

Humidity



Essential Standard 2.5

Understand the structure of and processes within our atmosphere.

Learning Objective 2.5.4

Predict the weather using available weather maps and data including surface and upper atmospheric winds, and satellite imagery.

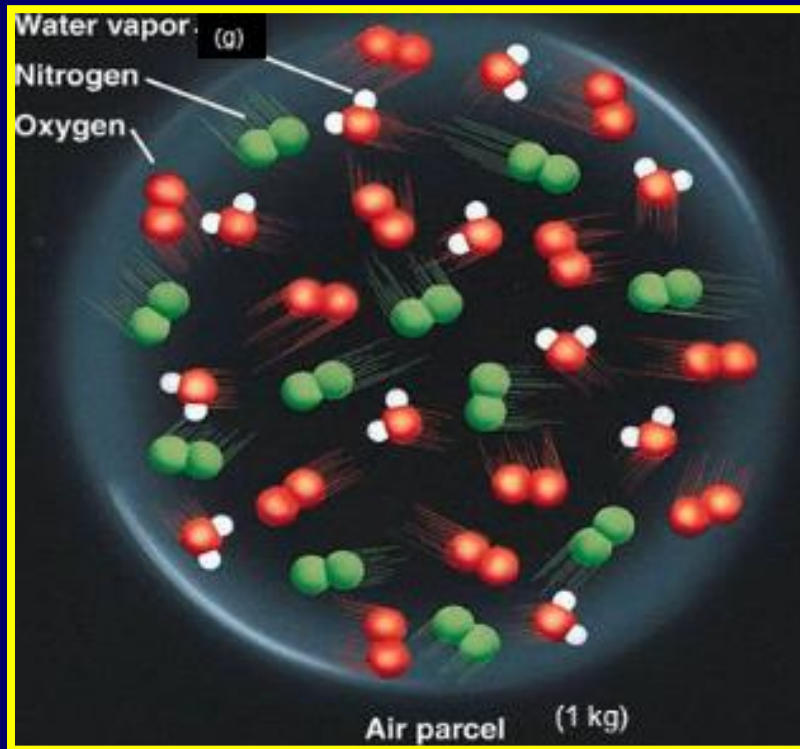
I Can Statements

At the end of this lesson, you should be able to say, with confidence:

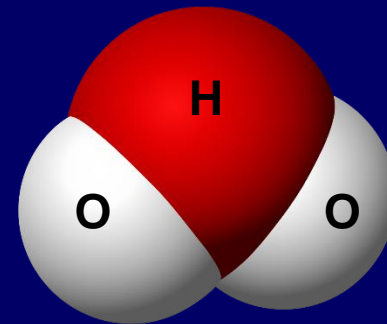
- I can explain what humidity is and the conditions that allow for condensation to occur.
- I can explain how lightning, thunder, and thunderstorms are formed.
- I can explain how tornadoes are formed and describe favorable conditions for tornado formation.
- I can explain how hurricanes are formed and their associated dangers.

Humidity

Humidity refers to the amount of water vapor present in the air.

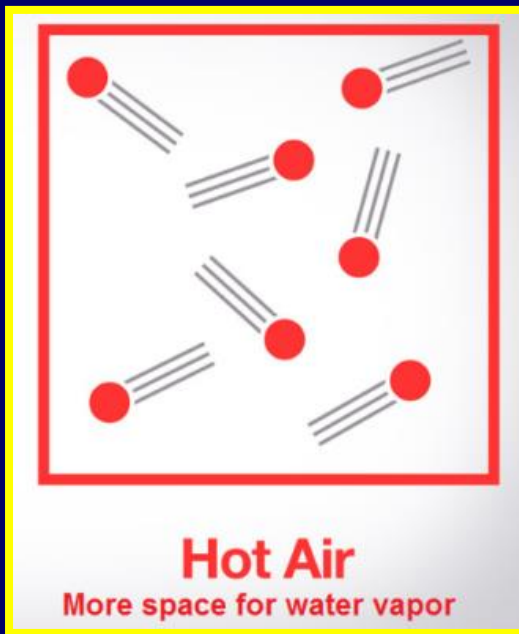
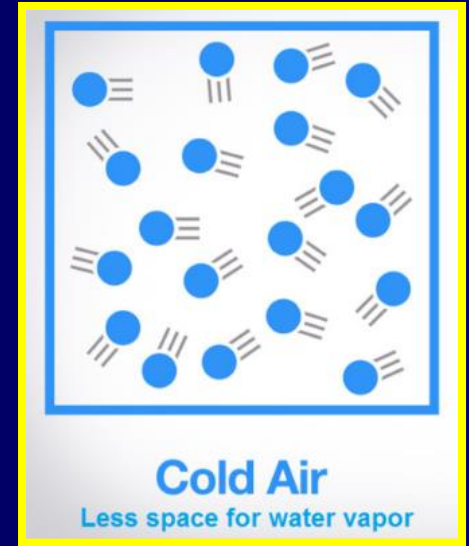


Water vapor consists of water molecules, H₂O, in the gas state.



Temperature and Humidity

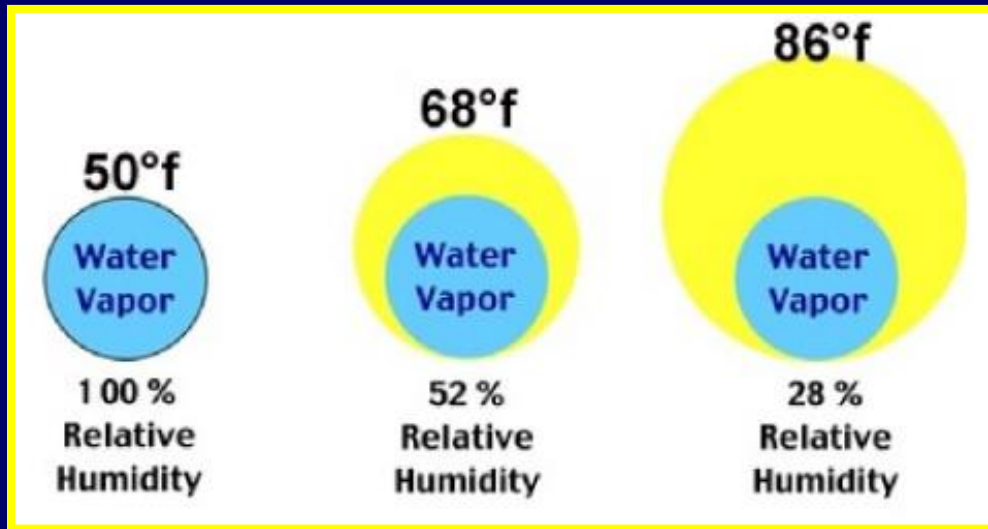
Because cold air molecules are more condensed, there is less space for water vapor. Therefore, cold air cannot hold that much water vapor and is often very dry.



In hot air, the air molecules expand and spread out creating a lot more space for water vapor. Therefore, hot air can hold a lot of water vapor and is often very humid.

Relative Humidity

Relative humidity refers to how much water vapor is actually present in the air compared to how much the air is capable of holding.

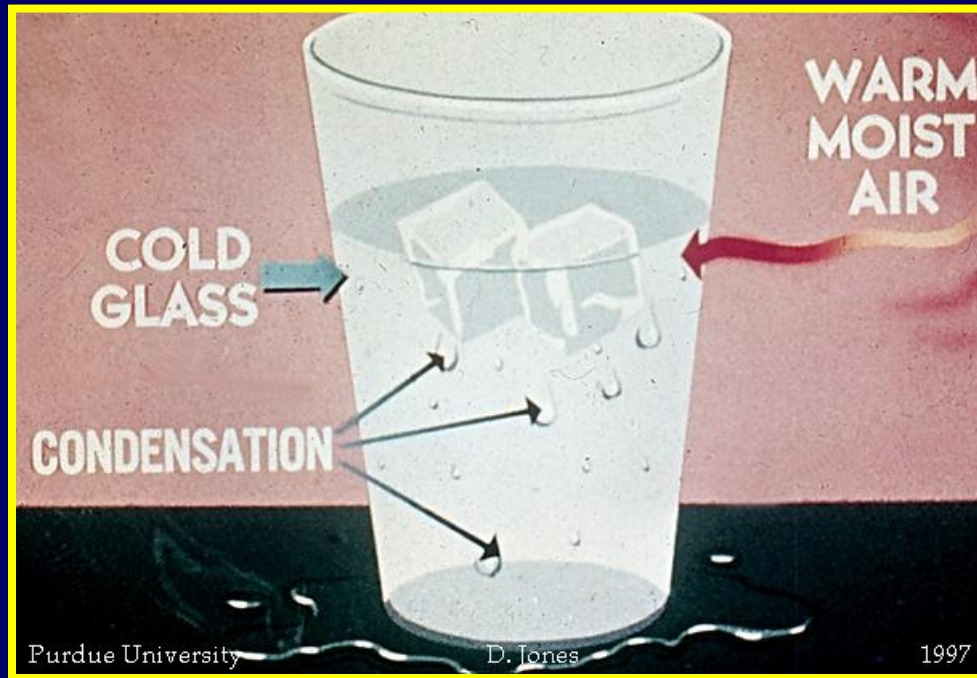


When the air holds as much water vapor as possible, relative humidity reaches 100%.

Because cold air holds less water vapor, relative humidity reaches 100% in cold air much faster than it does in warm air.

Condensation

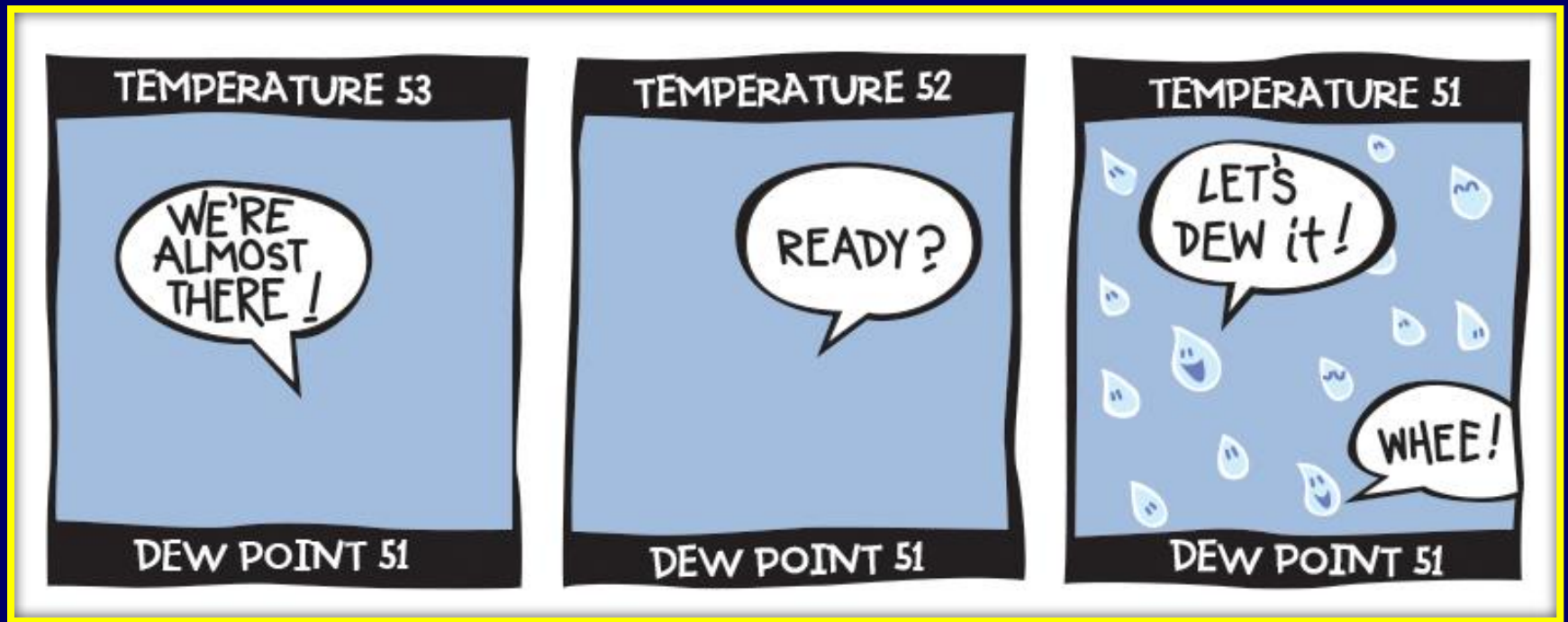
Condensation occurs when air cools down and water vapor turns into water droplets.



Condensation will only occur when the relative humidity reaches 100%.

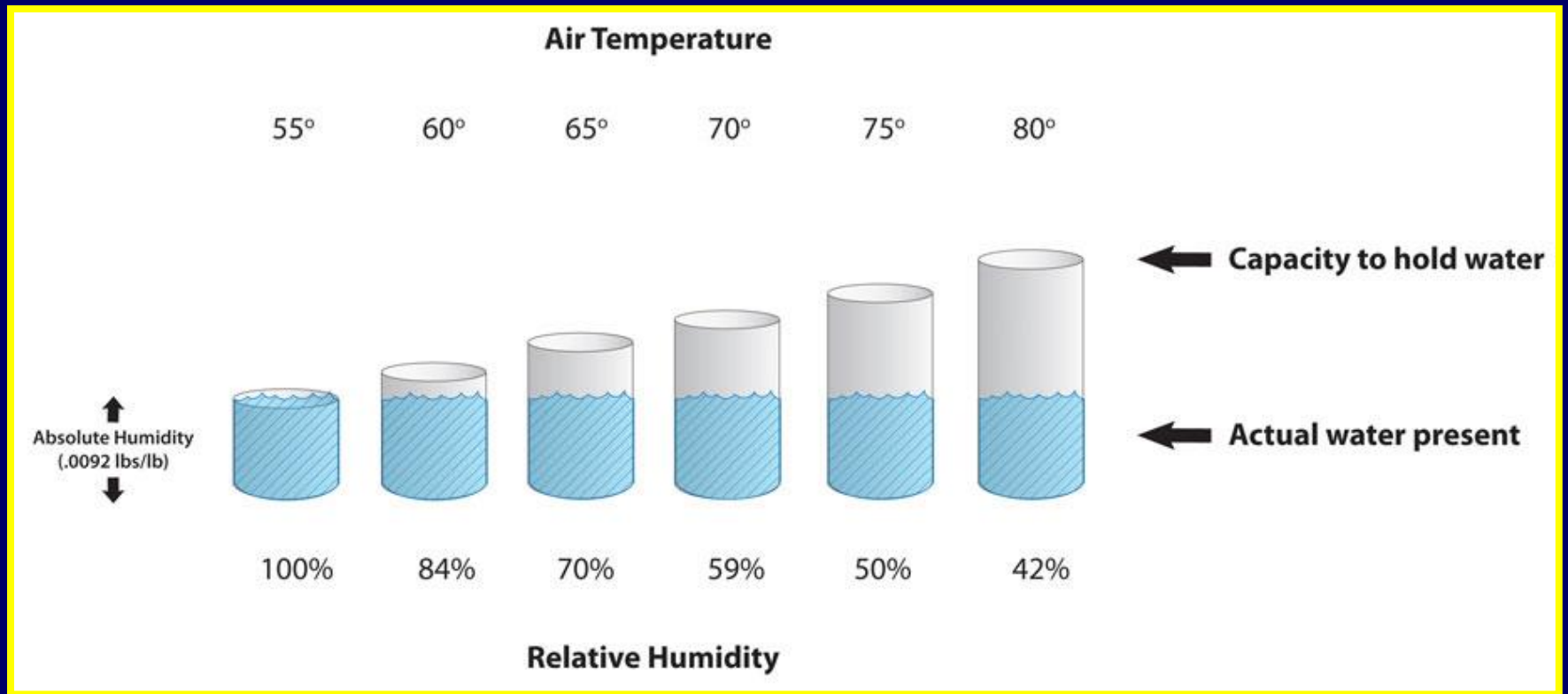
Dew Point

The Dew Point is the temperature to which air must be cooled in order to reach 100% humidity so that condensation can occur.



Dew Point and Temperature

Because the relative humidity can vary with temperature, the dew point can also vary with temperature.



Dew Point

If the dew point is above freezing, condensation will occur as water or dew.



If the dew point is below freezing, condensation will occur as frost.

Humidity and You

On hot days, you sweat.

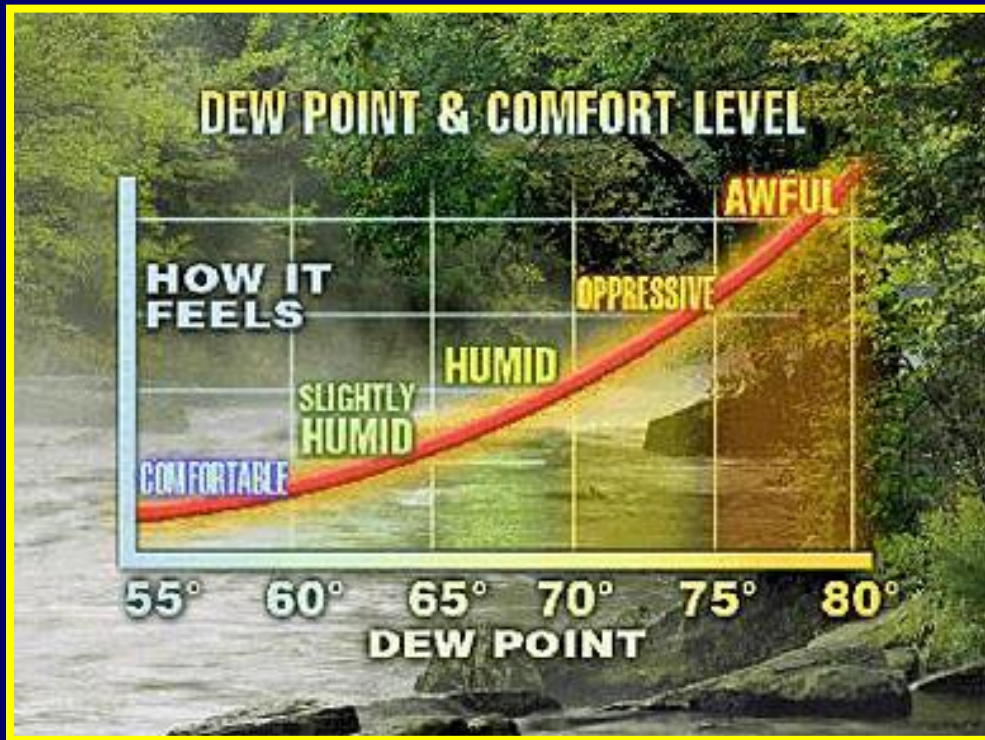


Body heat is used to evaporate the water from your skin.

The loss of body heat lowers your body temperature, making you feel much cooler.

Humidity and You

Air in which the dew point is very high contains a high amount of water and feels very humid.

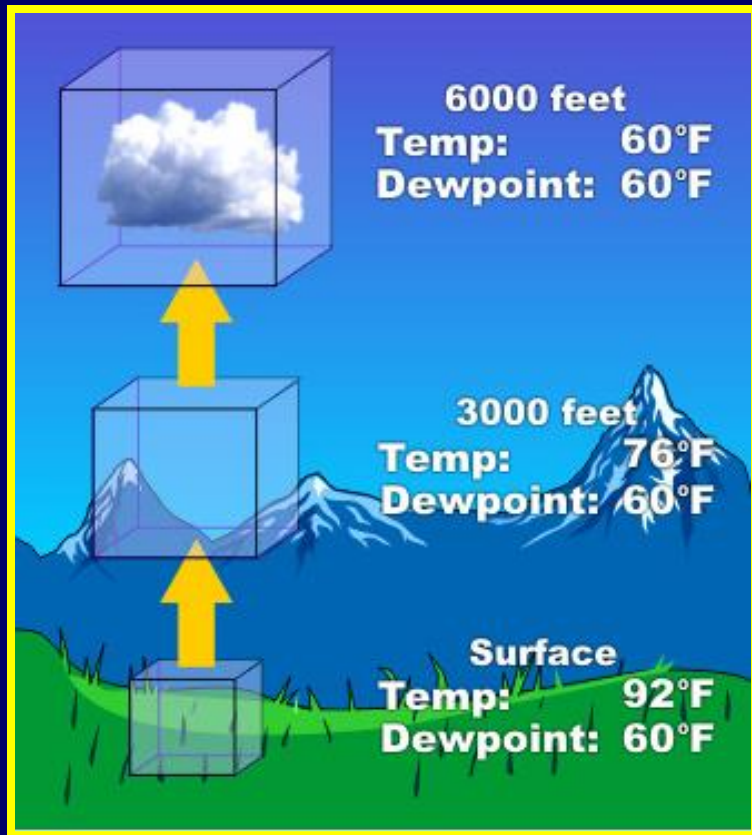


On days like this, the air can't hold any more water.

Sweat does not evaporate and you do not feel cooler, just sticky, hot, and miserable.

Cloud Formation

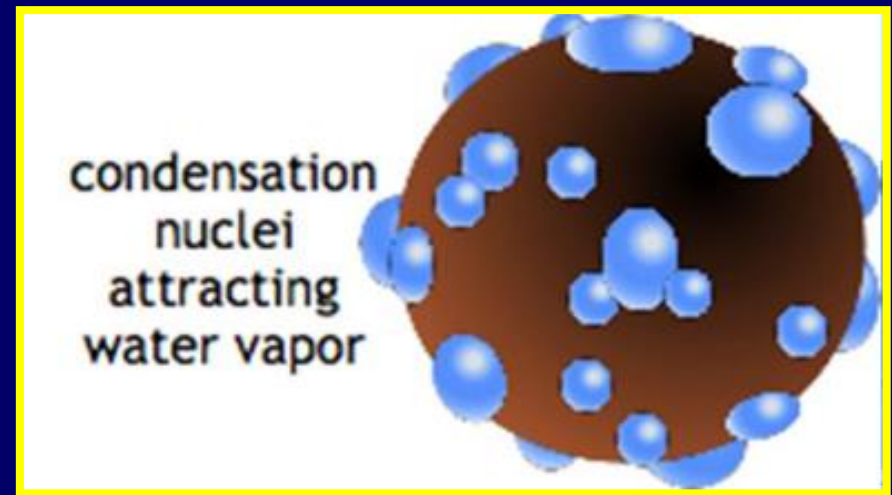
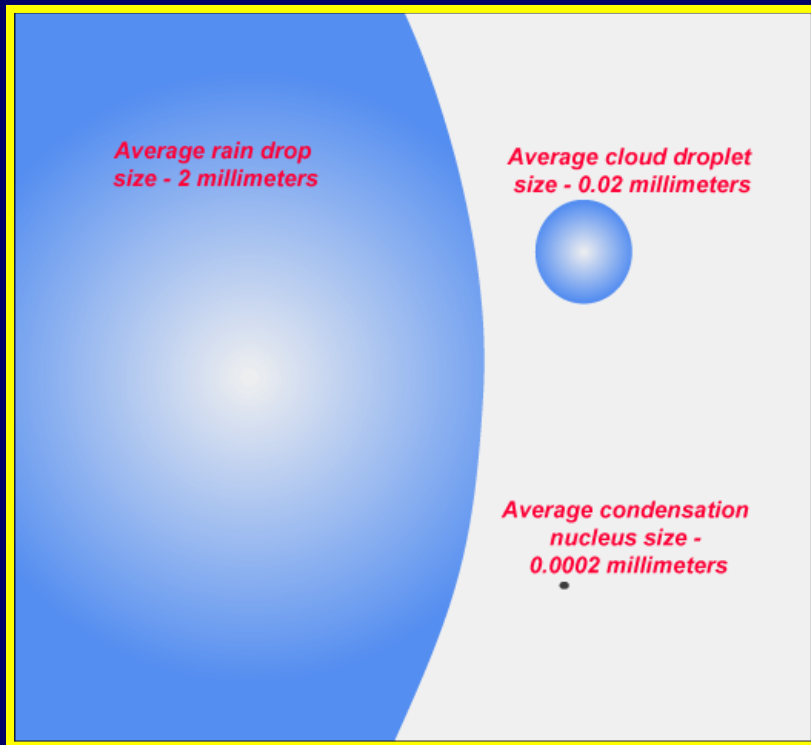
Clouds form when warm, moist air rises and cools to its dew point causing water vapor to condense into tiny water droplets.



Clouds form best on warm, sunny days and often result in afternoon showers.

Condensation Nuclei

Condensation is increased by the presence of condensation nuclei or particles of dust, sea salt, or smoke, that water particles can cling to while attracting more water molecules.



Tiny particles of dust or salt are called particulate solids.

Types of Clouds

Clouds are classified according to the altitude in which they form and their shape.



Height	Shape
Cirro – High	Cirrus – Wispy
Alto – Middle	Cumulus – Puffy
Strato - Low	Stratus - Layered
Nimbus – Gray , Rain Clouds	

Low Clouds - Strato

Cumulus

Hot Days

Stratocumulus

As Hot Day Cools

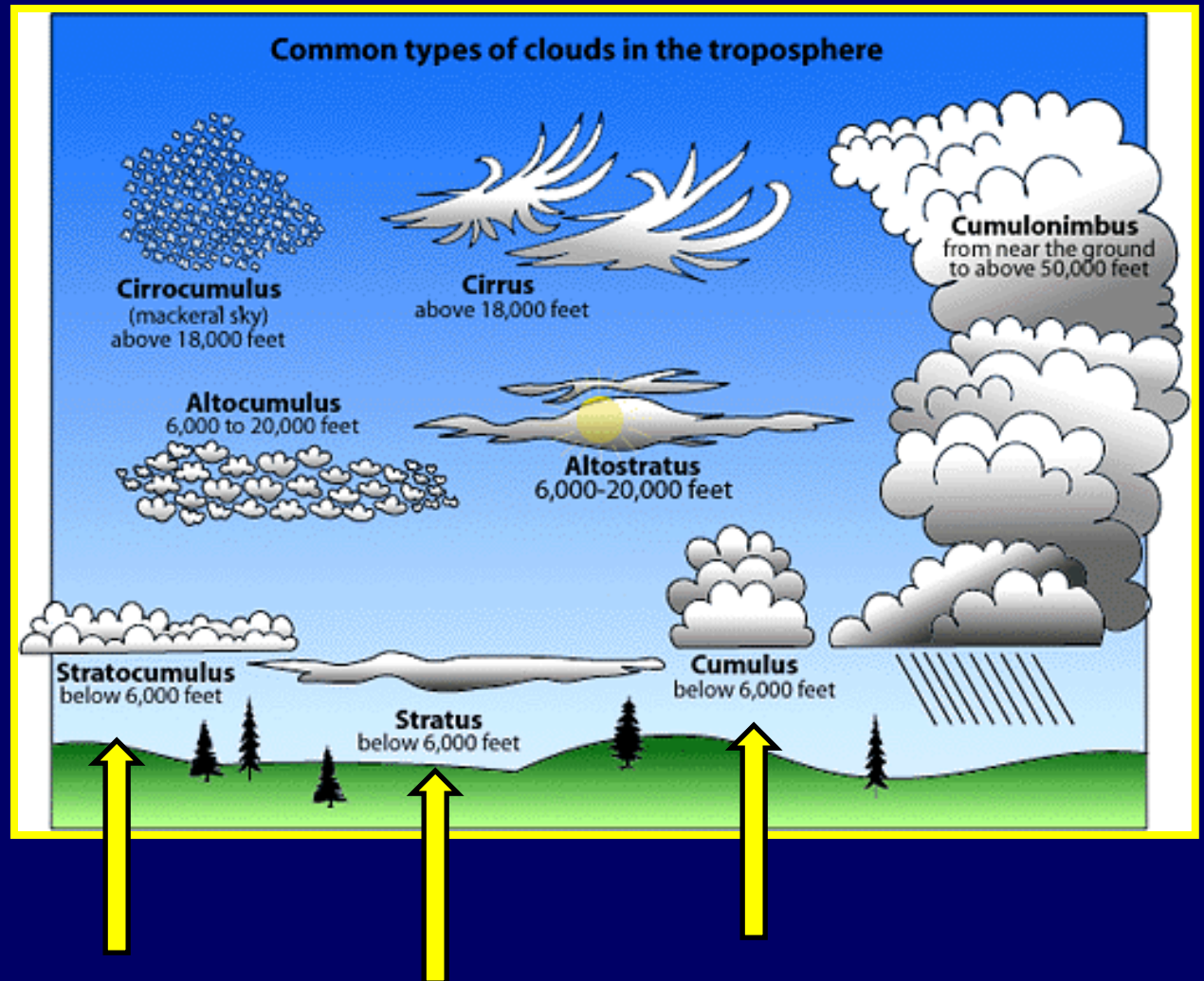
Stratus

Lifted Fog

Nimbostratus

Gray Rain

Clouds





Cumulus Clouds

Hot, Summer Days – Fair Weather



Stratocumulus Clouds

Cumulus clouds spread out as air cools



Stratus Clouds

Lifted Fog – Light Mist or Drizzle

Common in the mountains

Middle Clouds - Alto

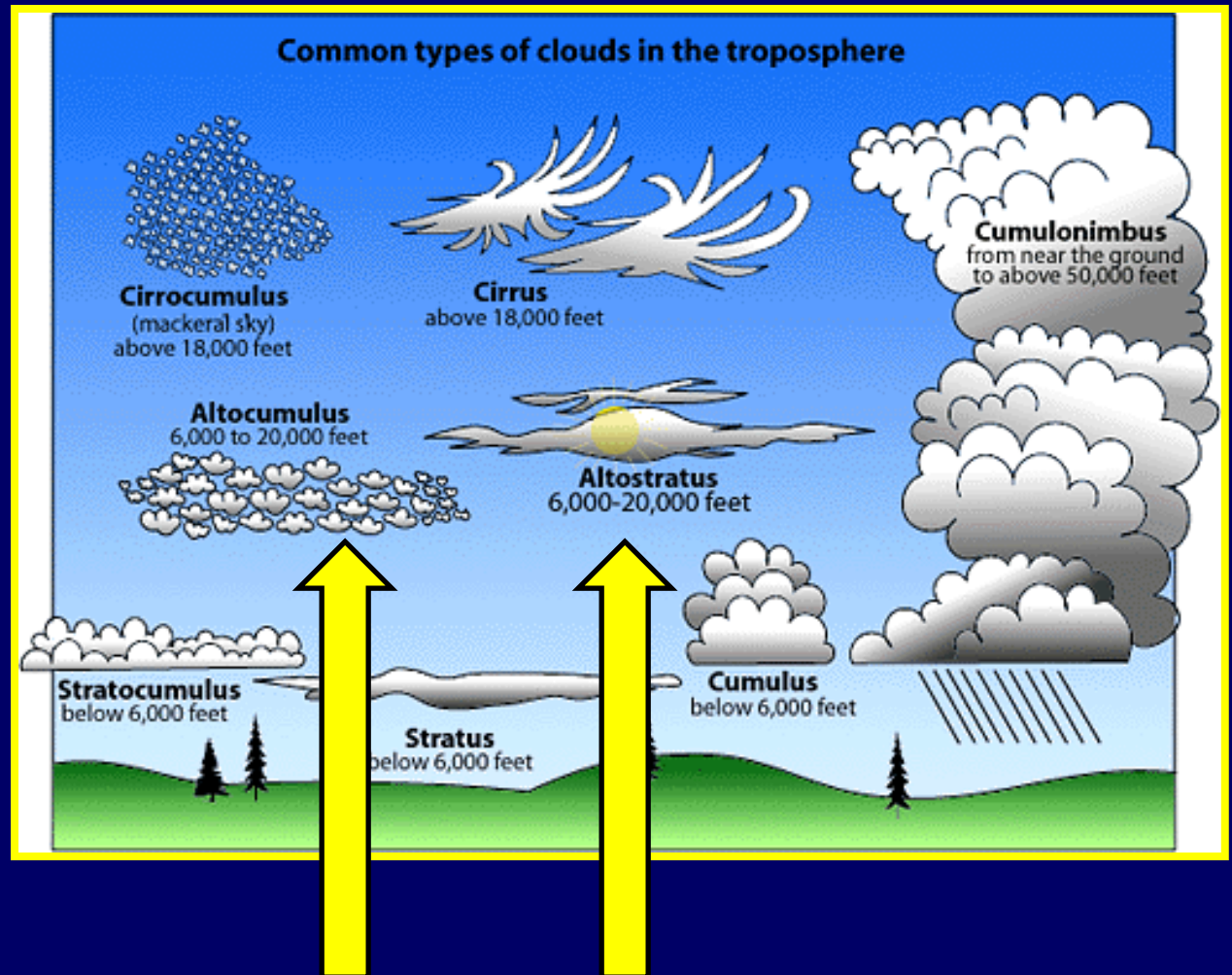
Contain Liquid and Ice Droplets

Altostratus

Hot Days

Altostratus

Hazy Days





Altocumulus Clouds

Grey-white with one part being darker than other – fair weather



Altostratus Clouds

Dark, thin veil of clouds that usually form before continuous rain or snow.



Nimbostratus Clouds

Rain or Snow

High Clouds - Cirro

Contain Ice Crystals

Cirrocumulus

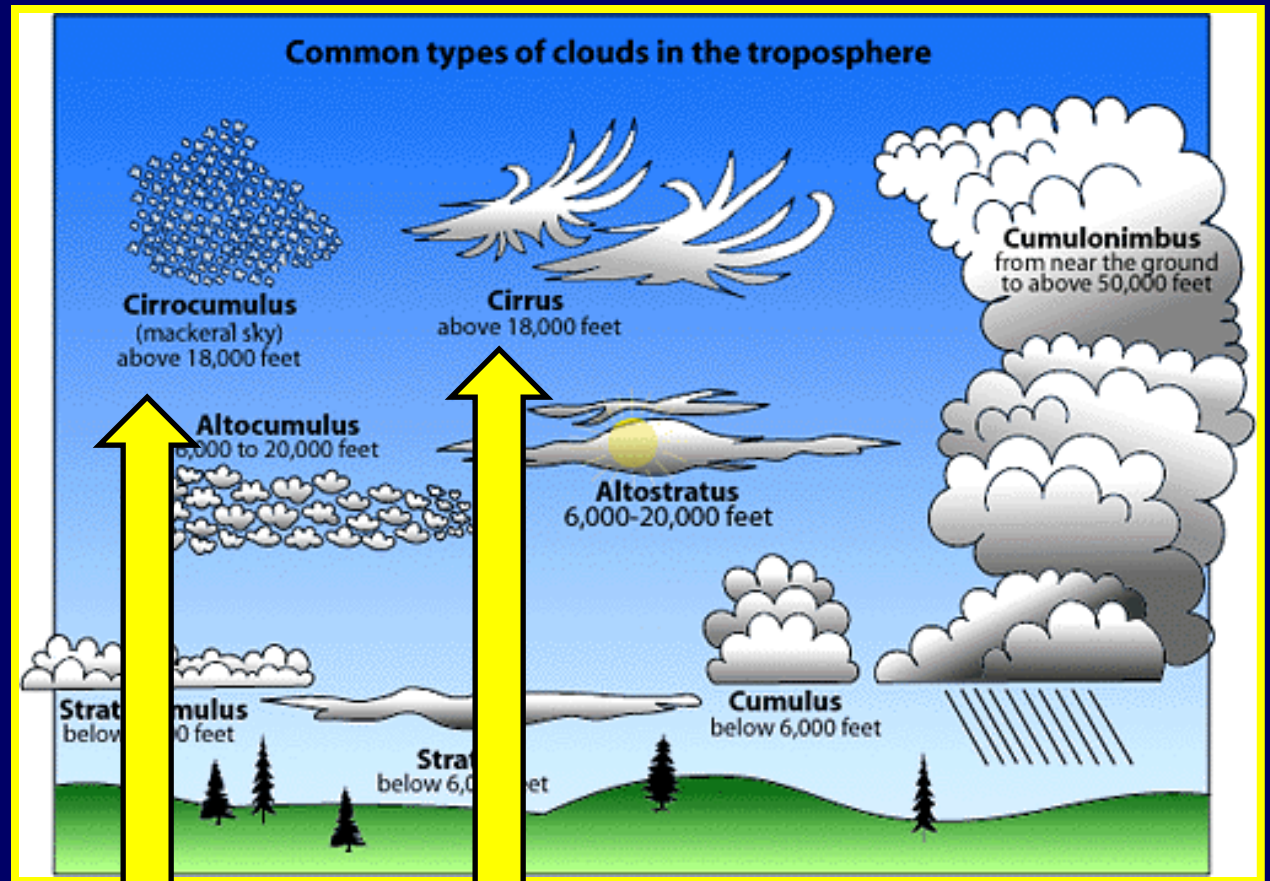
Fair but Cold

Cirrostratus

Hazy Days

Cirrus

Fair Weather





Cirrocumulus Clouds

Lines of small rounded puffs
Mackerel Sky
Winter – Fair but cold



Cirrus Clouds

Composed of ice and have long, wispy
streamers
A change in weather is on its way

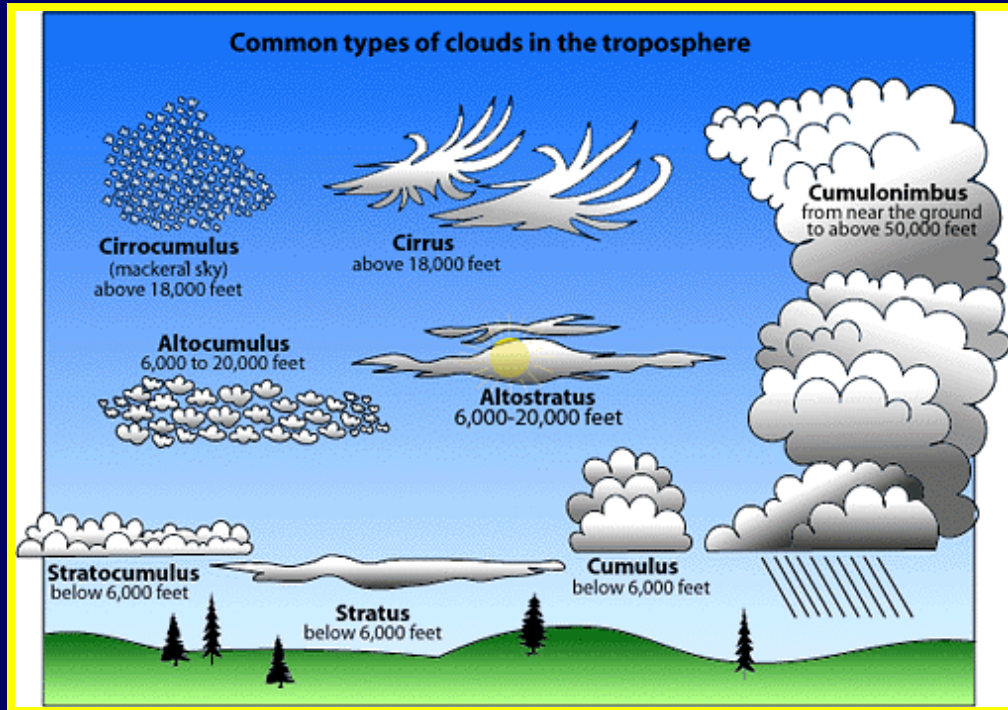


Cirrostratus Clouds

Sheet-like thin clouds that cover entire sky
Day or two before rain or snow storm

Cumulonimbus

Really tall clouds



These clouds grow on hot days when moist air continues to rise. Look out for rain, hail, and tornadoes.

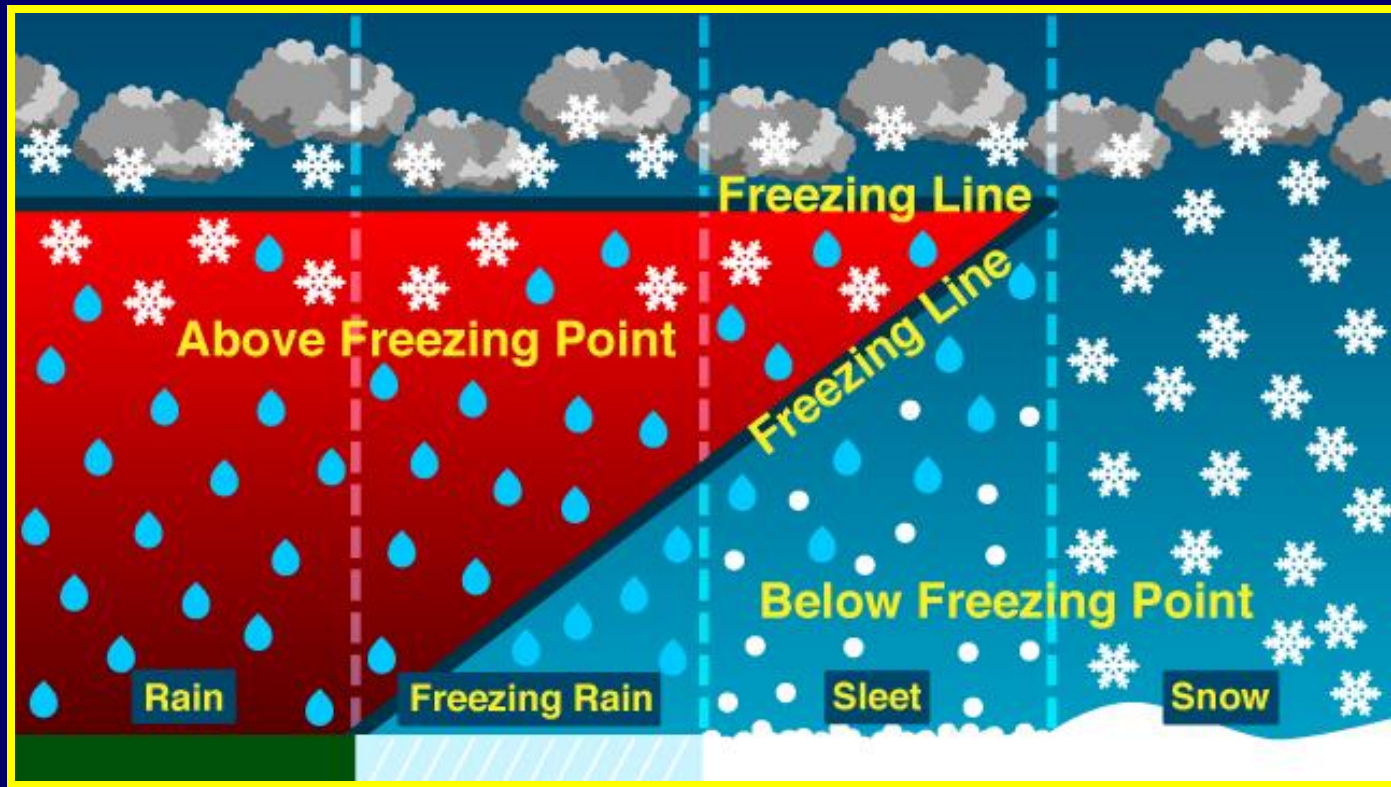
Contrails



Made by high-flying jet airplanes when the water vapor in the exhaust condenses into clouds.

Precipitation

When cloud droplets are too heavy to stay aloft, gravity pulls them downward and they fall to Earth as precipitation in the form of rain, sleet, or snow.



Precipitation

Rain will fall when the temperatures are above freezing.



Freezing Rain will fall like rain but will freeze when as soon as it lands.

Precipitation

Sleet forms when a layer warm of air forms between two layers of cold air.



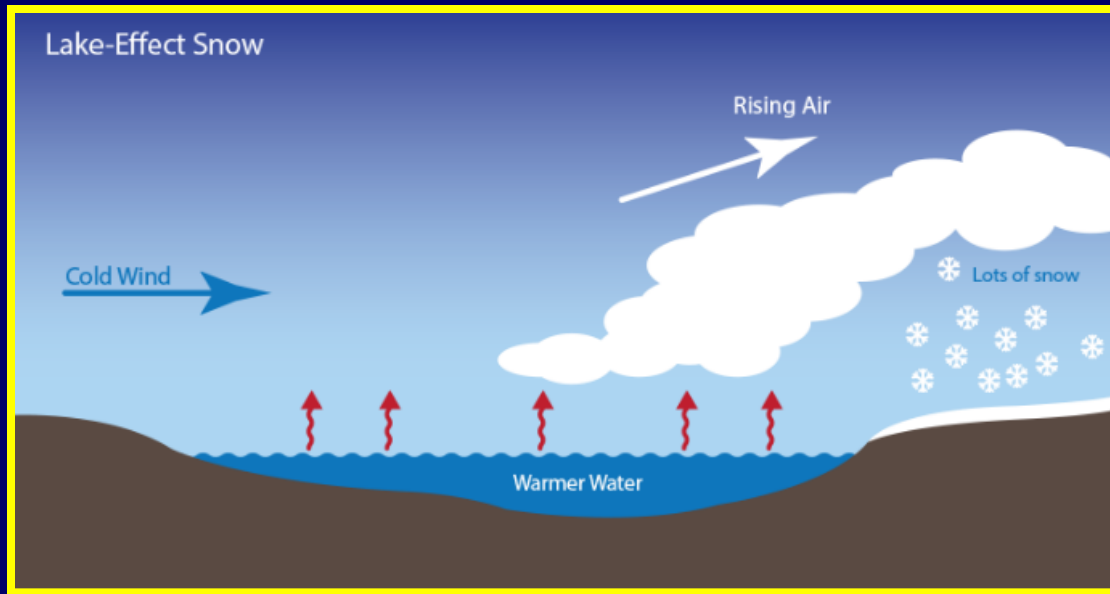
The sleet begins to fall as ice, melts, then turns back into wet ice.



Snow falls when all the air between the clouds and Earth's surface is below freezing.

Lake Effect Snow

When cold air moves over a lake in which the water is warmer than the air, the air will become warmer and water will evaporate into the air, increasing the moisture in the air.



When the moist, air moves back over cold land, the air will rise, causing the water to condense and fall to ground as snow.

Lake Effect Snow

This is a common phenomenon around the Great Lakes, especially in Buffalo New York that sits on the shores of Lake Erie. Buffalo has been known to get snow as deep as 27 feet.



After the lake freezes, water can't evaporate into the air and lake effect snow decreases.

Not Lake Effect Snow

Due to a warmer than normal winter, Lake Erie didn't freeze.



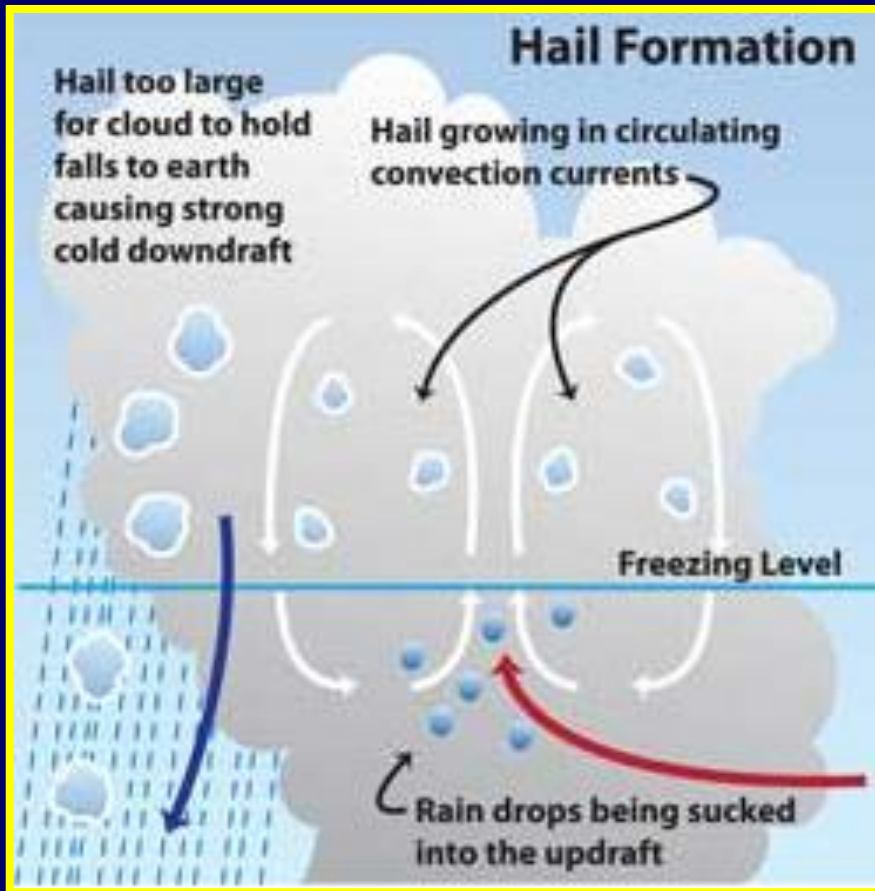
A winter storm with 50 mph gusts of wind sprayed lake water over the homes.

The water froze to create ice up to 3 feet thick.



Hail

Hail is formed when there are strong convection currents in a cloud.



Water will freeze in the upper part of the cloud, melt on the way down, and then refreeze and grow larger as it rises again.

Hail will fall to the ground when they become too heavy to stay aloft.

Hail

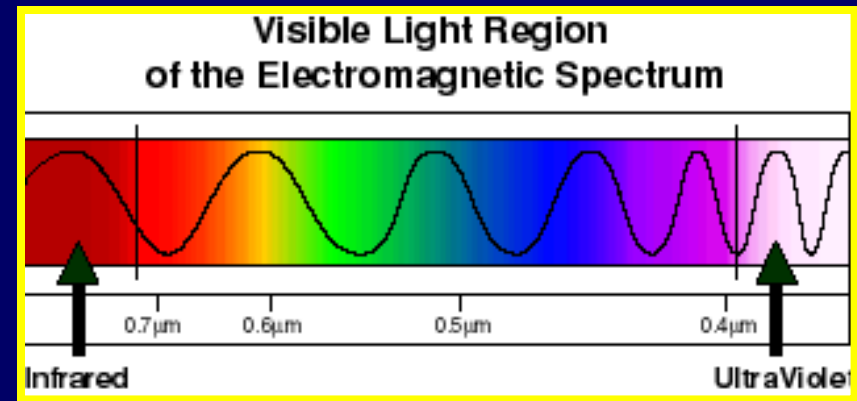
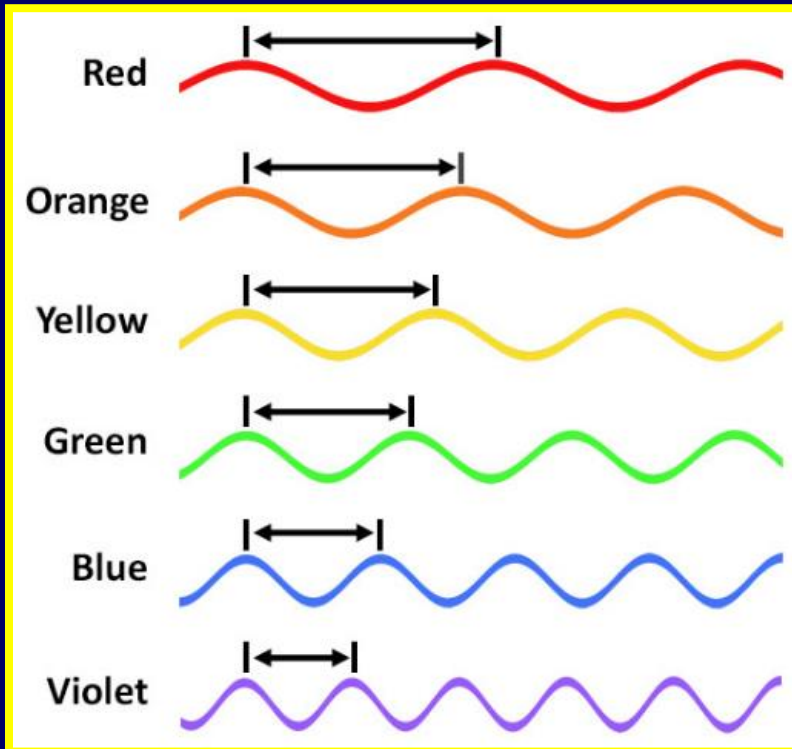
Hail is common with supercell thunderstorms and tornadoes, which usually occur during warmer months.



Largest piece of hail ever recorded fell in South Dakota on July 23, 2020.

Rainbows

White light is made up of a combination of electromagnetic waves of various wavelengths.

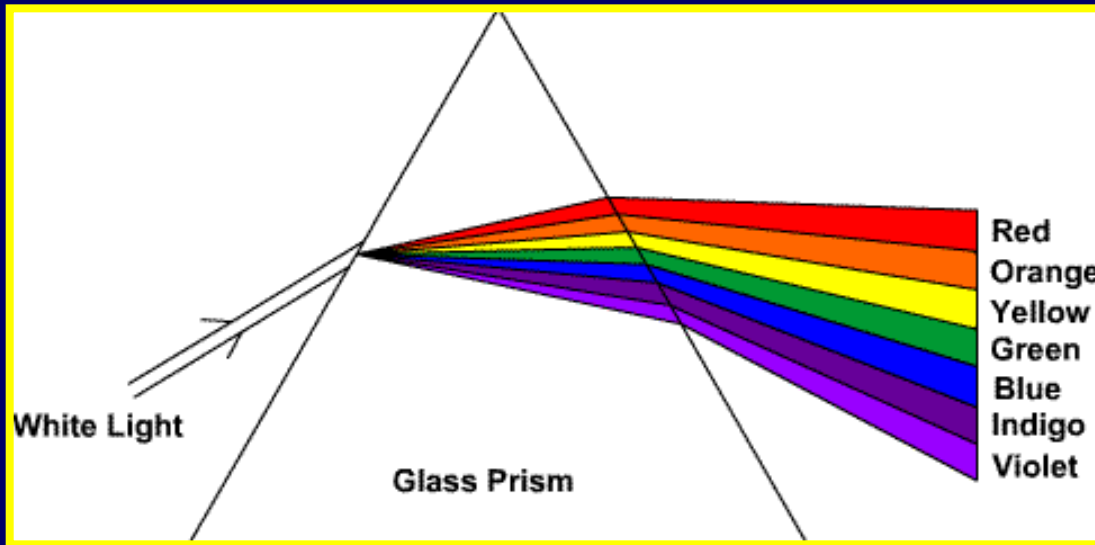


R O Y G B I V

Red and orange light have the longest wavelengths and violet and blue light have the shortest wavelengths.

Rainbows

When light travels from one medium, such as air, into another medium, prism, the different sized light waves are bent or refracted differently.

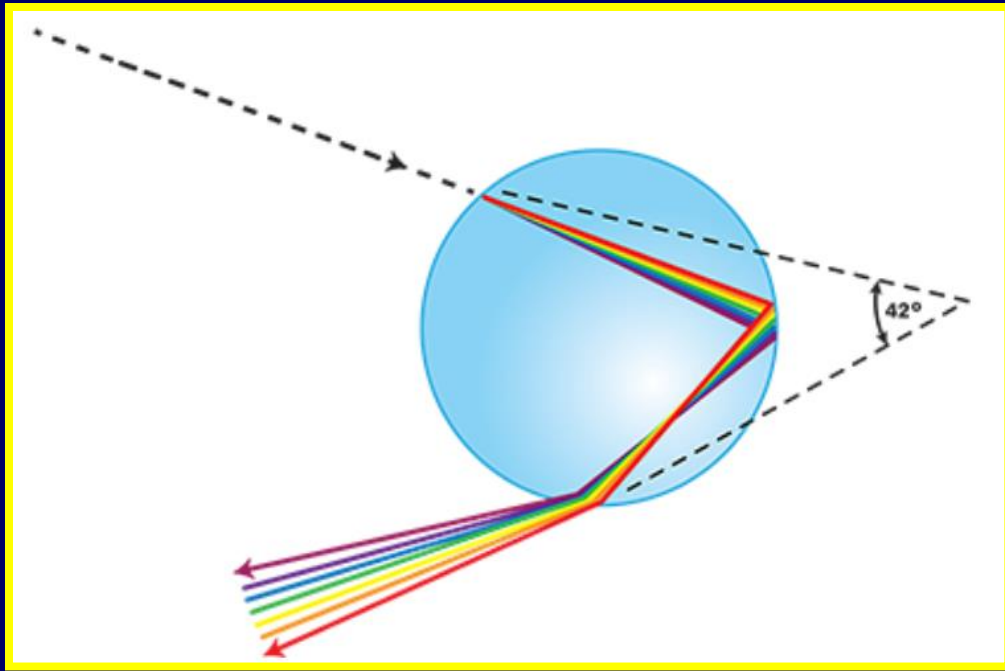


The longer red wavelengths are bent the least and the shorter violet wavelengths are bent the most.

After the light waves bend or refract, the different colors of light spread out and can be seen.

Rainbows

When sunlight enters a water droplet, the light waves are bent or refracted into the various colors of light.



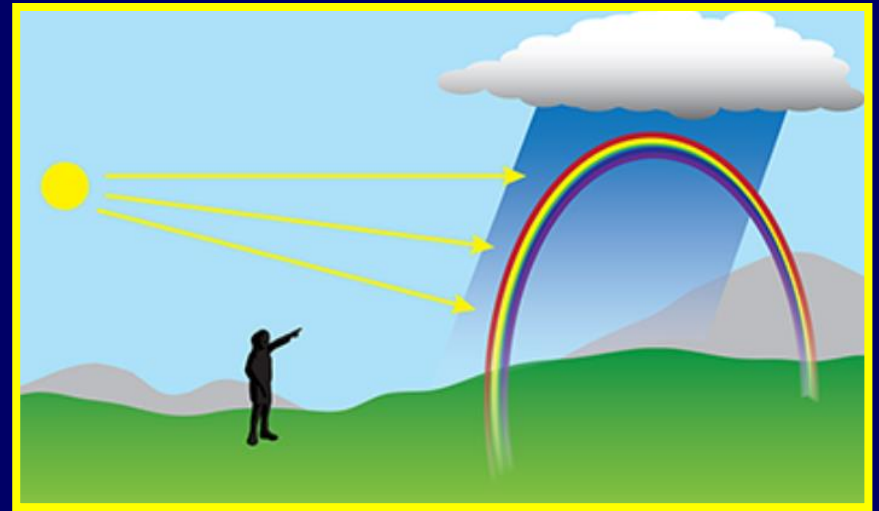
The light then hits the back of the water droplet and is reflected back to the front of the water droplet.

R O Y G B I V

As the light leaves the water droplet, it is refracted once again into all the colors of the rainbow.

Rainbows

Rainbows can only be seen when there are water droplets floating in the air, the sun is behind the observer, and the clouds are cleared away.



A rainbow is actually a complete circle, which can be seen from an airplane. But, on the ground, the circle is cut off, so it appears as an arc.

Double Rainbows

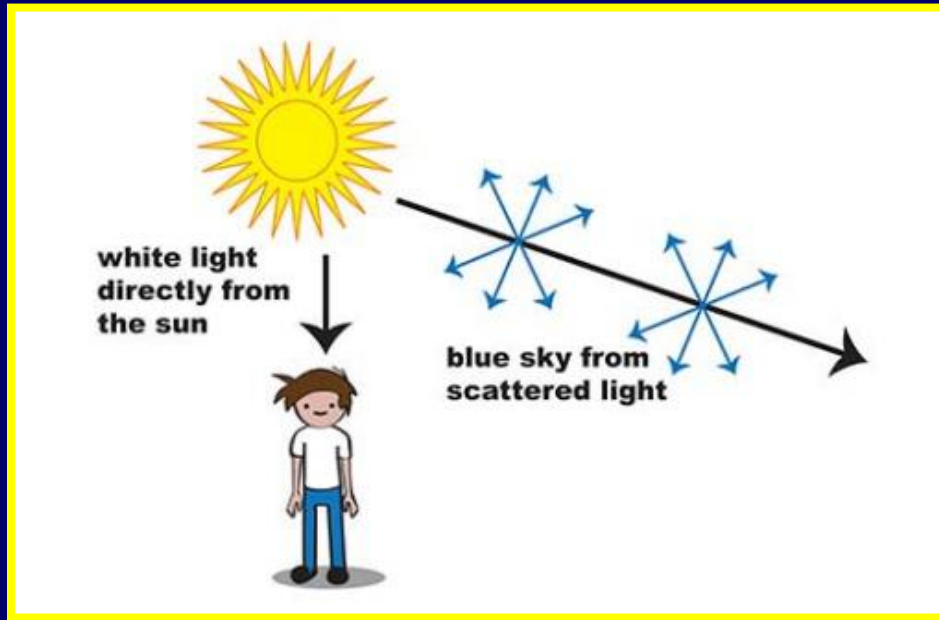


Double rainbows occur when the light is reflected twice inside the raindrop at a slightly different angle.

The second rainbow appears above the first and is fainter with the colors reversed.

Blue Skies

When sunlight enters our atmosphere, a lot of the violet light is absorbed in the upper atmosphere.



The red, orange, yellow, and green light waves pass straight through the atmosphere to our eyes and appear as white light because they are still together.

The blue light waves get scattered as they collide with gas molecules in the air and dominate the sky, making it appear blue.

Sunrise and Sunset

As the Sun gets closer to the horizon, the sunlight encounters more water vapor, dust, and air pollution, which scatters more of the red, orange, and yellow light.



The End

