even the slightest drop of water leaves a pond, puddle, ocean, lake, or stream.
- When the molecule evaporates, it takes some heat / energy from the object it is left. The heat is known as latent heat.

*Think about sweating. On a hot day, your body begins to sweat. You can feel the sweat on your body. When you cool down, the sweat begins to disappear / dry.*

- Evaporative cooling is the process of cooling down an object through evaporation.
- The speed of evaporation is affected by these factors:
  - Temperature
  - Amount of water vapor in the air
  - Wind speed
- Evaporation occurs at any temperature, but occurs quicker in warmer temperatures. The molecules move faster when warmer and evaporation is quicker.
- Water vapor that is in the air is known as humidity.

- The opposite of evaporation is condensation.
- Condensation is the process in which a vapor turns back into a liquid.
- Condensation occurs when the atmosphere is saturated (full of water).
- In order for the water to condense, there must be a surface—such as grass, a window, or a water bottle.

*Think about a water bottle. Suppose you take a water bottle out of the refrigerator. You drink a little bit of the water, but do not finish all of the water. If you leave the bottle out of the refrigerator for a while, you will notice tiny water droplets on the outside of the bottle. This is condensation.*

- Dew point is the atmospheric temperature (varying according to pressure and humidity) below which water droplets begin to condense and dew can form.

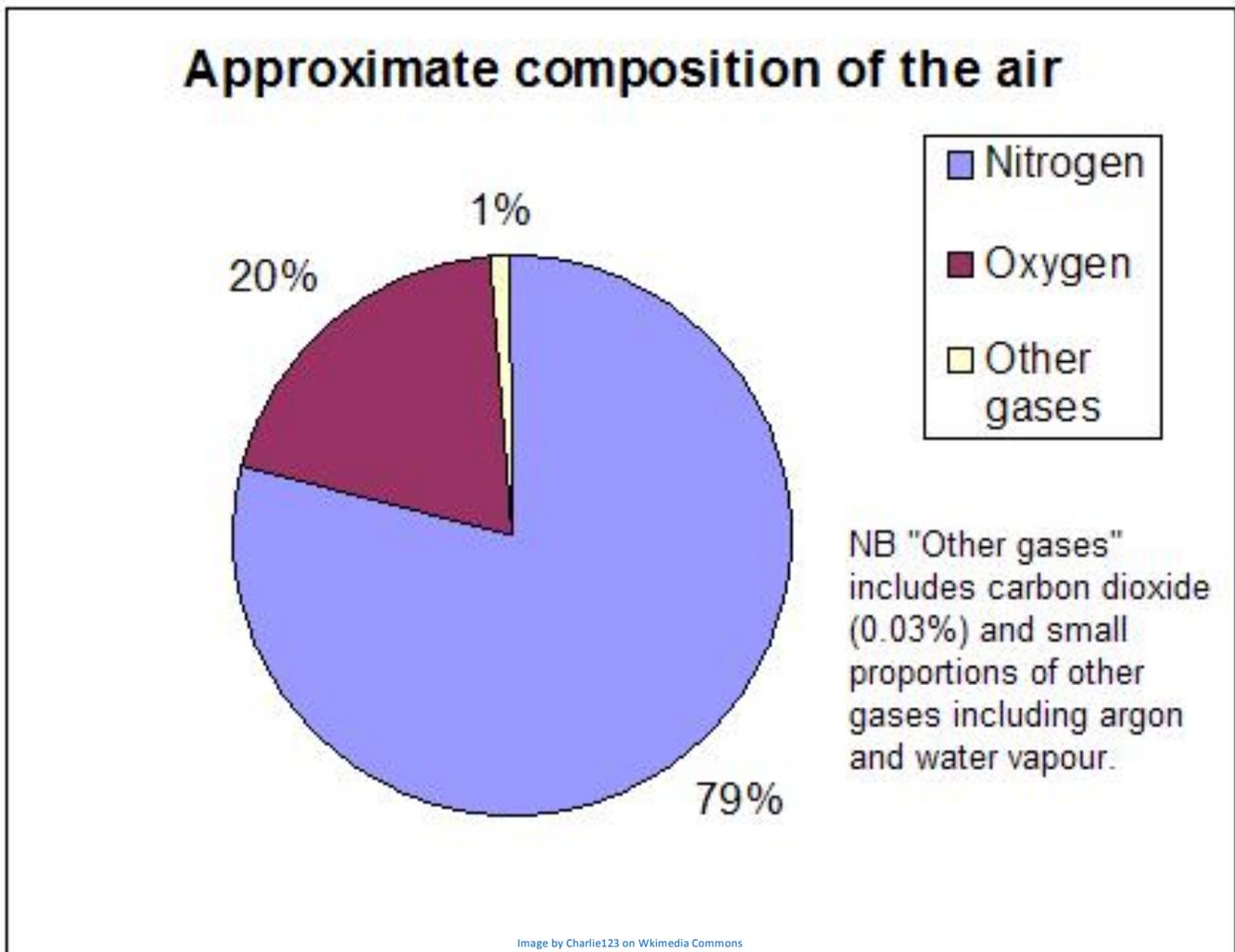


# Rain, Dew, and Fog: What is the Difference?

<b>Rain</b>	Moisture condensed from the atmosphere that falls visibly in separate drops.	 <p><small>Image by Giuliamar on Pixabay</small></p>
<b>Dew</b>	Tiny drops of water that form on cool surfaces at night, when atmospheric vapor condenses.	 <p><small>Image by Valentin Riess on Pexels</small></p>
<b>Fog</b>	a thick cloud of tiny water droplets suspended in the atmosphere at or near the Earth's surface that obscures or restricts visibility.	 <p><small>Image by David Boozer on Pexels</small></p>

# What is Air?

- Air is another word for atmosphere.
- Air is colorless and odorless.
- Air is made up of nitrogen, oxygen, argon, carbon dioxide, and a small percentage of water vapor.
- Air is required for human, animal, and plant survival.
- Polluted air is the result of gases, such as ozone and carbon monoxide, ash, and smoke.



# Words About Air

<b>Term</b>	<b>Definition</b>
<b>Humidity</b>	a quantity representing the amount of water vapor in the atmosphere
<b>Air Pressure</b>	force exerted onto a surface by the weight of the air
<b>Air Quality</b>	the degree to which the ambient air is pollution-free, assessed by measuring a number of indicators of pollution.
<b>Warm Front</b>	the boundary of an advancing mass of warm air, in particular the leading edge of the warm sector of a low-pressure system.
<b>Cold Front</b>	the boundary of an advancing mass of cold air, in particular the trailing edge of the warm sector of a low-pressure system.

## Warm Air vs. Cool Air

- When air is hot, the molecules are farther apart.
- Hot air is less dense and lighter than cold / cool air.
- Closer to the Earth's surface, the air is warmer. The Sun's heat warms the air, so it rises.
- As the air rises, it cools down. When air is cool, the molecules are closer together.
- Cool air is not as dense or light as hot air. Since the cooler air is "heavier", it sinks.

*Think about the temperature in the morning compared to the temperature in the afternoon. In the morning, especially in the Summer, it is cooler than the afternoon. This is because the thermals or heat pockets, cannot rise very high. The air during the night is cooler because the Sun is not out. Once the Sun comes out, the thermals can rise higher and create warmer temperature.*

- Tornados, thunderstorms, hurricanes, and even breezes are the result of the cycle of rising warm air and the sinking cool air.

# Life Cycle of a Cloud

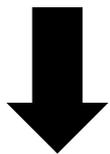
- A cloud is a collection of water droplets or ice pellets that forms in the sky.
- The water droplets / ice pellets are very light that they can float in the air.
- Since clouds are made up of many droplets / ice pellets, they can each scatter the seven color wavelengths. When all the colors (red, orange, yellow, green, blue, indigo, violet) come together, white is produced. Therefore, clouds are white.

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## How a Cloud Forms

**Warm air rises, expands and cools.**

Image by Ciker-Free-Vector-Images on Pixabay



**Droplets attach to dust particles in the air. The water droplets surround the dust particles. and cools.**

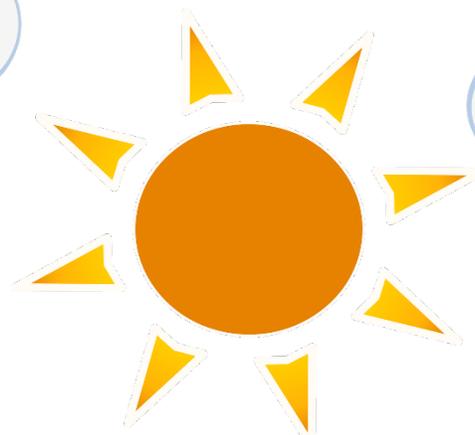
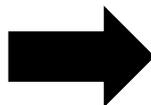


Image by Ciker-Free-Vector-Images on Pixabay



**When billions of droplets come together, a cloud is formed.**



**As these new droplets form, they attach to each other.**

# Types of Clouds

- There are three types of cloud groups:
  - Cirrus: high clouds → above 18,000 feet
  - Alto: middle clouds → 6,500 feet to 18,000 feet
  - Stratus: low clouds → up to 6,500 feet

Cloud Name	Description	Picture
Cirrus	high cloud; made up of ice; white; indicate pleasant weather, but a change of weather within 24 hours.	 <small>Image by Fir0002 on Wikimedia Commons</small>
Cirrocumulus	high cloud; small, round, and appear in rows; often resemble fish scales; seen in the winter and are a predictor of cold weather; can also be an indicator of a hurricane (in the tropics)	 <small>Image by Biswarup Ganguly on Wikimedia Commons</small>
Cirrostratus	high cloud; thin, covers the entire sky; light from the Sun and Moon can be seen through them; seen 12-24 hours prior to a snow or rain storm.	 <small>Image by Simon Eugster on Wikimedia Commons</small>
Altostratus	mid-level cloud; gray or blue; made of water vapor and ice; cover the entire sky; some light can get through; sign of continuous rain or snow	 <small>Image by The Great Cloudwatcher on Wikimedia Commons</small>
Alto cumulus	mid-level cloud; made up of water droplets; gray; form in groups; sign of a thunderstorm later in the day	 <small>Image by Bidgee on Wikimedia Commons</small>

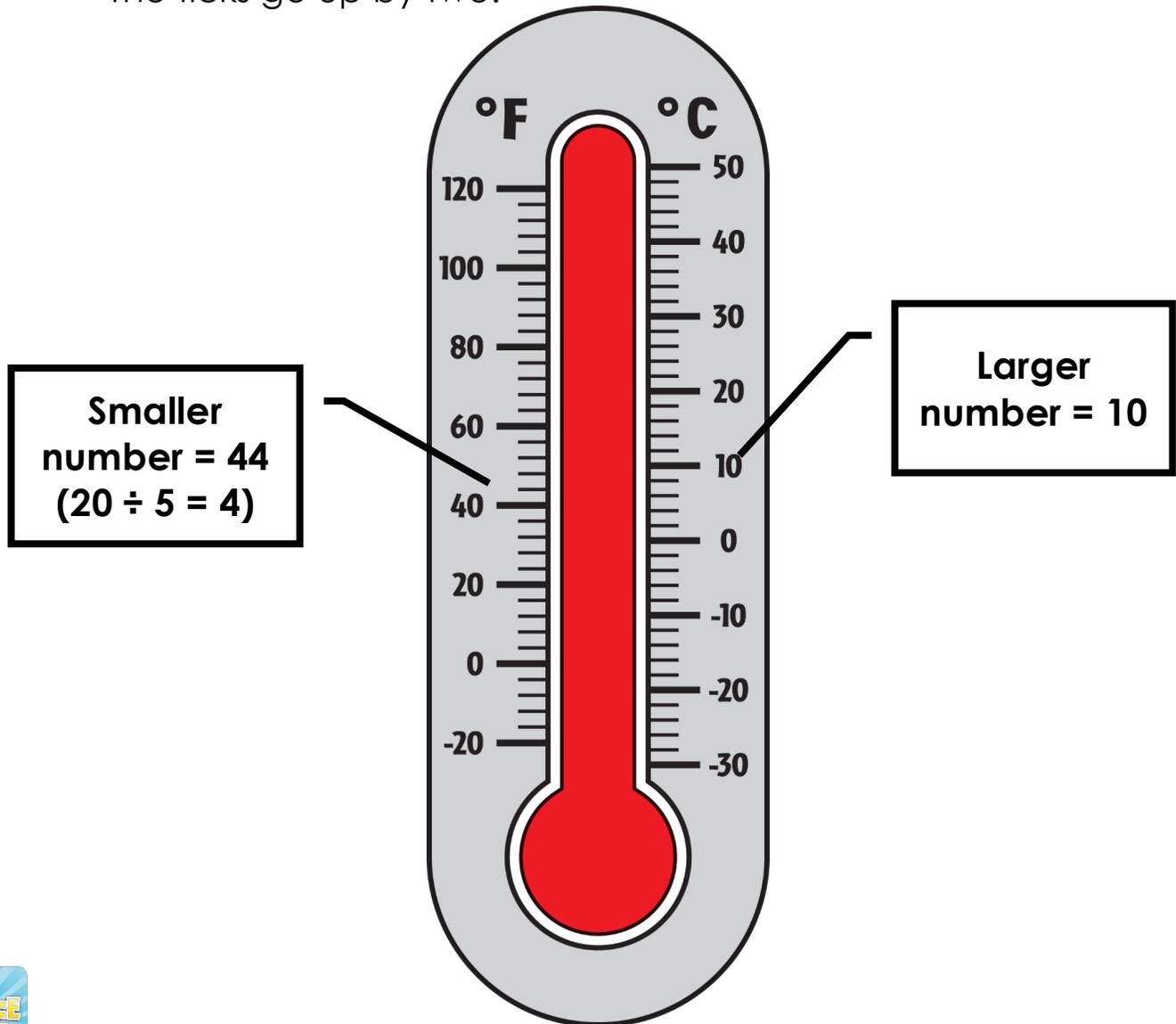
Cloud Name	Description	Picture
Nimbostratus	dark gray; wet; associated with precipitation- falling rain or snow	 <p><small>Image by Simon Eugster on Wikimedia Commons</small></p>
Stratus	gray clouds that cover the sky; looks like fog that is high in the sky; can produce light mist or drizzle	 <p><small>Image by Kevin on Coclouds</small></p>
Stratocumulus	light, gray, and puffy; form in rows; can see parts of the sky between the clouds; can turn into nimbostratus clouds	 <p><small>Image by Simon Eugster on Wikimedia Commons</small></p>
Cumulus	white and puffy; indicate fair weather; flat base and rounded towers; can develop into cumulonimbus clouds	 <p><small>Image by Alexas_Fotos on Pixabay</small></p>
Cumulonimbus	thunderstorm clouds; top of the cloud resembles an anvil, which indicates which way the storm is moving; indicates snow, rain, hail, lightning, and tornados.	 <p><small>Image by Simon Eugster on Wikimedia Commons</small></p>

# Why Does it Rain?

- Rain is water that falls from the sky.
- Rain is considered precipitation. Precipitation is any water that falls from the Earth—snow, hail, ice, sleet, or drizzle.
- Through the process of evaporation, water from lakes, oceans, puddles, and other bodies of water turns into water vapor in the atmosphere.
- The water vapor uses the Sun's energy to form tiny droplets. This process is called condensation.
- These tiny water droplets come together and create a cloud.
- When the droplets come together, the cloud becomes heavy. When the cloud becomes too heavy, the water droplets fall as precipitation.

# Reading a Thermometer

- A thermometer is a tool used to measure what the temperature is.
- When reading a thermometer, we count by 10's. Each tick/line between represents numbers between each larger number. The ticks can be calculated by dividing the number of ticks in between the two numbers by the difference of the two numbers. For example, there are 5 ticks between 20 and 30 (diff. of 10) so  $10 \div 5 = 2$ . The ticks go up by two.



# Celsius vs. Fahrenheit

- Celsius and Fahrenheit are the two units for measuring temperature.
- The main difference between Celsius and Fahrenheit is the temperature at which they begin measuring.

*Let's begin with Celsius!*

- Swedish astronomer, Anders Celsius in 1742, invented the Celsius unit for measuring.
- Celsius is used in mostly every country except for the United States.
- Originally, Celsius was known as Centigrade because it is divided into 100 degrees.
- In Celsius, water freezes at 0° and boils at 100°.

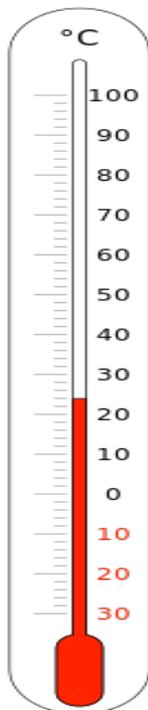


Image by Gringer on Wikimedia Commons



Image by Olof Arenius on Wikimedia Commons

## *Now let's learn about Fahrenheit!*

- German physicist, Daniel Gabriel Fahrenheit in 1724, invented the Fahrenheit unit of measurement.
- In the Western world, since the 1960s, Fahrenheit has been used for climatic, industrial, and medical purposes.
- Due to the simplicity of the Celsius scale, Fahrenheit is rarely used in countries, except for the United States.
- Some people view Fahrenheit as the “old-fashioned” way of measuring temperature.
- In Fahrenheit, water freezes at 32° and boils at 212°.

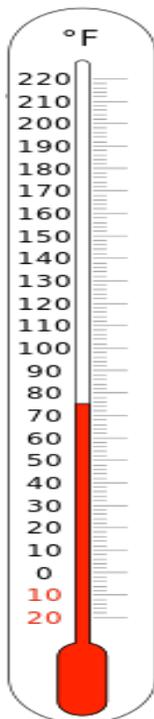


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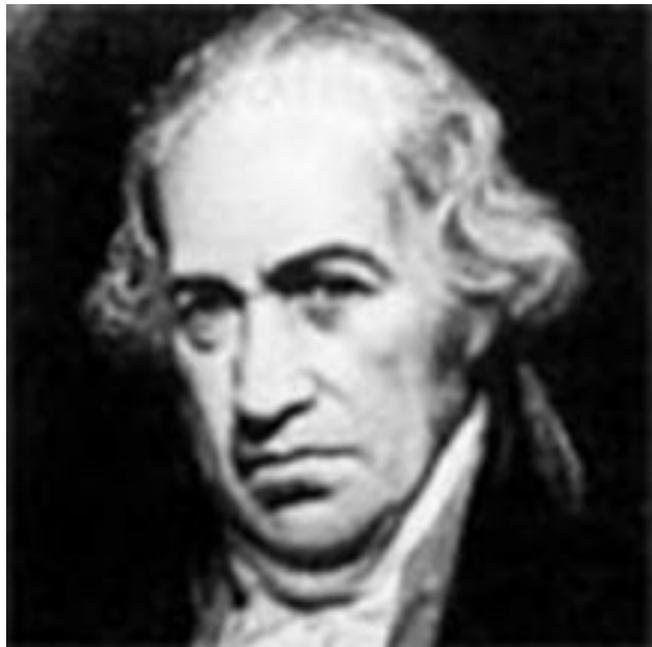


Image on Wikimedia Commons {{PD-old-100}}

# What is the Wind Chill?

- The wind chill is the temperature you feel when the wind speed and the air temperature combine.
- When the wind speed is higher, the areas of your body that are exposed—such as your face or hands—will lose heat faster.
- When the wind chill is between  $-10^{\circ}$  and  $-24^{\circ}$ , a wind chill advisory is issued.
- When the wind chill is  $-25^{\circ}$  or lower, a wind chill warning is issued. It is at these temperatures where it is possible to get frostbite if you are out and not properly dressed.



Image by OpenClipart-Vectors on Pixabay

Image by Pfeilgiftfeder on Pixabay

# Think About It!

**What are some ways you can protect yourself when it is bitter cold outside?**

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## What is the Heat Index?

- The heat index is a combination of air temperature and humidity.
- The heat index describes the temperature we feel, but is not the actual temperature.
- When the heat index is too high, you can risk getting heat stroke.
- Heat stroke is a type of heat injury, in which the person becomes too hot and the body cannot sweat to cool the body temperature. Heat stroke occurs if the person spends too much time in extremely hot temperatures.

Heat Index	How It Affects the Body
130° and higher	Strong probability of heat stroke.
105° to 130°	Moderate probability of heat stroke
90° to 105°	Slight probability of heat stroke

- If the heat index is predicted to be above 115° F within the next few days, an excessive heat watch is issued.
- When the heat index is 115°F or higher for 3 or more hours a day and will continue for 2 consecutive days, an excessive heat warning is issued.
- When the heat index is 105°F or lower for 3 or fewer hours during the day and 80°F during the night for 2 consecutive days, a heat advisory is issued.

# Severe Weather

- Severe or extreme weather is weather that doesn't occur often. Severe weather is often detrimental—causing harm or destruction—and can result in the loss of infrastructures (buildings, roads) and even people's lives.

Severe Weather	Description	Picture
<p><b>Hurricane</b></p>	<p>a big storm that forms over the ocean, 5 to 15 degrees latitude north or south of the Equator; also known as a tropical cyclone; temperature must be 80° F or warmer in order for a hurricane to form; winds from a hurricane range from 75 mph to 200 mph; last for more than a week; move 10-20 mph; hurricanes are named by the World Meteorological Organization; if a hurricane does significant damage/ is historical, its name is retired.</p>	 <p><small>Image by Jeff Schmale on Wikimedia Commons</small></p> <p><b>Eye of the Storm</b></p>
<p><b>Tornado</b></p>	<p>a mobile, destructive vortex of violently rotating winds having the appearance of a funnel-shaped cloud; form from thunderstorms when the warm, moist air from the Gulf of Mexico combines with the cool, dry air from Canada; wind speeds can reach 300mph; area of rotation is between 2 and 6 miles wide; common in the Great Plains (USA); "funnel;" is the air spiraling away from the thunderstorm, when it reaches the ground, it is called a tornado</p>	 <p><small>Image by Daphne Zaras on Wikimedia Commons</small></p>
<p><b>Tropical Storm</b></p>	<p>a localized, very intense low-pressure wind system, forming over tropical oceans and with between 39 mph and 73 mph; step down from a hurricane.</p>	 <p><small>Image by NASA on Wikimedia Commons</small></p>

Severe Weather	Description	Picture
<p><b>Typhoon</b></p>	<p>a tropical storm in the region of the Indian or western Pacific oceans (near Hawaii and Asia/Southeast Asia); form during the late summer; wind speeds can be anywhere between 74 mph and 110 mph</p>	 <p>Image by NASA on Wikimedia Commons</p>
<p><b>Tsunami</b></p>	<p>a long high sea wave caused by an earthquake, submarine (underwater) landslide, or other disturbance, such as a volcanic eruption; very common in the Pacific Ocean because of the active submarine earthquake zones; two tsunamis occur per year; in 15,000 feet of water, a tsunami travels at a speed of 475 mph; in 100 feet of water, the speed drops to 40 mph; out at sea, tsunamis rarely go above 3 feet, as they approach shore, the height increases and they can be over 10 feet; when a tsunami hits land, it looks like a giant wave; tsunamis last anywhere between 5 and 60 minutes</p>	 <p>Image by rolandmey on Pixabay</p>
<p><b>Blizzard</b></p>	<p>a severe snowstorm with high winds and low visibility; in order for a blizzard to form, there needs to be: moisture, cool air at the surface, and a lift—where warm air rises above the cold; a Nor'easter is similar to a blizzard, but occurs in the eastern part of the United States; named for the type of wind that occurs during this storm; the storm travels up the Gulf Stream—warm waters off the Atlantic Coast.</p>	 <p>Image by Department of Transportation on Wikimedia Commons</p>

# Categorizing Hurricanes: The Saffir-Simpson Hurricane Wind Scale

- The Saffir-Simpson Hurricane Wind Scale is a scale used to measure the categories of a hurricane based on wind speed.

Category	Winds (MPH)	Pressure (Inches)	Storm Surge (Feet)	Damage
<b>1</b>	74-95	<28.94	4'-5'	Minimal
<b>2</b>	96-110	28.91-28.50	6'-8'	Moderate
<b>3</b>	111-130	28.47-27.91	9'-12'	Extensive
<b>4</b>	131-155	27.88-27.17	13'-18'	Extreme
<b>5</b>	>155	<27.17	>18'	Catastrophic

Damage	Examples
<b>Minimal</b>	slight damage to roof tiles, shingles, gutters, power lines; loss of tree branches power outages for a few to several days.
<b>Moderate</b>	severe damage to homes; power outages that could last several days to weeks
<b>Extensive</b>	severe damage to homes; trees uprooted that could block roads; loss of power for several weeks
<b>Extreme</b>	homes mostly destroyed; trees uprooted; roads blocked from trees; loss of power for several weeks to months; area uninhabitable
<b>Catastrophic</b>	Homes completely destroyed; trees uprooted; loss of power for months; area is uninhabitable and will stay like that for several months.

# Categorizing Tornadoes: The Fujita Tornado Intensity Scale

- The Fujita Tornado Intensity Scale is used to rate a tornado intensity based on its damage to infrastructure and vegetation.

Scale	Wind Speed (MPH)	Damage	Enhanced Operational Fujita Scale
<b>F0</b>	40-72	light damage to trees, homes, roofs	EFO 65-85 mph
<b>F1</b>	73-112	broken tree branches, mobile homes pushed, roofs damaged	EF1 86-110 mph
<b>F2</b>	113-157	trees uprooted; mobile homes completely damaged; structured homes slightly damaged	EF2 111-135 mph
<b>F3</b>	158-206	severe damage to cars and trains; homes somewhat destroyed	EF3 136-165 mph
<b>F4</b>	207-260	Homes completely destroyed; area looks like a giant pile of debris; cars thrown 300 yards or more	EF4 166-200 mph
<b>F5</b>	261-318	catastrophic damage; trees, homes, an other infrastructures destroyed	EF5 Over 200 mph

# Historical Storms

Storm Name/ Type	Year & Location (s)	Description	Picture
<b>Hurricane Katrina</b> <b>[Hurricane]</b>	August 2005 Louisiana & Mississippi (USA)	Category 3 cyclone; winds of over 125mph; death toll of 1,200; thousands of people lost their homes; 80% of New Orleans was under water; \$108 billion in damages.	 <p><small>Image by Paul Morse on Wikimedia Commons</small></p>
<b>Hurricane Andrew</b> <b>[Hurricane]</b>	August 1992 Bahamas, South Florida, and Louisiana	Category 5 hurricane; highest wind speed recorded was 175 mph; death toll of 65; \$26.5 billion in damages.	 <p><small>Image by National Hurricane Center on Wikimedia Commons</small></p>
<b>Daulatpur-Saturia, Bangladesh Tornado</b> <b>[Tornado]</b>	April 1989 Daulatpur, Saturia, Bangladesh	F1-F4 tornado, making it the deadliest tornado in history; death toll of 1,300, 12,000 casualties; completely destroyed homes and trees; cost \$1.5 million in damages.	 <p><small>Image by Kmusser on Wikimedia Commons</small></p>
<b>Iran Blizzard</b> <b>[Blizzard]</b>	February 1972 Northwestern, Central, and Southern Iran	lasted 6 days; estimated 10 feet of snow fell; death toll of 4,000, with more buried under the snow; two villages saw no survivors	 <p><small>Image by Uwe Dederich on Wikimedia Commons</small></p>

Storm Name/ Type	Year & Location (s)	Description	Picture
<b>Haiti Earthquake of 2010</b> <b>[Earthquake]</b>	January 2010 Haiti	7 M. earthquake; three million people affected; death toll recorded was between 100,000 and 160,000; 250,000 homes and 30,00 commercial buildings were destroyed; \$14 billion in damages.	 <p><small>Image by Marco Dormino on Wikimedia Commons</small></p>
<b>1980 United States Heatwave</b> <b>[Heatwave]</b>	July 1980 Midwestern United States/ Southern Plains	42-day heatwave; cost \$20 billion in damages, especially to agriculture and livestock; death toll of 10,000 people; temperatures did not drop down below 100°F for days;	 <p><small>Image by Pexels on Pixabay</small></p>
<b>Indian Ocean Earthquake and Tsunami</b> <b>[Tornado]</b>	December 2004 Indonesia, Sri Lanka, India, Thailand, Maldives, Malaysia, Madagascar, Somalia, Kenya, Tanzania, and South Africa	9.1-9.3 M earthquake; tsunami waves of 50-100 feet; third largest earthquake ever recorded; death toll of 230,000-280,000 with many more people missing/ never found; \$14 billion in damages	 <p><small>Image by Michael L. Bak on Wikimedia Commons</small></p>
<b>1931 China Floods</b> <b>[Floods]</b>	July-August 1931 China	28.5 million people affected; death toll between 145,000 and 4 million; 24 inches of rain fell within one month; many people died from starvation or water-borne diseases;	 <p><small>Image by Bundesarchiv, Bild 102-12231 on Wikimedia Commons</small></p>

# Thunderstorm Terms

Word	Definition
<b>Severe Thunderstorm Watch</b>	a thunderstorm with winds that exceed 58 mph and hail that is 1 inch or more in diameter.
<b>Severe Thunderstorm Warning</b>	a thunderstorm with winds that exceed 58 mph and hail that is $\frac{3}{4}$ of an inch or more in diameter will occur in your area.
<b>Downdraft</b>	a downward current or draft of cool air to the ground, usually with precipitation; associated with a thunderstorm or rain showers.
<b>Updraft</b>	an upward current or draft of warm air. If the air is moist, it will form a cumulus cloud.



Image by Clker-Free-Vector-Images on Pixabay

# What Causes a Thunderstorm?

- A thunderstorm is a storm that includes rain, thunder, lightning, gusty winds, and sometimes hail.
- Thunderstorms form from cumulonimbus clouds.
- A thunderstorm forms when there is moisture, unstable air that is warm and rises quickly, and lift.
- Thunderstorms can happen anytime during the year, but are more common in the spring and summer.
- Thunderstorms usually happen in the afternoon and evening.
- An estimated 1,800 thunderstorms occur on Earth each day.



**Think About It!**

**Do you like thunderstorms? Why or why not?**

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# What is Lightning?

- Lightning is a bright flash of electricity that a thunderstorm produces.
- Lightning occurs during a thunderstorm and can be very dangerous. Lightning kills between 75 and 100 people a year.
- Lightning is the result of frozen raindrops bumping into each other within a thundercloud. The collisions result in an electric charge.
- Eventually, the entire thundercloud becomes filled with electrical charges.
- At the top of the thundercloud, there are positive charges. These attract to the negative charges at the bottom of the cloud.
- Since the positive and negative forces are attracting, a buildup of positive charges occurs on the ground.
- Mountains, people, tree—anything on the ground—allow the electrical charge to concentrate around it.
- The charge climbs up these objects and eventually reaches the charge that is coming down from the cloud. When the two meet, lightning occurs.

***Think about electrical shocks. Have you ever touched a light switch or a metal doorknob and got a shock? This is how lightning works!***

## How Far Away is the Storm?

- Thunder is the result of lightning.
- The sound we hear comes from the lightning bolt traveling from the cloud to the ground.
- As the lightning bolt travels, it creates a channel or an opening in the air.
- The air collapses and a sound wave is created once the lightning bolt disappears.
- Since light travels faster than sound, we see the lightning before we hear the thunder.

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### Let's learn how to calculate how far away the storm is!

- ◆ The first thing to do is watch for lightning.
- ◆ Once you see the lightning, begin counting.
- ◆ Once you hear the thunder, stop counting.
- ◆ Take the number of seconds between the lightning and the thunder and divide by 5.
- ◆ The answer tells you how many miles away the storm is!



**20 seconds / 5 = 4 miles**

**The storm is 4 miles away!**

# Rainbow Terms

Term	Definition
<b>Reflection</b>	the throwing back by a body or surface of light, heat, or sound without absorbing it.
<b>Refraction</b>	a change in the direction of light as a result of its traveling at different speeds at different points along the wave front.
<b>Dispersion of Light</b>	the separation of white light into colors.
<b>Moonbow / Lunar Rainbow</b>	a phenomenon similar to a rainbow, produced by moonlight reflecting and refracting off water droplets in the air.
<b>Fogbow</b>	a phenomenon similar to a rainbow, produced by sunlight shining on fog.



Image by Captain76 on Wikimedia Commons

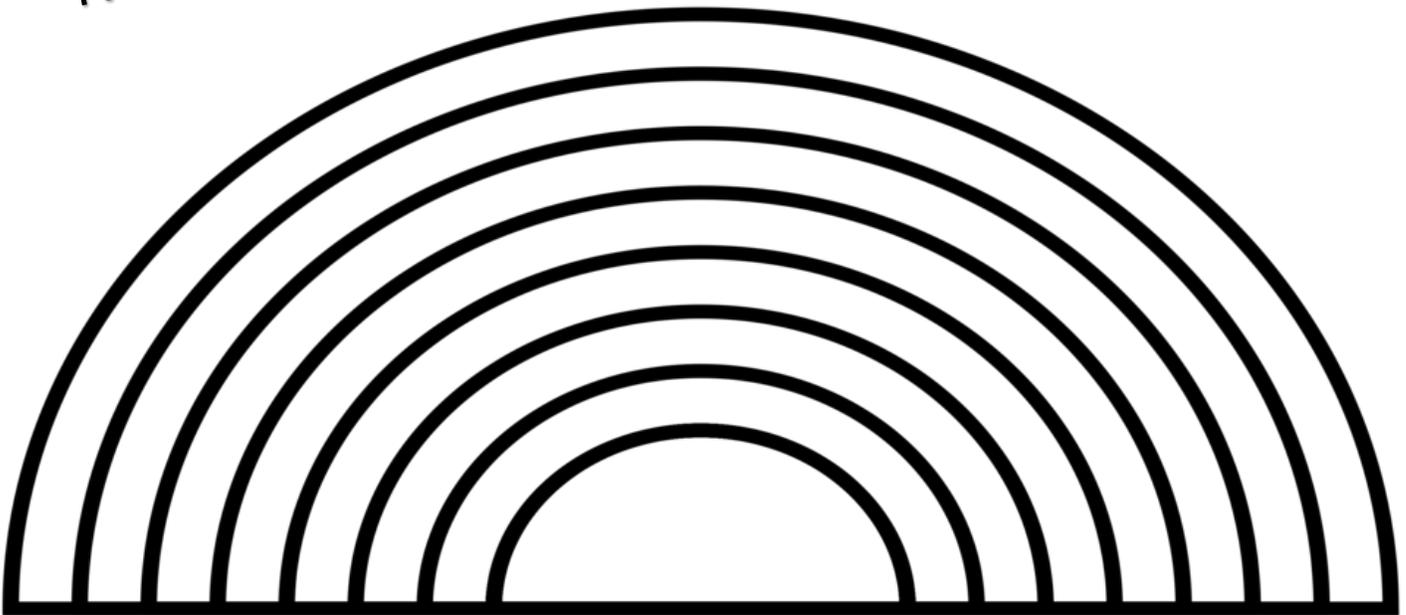
## What is a Rainbow?

- A rainbow is an arch of colors formed in the sky.
- The colors of the rainbow, in this order, are: red, orange, yellow, green, blue, indigo, and violet (ROY G BIV).
- A rainbow is the result of the refraction and dispersion of the Sun's light by rain or water droplets in the atmosphere.
- A rainbow is an optical illusion/ light trick—they do not exist.
- To see a rainbow, we must be standing between the Sun and the raindrops.
- Rainbows are a complete circle, but because we are standing on the ground, we only see the arch.
- When the sunlight hits a raindrop, the raindrop acts like a prism. The sunlight shines through the raindrop and the colors refract or bend. The colors then disperse and a rainbow is seen.
- Every raindrop can create its own rainbow, but we do not see the rainbow until millions of raindrops come together.
- Rainbows are formed when the light is spotted on the raindrops at a 42 degree angle.
- Sir Isaac Newton was the first person to explain what a rainbow is.
- No two people will see the rainbow the same. This is due to the light bending differently at different angles.

- Rainbows will be higher in the sky when the Sun is lower.
- Rainbows will be lower in the sky when the Sun is higher.
- A double rainbow is the result of the sunlight refracting twice through the raindrop. (see picture on page 42)
- Double rainbows are the reflection of the first rainbow.
- Double rainbows are lighter and have the colors reversed.
- Alexander's Band is the name given to the dark portion of the sky you observe when looking at a double rainbow.

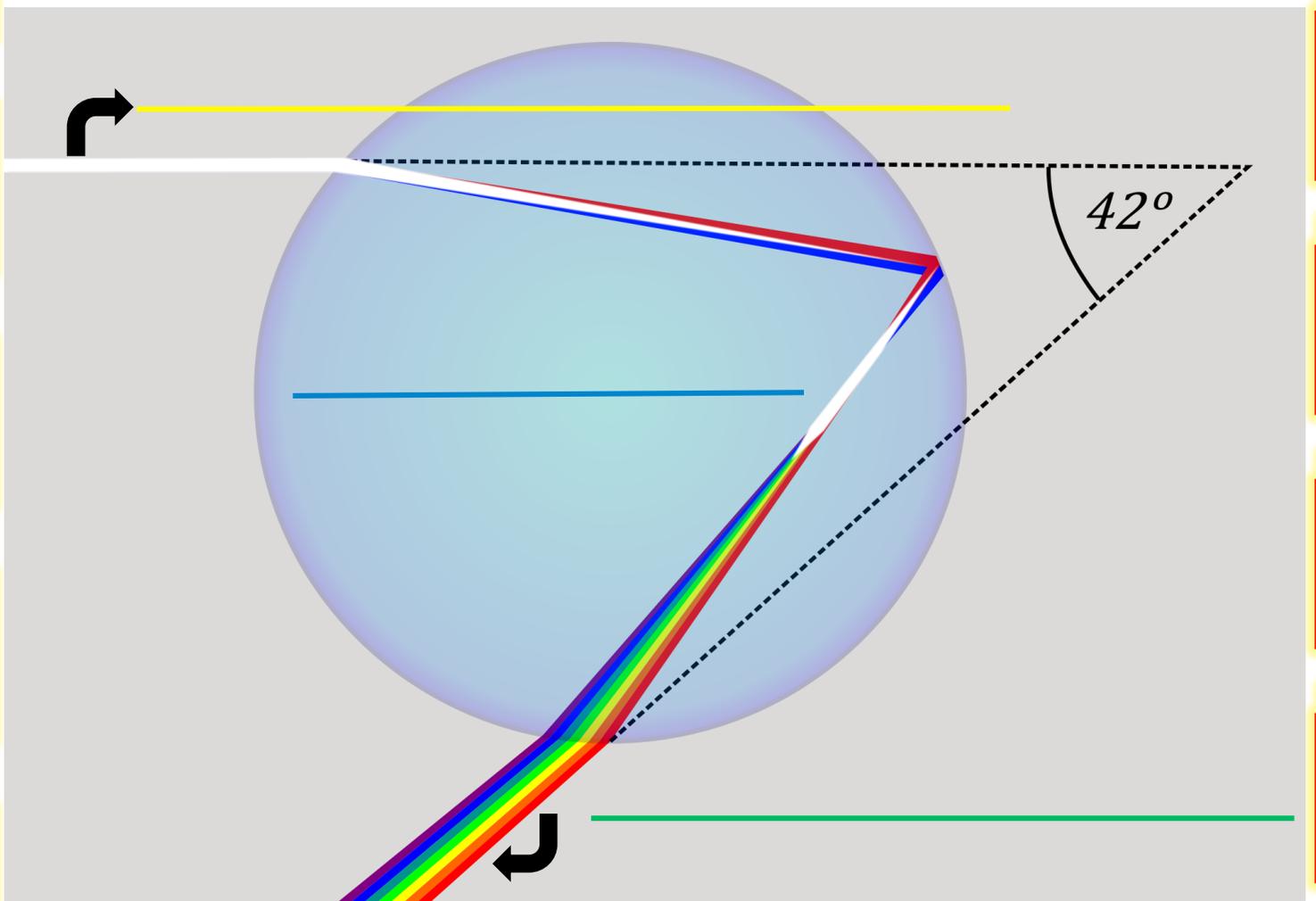
Don't forget:  
ROY G BIV!

# Color the Rainbow



# Refractive Dispersion of Light Activity Sheet

**Directions:** On the yellow line, write "Incoming Rays from the Sun". On the blue line, write "Raindrop." Trace over the dotted lines. On the green line, write "Outgoing Rays."



The sunlight must hit the raindrop  
at \_\_\_\_\_ degrees.

# What is Wind?

- Moving air is called wind.
- The Sun unevenly heats the Earth's surface.
- The unevenness comes from landforms and bodies of water absorbing the radiation / energy.
- Some places on Earth are in the Sun's direct path—these places are warm all year long. Other places on Earth receive the Sun's energy indirectly—these places are cooler all year long.
- Warm air is lighter, so it rises. As it rises, it is replaced by the cool / cold air. This is what causes the wind to blow.
- In order to specify the wind, you need two factors: speed and direction.

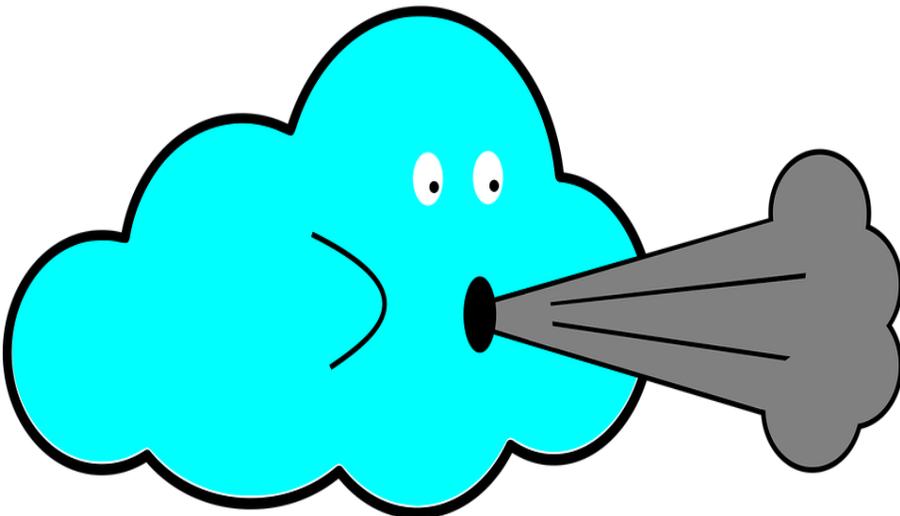


Image by monhtm on Pixabay

# Wind Terms

Term	Description
<b>Downburst</b>	a strong downward current of air from a cumulonimbus cloud, usually associated with intense rain or a thunderstorm.
<b>Derecho</b>	a line of intense, widespread, and fast-moving windstorms and sometimes thunderstorms that moves across a great distance and is characterized by damaging winds.
<b>Doldrums</b>	an equatorial region of the Atlantic Ocean with calms (wind-free weather), sudden storms, and light unpredictable winds.
<b>Santa Ana Winds</b>	strong, dry, winds that slope downward and affect Southern California and Northern Baja California. These winds are either very cold or very hot, depending on the temperature. The winds bring very hot and dry weather and often cause wildfires in California.



Term	Description
<b>Monsoons</b>	a seasonal prevailing wind in the region of South and Southeast Asia, blowing from the southwest between May and September and bringing rain (the wet monsoon), or from the northeast between October and April (the dry monsoon).
<b>Prevailing Westerlies</b>	winds that occur between 30 and 60 degrees latitude and blow from the west to the east. These winds play a big role in the weather patterns of the United States and Canada.
<b>Polar Easterlies</b>	dry, cold, winds that occur at 60 degrees latitude (north and south). The winds blow from the high pressure areas in the poles to the low pressure areas within the Westerlies.
<b>Jet Stream</b>	a narrow, variable band of very strong, predominantly westerly air currents encircling the globe several miles above the Earth. There are typically two or three jet streams in each of the northern and southern hemispheres.

# The Beaufort Scale

- Created by Sir Francis Beaufort in 1806.
- Measures the weather's intensity based on wind power.

Beaufort Number	Wind Speed (MPH)	Description	Sea Conditions	Land Conditions
0	<1	Calm	Flat	Calm
1	1-3	Light Air	Ripples (no crests)	Wind motion is visible through smoke
2	4-7	Light Breeze	Small wavelets	Rustling leaves
3	8-12	Gentle Breeze	Large wavelets	Movement of small twigs
4	13-18	Moderate Breeze	Small waves	Movement of small branches
5	19-24	Fresh Breeze	Moderate longer waves	Swaying of small trees
6	25-31	Strong Breeze	Large waves; foam crests	Movement of large branches
7	32-38	Near Gale	Sea heaps up; foam streaks	Movement of whole trees
8	39-46	Gale	Somewhat high waves; crests break	Broken twigs
9	47-54	Severe Gale	Waves are high; foam is dense	Some structure damage
10	55-63	Storm	Very high sea waves; sea surface is white	Uprooted trees; moderate damage
11	64-72	Violent Storm	Extremely high waves	Moderate structural damage
12	73-82	Hurricane	Sea surface is entirely white	Massive structural damage

# How is Wind Measured?

- Wind has two factors: speed and direction.
- There are two different devices that are used to measure wind: anemometers and weather vanes.
- Weather vanes measure wind direction
- Anemometers measure wind speed.

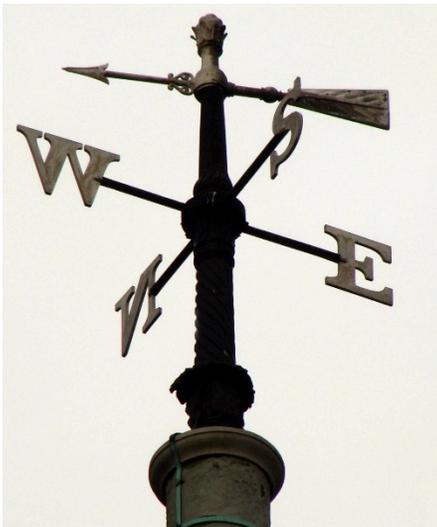


Image by ProfDEH on Wikimedia Commons

## Weather Vane

- Typically mounted on the top of a building.
- Has four points: north, south, east, west
- The weather vane always points into the wind.
- For example, if the wind is blowing east, the weather vane will point towards the east.



THE ROBINSON ANEMOMETER.

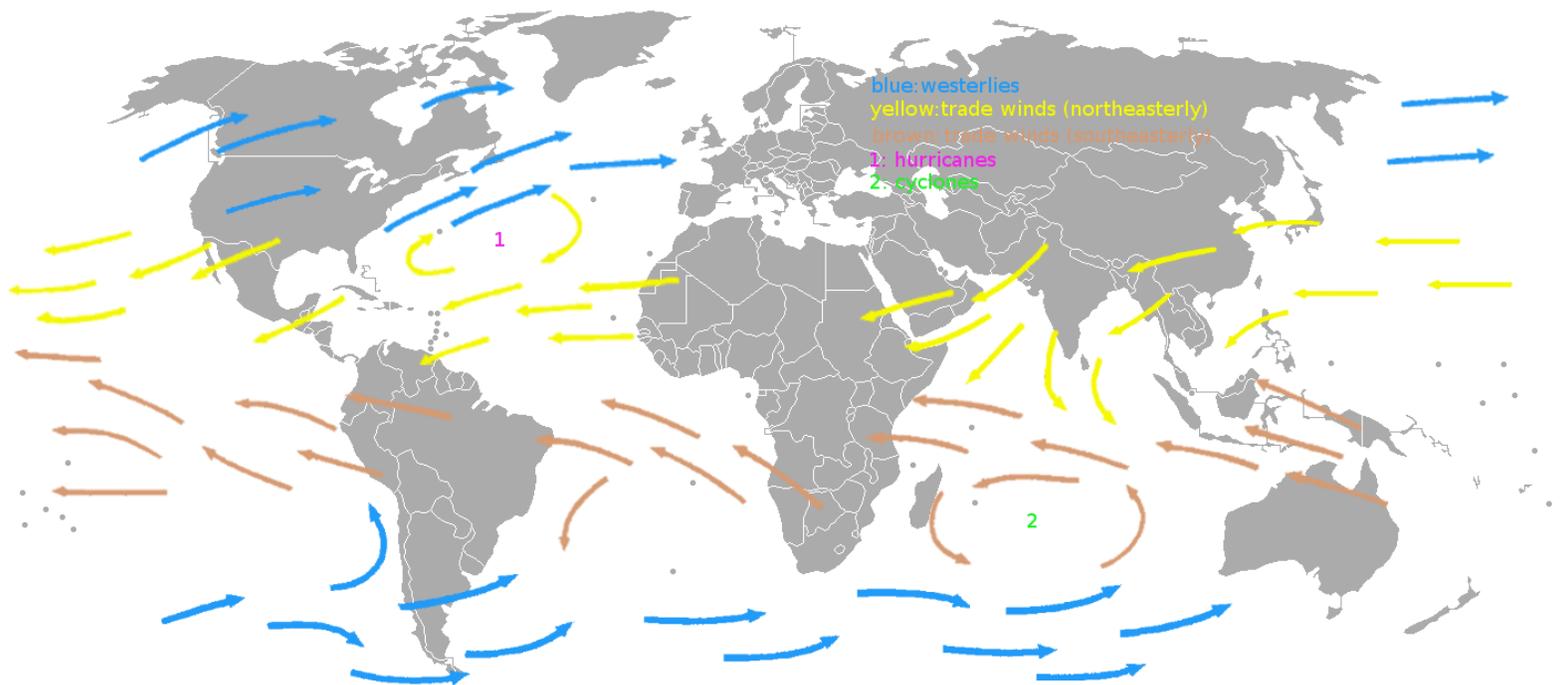
Image by Sean Linehan on Wikimedia Commons

## Anemometer

- Has four cups.
- The cups catch the wind and a pressure difference is produced within the cup.
- The pressure difference and the wind force cause the cups to rotate.
- The speed of rotation is measured by an electrical switch and is proportional to the wind speed.

# Global Winds, Local Winds, and Trade Winds

Global Winds	Local Winds	Trade Winds
<p>Winds that are named for the direction in which they blow. Each hemisphere has three wind belts, for a total of six belts on Earth. The belts move north in the summer in the Northern Hemisphere and south in the winter in the Southern Hemisphere.</p>	<p>winds that are caused by differences in air temperature in a local area.</p>	<p>a wind blowing steadily toward the Equator from the northeast in the northern hemisphere or the southeast in the southern hemisphere, especially at sea.</p>



# Wind Systems

Wind System	Location	Picture
<p><b>Chinook</b></p>	<p>Westerly wind; eastern side of the Rocky Mountains (USA)</p>	 <p><small>Image by Kanadano on Wikimedia Commons</small></p>
<p><b>Santa Ana</b></p>	<p>Easterly wind; blow towards Southern California</p>	 <p><small>Image by NOAA's National Weather Service on Wikimedia Commons</small></p>
<p><b>Sirocco</b></p>	<p>Southerly wind; blows from North Africa to Southern Europe</p>	 <p><small>Image by Piotr Flatau on Wikimedia Commons</small></p>
<p><b>Mistral</b></p>	<p>Northwesterly wind; blows from central France to the Mediterranean</p>	 <p><small>Image by Pflatau on Wikimedia Commons</small></p>

Wind System	Location	Picture
<p><b>Marin</b></p>	<p>Southeasterly wind; blows from the Mediterranean to France</p>	 <p>Image by Eric Gaba on Wikimedia Commons</p>
<p><b>Bora</b></p>	<p>Northeasterly wind; blows from Eastern Europe to Italy</p>	 <p>Image by Joy on Wikimedia Commons</p>
<p><b>Gregale   Etesian</b></p>	<p>Northeasterly wind; blows from Greece</p> <p>Northwesterly wind; blows from Greece</p>	 <p>Image by Lencer on Wikimedia Commons</p>
<p><b>Libeccio</b></p>	<p>Southwesterly wind; blows from Italy</p>	 <p>Image by F i a n k e r on Wikimedia Commons</p>

## Why Do We Have Four Seasons?

- The four seasons are: winter, spring, summer, and autumn (fall).
- The Earth spins on its axis. This spin is what causes night and day.
- The Earth also orbits around the Sun. This orbit, which takes 365  $\frac{1}{4}$  days, is what causes the four seasons.

*The tilt of the Earth's axis is what causes the four seasons!*

- The Earth's axis is tilted to 23.5 degrees.
- Without the tilt of Earth's axis, the Sun would be over the Equator and both hemispheres would experience the same weather year-round.
- When the Earth's axis is pointed towards the Sun, summer occurs. During this time, the Sun's rays are vertical, which produce light and heat more effectively than slanting rays.
- When the Earth's axis is pointed away from the Sun, winter occurs.
- During the winter solstice, the Sun is actually closer to the Earth.

- The seasons are opposite in the Northern and Southern Hemispheres.

### Northern Hemisphere Seasons & Dates

Seasons	Dates
<b>Winter</b>	December 21 <sup>st</sup> – March 20 <sup>th</sup>
<b>Spring</b>	March 20 <sup>th</sup> – June 21 <sup>st</sup>
<b>Summer</b>	June 21 <sup>st</sup> – September 22 <sup>nd</sup>
<b>Autumn (Fall)</b>	September 22 <sup>nd</sup> – December 21 <sup>st</sup>

### Southern Hemisphere Seasons & Dates

Seasons	Dates
<b>Winter</b>	June 21 <sup>st</sup> – September 20 <sup>th</sup>
<b>Spring</b>	September 21 <sup>st</sup> – December 20 <sup>th</sup>
<b>Summer</b>	December 21 <sup>st</sup> – March 20 <sup>th</sup>
<b>Autumn (Fall)</b>	March 21 <sup>st</sup> – June 20 <sup>th</sup>



# The Equator and Seasons

- The Equator is an imaginary line that goes around the center of the Earth.
- The Equator is half way between the North and South Poles.
- The Sun is very high in the sky at the Equator, which is why it is always very hot and humid.
- Places located at the Equator do not experience seasons.
- This is because the Equator is at the center of the Earth.
- The center of the Earth does not tilt very much. Since the four seasons are the result of the tilt of the Earth's axis, the Equator does not experience seasons like the rest of the world does.



Image by nadisna on Pixabay

## Think About It!

**Would you like to live near the Equator? Why or why not?**

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# Seasonal Weather

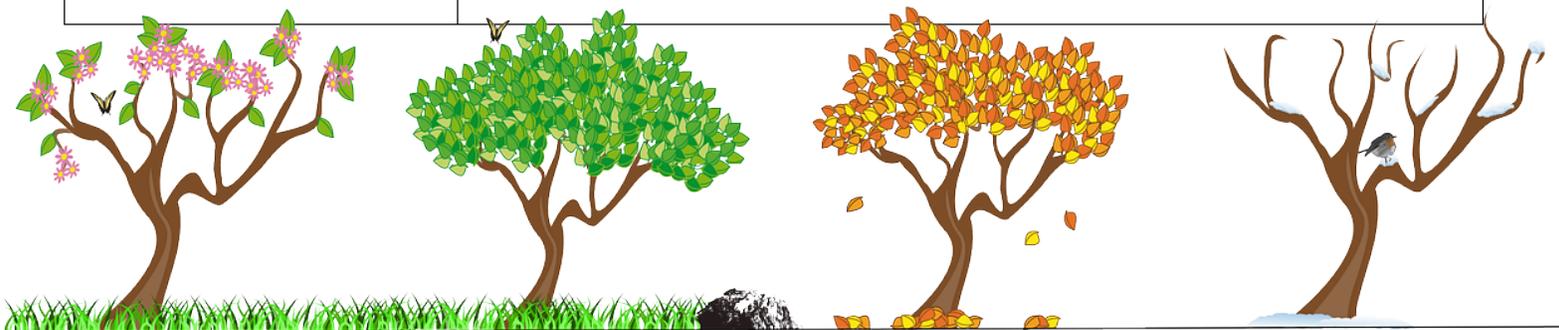
Season	Weather
<b>Winter</b>	<ul style="list-style-type: none"> <li>❄ Coldest season.</li> <li>❄ Occurs when the Earth is tilted away from the Sun.</li> <li>❄ Typical weather includes: snow, ice, freezing rain, very cold temperatures, and wind.</li> </ul>
<b>Spring</b>	<ul style="list-style-type: none"> <li>♣ Season after winter,</li> <li>♣ Temperatures begin to warm and snow/ice begin to melt.</li> <li>♣ Typical weather includes: warmer temperatures, rain, and sunshine.</li> </ul>
<b>Summer</b>	<ul style="list-style-type: none"> <li>☀ Hottest season.</li> <li>☀ Occurs when the Earth is tilted towards the Sun.</li> <li>☀ Marked by long days and short nights.</li> <li>☀ Typical weather includes: hot temperatures, sunshine, and thunderstorms.</li> </ul>
<b>Autumn (Fall)</b>	<ul style="list-style-type: none"> <li>🍏 Season after summer.</li> <li>🍏 Temperatures begin to cool down.</li> <li>🍏 Change in foliage—leaves begin to change colors. Harvest begins to occur.</li> <li>🍏 Typical weather includes: cooler temperatures, and cloudy skies. Occasionally an Indian Summer—summerlike temperatures—can occur.</li> </ul>



# Seasonal Weather

**Directions:** Describe the weather for each season based on your location!

Season	Weather
Winter	
Spring	
Summer	
Autumn (Fall)	



# Weather vs. Climate

Weather	Climate
<ul style="list-style-type: none"> <li>▪ Describes the state of the atmosphere at a given time.</li> <li>▪ Weather is measured over a short period.</li> <li>▪ The weather in an area changes all the time.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Describes the weather of a specific area over a long period of time (30 years).</li> <li>▪ When talking about climate, scientists look at wind patterns, temperatures, the temperature of the surface of the ocean, and precipitation.</li> <li>▪ The climate in an area does not change.</li> </ul>

▪ The Earth's climate system includes:

- Atmosphere
- Oceans
- Land
- Ice
- Biosphere

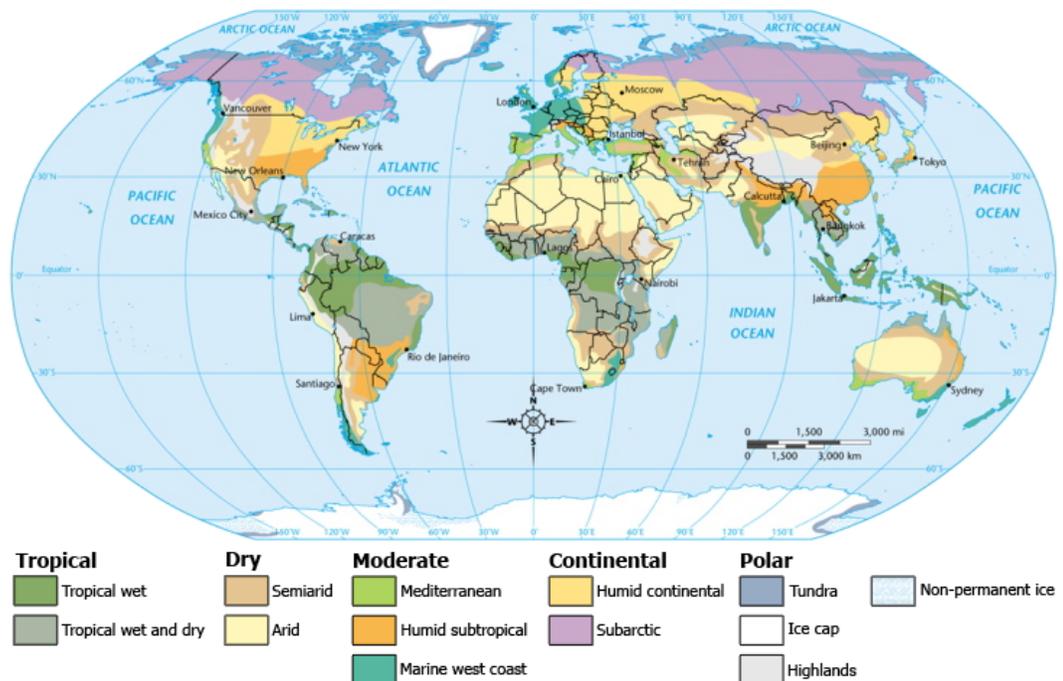


Image by Waitak on Wikimedia Commons

# Causes for Climate

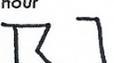
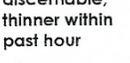
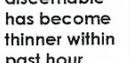
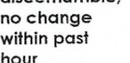
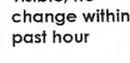
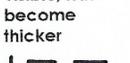
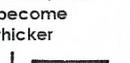
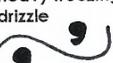
Cause	Description
<b>Latitude</b>	describes the area's closeness to the Equator. Places that are close to the Equator are warmer.
<b>Elevation</b>	describes how high above sea level an area is. Places that have a higher elevation are generally cooler.
<b>Ocean/Wind Currents</b>	describes the rising of hot air/ water and the sinking of cool air/ water. These create currents that move heat around the Earth.
<b>How Close the Location is to Water</b>	places that are close to the water can see an increase in precipitation.
<b>Terrain</b>	mountains can play a role in how much rain or sun an area receives. The north side and south side of a mountain usually have different climate.

# Types of Climate

Climate	Location	Seasons	Temperatures	Precipitation
<b>Tropical Wet</b>	Philippines; Indonesia; Democratic Republic of the Congo; Brazil	1	Average = 80°F Daytime temperatures do not go above 93°F and nighttime temperatures do not drop below 68°F	100-300 inches per year
<b>Tropical Wet/Dry</b>	Africa; Brazil; India	2 Wet summer and dry winter	Wet season = 77°F Dry season = 68°F	Wet season = 25 inches Dry season = less than 4 inches
<b>Mediterranean</b>	Western side of the continents	2	Summer = above 50°F Winter = 30°F – 65°F	20 inches per year
<b>Humid Subtropical</b>	Eastern side of the continents	2	Summer = 70°F – 80°F Winter = 45°F – 50°F	48 inches per year
<b>Marine West Coast</b>	West coast of regions that are mid-latitude	2	Summer = ~72°F Winter = never below 30°F	Between 30 and 98 inches per year
<b>Humid Continental</b>	Interior parts of the continents	4	Summer = ~71°F Winter = ~25°F	Between 20 and 50 inches per year
<b>Subarctic</b>	Interior (non-coastal) areas of high latitude continents; only found in the Northern Hemisphere	2	Summer - ~85°F Winter = ~ - 25°F	Between 10 and 20 inches per year
<b>Tundra</b>	Coast of the Arctic Ocean	2	Summer = 35°F – 50°F Winter = -18°F - -50°F	5-15 inches per year
<b>Ice Cap</b>	Only near the poles	2	Summer = ~ -16°F Winter = ~ -90°F	Less than 10 inches per year
<b>Arid</b>	Desert regions	2	Between -30°F and 130°F	Less than 10 inches per year
<b>Semiarid</b>	Outer edge of arid regions	2	Depends on region's latitude	Depends on ocean currents
<b>Highland</b>	High mountain areas	0	Depends on elevation	Depends on elevation

# Weather Map Symbols

The numbers in each box represent the weather codes use in weather reports.

00 Cloud development during past hour 	01 Clouds dissolving during past hour 	02 Sky unchanged during past hour 	03 Clouds forming during past hour 	04 Visibility reduced by smoke 	05 Haze 	06 Dust suspended by air 	07 Dust or sand raised by wind 	08 Dust devils within the past hour 	09 Dust storm/ Sandstorm in sight 
10 Mist 	11 Patches of fog 	12 Continuous shallow fog 	13 Visible lightning, no thunder 	14 Precipitation visible, but not reaching ground 	15 Precipitation reaching the ground at a distance 	16 Precipitation reaching the ground at nearby 	17 Thunder, no precipitation 	18 Wind squall within past hour 	19 Tornado/ funnel cloud observed within past hour 
20 Recent drizzle 	21 Recent rain 	22 Freezing snow 	23 Recent rain/snow 	24 Freezing rain 	25 Rain showers 	26 Snow showers 	27 Hail or hail and rain 	28 Fog within past hour 	29 Thunderstorm within past hour 
30 Slight/moderate dust storm decreased 	31 Slight/moderate dust storm, no change 	32 Slight/moderate dust storm increased 	33 Severe dust storm decreased 	34 Severe dust storm increased 	35 Severe dust storm no change 	36 Drifting snow, slight or moderate 	37 Drifting snow, heavy 	38 Blowing snow, slight/moderate 	39 Blowing snow, heavy 
40 Distant fog 	41 Patchy fog 	42 Fog, sky discernable, thinner within past hour 	43 Fog, sky not discernable, has become thinner within past hour 	44 Fog, sky discernable, no change within past hour 	45 Fog, sky not visible, no change within past hour 	46 Fog, sky visible, has become thicker 	47 Fog, sky not visible, has become thicker 	48 Freezing fog, sky visible 	49 Freezing fog, sky not visible 
50 Light intermittent drizzle 	51 Light continuous drizzle 	52 Moderate intermittent drizzle 	53 Moderate continuous drizzle 	54 Heavy intermittent drizzle 	55 Heavy continuous drizzle 	56 Light freezing drizzle 	57 Moderate/heavy freezing drizzle 	58 Light drizzle/rain 	59 Moderate drizzle/rain 
60 Light intermittent rain 	61 Light continuous rain 	62 Moderate intermittent rain 	63 Moderate continuous rain 	64 Heavy intermittent rain 	65 Heavy continuous rain 	66 Light freezing rain 	67 Moderate/heavy freezing rain 	68 Light rain/snow 	69 Moderate/heavy rain/snow 
70 Light intermittent snow 	71 Light continuous snow 	72 Moderate intermittent snow 	73 Moderate continuous snow 	74 Heavy intermittent snow 	75 Heavy continuous snow 	76 Ice needles, with/ without fog 	77 Snow grains, with/ without fog 	78 Snow crystals, with/ without fog 	79 Ice pellets (sleet) 
80 Light rain showers 	81 Moderate/heavy rain showers 	82 Torrential rain showers 	83 Light rain/snow showers 	84 Moderate/heavy rain/snow showers 	85 Light snow showers 	86 Moderate/heavy snow showers 	87 Light ice pellet showers 	88 Moderate/heavy ice pellet showers 	89 Light hail. Not associated with thunder 
90 Moderate/heavy hail. Not associated with thunder 	91 Light rain, thunder within past hour 	92 Moderate rain, thunder within past hour 	93 Light snow, rain/snow, hail., thunder 	94 Moderate snow, rain/snow, hail, thunder 	95 Light thunderstorm, rain/ snow, no hail 	96 Light thunderstorm, hail 	97 Severe thunderstorm, rain/ snow, no hail 	98 Thunderstorm with dust storm 	99 Severe thunderstorm, hail 

# El Niño and La Niña

El Niño	La Niña
<ul style="list-style-type: none"><li>⚙ Spanish for “little boy”, “Christ child.”</li><li>⚙ Term originates from the 1600s, when South American fisherman noticed how warm the waters of the Pacific were during December.</li><li>⚙ Effects the winter season weather of North America.</li><li>⚙ Effects include:<ul style="list-style-type: none"><li>– Warmer than average temperatures in wester/central Canada and western/northern United States</li><li>– Wetter than average conditions in the U.S. Gulf Coast and Florida.</li><li>– Drier than average conditions in the Ohio Valley and Pacific Northwest.</li></ul></li><li>⚙ El Niño also effects the ocean currents.</li></ul>	<ul style="list-style-type: none"><li>⚙ Spanish for “little girl”.</li><li>⚙ Produces colder or below-average sea temperatures in the east-central Equatorial Pacific.</li><li>⚙ The effects of La Niña are the opposite of El Niño.</li><li>⚙ During La Niña, winter temperatures in the Southeast are warmer, while temperatures in the Northwest are cooler.</li></ul> <div data-bbox="906 1142 1377 1688" data-label="Image">A stylized illustration of a tropical landscape. It features two green palm trees with brown trunks on a brown mound of earth. To the right of the trees is a bright yellow sun. The background is a light blue sky, all contained within a light blue arch shape.</div> <p data-bbox="1024 1698 1247 1713"><small>Image by OpenClipart-Vectors on Pixabay</small></p>

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