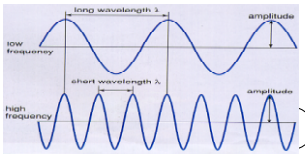
Radiant Energy

- Electromagnetic Waves
- Light
- Calorimetry

Electromagnetic Waves

Light, X-rays, gamma rays and radio waves are all examples of electromagnetic radiation. Waves can be described by five properties:

1) Amplitude - the height of the wave. (m)
2) Wavelength - A crest and trough of a wave (m)
3) Frequency - how fast the wave oscillates up and down per second. (Hz)



Electromagnetic Waves

More Properties:

4) Speed - electromagnetic radiation all moves at a constant speed 3 x10^8 m/s.
5) Energy - amount of work done by the wave (J)

From these properties, we can determine the wavelength and the frequency using the equation:

$$v = \lambda f$$

Planck's Theory

As wavelength increases, the ability of the radiation to penetrate bodies decreases. This means that higher frequencies have more energy, which can be related by Planck's theory:

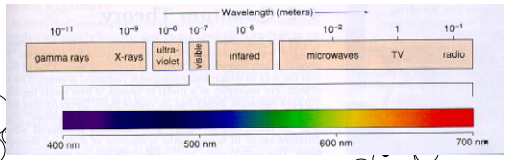
$$E = hf$$

h is Planck's constant = 6.63×10^{-34} J•s

Types of EM Radiation

There are 7 types of electromagnetic radiation:

1) Radio waves - lowest E
2) Microwaves
3) Infrared (IR) - heat
4) Visible Light - only type visible
5) Ultraviolet (UV)
6) X-rays
7) Gamma Rays - highest E



The Visible Spectrum

The visible spectrum of the electromagnetic spectrum is quite small in comparison to the rest of the electromagnetic spectrum.

Light is produced by a luminous body, and visible light has 7 natural colors - ROYGBIV

Calorimetry

The study of heat flow and heat measurement

Calorimetry experiments determine the heat changes of reactions by making accurate measurements of temperature changes within a calorimeter.

Heat & Specific Heat

The temperature increase depends on the specific heat of the surroundings. The specific heat tells how much heat is required to increase the temperature of 1 gram of a material by 1 degree Celsius.

The equation for finding the heat lost or gained is: $Q = mc\Delta T$, where c is the specific heat of the substance. ($c_{water} = 4.184$ J/g °C)

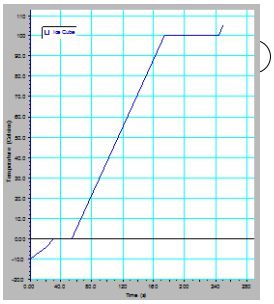
The heat lost (or gained) in the reaction is equal to the heat gained (or lost) by the surroundings, or $Q_{rxn} = -Q_{sur}$

Heating Curves

As something is heated from a solid to a liquid to a gas with constant heat, there are two abnormalities to the curve.

The two abnormalities occur at the fusion and vaporization (melting and boiling) points of the substance.

It is also observed that the specific heat for solids are different from liquids which are different from gases.



Heat of Vaporization & Fusion

The temperature of the substance does not increase until all of the solid (or liquid) has melted (or boiled off). The amount of heat needed to melt and boil a substance is called its heat of fusion and heat of vaporization.

ΔH_f = 334 J/g for water

ΔH_v = 2260 J/g for water