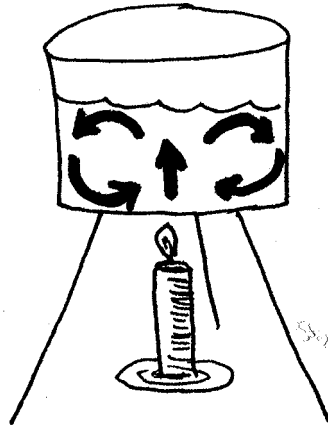


Energy in Earth Processes

- I. Energy - the ability to do work
- A. Electromagnetic Energy – energy given off by ALL matter (unless it at absolute zero), radiated in the form of **waves**.
1. Wavelength – determines the **type** (and name) of the energy.
 2. The total range of all *types* (wavelengths) of energy (from the smallest to the longest) is called the **electromagnetic spectrum**. (see Ref. Tables, page 14)
- B. Interaction of electromagnetic energy with the environment... energy can be:
1. reflected - bounced back (more on a smooth, white surface)
 2. refracted - bent
 3. scattered - in various directions
 4. absorbed - taken into the material (more on dark, rough surface)
- C. Potential and Kinetic Energy
- 1) Potential Energy - stored energy of position (greater the higher something is)
 - 2) Kinetic Energy - energy of motion (greater the faster something is moving).
- One can change into the other (swinging pendulum), though some energy is lost...turned into heat due to friction.
- II. Energy is transferred by:
- A. **Conduction** - transfer of energy (heat) through **molecular collisions**
1. **Happens in a SOLID** (where molecules are close together)
ex. frying pan on a stove
- B. **Convection** - transfer of energy (heat) in LIQUIDS and GASSES due to differences in temperature and density.
1. Hot air/water **rises** (is *less* dense) and is replaced by **sinking** cold air/water (is *more* dense).

A convection current:



- a.) Only works when heat source is at the **bottom**.
- b.) Examples are found in the hydrosphere, atmosphere, and mantle (see Ref. Tables ... p. 10 and p. 14)

C. Radiation - moving at the speed of light through space... **NO MEDIUM** (material) **NEEDED**.

1. Also moving through *air*, like the heat/light from a light bulb.

III. Heat Flow

A. Heat always flows from the **hot** thing to the **cold** thing

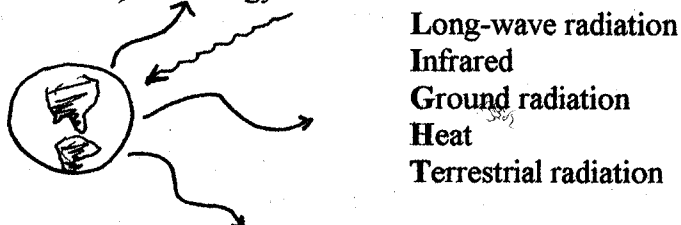
1. In a **closed system**, the amount of heat **lost** by the hot thing **equals** the amount **gained** by the cold thing... Law of Conservation of Energy.
2. Are always “leaks” of heat to the surroundings, though, so a closed system doesn’t exist.
3. When the hot thing and cold thing reach **equal** temperatures, heat flow stops, and both are at **dynamic equilibrium** (temp. stays the same).

IV. Transformation of wavelength

- A. Energy absorbed by an object will be re-radiated at a **LONGER** wavelength.

**“IN COME THE SHORT WAVES,
OUT GO THE LONG WAVES”**

Earth absorbs short wave, visible light from the sun, then re-radiates (gives back off) this energy as:



V. Temperature and Heat

- A. Temperature - the AVERAGE kinetic energy (motion) of the molecules in a substance.
1. Measured in degrees, using various scales
(See Ref. Tables, p. 13)
- B. Heat - how much TOTAL kinetic energy something has, based on its **size** and the **type** of substance.
1. Measured in Joules

VI. Specific Heat

- A. Not all substances heat up or cool down at the same rate.
(styrofoam cup vs metal cup)
1. The heat needed to raise the temp. of 1 gram of a substance by 1° C is called its **specific heat**. (see Ref. Tables, page 1)

NOTE: - Liquid water has the ***highest*** specific heat of all substances on the chart. This means it heats up SLOW (takes lots of heat to make it warm, and cools down SLOW (has to give off lots of heat to make it cool.)

VII. Phase changes (water) and energy (see Ref. Tables, p. 1)

<u>Process</u>	<u>meaning</u>	<u>Heat is:</u>
1. melting	change from a solid to a liquid	gained (334 J/g)
2. freezing	change from a liquid to a solid	released (334 J/g)
3. vaporization (evaporation or boiling)	change from a liquid to a gas	gained (2260 J/g)
4. condensation	change from a gas to a liquid	released (2260 J/g)

VIII. Earth's energy supply

A. Primary source for most Earth processes is the sun

1. Gives off all wavelengths of energy, but mostly **visible light**.

B. Radioactive decay - deep inside the earth

1. Is an additional source of energy for some earth processes, like mountain building and crustal movements.

IX. Energy generation

A. Solar - using sunlight directly (solar panels/ hot water)

B. Hydro-electric - falling water turns turbines to generate electricity

C. Wind - windmills turn turbines

D. Coal Burning - boils water... steam turns turbines

E. Nuclear - radioactive decay boils water for steam