

# 4-1 A New Atomic Model

## Electromagnetic Radiation

### Section 4-1

Electromagnetic Radiation – form of energy that has wavelike behavior as it travels through space

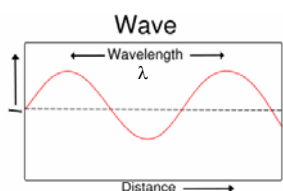
Electromagnetic Spectrum – all forms of electromagnetic radiation presented together (p92)

Energy travels at  $3 \times 10^8$  m/s through space (air)

Wavelength ( $\lambda$ ) – Distance between corresponding points of an adjacent wave (measured in meters or nanometers)

Frequency ( $\nu$ ) – Number of waves that pass over a period of time

1 wave/second = 1 Hz



$c = \lambda \nu$  where  $c = 3 \times 10^8$  (speed of light)

$$\frac{c}{\lambda} = \nu \quad \frac{c}{\nu} = \lambda$$

1

### Section 4-1 (Cont'd)

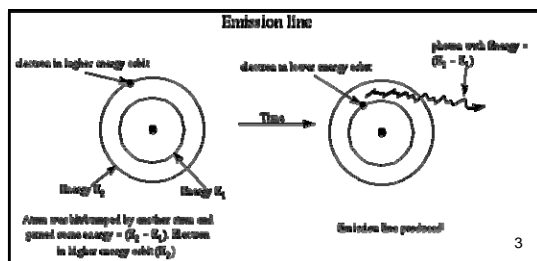
Different elements have different line emission spectra

Lyman Series	Balmer Series	Paschen Series
Ultraviolet Light	Visible Light	Infrared Light

Bohr Model

- electrons travel in specific paths called orbitals
- energy levels are like rungs on a ladder
- energy can move an electron from one orbital to another orbital using the exact amount of energy difference of the orbitals
- when an atom drops to a lower state, a photon is emitted

$$E_{\text{photon}} = h\nu$$



### Section 4-1 (Cont'd)

Photoelectric Effect – emission of electrons from a metal when a light shines on the metal

Quantum – minimum quantity of energy that can be lost or gained by an atom

$E = h\nu$  where  $h = 6.626 \times 10^{-34}$  J-s (Planck's Constant)

Photon – particle of electromagnetic radiation with zero rest mass and carrying a quantum of energy

Ground State – lowest energy state of an atom

Excited State – atom at a higher potential energy than the ground state

Line Emission Spectrum - bands of light at specific frequencies that have been separated by a prism

Study of hydrogen's emission led to the Quantum Theory

When an excited atom moves to ground state it releases photon

