

Key Concepts

Earth/Space Systems and Cycles (SOL 4.6)

Weather

- **Temperature** is the measure of the amount of heat energy in the atmosphere.
- **Air pressure** is due to the weight of the air and is determined by several factors including the temperature of the air.
- A **front** is the boundary between air masses of different temperature and humidity.
- **Cirrus, stratus, cumulus, and cumulo-nimbus** clouds are associated with certain weather conditions.
- **Cumulus clouds** are fluffy and white with flat bottoms. They usually indicate fair weather. However, when they get larger and darker on the bottom, they become cumulo-nimbus clouds that may produce thunderstorms.
- **Stratus clouds** are smooth, gray clouds that cover the whole sky (block out direct sunlight). Light rain and drizzle are usually associated with stratus clouds.
- **Cirrus clouds** are feathery clouds. They are associated with fair weather. Cirrus clouds often indicate that rain or snow will fall within several hours.
- Extreme atmospheric conditions create various kinds of storms such as **thunderstorms, hurricanes, and tornadoes**.
- Different atmospheric conditions create different types of precipitation (rain, sleet, hail, and snow).
- **Meteorologists** gather data by using a variety of instruments.
- Meteorologists use data to predict weather patterns.
- A **barometer** measures air pressure.
- An **anemometer** measures wind speed.
- A **rain gauge** measures precipitation.
- A **thermometer** measures the temperature of the air

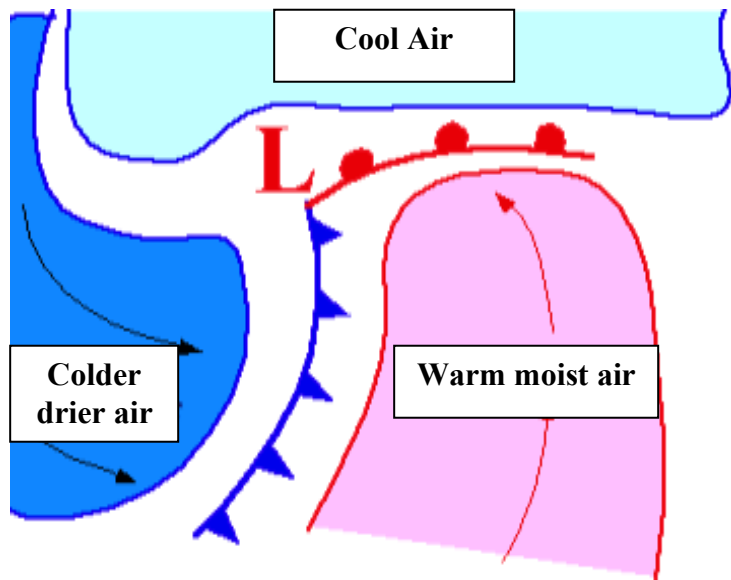


Air Masses

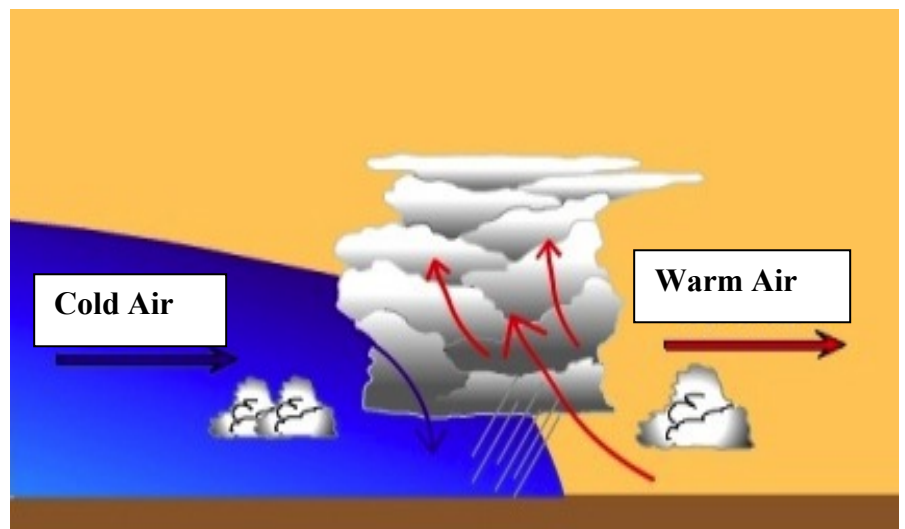
Air can be cold or it can be warm. Air can be dry or it can be humid. A very large body of air that has about the same temperature and humidity throughout is called an **air mass**. Air masses are hundreds of kilometers wide and three to six kilometers high.

When an air mass forms, it takes on the temperature and humidity of its surrounding area. Air masses that form in tropical areas are warm, and air masses that form in polar areas are cold. Air masses that form over dry land are dry, and air masses that form over water are humid.

Air masses move. When two air masses meet, you might expect them to mix together, but this does not happen. The boundary between air masses of different temperature and humidity is called a **front**. Since there are different kinds of air masses, there are different kinds of fronts. Naturally, you would expect different kinds of fronts to produce different kinds of weather.

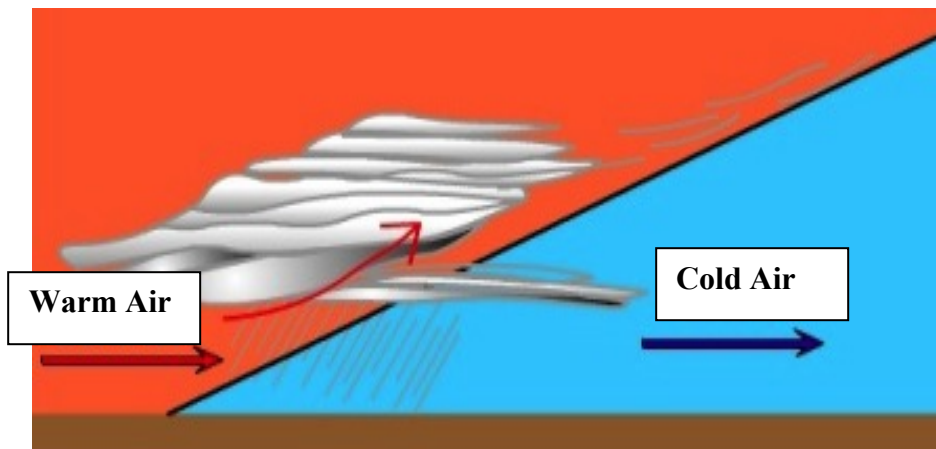
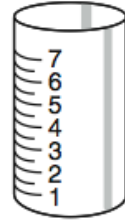


A **cold front** is easy to identify. When cold air pushes into warm air, the warm air rises quickly up out of the way. The rising warm air cools rapidly and produces enormous, towering clouds. Since cold fronts move quickly, the rain or snow they produce does not last very long. Cold fronts can also produce thunderstorms. After the storm, the weather is cooler, drier, and sunny.



Warm fronts are easy to identify, too. The weather they produce is usually much less exciting. In a warm front, a warm air mass moves toward a cold air mass. The warm air does not push the cold, heavier air out of the way. Instead, the warm air slides up slowly over the cold air mass producing a gentle, light rain or snow.

The rain or snow produced by a warm front can last for several days. When the front passes by, you will have warmer, milder, weather until the next front comes! A **rain gauge** is a tool used to measure the amount of rain that falls.



Air Pressure

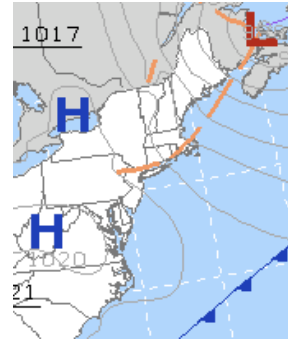
Because air has weight, it can exert pressure. The weight of the atmosphere, or the air over the whole earth, is constant, but it changes locally. The weight of the air over a given spot is called **air pressure**. Air pressure can be measured with a tool called a **barometer**. Warm air is lighter than an equal volume of cold air. The particles of matter are farther apart. Because warm air is lighter, it tends to rise from the Earth's surface. Because it is rising, warm air presses down on the Earth's surface with less force. This is called a **low-pressure area**.

Warm air can hold more moisture than cold air. As air rises, it cools. What do you think will happen? The cooled air cannot hold as much water vapor as before. The air's extra moisture condenses, and clouds form. You could find yourself wet from rain or covered



in snow because low-pressure systems often produce wet weather.

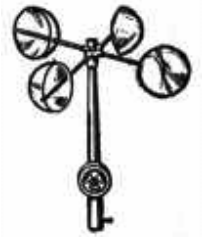
Unlike warm air, cold air is heavier air. Its matter is more closely packed together. It pushes down harder on the earth's surface, so a cold air mass is called a **high-pressure area**. Since cold air holds less water vapor, it also tends to be drier air. If you are outside, feeling pleasantly dry and cool, chances are you are in a high-pressure system.



Often an “H” will represent a **high-pressure** system on a map and a “L” will represent a **low-pressure system**.

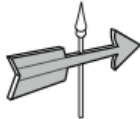
Wind

Wind is the movement of air from high to low pressure areas. Gentle breezes result when the difference in air pressure between the two pressure areas is small. When the difference between high and low pressure areas is great, you might be facing a very windy day or changing weather. Wind speed can be measured with a meteorological tool called an **anemometer**.



Weather Tools

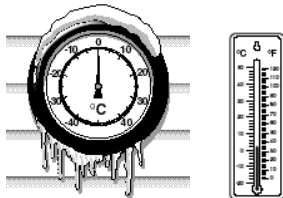
Wind Vane



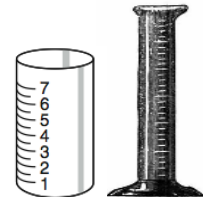
Barometers



Anemometer



Thermometer

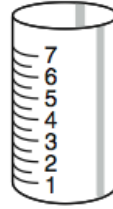


Rain Gauge



Directions: Match the picture of the following weather instruments to their functions:

Measures air pressure



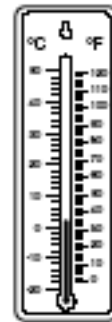
Measures air temperature



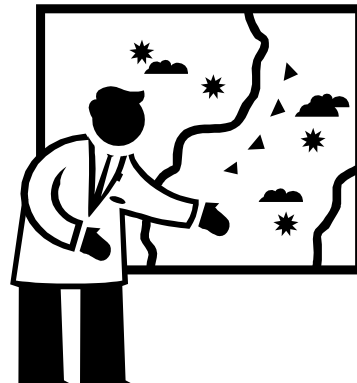
Measures the amount of rain that has fallen






Measures wind speed



Meteorology is the study of Earth's air, especially the movements and events that cause weather. A **meteorologist** is a scientist who studies meteorology. Weather predictions, or forecasts, are made by studying air movements, air temperature, and air pressure. Forecasters also observe clouds and monitor precipitation levels.



Storm Types

Storm Type	Associated Weather Conditions	When Storms Occur
<p>Thunderstorm</p> 	<p>Heavy rain, strong wind, flashes of lightning, rolls of thunder</p>	<p>When a warm, moist air mass near the ground is covered by a mass of cold air (Severe thunderstorms have winds of 58 mph or greater.)</p>
<p>Hurricanes (tropical storms over the Atlantic Ocean)</p> 	<p>Heavy rain, strong whirling winds, high tides, and huge waves</p>	<p>When a warm, low-pressure weather system is surrounded by cooler air (Winds exceed 75 mph.)</p>
<p>Tornadoes (funnel-shaped cloud)</p> 	<p>Strong, whirling winds in a funnel-shaped cloud</p>	<p>When a warm, moist air mass near the ground is covered by a mass of cold air and creates a strong, rotating column of air that reaches from a cumulonimbus cloud to the ground</p>

Cloud Types

CUMULUS:



CUMULUS

- Fluffy and white with flat bottoms
- Usually indicate fair weather

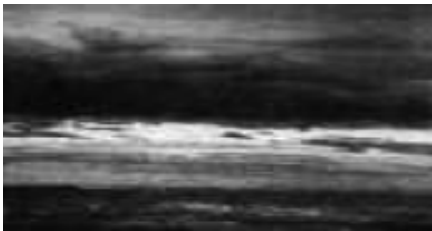
CIRRUS:



CIRRUS

- Thin, feathery clouds high in the sky
- Associated with fair weather
- Often indicate that rain or snow will fall within several hours

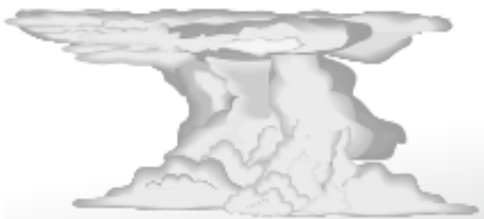
STRATUS:



STRATUS

- Smooth, gray clouds that cover the whole sky (block out direct sunlight)
- Usually associated with light rain and drizzle

CUMULO-NIMBUS:



CUMULO-NIMBUS

- Look like a gray blanket or puffs of smoke
- Made up of piles of cumulus clouds
- Usually produce thunderstorms



Directions: Fill in the blanks using the word bank below.

temperature

sun

precipitation

meteorologist

front

tornado

air pressure

hurricane

thunderstorm

1. A _____ is a boundary between air masses of different temperatures and humidity.
2. Rain, sleet, and snow are types of _____.
3. A _____ is a tropical storm that forms over an ocean. These storms produce high winds, heavy rain, and large waves.
4. The _____ is a measure of the amount of heat energy in the atmosphere.
5. The weight of the air in the atmosphere over a given area is called _____.
6. A _____ is a storm that produces high wind speeds and funnel-shaped clouds.
7. A _____ is a scientist who studies the weather and uses data to predict weather patterns.
8. The _____ provides the heat energy that causes weather.
9. A _____ forms when warm, moist air rises quickly creating cumulo-nimbus clouds that can produce heavy rain, strong wind, lightning, and thunder.



Directions: Match the clouds to their descriptions.

1. **Cumulus**

A flat sheet-like cloud that spreads out over the sky. Usually has light rain or drizzle.

2. **Stratus**

Thin, wispy clouds made of ice crystals; these clouds often indicate that rain or snow will fall within several hours

3. **Cirrus**

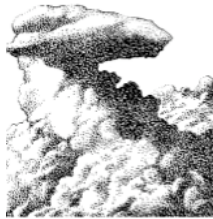
Fluffy and white with flat bottoms; Usually indicate fair weather

4. **Cumulo-nimbus**

Made up of piles of cumulus clouds; Usually produce thunderstorms



Directions: Write the name of the cloud below its picture.



1. _____

2. _____



3. _____

4. _____