

Chapter 4 – Electron Structure and the Periodic Table

Electronic Structure – the way an atoms electrons are arranged **EMR**-X rays, light, IF, UV, Gamma, etc

Amplitude – maximum height of peaks. **Wavelength** – distance between consecutive peaks

Frequency (v) – number of peaks that pass a given point in 1 second. **Speed of wave = Wavelength * Freq**

Hertz – Hz, number of vibrations/second **Speed of light = $3 * 10^8$** **WL = wavelength**

Continuous spectrum – all wavelengths of light are present. Each element produces unique set of WL's

Line spectrum/Atomic Emission Spectrum– element that's excited, only certain wavelengths/colors

Rydberg Equation– $1/\lambda = 109,678 \text{ cm}^{-1} * [(1/n_1^2) - (1/n_2^2)]$ n_2 greater than n_1 (if $n_1 = 1$, n_2 equals 2, 3, 4, etc. (Lyman Series) $n_1 = 2$, $n_2 = 3, 4, 5$, etc. (Balmer Series)_ $n=3$ (Paschen) $n=4$) Brackett) Page 109/110

Moseley – dude that concluded that the freq of X rays depended on the material used for the anode

Atomic number represented the # of proton in nucleus. Electrons move /w acceleration, they give off EMR

Light also has particle properties, sometimes, behaves like tiny packets, called **photons**

Energy of photon = frequency * h (Planck's constant, $6.63 * 10^{-34}$ Joule seconds)

Light is emitted by an atom only at certain frequencies, so electron is **quantized**, only has certain energies

Energy of the electron = $-A * (1/n^2)$. $A = 2.18 * 10^{-18}$ **n = quantum #, whole #'s only 1 is lowest NRG**

Wave mechanics – theory explaining the behavior or electrons in atoms $E=mc^2$

Calculating the wavelength of a PARTICLE. Wavelength = $6.63 * 10^{-34} / (mv)$

Diffraction – light passes through slit whose width is the same as WL, slit acts as a light source, scatters light

Diffraction pattern – the pattern in which a slit diffracts light

In Phase – two waves add to greater intensity **Out of phase** – waves canceled each other out

Node – place of 0 amplitude. **Antinode** – height of amplitude **Standing Waves** – waves w/ stationary nodes

Electron “waves” are standing waves. However, since there are 3 dimensions, 3 quantum numbers

n – principle quantum number. The greater the n, the greater the average distance of the electron from nucleus.

N starts from 1, 2, 3, to infinity. 1 is the K shell, 2 L, 3M, 4N, etc. Determines number of shells

L – azimuthal quantum number each main shell has 1 or more subshells, starts from 0, 1, 2 – n-1 for that shell

Ground State – state of lowest energy.

M – Magnetic Quantum Number – orbital within a particular subsheel is distinguished by it's value of m.

Always in the range of $-L - +L$. If $l = 1$, then 3 orbitals, -1, 0, 1, so 2p orbital. Know electron hotel

Spin = to complete the set of 4 quantum numbers, each orbital can hold 2 electrons, so $+1/2$ or $-1/2$ spin

Pauli Exclusion Principle – no two electrons in any one atom may have all 4 quantum numbers the same

Diamagnetic – no attraction for another magnet **Paramagnetic** – weakly attracted

Ferromagnetic – REALLY attracted. All attractions/non attractions due to electrons pin

Electron configuration – the way the electrons are distributed among the orbital. Read Sec 4.5 – 4.7

As you go down a column, atom size goes up. Left to right, atom size goes down. Read study cards for reason

Lanthanide contraction – Hf is the same size as Zr, even though Hf is lower, due to the decrease in size of the lanthanides. **Positive ions are smaller than normal** (electrons removed to get noble gas config, less electrons, less -/- repulsion, more +/- repulsion, less shielding, smaller atom)

Negative ions are larger (Pick up electrons, more shielding, more -/- repulsion, outer shell increases in size)

Ionization energy – energy required to remove an electron from an isolated gaseous atom in ground state

Ionization energies increase as you get closer to nucleus (more +/- attraction).

Electron Affinity – energy that is released or absorbed when an electron is added

First electron is exothermic due to attraction, 2^{nd} is endothermic due to -/- repulsions. Read pages 138/139