MIND MAP

Atomic Structure

Rutherford's Gold Foil Experiment

$1eV = 1.6 \times 10^{-19}$ J

1. Most of the α-particles (nearly 99.9%) went straight without suffering any deflection.
2. A few of them got deflected.

Value of charge on electron $= 1.602 \times 10^{-19}$ C

The distance of closest approach for α-particle is $\boxed{r = \dfrac{2KZe^2}{K.E._{\alpha}}}$

Energy During Transitions

$$\Delta E = E_{\text{final state}} - E_{\text{initial state}}$$

$$\Delta E = 13.6\left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]Z^2 \quad (\text{in eV})$$

$$E = -13.6 \times \frac{Z^2}{n^2}\ \text{eV}$$

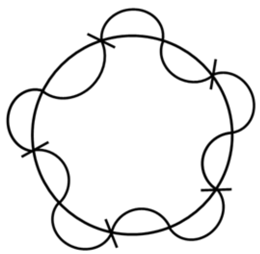
$$\frac{1}{\lambda} = R\left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]Z^2$$

−0.85 eV — n = 4, 3rd excited state

−1.51 eV — n = 3, 2nd excited state

−3.4 eV — n = 2, 1st excited state

−13.6 eV — n = 1, ground state



For nth Shell

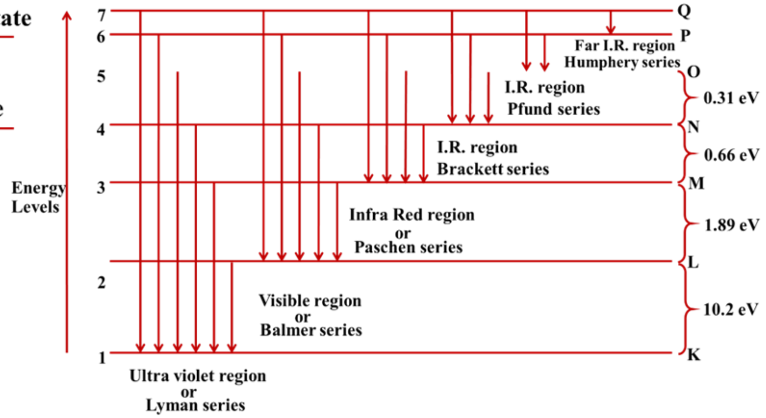
$\boxed{2\pi r = n\lambda}$

Bohr's Postulate

Electrons can revolve only in those orbits whose angular momentum (mvr) is integral multiple of $\dfrac{h}{2\pi}$ $\quad mvr = \dfrac{nh}{2\pi}$

$$\frac{k\,(Ze)\,e}{r^2} = \frac{mv^2}{r}$$

Hydrogen Line Spectrum



Radius of Bohr orbit:

$$r = \frac{n^2h^2}{4\pi^2 mKZe^2} \qquad r_n = 0.529\,\frac{n^2}{Z}\,\text{Å}$$

Bohr Radius $'a_0' = 0.529$ Å

Energy Of Electrons $\quad E = -KE = \dfrac{PE}{2}$

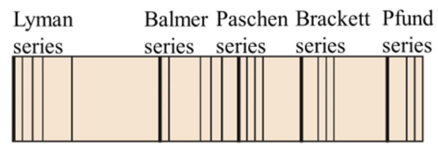
$$E = Rhc\,\frac{Z^2}{n^2}$$

R is 'Rydberg Constant' $\approx 1.1 \times 10^7\ m^{-1}$

$$E = -21.8 \times 10^{-19} \times \frac{Z^2}{n^2}\ J$$

Velocity of electron: $v = \dfrac{2\pi KZe^2}{nh}$

$$v = 2.2 \times 10^6\ \frac{Z}{n}\ \text{m/s}$$



Total no. of emission lines between n_2 & n_1 ($n_2 > n_1$) are

$$\frac{(n_2 - n_1 + 1)\,(n_2 - n_1)}{2}$$