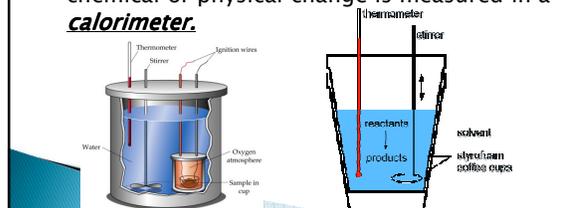


Thermochemistry: Temperature and Heat

Mr. Sudbury

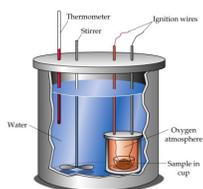
Thermochemistry

- ▶ **Thermochemistry** is the study of the transfer of energy as heat that accompanies chemical reactions and physical changes.
- ▶ The energy absorbed or released as heat in a chemical or physical change is measured in a **calorimeter**.



Calorimeter

- ▶ Contains a known amount of a substance (usually water).
- ▶ A hot object is placed in the water and you observe the change in temperature of the water.
- ▶ Able to determine how much heat was transferred.



Temperature

- ▶ How “hot” or “cold” you perceive something to be.
- ▶ Measured with thermometers.
- ▶ A measure of the average kinetic energy of particles in a substance.

Temperature

- ▶ Temperature is a measure of the average **Kinetic Energy** (KE) of the particles in a sample of matter.
 - The greater the KE in a sample, the higher the temperature, the hotter it feels.
 - This is because the particles are moving faster (more KE) and have more collisions.
 - At a cooler temperature, the particles move slower and have fewer collisions.
- ▶ The ability to measure temperature is based on heat transfer, and the amount of energy transferred is measured in joules (J).
 - The joule is the SI unit of heat as well as other forms of energy.
 - Heat energy can also be measured in calories: 1 cal = 4.18 J

Temperature Scales

- ▶ In thermochemistry, we use the Kelvin and Celsius scales.
 - 1 Degree change is the same in the Kelvin and Celsius scales.

$$K = ^\circ C + 273 \quad ^\circ C = K - 273$$

$$^\circ F = \frac{9}{5} ^\circ C + 32 \quad ^\circ C = \frac{5}{9} (^\circ F - 32)$$

Temperature Scales

- Convert 76°C to K.
 $K = ^\circ C + 273$
- Convert 24°C to °F.
 $^\circ F = \frac{9}{5}^\circ C + 32$
- Convert 323 K to °C.
 $^\circ C = K - 273$
- Convert 88 °F to °C.
 $^\circ C = \frac{5}{9}(\ ^\circ F - 32)$

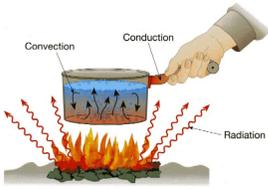
Heat

- Heat** can be thought of as the energy transferred between samples of matter because of a difference in temperature.
- Energy transferred as heat ALWAYS moves spontaneously from matter of higher temperature to matter at lower temperature.



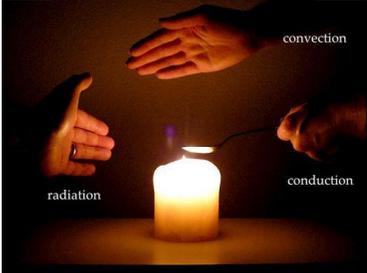
Heat Transfer

- Conduction** - Heat transferred through a material or through contact between two different materials.
- Convection** - Heat transferred through a fluid (liquid or gas). I.e. Convection currents.
- Radiation** - Heat transferred through electromagnetic waves. (Does not require matter to transfer heat).
- Heat transfer stops at thermal equilibrium.



Heat Transfer

- Conduction
- Convection
- Radiation



Heat Transfer

Conduction



Convection



Radiation



Heat Transfer



The End

▶ Summary

- Thermochemistry
- Temperature - Measurement of average KE in a material.
 - Temp. scale conversions.
- Heat - Transfer of thermal energy
 - Always moves hot to cold.
 - Convection-conduction-radiation.

