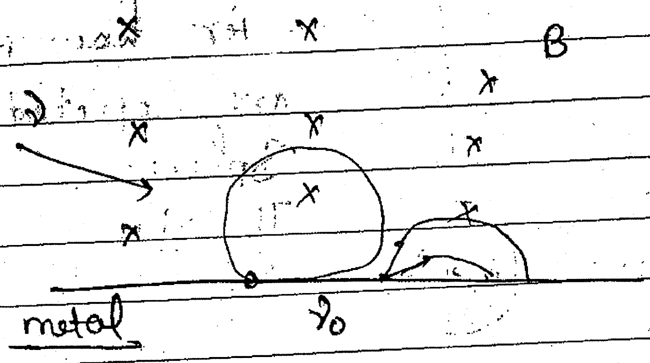
Q.3



what maximum distance of a electron from metal surface after ejections.

$$r_{max} = \frac{\sqrt{2m E_{max}}}{eB}$$

$$E_{max} = h\nu - h\nu_0$$

$$2r_{max} = \frac{2\sqrt{2m E_{max}}}{eB}$$

De-broglie Wavelength

As the light shows dual nature of wave and particle together similarlily the particles, also shows dual nature.

The wave associated with particle ~~matter~~ is called matter wave.

Wavelength of ~~metal~~ matter wave is given by $\lambda = \frac{h}{p}$

$$= \frac{h}{mv} \text{ — speed}$$

$$= \frac{h}{\sqrt{2mE}}$$

PAGE NO.: SN
DATE: / /

$\frac{h}{\sqrt{2mqV}}$ V is voltage (V)

$K.E = qV \rightarrow$ P.D

$$\boxed{\lambda = \frac{h}{p} = \frac{h}{m v_{speed}} = \frac{h}{\sqrt{2mE}} = \frac{h}{\sqrt{2mqV_{P.D}}}}$$

Q1 If proton and α-particle are accelerated through same P.D what is ratio of their debroglie wavelength.

Ans
$$\lambda = \frac{h}{\sqrt{2mqV}}$$

$$\lambda_p = \frac{h}{\sqrt{2 \times 1 \times 1 V}} \qquad \lambda_\alpha = \frac{h}{\sqrt{2 \times 4 \times 2 \times V}}$$

$$\frac{\lambda_p}{\lambda_\alpha} = \frac{2\sqrt{2}}{1}$$

Rest

p_1 b_2

m_1 m_2

$$\vec{p_1} + \vec{b_2} = 0$$

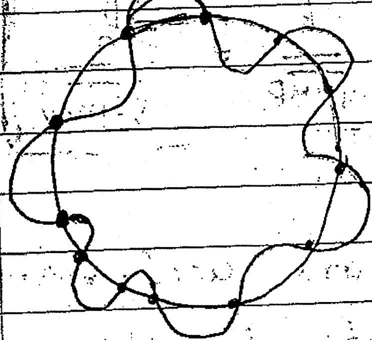
momentum not same due to direction because momentum is (vector).

$$|\vec{p_1}| = |\vec{b_2}|$$

$$\lambda_1 = \lambda_2$$

PAGE NO.:
DATE: / /

If an electrons revolve in Bohr's orbit its circumference is n times of de-broglie wavelength where n is principal quantum number.



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

$$2\pi r = \frac{nh}{mv}$$

~~circumference~~ $= n\lambda m$

$$\boxed{\text{circumference} = n\lambda m}$$

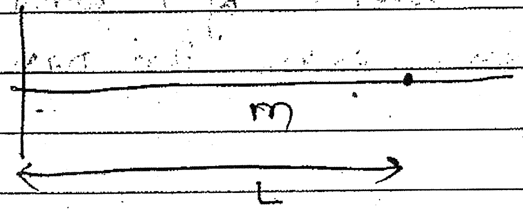
wave function of the wave associated with any particle represents the probability of finding of particle at a place or (position)

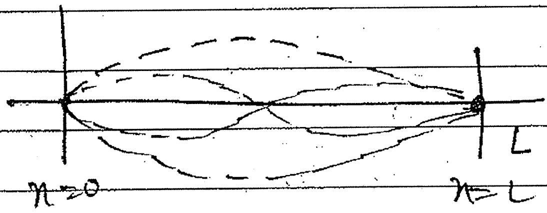
Place where wave function is zero, electron finding in zero.

For free particle the wave function is in form of progressive wave, while for a bound particle the wave function is in form of standing wave.

Q1 A particle of mass m is bound to exist b/w $x=0$ & $x=L$, find possible value of energy of particle (i)

Find the minimum energy that particle can be observed.





$$L = n\frac{\lambda}{2}$$

$$\lambda = \frac{2L}{n}$$

$$\frac{h}{p} = \frac{2L}{n}$$

$$p = \frac{nh}{2L}$$

$$E_n = \frac{p^2}{2m} = \frac{n^2h^2}{8L^2m}$$

$$(\Delta E)_{min} = E_2 - E_1$$

$$= \frac{3h^2}{8mL^2}$$

Q.2 If two particles are moving mutually $\perp$ such that their de Broglie wavelength are λ_1 and λ_2 respectively.

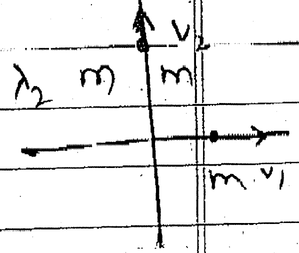
(i) Find debroglie wavelength of 1 w.r.t to other

(ii) Find debroglie wavelength of 1 w.r.t to centre of mass (assume that masses are equal.

→

$$\lambda_1 = \frac{h}{mv_1} \qquad \lambda_2 = \frac{h}{mv_2}$$

$$\lambda_{1/2} = \frac{h}{mv_{1/2}} = \frac{h}{m\sqrt{v_1^2+v_2^2}}$$



$$m = \frac{h}{\sqrt{\frac{h^2}{m^2\lambda_1^2}+\frac{h^2}{m^2\lambda_2^2}}}$$

$$\vec{v}_{cm} = \frac{v_1\hat{i}+v_2\hat{j}}{2}$$

w.r.t m

$$\vec{p}_1 + \vec{p}_2 = 0$$

$$\vec{p}_1 = -\vec{p}_2$$

$$\lambda_{1/cm} = \frac{h}{m|\vec{v}_{1/cm}|}$$

$$= \frac{h}{m\left|v_1\hat{i} - \left(\frac{v_1\hat{i}+v_2\hat{j}}{2}\right)\right|}$$