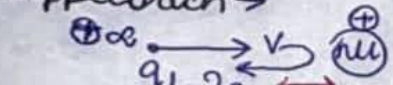
ATOMS

Rutherford scattering experiment :-

- Distance of closest approach →



$q_2 = Ze$ B

$$\frac{1}{2}mv^2 = \frac{Kq_1q_2}{r_0}$$

Bohr's Model Atom :-

→ only valid for hydrogen like species.

→ Angular momentum;

$$mv_r = \frac{nh}{2\pi}$$

$$r_n = 0.529 \times \frac{n^2}{Z} \text{ Å}$$

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

n = Principal quantum number.

Energy of n^{th} orbit :-

$$E_n = E_1 \cdot \frac{Z^2}{n^2}$$

$$E_{total} = -13.6 \frac{Z^2}{n^2}$$

$$E_{KE} = +13.6 \frac{Z^2}{n^2}$$

$$E_{PE} = -27.2 \frac{Z^2}{n^2}$$

$$|E_{Total}| = |E_{KE}|$$

n = 1 (ground) = −13.6

n = 2 (1st excited) = −3.4

n = 3 (2nd excited) = −1.51

n = 4 (3rd excited) = −0.85

Energy gap :-

$n_1 \rightarrow n_2 = 10.2 eV$

$n_2 \rightarrow n_3 = 1.89 eV$

$n_3 \rightarrow n_4 = 0.66 eV$

$E_{excitation} = E_f - E_i$

$n_2 \rightarrow E_f$

$n_1 \rightarrow E_i$

$$E_{exi} = 13.6 \left[\frac{1}{n_S^2} - \frac{1}{n_L^2}\right]$$

$$\frac{1}{\lambda} = R\left(\frac{1}{n_S^2} - \frac{1}{n_L^2}\right)$$

R = Rydberg's constant

Ionisation Energy :-

$$E_{ion} = +\frac{13.6}{Z^2}$$

$R = 1.097 \times 10^7 \text{ m}^{-1}$

SPECTRAL LINE :-

Lyman → Ultra Violet

Balmar → Visible

Pashchen → IR

Brackett → I.R

Pfund → I.R

$\downarrow E = \frac{hc}{\lambda\uparrow}$ → any first line of any series shows min energy i.e mass energy where as vice a versa with its last line of Spectrum.

Ques

what is the ratio of the shortest wavelength of the Balmar series to the shortest wavelength of lymann series?

Balmar: $n = \infty \rightarrow n = 2$

$$\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{\infty}\right)$$

$$1/\lambda_B = 4/R$$

lymann: $n = \infty \rightarrow n = 1$

$$\frac{1}{\lambda_L} = R\left(\frac{1}{1} - \frac{1}{\infty}\right)$$

$$\frac{1}{\lambda_L} = \frac{1}{R}$$

$\therefore 4 : 1$ Ans

Number of Transition :-

$$\frac{n(n-1)}{2}$$

from nth state higher orbital