

17.1 ATMOSPHERE CHARACTERISTICS

Weather- the state of the atmosphere at a specific time

Climate- the average weather conditions in a region

I. Atmosphere **composition** (what it's made of):

a. gases

1. 76.5% nitrogen
2. 20.5% oxygen
3. 2% water vapor (average-lower over deserts, higher in tropics)
4. 1% trace gases (CO₂, argon, etc.)

b. Solids

1. Fine soil dust, sea salts, smoke, soot, pollen, microorganisms, dust from meteorites, ash and dust from volcanoes
2. Used as **condensation nuclei** (the center of every raindrop)

II. Layers of the atmosphere

a. **Troposphere**- lowest layer of the atmosphere

1. from 0 to 12 km
2. All weather occurs here
3. Those are most dense
4. Greatest pressure
5. Temperature Drops as you go up

b. **Stratosphere**

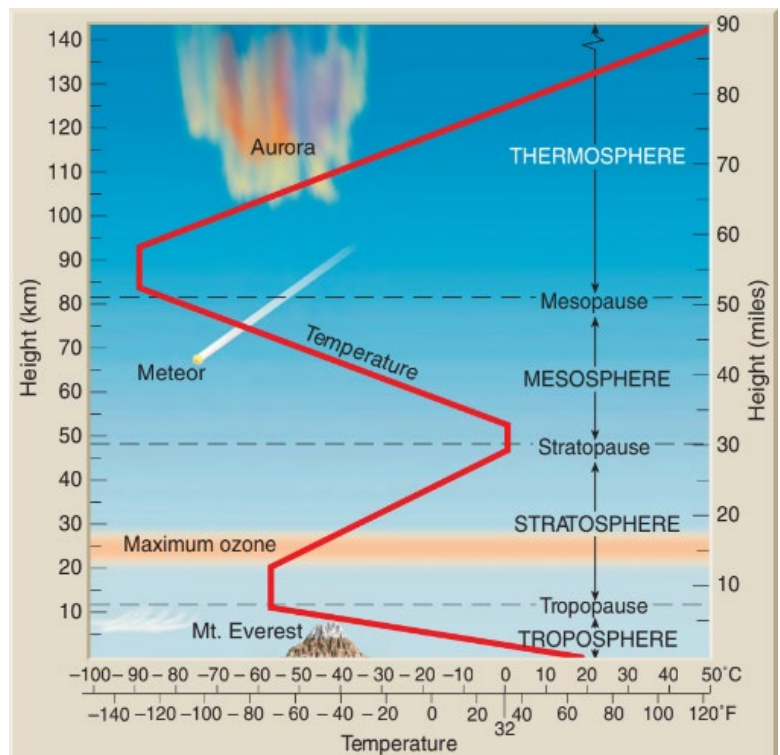
1. From 12 to 50 km
2. Temperature warms as you go up
3. Contains the **ozone layer** which blocks harmful ultraviolet rays from the Sun (This is why the stratosphere gets warmer)

c. **Mesosphere**

1. from 50 to 80 km
2. Gets colder as you go up
3. Coldest of all the layers
4. burns up meteors

d. **Thermosphere**

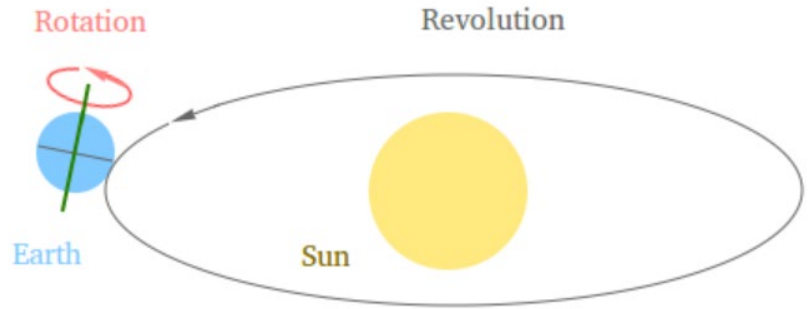
1. From 80 to 140 km
2. Gets warmer as you go up
3. Least dense layer
4. Least amount of pressure
5. Temperature very high (Molecules Moving very fast)
6. There is not a lot of heat transfer because molecules are too spread apart



III. Earth Sun relationships

a. Earth's motions

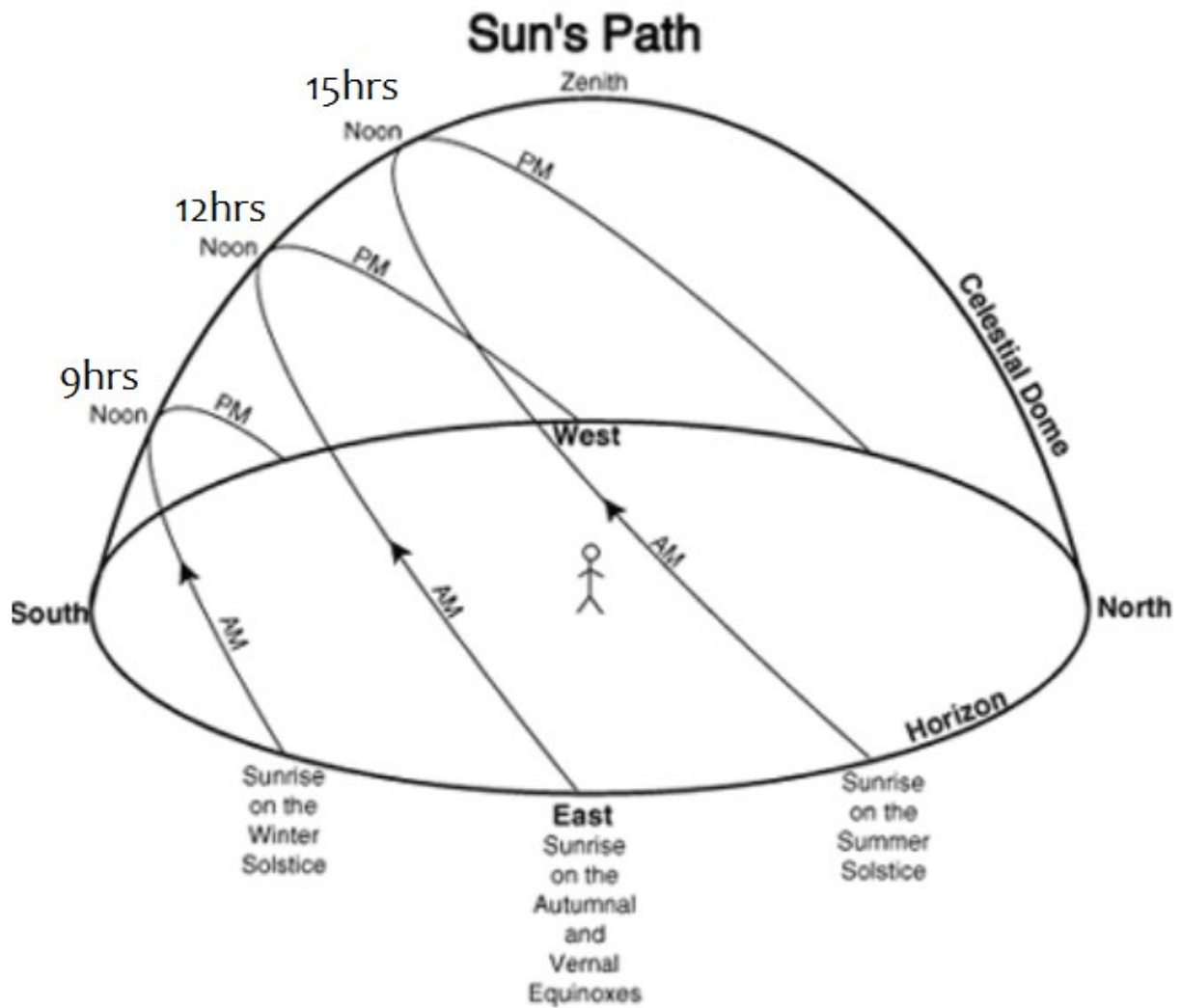
1. **Rotation**-Spinning in place, One time per 24 hours
2. **Revolution**-Orbiting around the Sun, 1 Time per 365 and 1/4 days

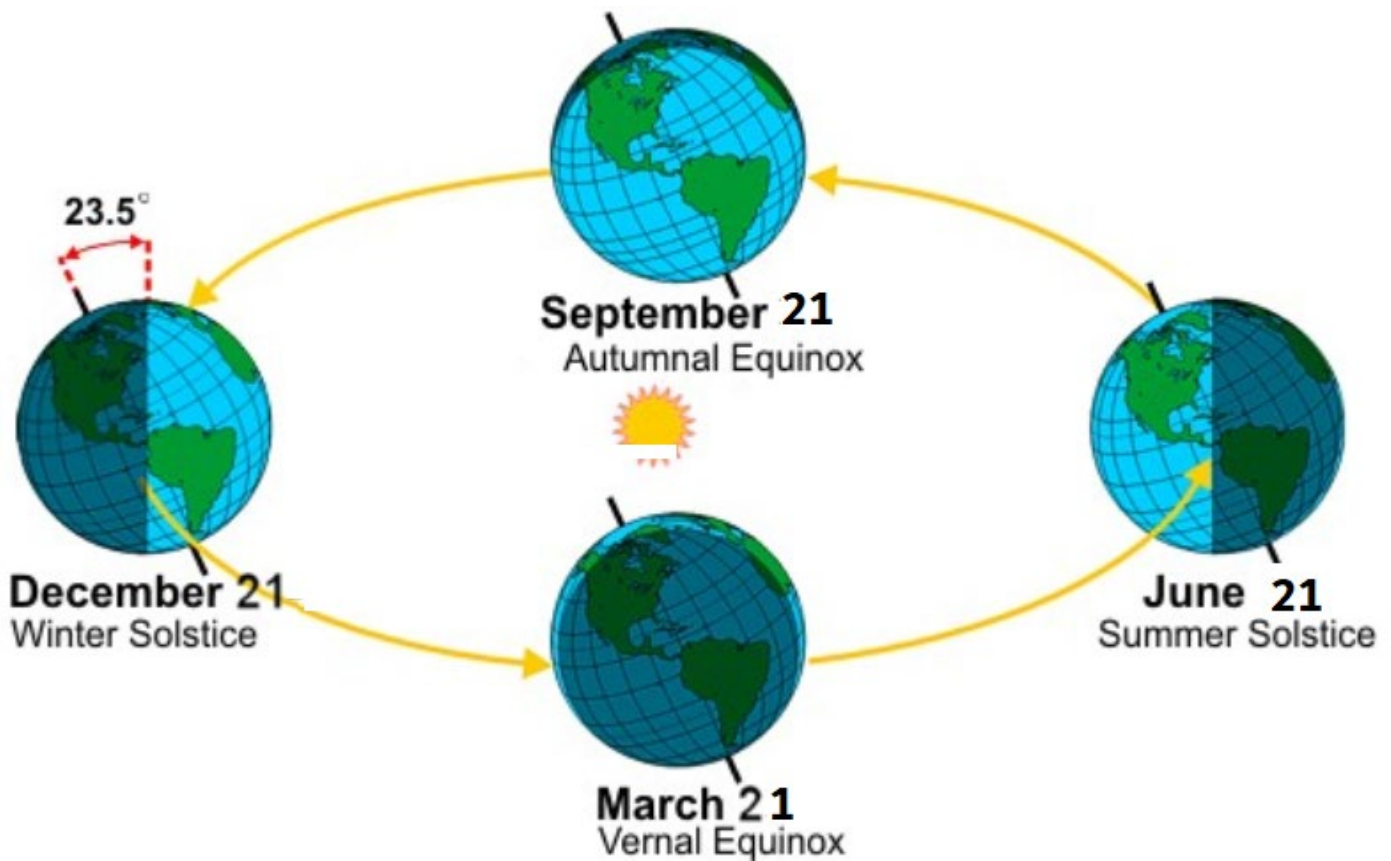


b. Earth's Seasons-

1. Earth has Seasons because it is tilted 23.5°
2. If the tilt was greater than 23.5 our seasons would become too hot and too cold
3. If there was no tilt we would have a scorched equator and giant glaciers at both poles leaving only a tiny portion of Earth habitable

IV. Sun's apparent path





- a. Earth's Tilt causes the Sun to beam down at different angles at during different times of the year
 1. During summer it is 73.5° (More straight down on our heads)
 - i. Causes the sunlight to be more concentrated
 - ii. Each square unit gets brighter sunlight
 2. Winter it is 40° (Coming down at a more extreme angle)
 - i. Causes the sunlight to be more spread out
 - ii. Each square unit gets dimmer sunlight

V. Solstices and equinoxes

- a. **Summer solstice**, June 21st, 15 Hours of daylight, Northern Hemisphere pointed directly at Sun
- b. **Fall equinox**, September 21st, 12 hours Of daylight, neither hemisphere pointed directly at Sun
- c. **Winter solstice**, December 21st, 9 hours of daylight, southern hemisphere pointed directly at Sun
- d. **Spring equinox**, March 21st, 12 hours of daylight, neither hemisphere pointed directly at Sun
- e. The combination of **longer days** and **direct sunlight** creates warmer temperatures of summer
- f. The combination of **shorter days** and **indirect sunlight** creates colder temperatures of winter

17.2 HEATING THE ATMOSPHERE

Temperature-The measure of how fast molecules are moving

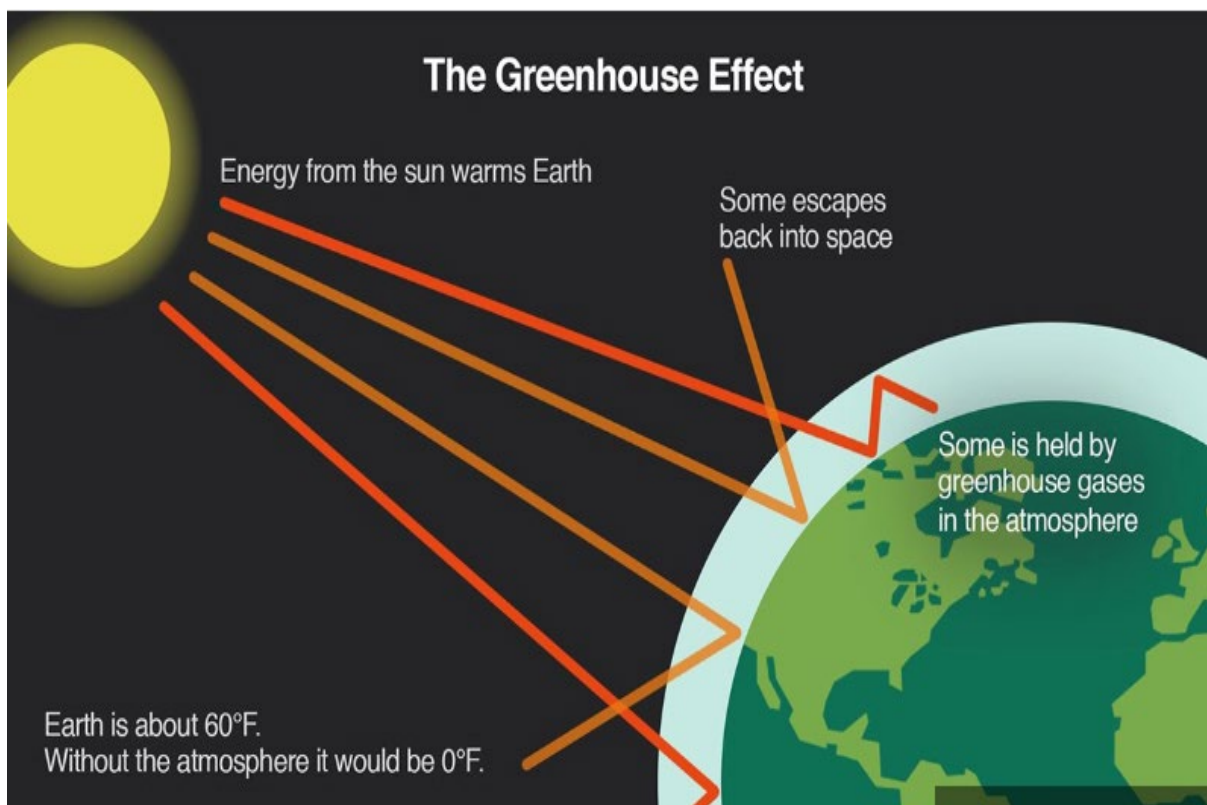
Heat-The measure of how much energy transfers from one object to another

I. **The ways heat energy moves:**

- a. **Conduction**-transfer of heat by matter touching (Individual molecules collide, Sending their kinetic energy into others Like balls on a pool table) Must have a medium

- b. **Convection**-transfer of heat when Liquids or gases rotate and take their heat with them (Heat rises and cold sinks) Must have a medium
- c. **Radiation**-Transfer of heat by electromagnetic waves. Does not need a medium (Can travel through emptiness)
 1. Solar Radiation can be **absorbed** (soak in to atmospheric gases, clouds, land)
 2. solar Radiation can be **reflected** (Bounce off substances)
 3. Solar radiation can be **transmitted** (pass Through substances)
 4. Solar radiation can be **scattered** (Turn into a large number of weaker rays traveling in different directions) as they hit dust particles and gas molecules. This is why the sky is blue.
 5. Solar radiation can be **used** in photosynthesis (Radiant energy is transformed into chemical energy making all life possible)

- II. **Greenhouse effect**- Greenhouse gases can absorb radiation from the Sun and become warmer
 - a. Makes it so all life is possible
 - b. Too much may create climate change too fast for organisms to adapt



17.3 TEMPERATURE CONTROLS

Why temperatures vary on Earth

I. **Latitude**

- a. The closer you are to the equator the warmer it is due to **direct** (Straight down) sunlight
- b. The farther you are from the equator the colder it is due to **indirect** (Diagonal) sunlight

II. **Land and water**

- a. Land Heats faster and cools down faster
- b. Cities surrounded by land have hotter Summers and colder Winters (More harsh)
- c. Water takes longer to heat up and longer to cool down due to its high heat capacity

d. Cities near water have cooler Summers and warmer Winters (Milder)

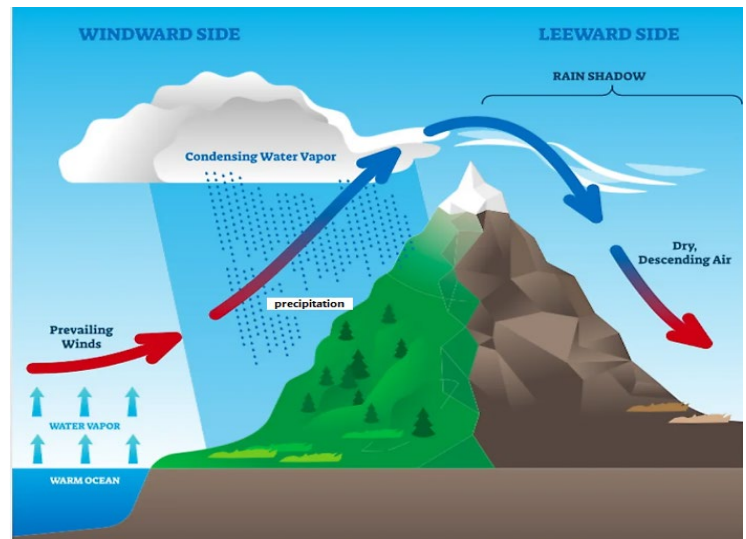
III. Windward Coast versus Leeward Coast

- a. Windward Coast-Where the wind blows from the ocean onto the shore
 1. Cities get Milder climates
- b. Leeward Coast-Air above the ocean is not blowing toward land
 1. Cities get continental climates



IV. Geographical Position (Mountains as a barrier)

- a. Windward side of mountain- air goes up mountain, cools, condenses out all water
 1. Gets more rain
 2. Temperatures more mild due to water in air
- b. Leeward side of mountain- air goes down other side, but now has no moisture
 1. Gets little to no rain
 2. Temperatures more extreme due to less water in air



V. Altitude (how high up the mountain you are)

- a. The higher you are in the troposphere, the lower the temperature
- b. The lower you are in the troposphere, the higher the temperature

VI. Cloud cover

Albedo the fraction of total radiation that is reflected by a surface

- a. High Albedo is very reflective (Light surfaces like clouds and Icy glaciers)
- b. low albedo is not reflective (Dark surfaces like land)
- c. Lots of clouds during the day reflects sunlight and makes days cooler (high albedo)
- d. Lots of clouds during the night traps heat like an insulating blanket, and makes night time warmer
- e. Overall, cloud cover creates milder temperatures