

Weather and Climate

Weather

the condition of the Earth's atmosphere at a particular time and place

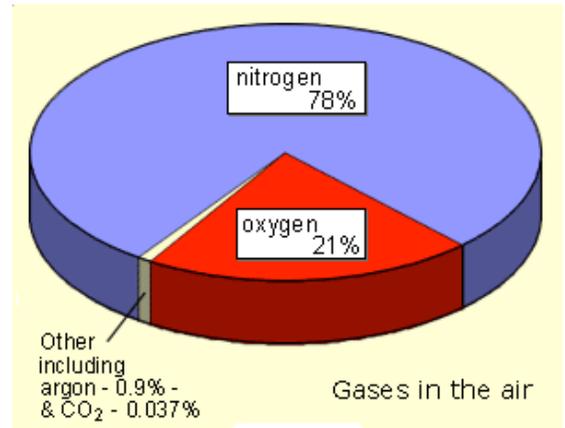
Climate

the average year-after-year conditions of temperature, precipitation, winds and clouds in an area

Atmosphere

the envelope of gases that surrounds the planet

- ★ The two most abundant gases in the Earth's atmosphere are 78% nitrogen and 21% oxygen. Only 1% of the atmosphere is made of other gases.
- ★ The atmosphere makes conditions on Earth suitable for living things.



Air Pressure

a column of air that extends upward through the entire atmosphere.

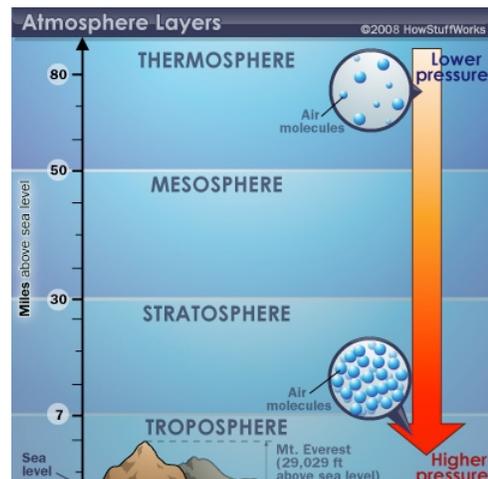
- ★ Air pressure is measured with a barometer.
- ★ There is 14.7 pounds per square inch.
- ★ Air pressure decreases as altitude increases.

14.7 pounds of air in every inch. How many square inches are on your arm.

Layers of the Atmosphere

Scientists divide the Earth's atmosphere into four main layers classified according to changes in temperature.

- Troposphere - weather and airplanes
- Stratosphere - ozone layer
- Mesosphere - protecting Earth from meteors
- Thermosphere - Northern Lights and Satellites



Air Quality

Human activities such as farming and constructions can send soil and dust into the air. The burning of fossil fuels is the main cause of poor air quality. Factories and power plants burn fossil fuels.

- ★ Automobiles are the number one causes of air pollution.
- ★ Air pollution affects people's health, plants and animals.

Energy in the Earth's Atmosphere

Sun

Nuclear reactions fuels the sun.

This energy travels to the Earth as "**light**" and "**infrared radiation (heat)**".

Heat Transfer

Heat is transferred in three ways: radiation, conduction and convection.

- **radiation**
the energy from the sun. You can feel the warm of the sun's rays on your face.
- **conduction**
when heat is transferred from one object to another object it is touching
- **convection**
the transfer of heat by the movement of a liquid or gas. The troposphere is heat mainly by convection currents.

NOW TRY THIS!

Label each example as either radiation (r), conduction (c) and convection (cv)

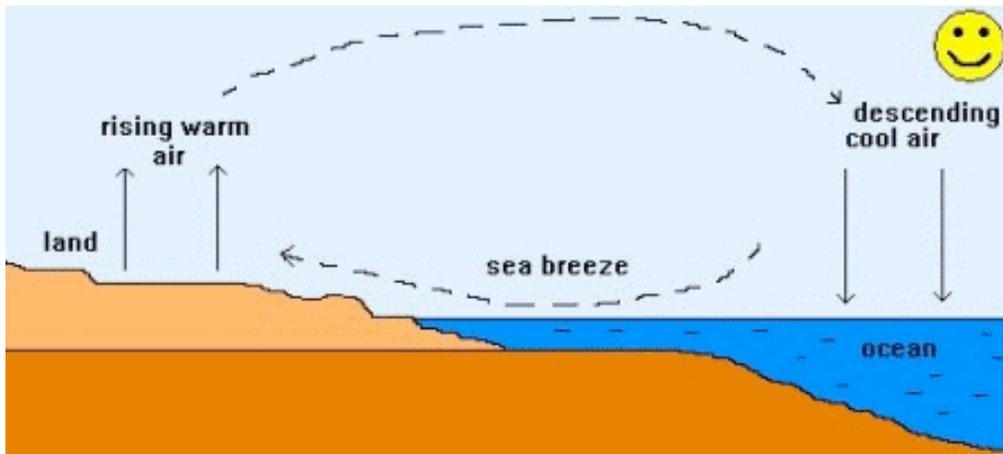
- _____ feeling the heat on the black pavement
- _____ the lake water heating up during the summer
- _____ the sand is hotter than the sand
- _____ the heat raise from the street
- _____ feeling the heat on a metal slide as you go down it
- _____ feeling the heat on your back as you seat in the bleachers at a baseball game
- _____ burning your hand when picking up a hot plate
- _____ warming your hands above a hot cup of soup

Wind

is caused by the difference in temperature and air pressure. An anemometer measures the speed of the wind.

- **Local Winds**

are winds that blow over **short** distances

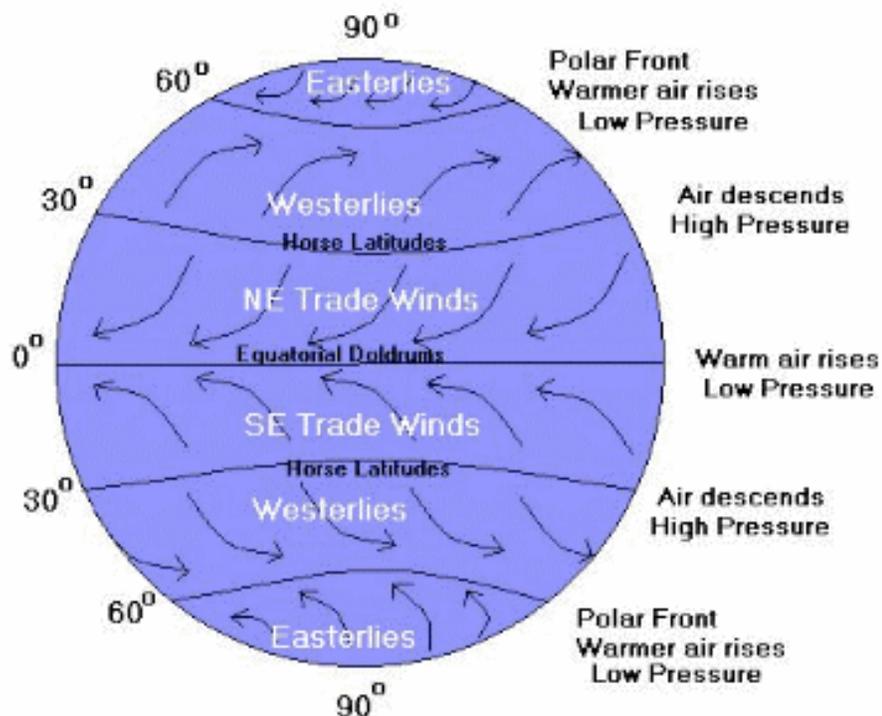


- **Global Winds**

are winds that blow over **large** distances (globe).

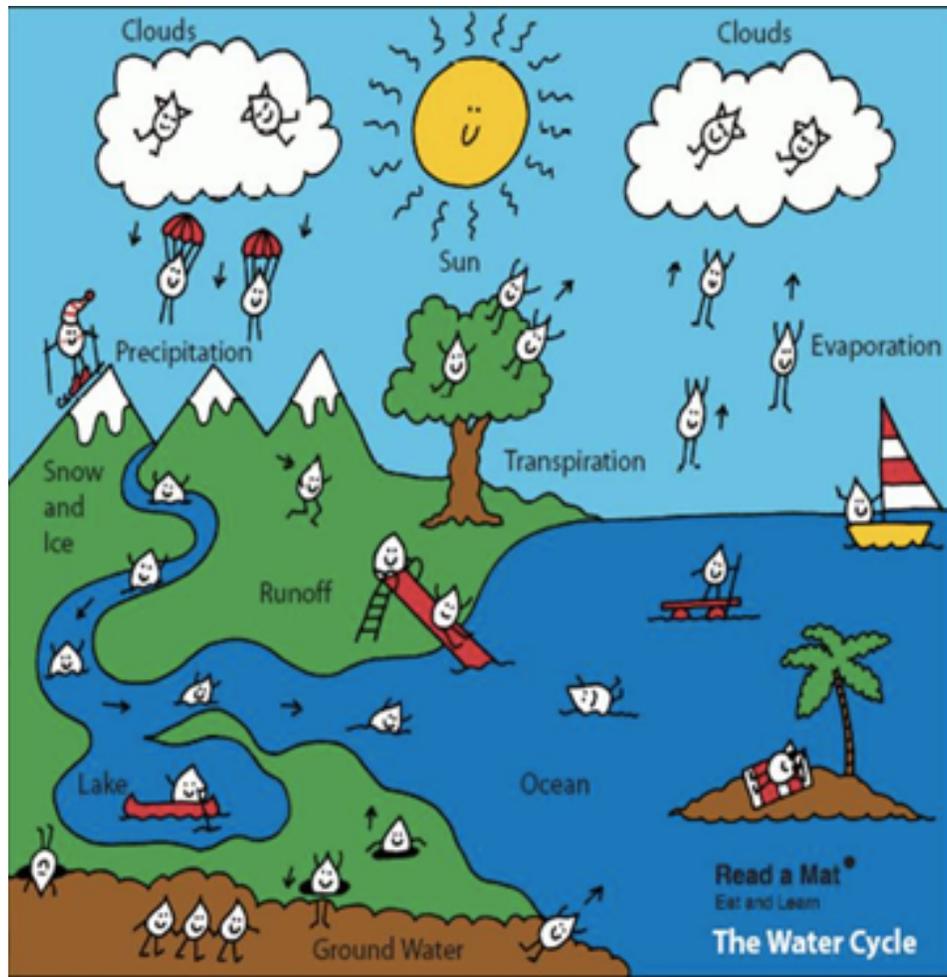
- ★ **Coriolis Effect**

the winds curve because of the rotation of the Earth



Water Cycle (Hydrologic Cycle)

the movement of the water between the atmosphere and the Earth's surface.



evaporation

liquid water changes to a vapor (gas)

transpiration

water taken from the trees and other plants

condensation

water vapor cools down and forms clouds

precipitation

water that falls from the clouds in the form of snow, sleet, hail or rain

surface runoff

water that runs off the surface of mountains, buildings, roads and other places.

infiltration

water that soaks into the ground

ground water

water that is found between the rocks and soil

water shed

area of land that feeds all the water running under it and draining off of it into a body of water

Air Masses and Fronts

Air Mass

a large body of air that has similar temperature , humidity and air pressure
 Air masses move from the west to the east.

- **Temperature**
 polar (cold)
 tropical (warm)
- **Humidity (Moisture)**
 continental (dry)
 maritime (wet)

Warm

Cold

| | Wet | Dry |
|------|--|--|
| Warm |  Maritime Tropical (mT) |  Continental Tropical (cT) |
| Cold |  Maritime Polar (mP) |  Continental Polar (cP) |

NOW TRY THIS!

Where in the United States would you find the different air masses?



Maritime Tropical (mT) _____

Continental Tropical (cT) _____

Maritime Polar (mP) _____

Continental Polar (cP) _____

Fronts

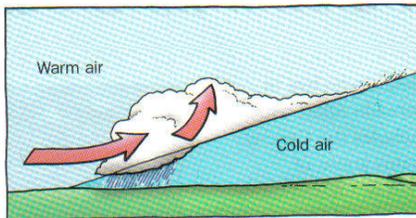
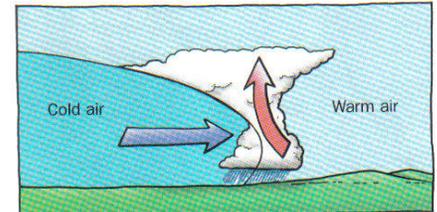
when two air masses meet

There are four different kinds of fronts: cold, warm, stationary and occluded.

★ Remember that hot air is light and rises and cold air is dense and heavy so it sinks.

- **Cold Front** 

A fast moving cold air mass overtakes a warm air mass
This front usually brings thunderstorms.

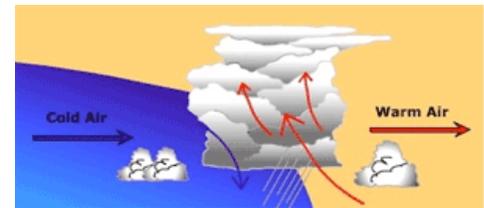


- **Warm Front** 

A warm air mass overtakes a slow moving cold air mass
This front will bring several days of cloudy and rainy weather.

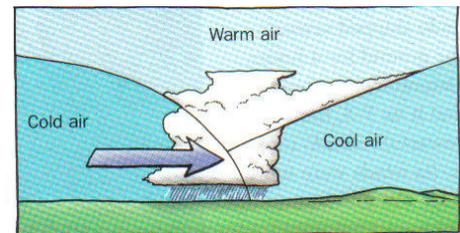
- **Stationary Front** 

Cold and warm air masses meet, but neither can move the other.
This front will bring rain, snow, fog or clouds.



- **Occluded Front** 

A warm air mass is caught between two cooler air masses.
This front brings clouds and rain or snow.



Storms

a violent disturbance in the atmosphere

★ In a storm, you will see lightning before you hear the thunder because light travels faster than sound.

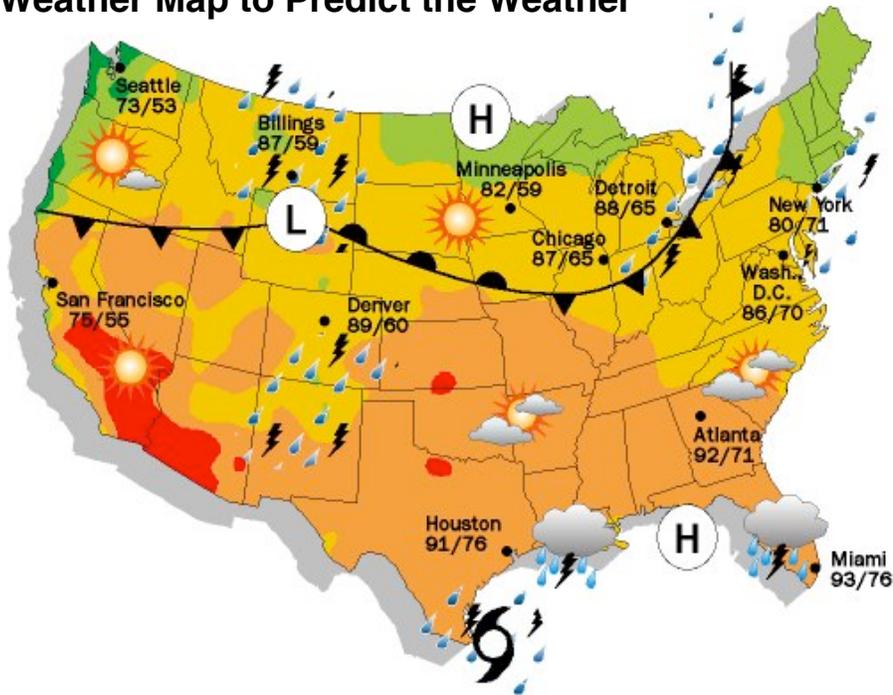
Predicting the Weather

A meteorologist, a person who studies the weather, collects data using weather balloons, satellites and other instruments. Then he interprets the data and makes observations to predict the weather.

★ The main reason Meteorologist study the weather is because it affects our daily lives.

How does the weather affect the things that you do? _____

Using a Weather Map to Predict the Weather



Name two states that have sunny weather. _____

What kind of pressure system is around the states with sunny weather? _____

Name two states that are having thunderstorms. _____

What kind of pressure system is around the states with stormy weather? _____

What is happening at the southern tip of Texas? _____

Name two states where there is a cold front. _____

Name two states where there is a warm front. _____

What weather is southeastern Michigan having? _____

What weather do you expect southeastern Michigan will have the next day? _____

The Causes of Climate Changes

- **Location on the Earth**

Places closer to the equator are warm and receive more of the sun's rays than at the poles.

- **Altitude on the Earth**

The higher the altitude, the colder the climate. As you go up into the 'atmosphere, the air particles spread out and there are less particles to be warmed by the sun.

- **Distance from Large Bodies of Water**

Oceans or large lakes can affect the temperature of a climate because water heats up more slowly than land and will also cool down more slowly.

★ *Ocean currents move similar to the way air currents move.*

- **Prevailing Winds**

Weather depends on the movement of large air masses, and these air masses move by the wind.

- **Mountain Ranges**

a mountain range in the path of a prevailing wind can influence where precipitation falls. Rain or snow will fall on the windward side of the mountain.

- **The Seasons**

Seasons are caused by the tilt of the Earth's axis as the Earth travels around the sun.

- **Human Activity**

Human activity is the biggest reason for climate changes. The burning of fossil fuels used in automobiles.

★ **Global Warming**

The gradual increase in the temperature of the Earth's atmosphere

Causes . . . 1) Changing levels of carbon dioxide

(burning wood, coal oil and natural gas)

2) Ozone depletion

using chlorofluorocarbons (CFCs) found in air conditioners, aerosol sprays and refrigerators.

3) Natural change in the climate

Some scientist believe that the rise in global temperatures over the past 120 years may be just the natural direction of the Earth's climate.



Results . . . 1) Farmers in cool areas could plant two crops a year instead of one.

2) Melting of the glaciers would raise sea levels and flood low-lying coastal areas.

WEATHER and CLIMATE

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E.ES.M.1 Solar Energy- The sun is the major source of energy for phenomena on the surface of the Earth.

E.ES.07.11 Demonstrate, using a model or drawing, the relationship between the warming by the sun of the Earth and the water cycle as it applies to the atmosphere (evaporation, water vapor, warm air rising, cooling, condensation, clouds).

E.ES.07.12 Describe the relationship between the warming of the atmosphere of the Earth by the sun and convection within the atmosphere and oceans.

E.ES.07.13 Describe how the warming of the Earth by the sun produces winds and ocean currents.

E.ES.M.4 Human Consequences- Human activities have changed the land, oceans, and atmosphere of the Earth resulting in the reduction of the number and variety of wild plants and animals, sometimes causing extinction of species.

E.ES.07.41 Explain how human activities (surface mining, deforestation, overpopulation, construction and urban development, farming, dams, land fills, and restoring natural areas) change the surface of the Earth and affect the survival of organisms.

E.ES.07.42 Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere, (car exhaust, industrial emissions, acid rain, and natural sources), and how pollution impacts habitats, climatic change, threatens or endangers species.

E.ES.M.7 Weather and Climate- Global patterns of atmospheric and oceanic movement influence weather and climate.

E.ES.07.71 Compare and contrast the difference and relationship between climate and weather.

E.ES.07.72 Describe how different weather occurs due to the constant motion of the atmosphere from the energy of the sun reaching the surface of the Earth.

E.ES.07.73 Explain how the temperature of the oceans affects the different climates on Earth because water in the oceans holds a large amount of heat.

E.ES.07.74 Describe weather conditions associated with frontal boundaries (cold, warm, stationary, and occluded) and the movement of major air masses and the jet stream across North America using a weather map.

E.ES.M.8 Water Cycle- Water circulates through the four spheres of the Earth in what is known as the "water cycle."

E.ES.07.81 Explain the water cycle and describe how evaporation, transpiration, condensation, cloud formation, precipitation, infiltration, surface runoff, ground water, and absorption occur within the cycle.

E.ES.07.82 Analyze the flow of water between the components of a watershed, including surface features (lakes, streams, rivers, wetlands) and groundwater.

E.FE.M.1 Atmosphere- The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different physical and chemical composition at different elevations.

E.FE.07.11 Describe the atmosphere as a mixture of gases.

E.FE.07.12 Compare and contrast the composition of the atmosphere at different elevations.

