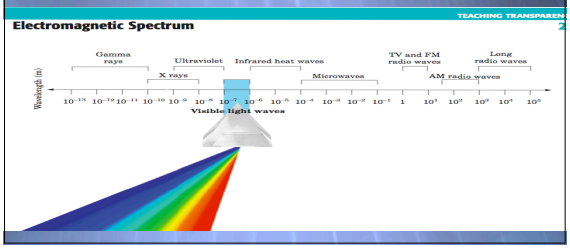
Atomic Theory Part 2

Chem10

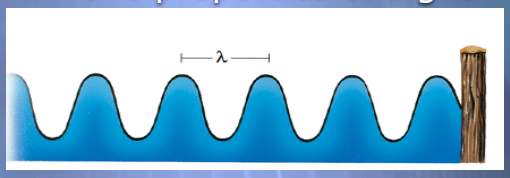
Thursday, June 24, 2010

Wave properties of Light

- Visible light is a form of electromagnetic radiation *a form of energy that exhibits wavelike behavior as it travels through space*



Wave properties of Light



Wave motion is repetitive in nature

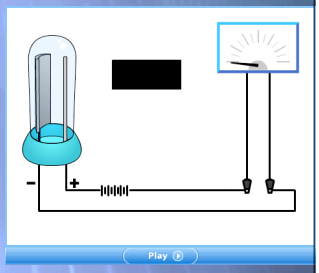
- Wavelength (λ) distance between corresponding points on adjacent waves
- Frequency (ν) number of waves passing a given point in a specified time

$c = \lambda \nu$

Particle properties of light

Photoelectric effect: emission of electrons from a metal when light shines on the metal

- Minimum frequency of light required to do this
- Contrary to wave theory of light



Particle properties of light

Max Planck suggested that objects emit energy in small quantitized packets called quanta

$E = h \nu$

E = energy in *Joules*

h = Planck's constant 6.626×10^{-34} J•s

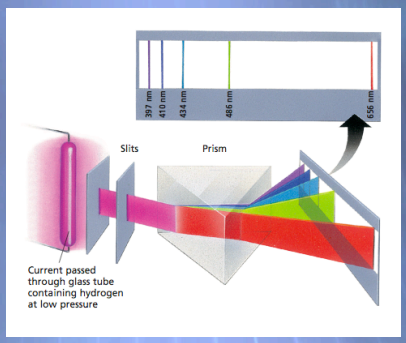
ν = frequency in s^{-1}

- Different elements required different energy to eject an electron

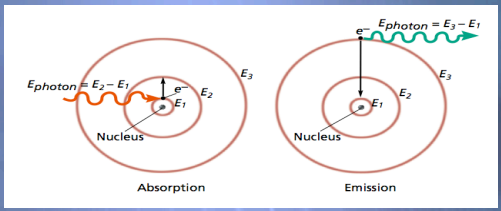
Einstein said light behaves as both a particle and wave (Dual wave-particle nature)

- Einstein called the quanta Photons

Hydrogen's Emission Spectrum



Bohr's interpretation



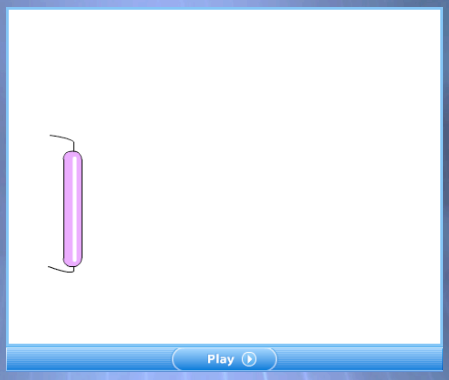
Ground state: lowest energy state of an atom

Excited state: state in which an atom has a higher potential energy than ground state

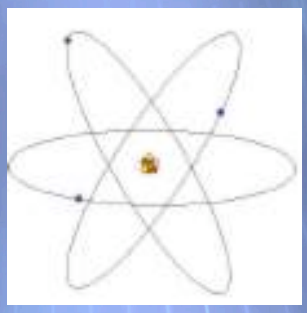
- As electrons drop to lower energy levels, light in specified wavelengths are emitted

Bohr Model

- Electrons exist in well-defined, specific paths or **orbits** that circle the nucleus
- Planetary Model or Orbit Model

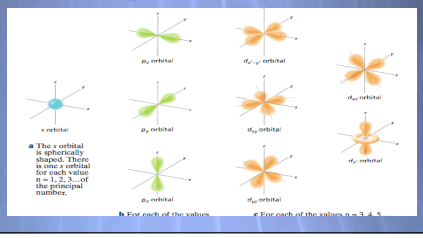


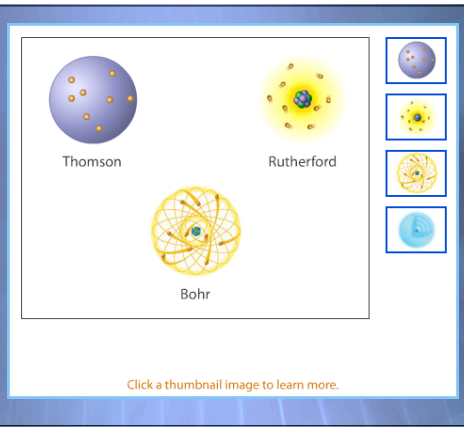
Bohr Model



Quantum "Cloud" Model

- Currently accepted atomic model
- Electrons exist in orbitals: 3-Dimensional clouds of probability that surround the nucleus
- Electrons move so fast ($3x10^8$ m/s or 671million mph) that they are thought to be everywhere at once





Quantum Mechanical Model