Energy Transfer in the Atmosphere

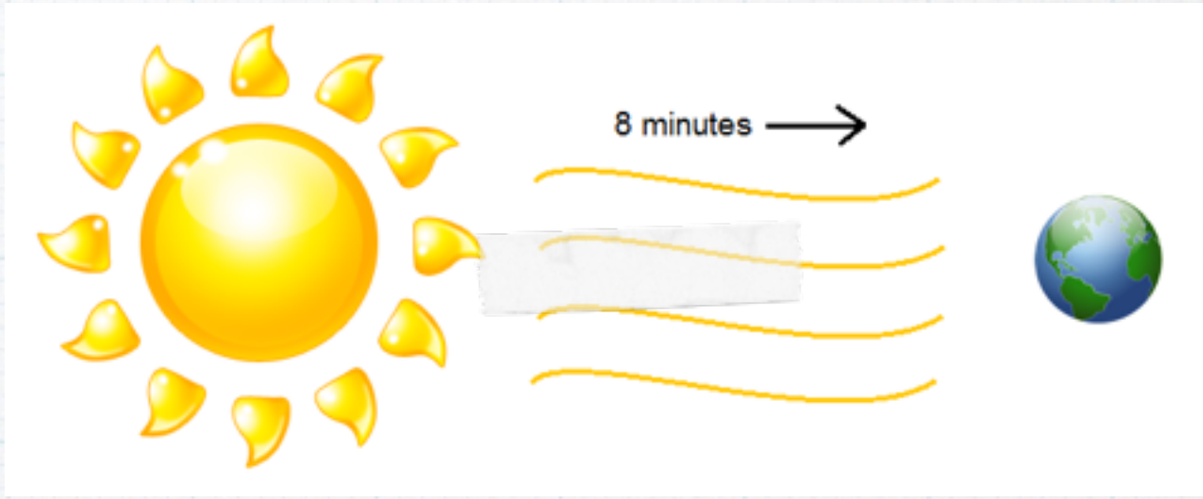
Essential Questions

* How does energy transfer from the sun to Earth and the atmosphere?
* How are air circulation patterns with the atmosphere created?

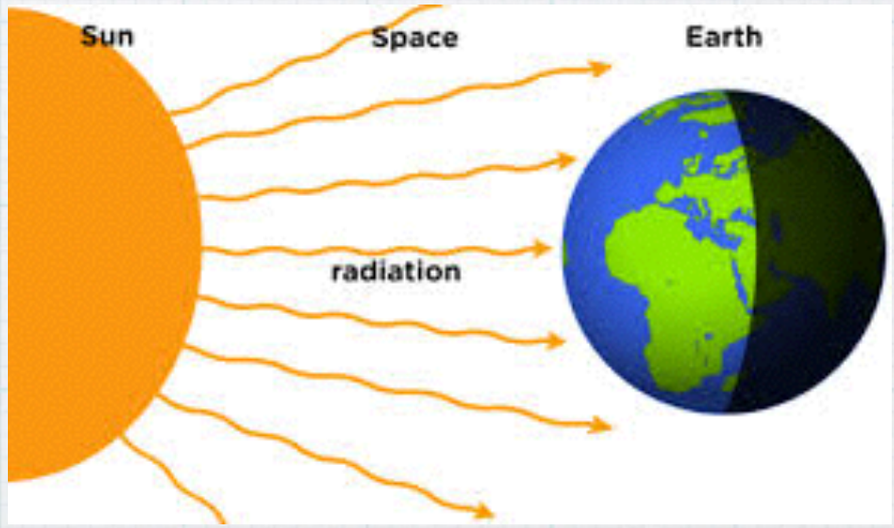
Vocabulary

* **Radiation:** The transfer of energy by electromagnetic waves
* **Conduction:** The transfer of thermal energy by collision between particles of matter through touch
* **Convection:** The transfer of thermal energy by circulation or movement in a liquid or gas.
* **Stability**: whether circulating air motions will be strong or weak
* **Temperature Inversion:** a temperature increase as altitude increases in the troposphere.

Energy from the Sun



* Sun's energy reaches Earth by the process of radiation (in only 8 minutes).



* Radiation: the transfer of energy by electromagnetic waves

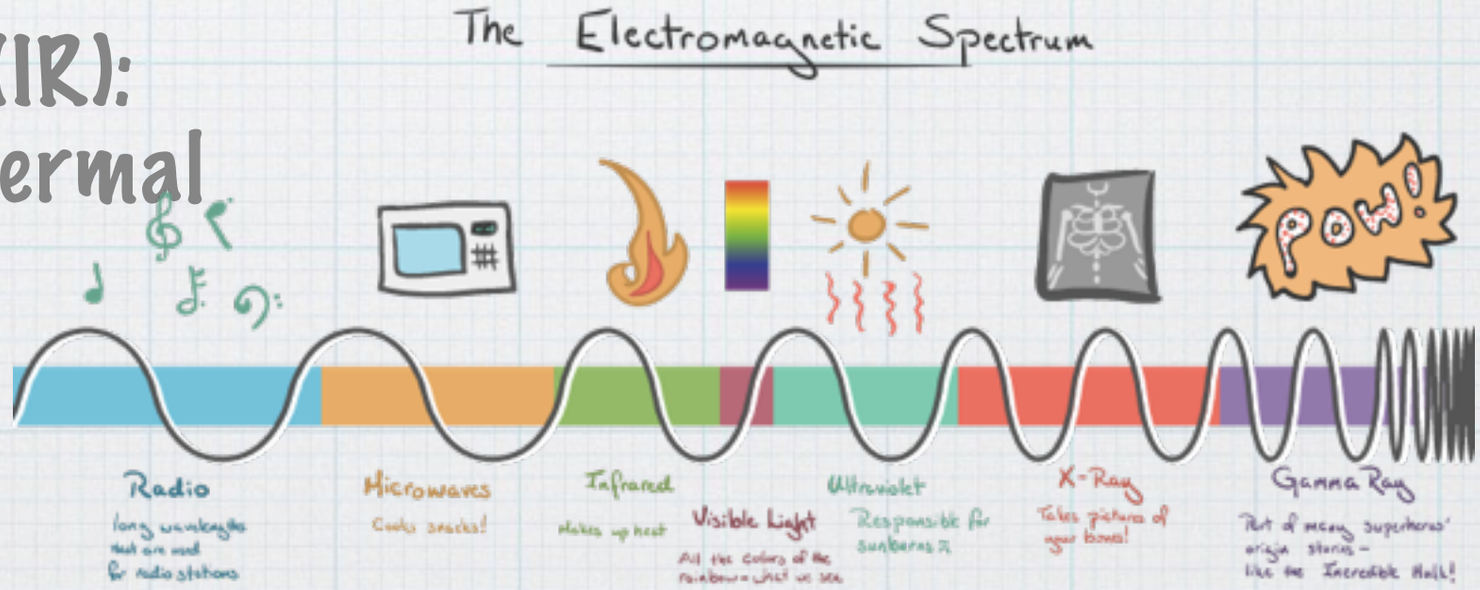
Radiation

* Visible light: light you can see

* Near-visible wavelengths:

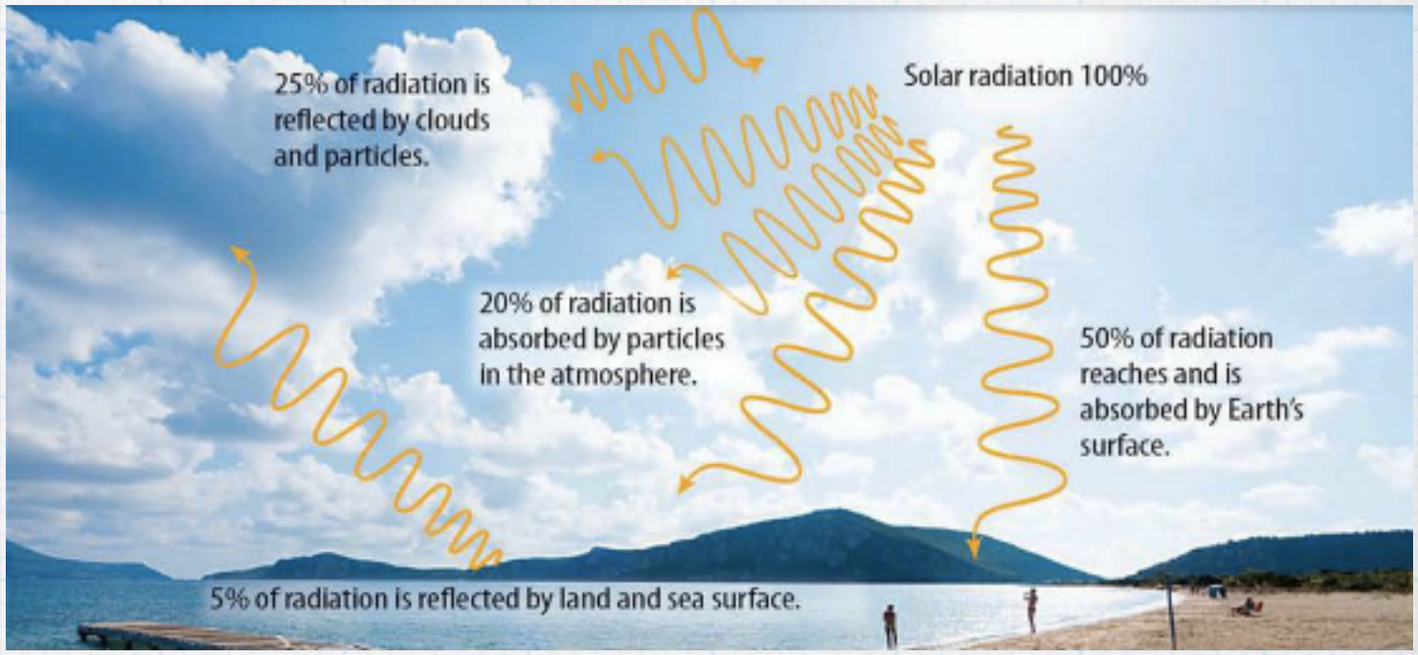
  * Ultraviolet (UV) light: can burn human skin and can cause skin cancer

* Infrared radiation (IR): can be sensed as thermal energy/warmth



Energy on Earth

* Absorption: 20% of incoming solar radiation is absorbed by gases and particles in the atmosphere
    * oxygen, ozone, water vapor, carbon dioxide
* Reflection: 30% of incoming solar radiation is reflected into space
    * clouds, land and sea surfaces, bright surfaces, snow covered surfaces



Radiation Balance

* Amount of solar energy absorbed by Earth and its atmosphere is equal to the amount of energy Earth radiates back into space

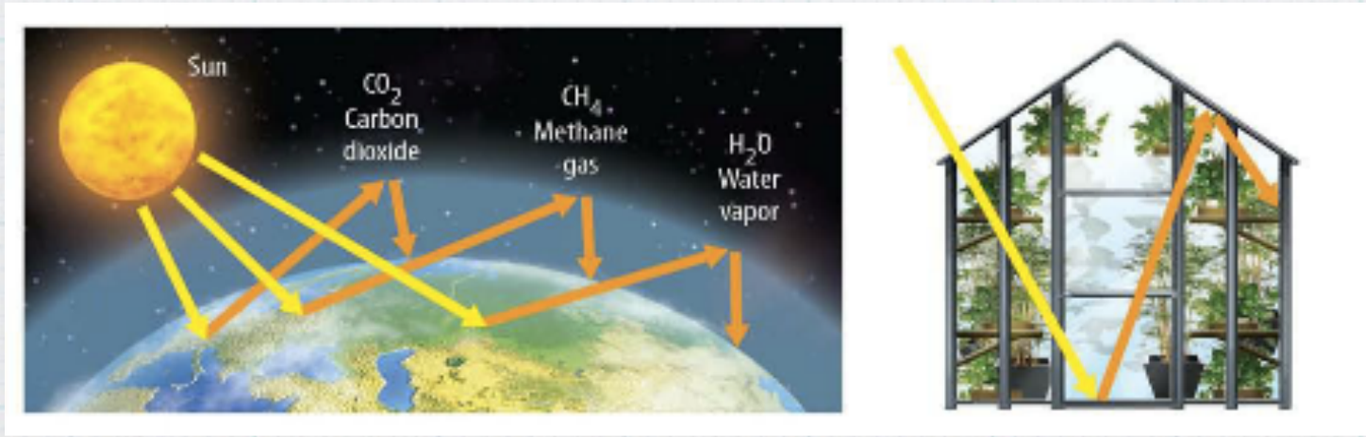
* this is why the Earth does not get hotter and hotter as it is heated

The Greenhouse Effect

* Greenhouses gases in Earth's atmosphere trap infrared radiation and direct it back to Earth's surface

    * this causes an additional buildup of thermal energy

    * greenhouse gases: water vapor (H20), carbon dioxide (CO2), methane (CH4)



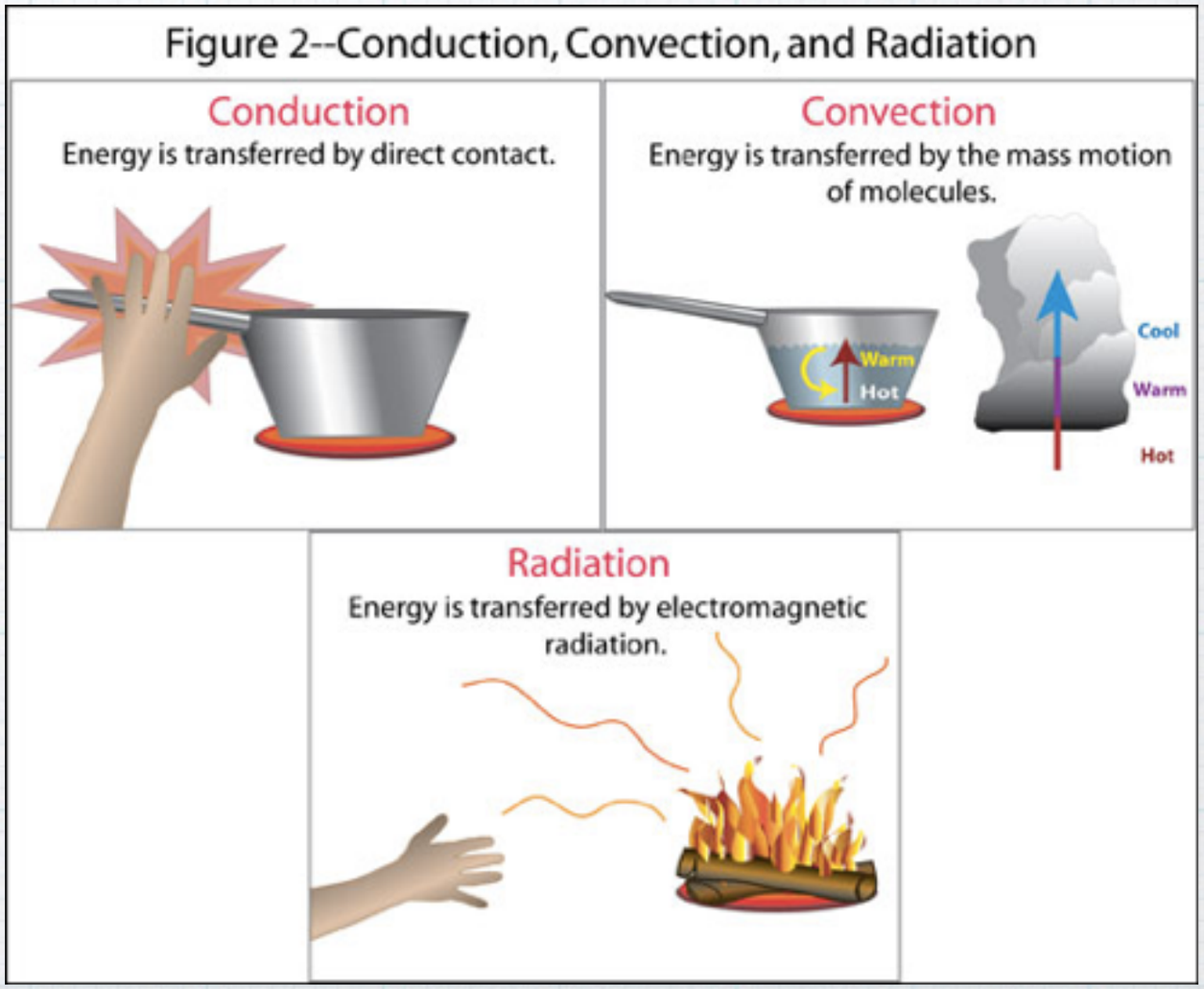
Thermal Energy Transfer

* Radiation: transfer of energy from Sun to Earth

* Conduction: transfer of thermal energy when objects are close enough to touch

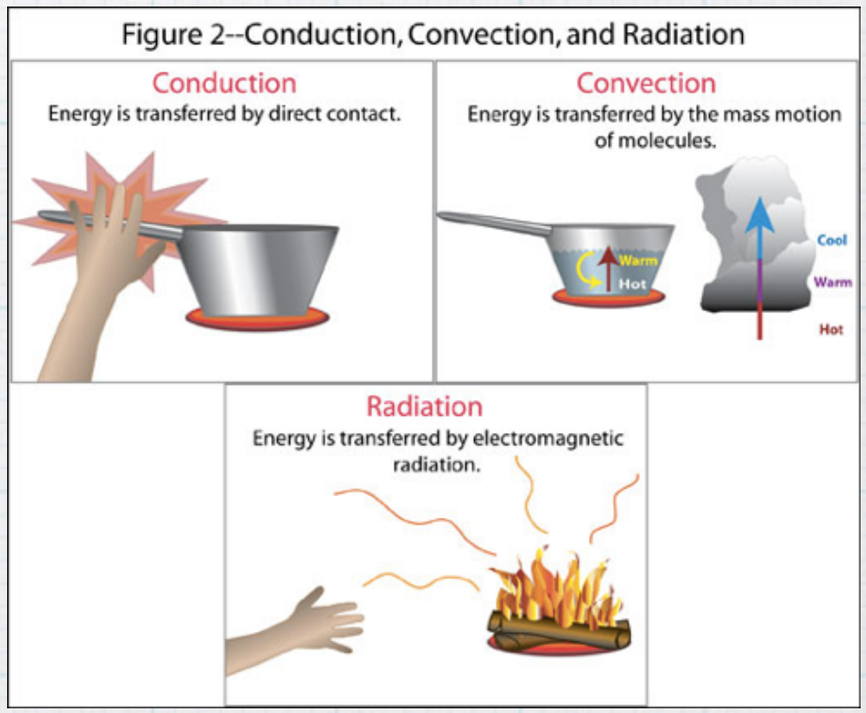
  * energy moves from object with higher temperature to an object with a lower temperature

  * example: touching hand to hot stove



Thermal Energy Transfer

* Convection: transfer of thermal energy by the movement of particles within matter
    * example: boiling water circulating and steam rising
* Latent heat: energy released when water changes physical form
    * examples ice —> liquid



Conductors and insulators

* Conductor: a material that allows the flow of energy such as electrical energy or thermal energy.
* Example: metal
* Insulator: a material that slows or prevents the flow of energy such as electrical energy or thermal energy.
* Example: wood

Circulating Air

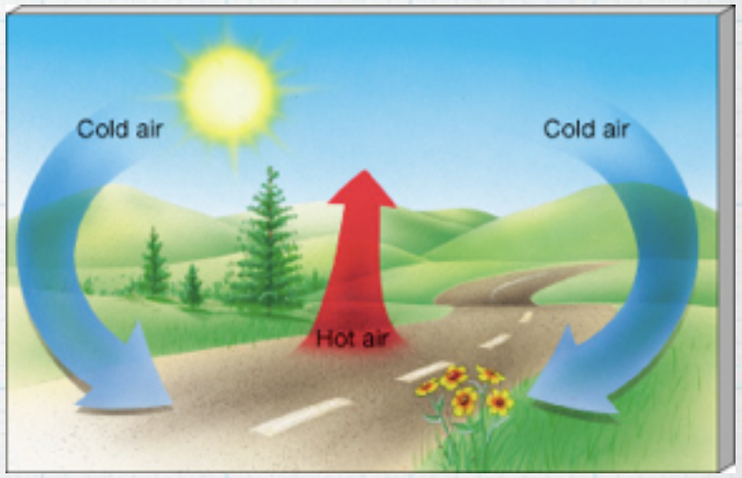
* Air is constantly moving—as air is heated, it become less dense and rises and is always accompanied by cooler, sinking air.

* Stable air: circulation motions are weak

* Unstable air: circulating motions are strong

  * warm, sunny days

  * ground level air much warmer than high altitude air and causes warm air to rise and form tall, large clouds



Temperature inversion

* occurs in the atmosphere when temperature increases as altitude increases

* a layer of cooler air is trapped by a layer of warmer air above it

  * this prevents air from mixing and and can trap pollution in the air close to Earth's surface