

Ch 1 – Sect. 2 “Atmospheric Heating” ---- Lecture Notes

- It takes 8 minutes for the energy from the sun to get to your face.

Energy in the Atmosphere

- Solar energy = SUN is what warms Earth and its atmosphere
- Energy from sun is absorbed and changed into “*thermal energy*”
 - 25% scattered and reflected by clouds & air
 - 20% absorbed by ozone, clouds, and gases in air
 - 50% absorbed by Earth’s surface
 - 5% reflected by Earth’s surface

Radiation: Energy Transfer by WAVES

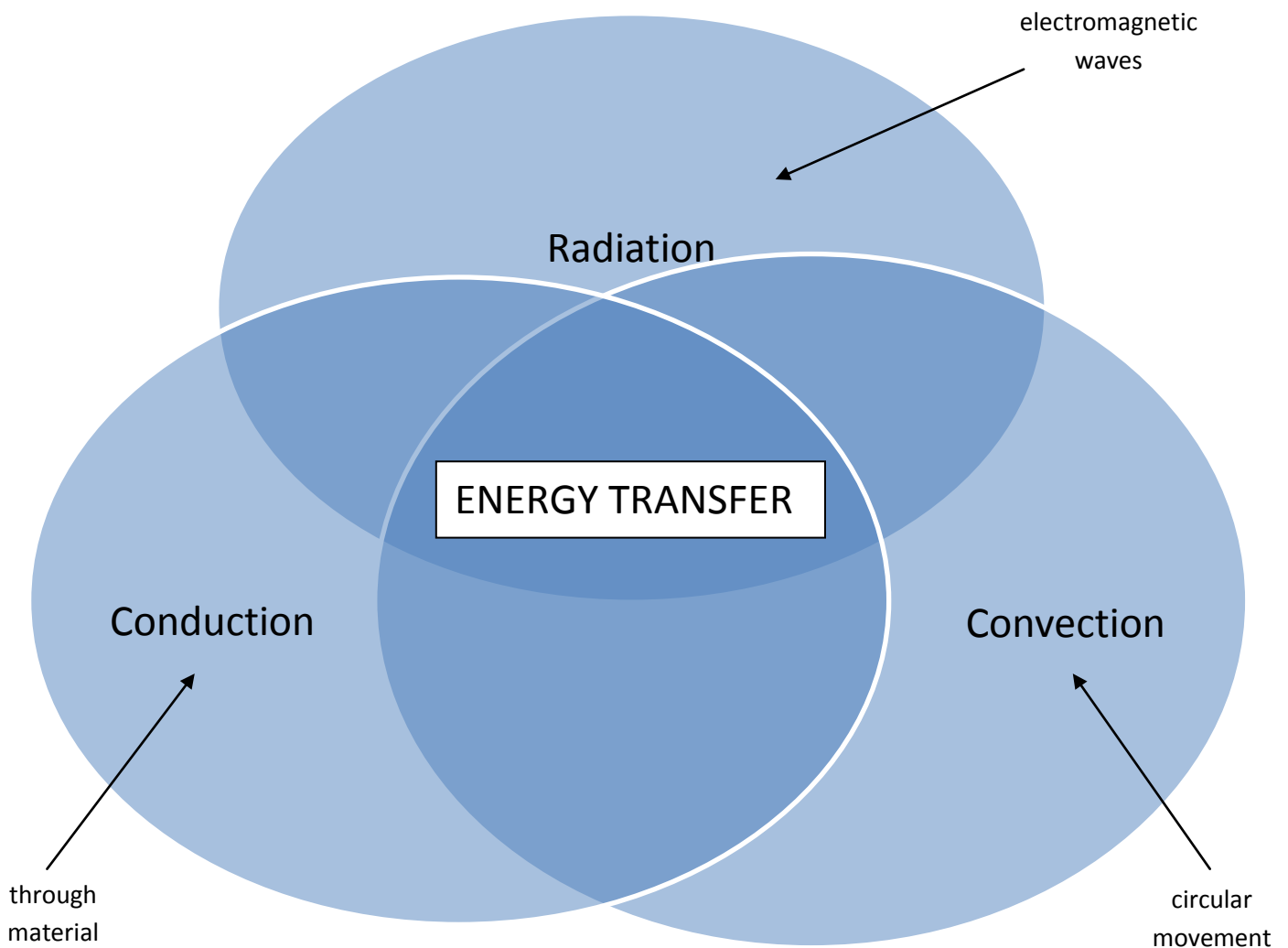
- Radiation = transfer of sun’s energy as electromagnetic waves
- Only **TWO-BILLIONTHS** of sun’s energy gets to Earth
 - That small amount of radiation from sun drives weather & makes Earth livable

Conduction: Energy Transfer by CONTACT

- Thermal Conduction = transfer thermal energy through a material (example: air molecules ... or ... your fingers ... or ... a spoon)
 - ALWAYS transferred from warm to cold
- YOU have experienced conduction when you touched something hot

Convection: Energy Transfer by CIRCULATION

- Convection = transfer thermal energy in liquid or gas by circulating / moving them
 - Cool air / water is dense & sinks
 - Warm air / water is less dense & rises
 - This CYCLE is called "*convection current*"
- YOU have witnessed convection when you boil a pot of water



The Greenhouse Effect and Life on Earth

- ~ 70% of short-wave VISIBLE light from the sun is absorbed by clouds and Earth's surface
 - Short-waves are converted into thermal energy (warms planet)

(AFTER short-waves are absorbed, they're reradiated BACK into atmosphere as long-wave thermal energy)
 - Atmosphere is like warm blanket that traps most of long-wave thermal energy and keeps it from going back into space. This trapped energy makes Earth livable.
- Greenhouse effect = **PROCESS** of trapping solar energy close to Earth
 - Atmospheric gases (e.g. water vapor & CO₂) absorb and "trap" thermal energy and radiate BACK to Earth like glass walls & roof of a greenhouse.

The Radiation Balance: Energy In, Energy Out

- Even though solar energy is "trapped" making Earth livable, it is eventually reradiated into space.
 - Earth receives more energy from sun every day so some MUST go back into space to maintain a balance (... called "*radiation balance*")

Greenhouse Gases and Global Warming

- Global Warming = increase in average global temperatures
 - 1 hypothesis: Caused by increased greenhouse gases like CO₂, which cause more absorption of thermal energy
 - Reason for increased greenhouse gases = humans burning fossil fuels and deforestation