Chem 115 Notes
4/1/08

*Test is very math heavy – use extra time to practice math

Describing Waves
*Light travels slower in higher density
*Sound travels faster in higher density
*Light travels at the same speed in the same medium
- In a vacuum, light travels at the speed of light, no faster, no slower
*Wavelengths are represented as λ, size of λ is usually described as long/short
*Frequency is represented as ν, size of ν is usually described as high/low
*Speed – How fast the wave is traveling
*Relation between wavelength and frequency is inverse

Amplitude = How high the wave goes
Wavelength = How long the wave is
Frequency = How fast a certain point on the wave moves up and down
If wave is flat = no disturbance

Light and other electromagnetic waves
c = speed
ν = frequency, measured in s^{-1} or Hz
λ = wavelength, measured in nm, which you convert to m

Electromagnetic spectrum divided up based on frequency
Short wavelength = 10^{-11}
Long wavelength = 10^{3}
High frequency = 10^{20}
Low frequency = 10^{4}

When colors are blended as in a rainbow, every wavelength is available

How light waves differ from each other
Visible wavelength is longer than UV light wavelength
Visible light frequency is lower than UV light frequency

Calculation of Light Properties
Speed of light = m/s
*must convert nm to m
s^{-1} = s is in denominator (there is a one (1) in numerator)
$c = \lambda \nu$
speed [m/s] = (wavelength [in m])(frequency [in s^{-1}])

Hz = frequency of waves (Hertz)

Black Body Radiation

Lava gives off red glow because it is so hot (same as electric stove)

High frequency = short wavelength

*You can tell the temperature of something that is glowing by the color that it glows

Planck's Genius

Oscillation = vibration energy

n = 1,2,3,4 (must be whole number – not 1.5, etc)

h = Planck's constant

*Light energy is relative to oscillation

*Solves ultraviolet catastrophe

Other properties of light

*Phenomenon of reflection

Waves: when looking in mirror, light waves reflect off of the metal behind the glass

Particle: Ball bounces on floor and bounces back (ball = particle)

*Diffraction – defined by wave behavior, see demonstration in class of laser beam passing through a diffraction grating

*Light as waves vs. particles

- If light were particles, we would see only one point as the light passes through diffraction grating
- Since light is transmitted as waves, we see numerous light dots as the beam passes through the diffraction grating

Photoelectric effect

Quantum energy - 250 nm wavelength light particles shot at zinc = 2 different speeds of electrons removed from zinc

1. Electrons at ground state: the energy from the photon goes into promoting the electron from the ground state to leaving the atom, and then the small amount of energy left over is seen as kinetic energy of the electron leaving the atom
2. Electrons at excited state: the energy of the photon goes into promoting the electron from the higher level excited state to leaving the atom, so there is more energy left over to go into kinetic energy of the electron leaving the atom, so these are the faster speed electrons we saw

You can play with the photoelectric effect experiment simulation yourself at http://phet.colorado.edu/new/simulations/sims.php?sim=Photoelectric_Effect

Click on the blue "run offline" button if you want to download the program to your own computer to run

Key points from today

**Know what s^{-1} means

$E = h\nu$ is the equation for photons (particles) of light