Doubt Clearing Session

Course on Atomic Structure for Class XI

akhilesh • Lesson 12 • Sept 15, 2021

44 100%

720

18 Rank - 1

685 → 450

396 topper 10

52

$$2\pi\left(0.529\,\frac{n}{Z}\right) = \lambda$$

$$2\pi\, r_0\, \frac{n}{Z} = a \times \pi r_0$$

$$2\cancel{\pi}\, \cancel{r_0}\, \frac{4}{1} = a \times \cancel{\pi}$$

$$\underline{\underline{a = 8}}$$

50

$$KE = \frac{1}{2} mv^2 \qquad \lambda = \frac{h}{mv}$$

$$= \frac{1}{2} \frac{(mv)^2}{m} = \frac{1}{2} \cdot \frac{1}{m} \frac{h^2}{\lambda^2}$$

$$KE = \frac{h^2}{2m} \frac{1}{\lambda_1^2}$$

$$\frac{hc}{\lambda} = \Delta KE = \Delta TE = \frac{h^2}{2m} \left[\frac{1}{\lambda_1^2} - \frac{1}{\lambda_2^2} \right]$$

53 $\lambda = \dfrac{h}{\sqrt{2mqV}}$

$$= \sqrt{\frac{150}{V}} \times \frac{1}{\sqrt{2}} \frac{1}{\sqrt{1836 \times 4}}$$

55 $\hbar = \dfrac{h}{2\pi}$

$d\lambda = 10^{-12}$ $\lambda = 5000\ A^{\circ}$

Schrodinger eqn : $\longrightarrow$ (Quantum mechanical Model)

$\longrightarrow$ based on quantum mechanism

$\longrightarrow$ Based on dual nature of particle

$$\left[\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} + \frac{\partial^2 \psi}{\partial z^2} + \frac{8\pi^2 m (E - V)}{h^2} \psi = 0\right]$$

E = Total Energy

V = Potential Energy

ψ = Wave function or amplitude of wave

$$\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z} = \nabla = \text{Nabla } \underline{\text{operator}}$$

del

$$\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} = \nabla^2$$

∇f

Laplacian operator

$$\underline{\nabla^2 \psi} + \frac{8\pi^2 m (E-V)}{h^2}\psi = 0$$

$$\frac{8\pi^2 m (E-V)}{h^2}\psi = -\nabla^2\psi$$

$$(E-V)\underline{\underline{\psi}} = -\frac{h^2}{8\pi^2 m}\nabla^2\psi$$

$$E\psi = -\frac{h^2}{8\pi^2 m}\nabla^2\psi + V\psi$$

$$E\psi = \left(-\frac{h^2}{8\pi^2 m}\nabla^2 + V\right)\psi$$

$$\boxed{E\psi = H\psi}$$

Hamiltonian operator

$\psi = f(x, y, z)$

$\psi = f(r, \theta, \phi)$

$\psi = f(r) \cdot f(\theta, \phi)$

$= R(r) \cdot \Theta(\theta, \phi)$

Radial part

(n, l)

Angular part

(l, m)

n, l, m

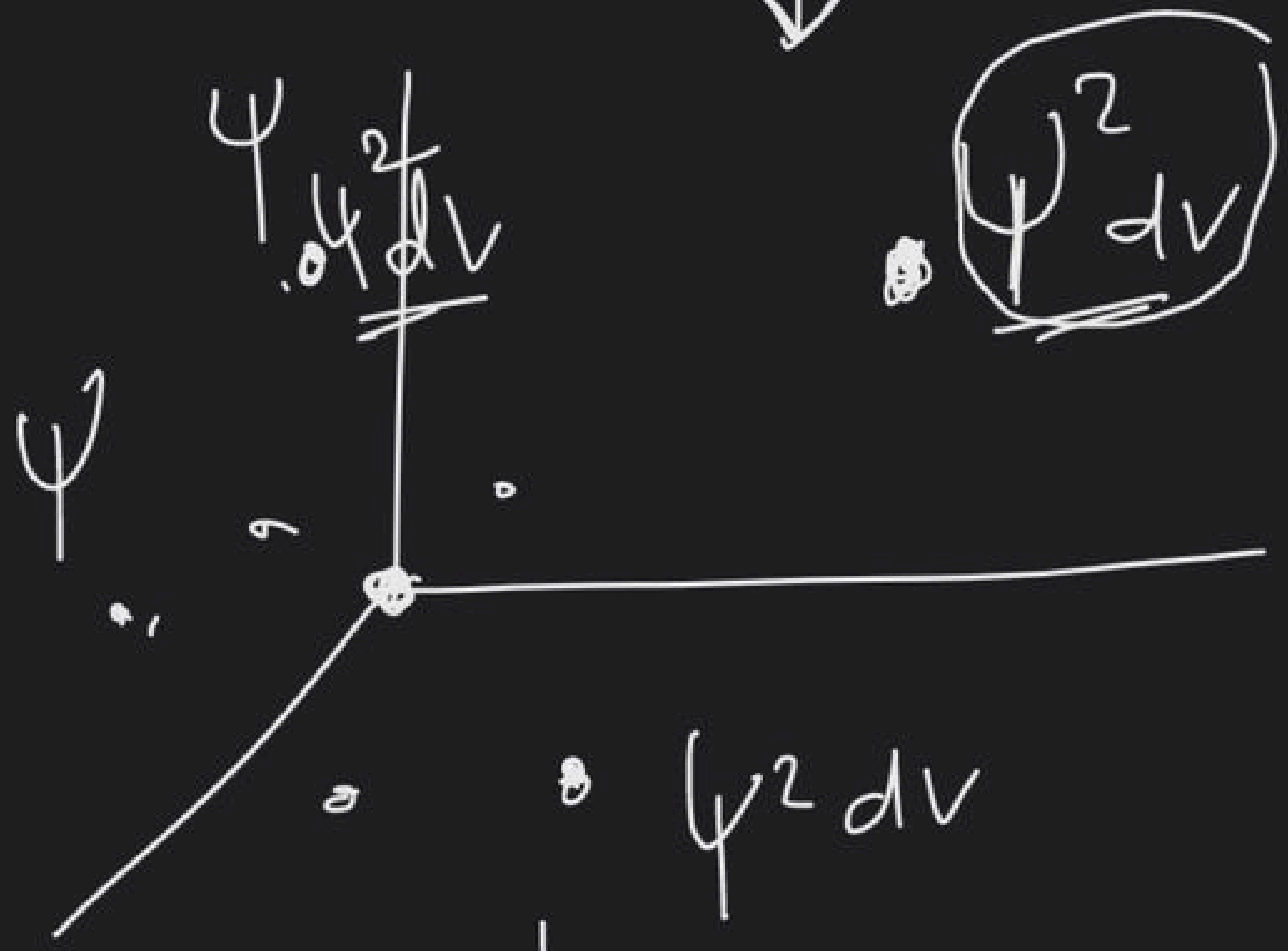
Integration

$n = 1, 2, 3 \ldots\ldots$

$l = 0, 1, 2 \ldots\ldots (n-1)$

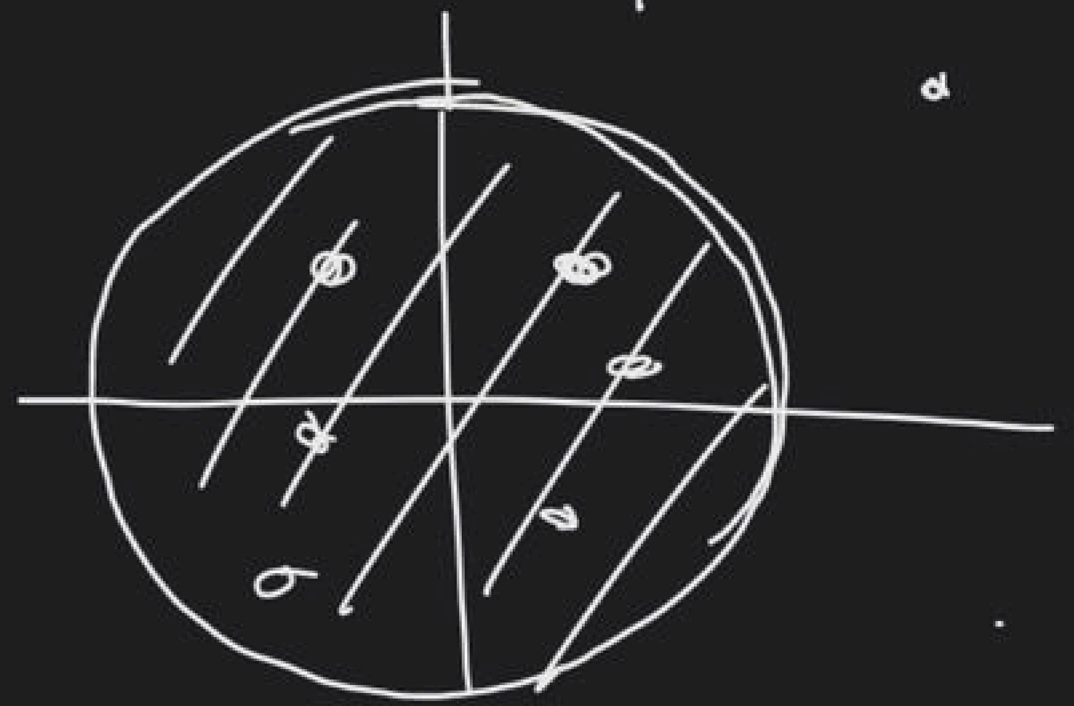
$n = 1 \quad l = 0 \quad m = 0$

$n = 2 \quad l = 1 \quad m = 0$



ψ^2 = Probability density
or
probabity per unit volume

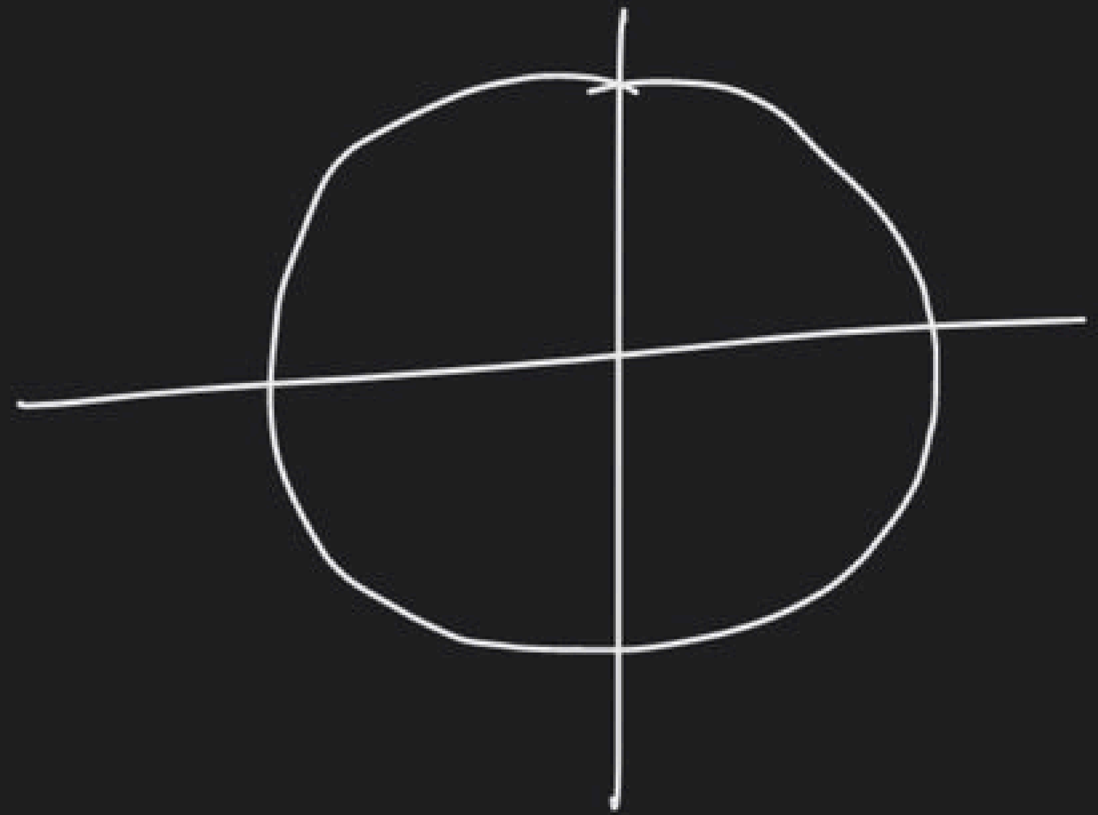
$\psi^2 dv$ = Probability



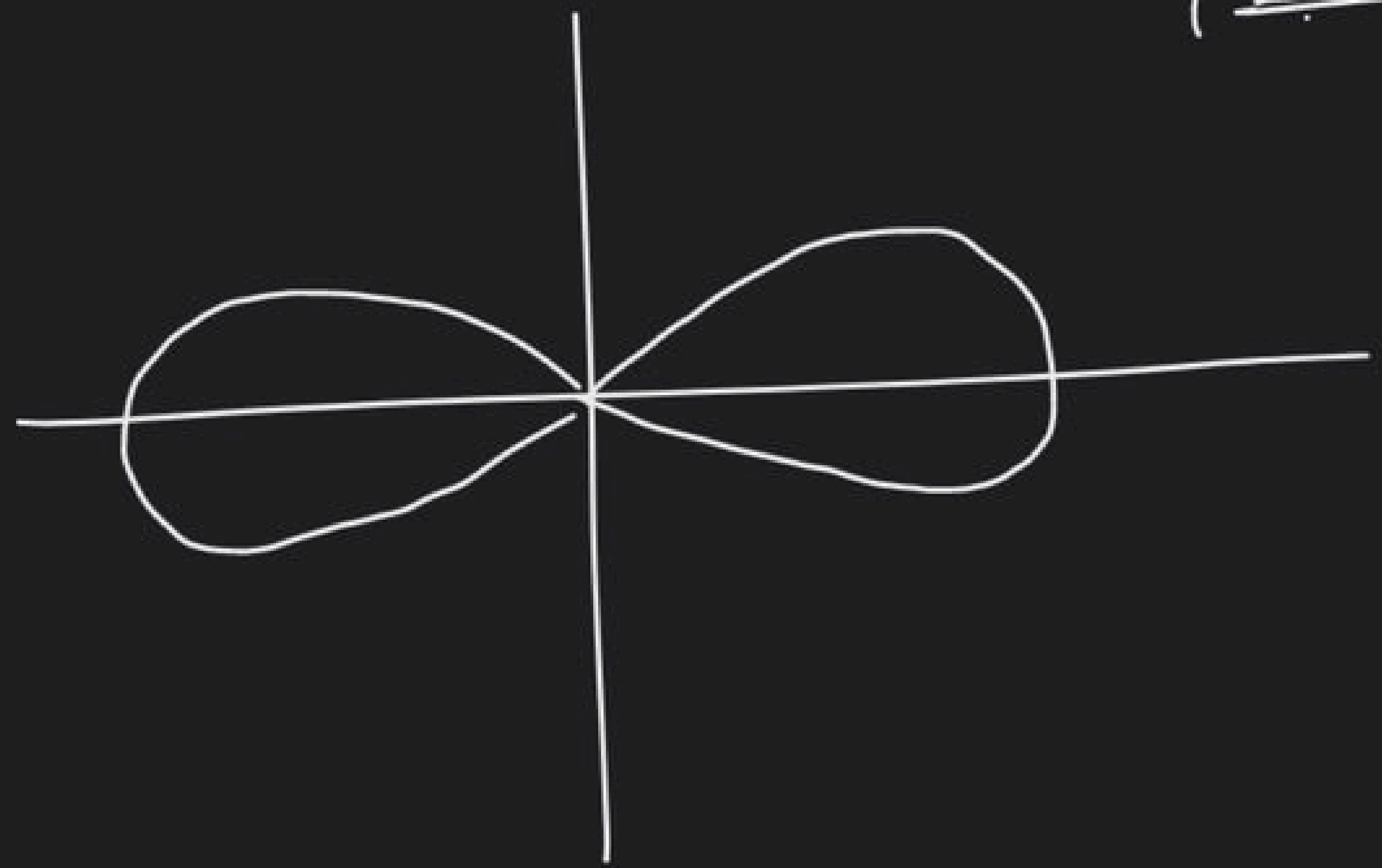
$\simeq 90\%$ orbital

Orbital : Volume in which probability of finding an e^- is nearly 90%..

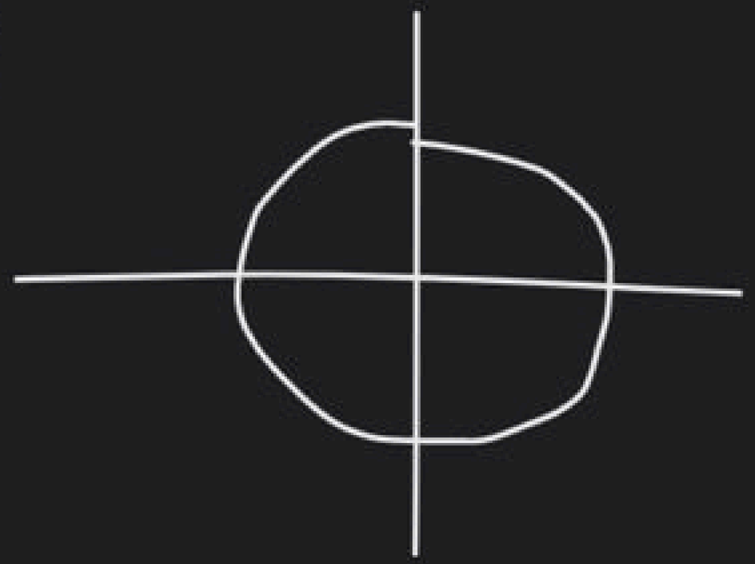
$n=2 \quad l=0 \quad m=0$

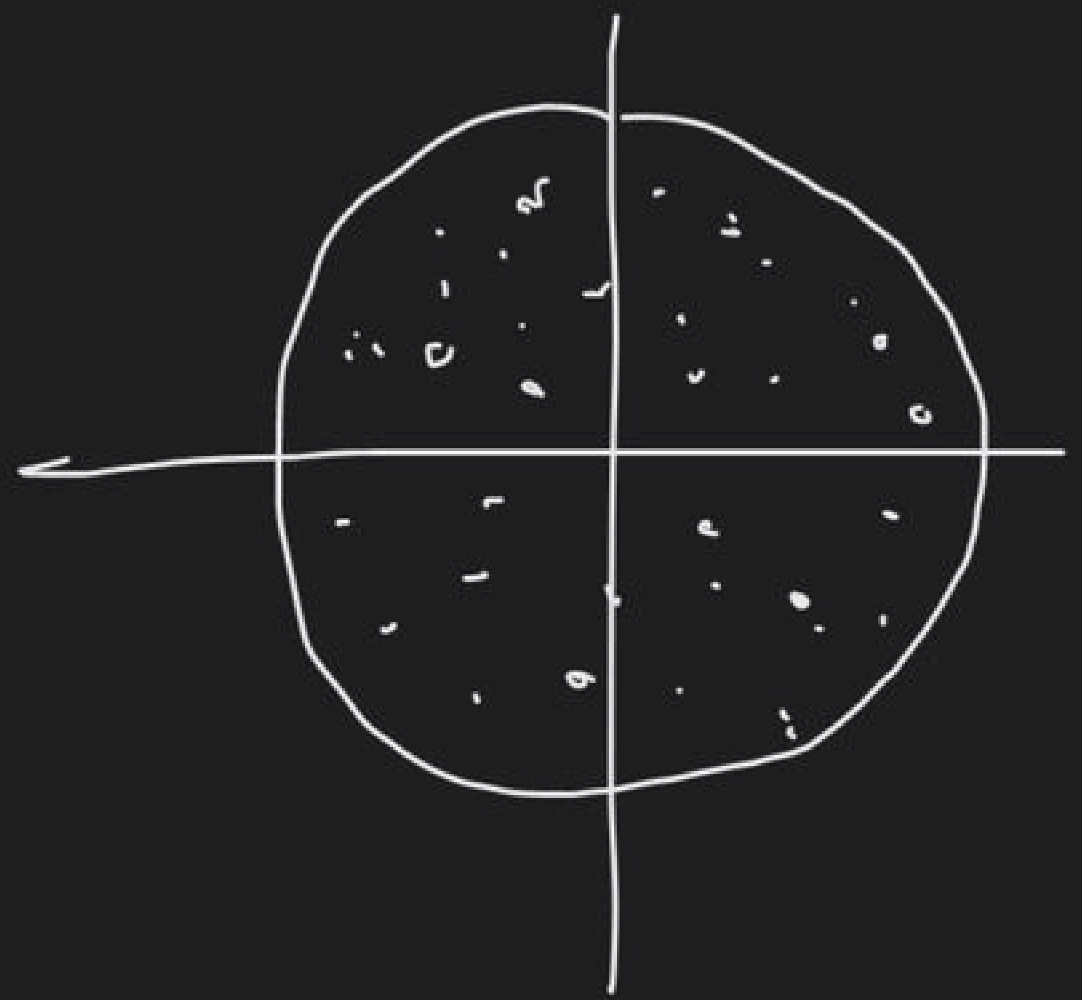


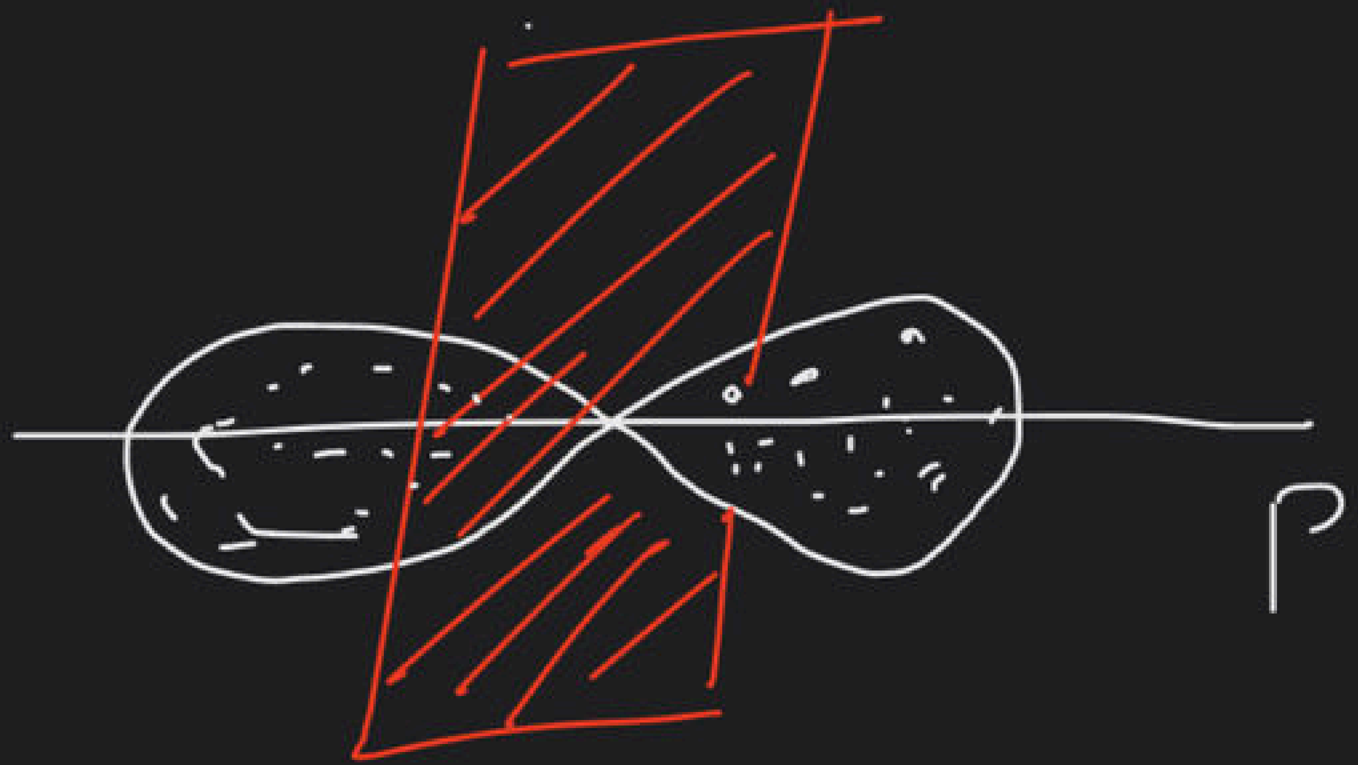
$n=2, \quad l=1, \quad m=0$



$n=1$

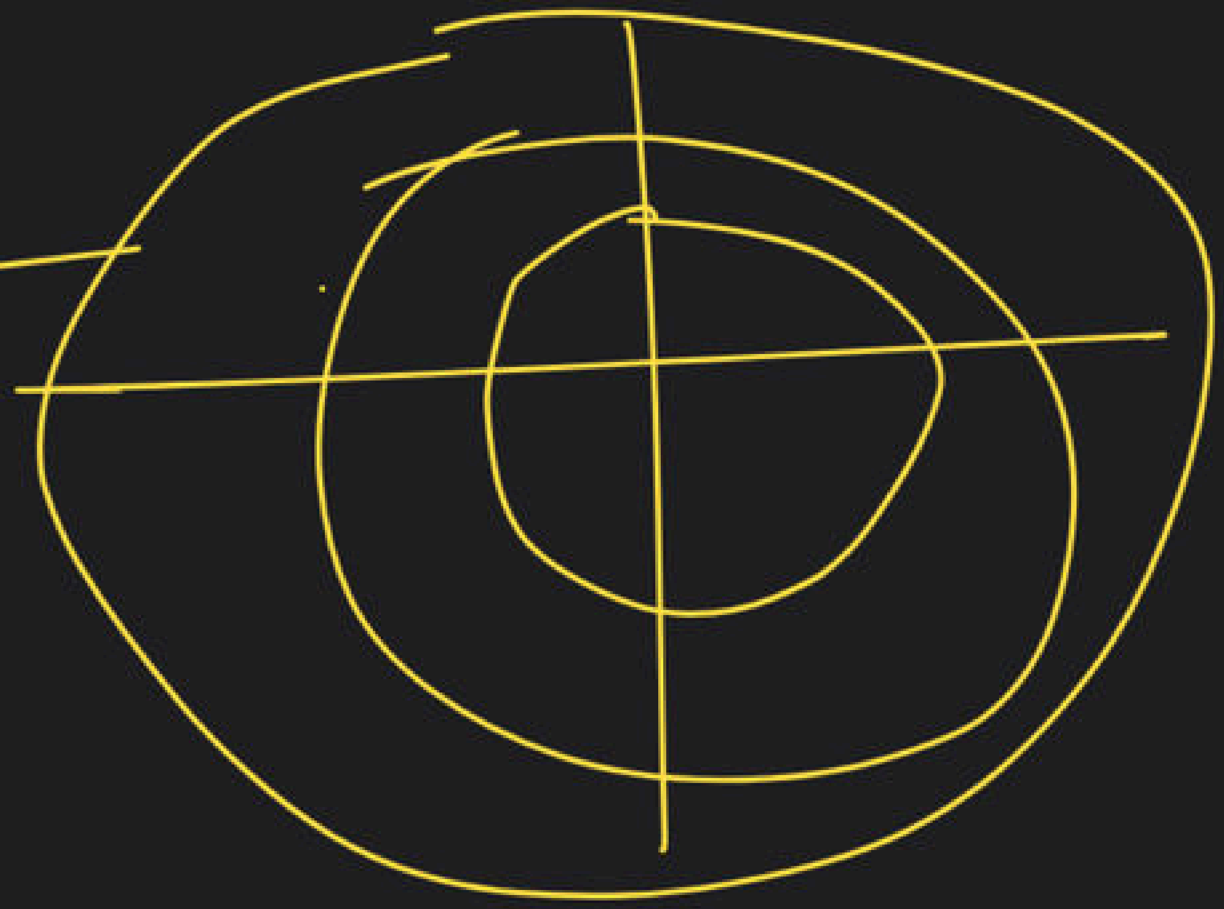


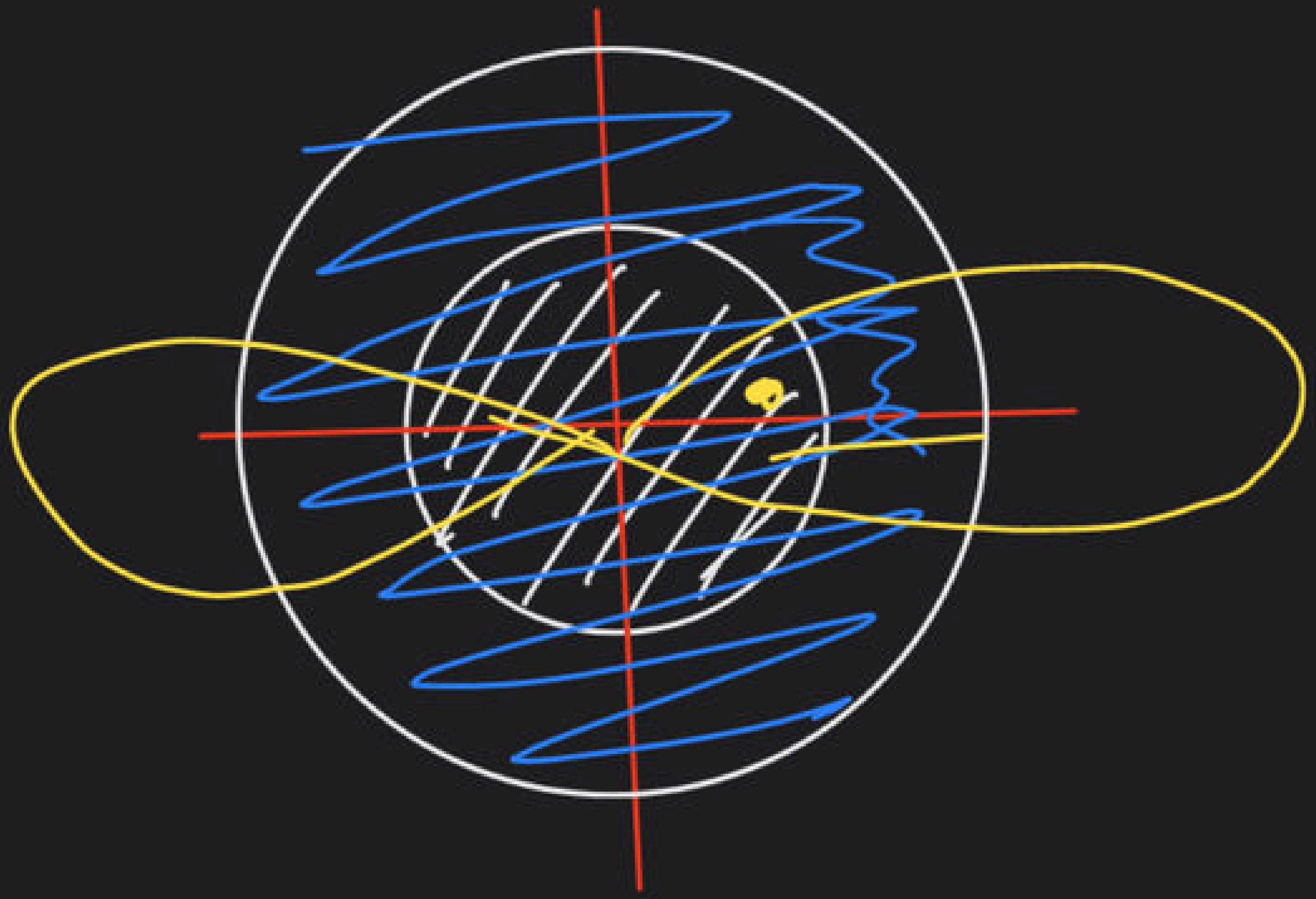




e^- cloud model

NCERT





$$\text{Intensity} \propto \underline{(\text{amplitude})}^2$$

$$X(d_{xz}) = \left(\frac{15}{4\pi}\right)^{1/2} \sin\theta \cos\theta \cos\phi$$

$$R(3s) = \frac{1}{9\sqrt{3}} \left(\frac{z}{a_0}\right)^{3/2} (6-6\sigma+\sigma^2)e^{-\sigma/2}$$

$$X(d_{yz}) = \left(\frac{15}{4\pi}\right)^{1/2} \sin\theta \cos\theta \sin\phi$$

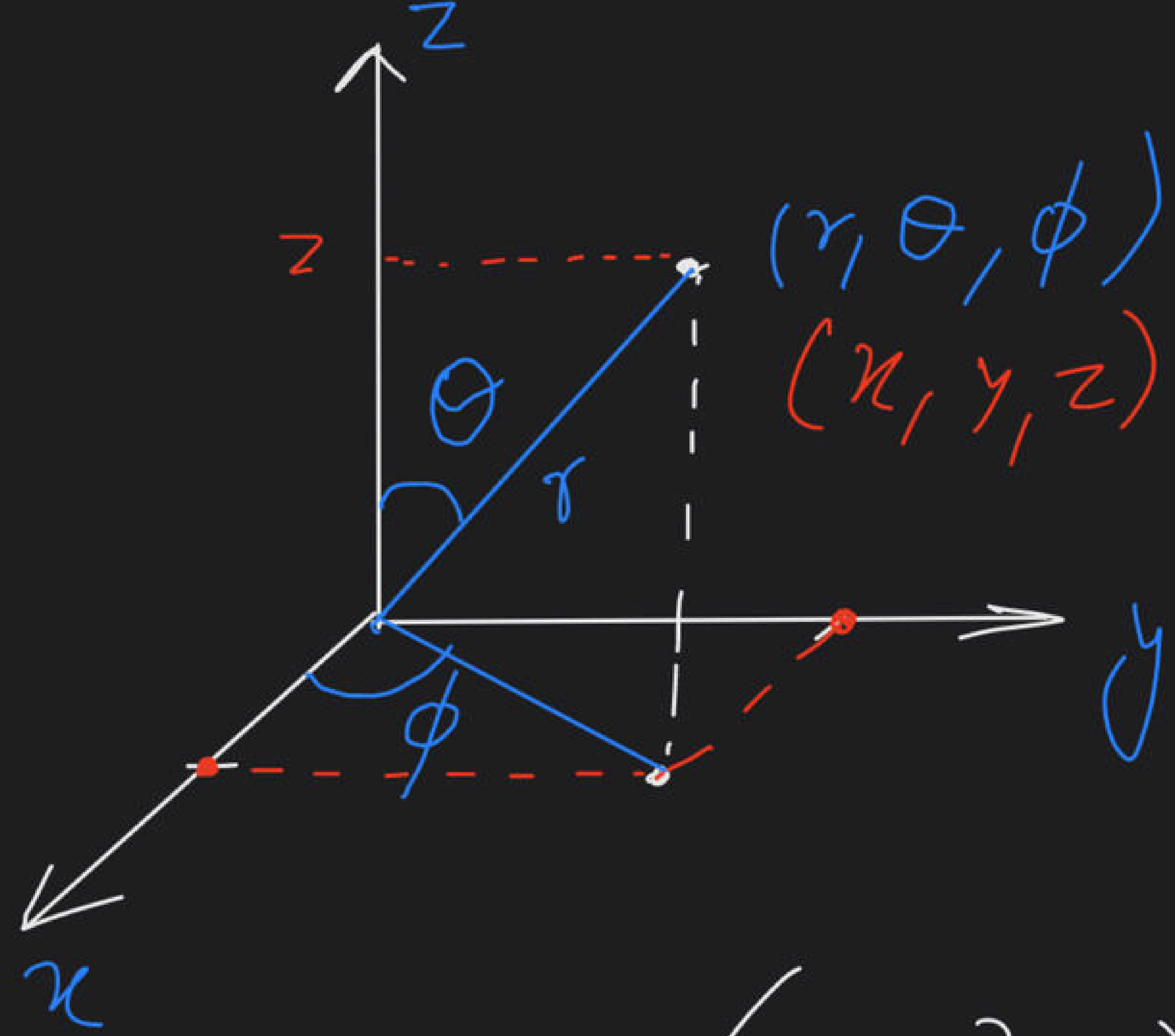
$$R(3p) = \frac{1}{9\sqrt{6}} \left(\frac{z}{a_0}\right)^{3/2} (4-\sigma)\sigma e^{-\sigma/2}$$

$$X(d_{x2-y2}) = \left(\frac{15}{4\pi}\right)^{1/2} \sin^2\theta \cos 2\phi$$

$$R(3d) = \frac{1}{9\sqrt{30}} \left(\frac{z}{a_0}\right)^{3/2} \sigma^2 e^{-\sigma/2}$$

$$\frac{df}{dt} = 3\frac{df}{dx}$$

Cartesian



$(2, 3, 4)$

Spherical coordinate system

(r, θ, ϕ)

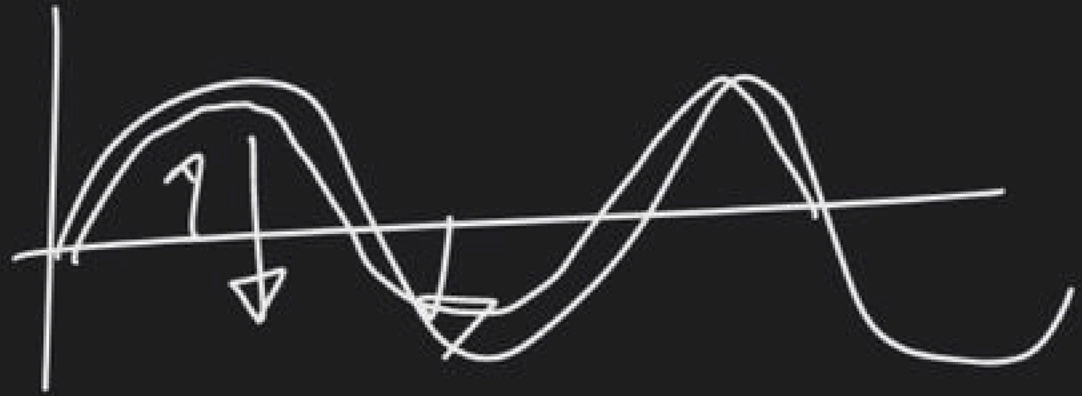
$$x = r \sin\theta \cos\phi$$

$$y = r \sin\theta \sin\phi$$

$$z = r \cos\theta$$

Electron is treated as an standing wave.

$$y = A \sin(\omega t - kx)$$



$$\frac{\partial^2 y}{dt^2} = c^2 \frac{\partial^2 y}{dx^2}$$

Speed

$$\frac{dx^2}{dt^2} = 2$$

$$\frac{dx}{dt} = 2t + C$$

$$d$$