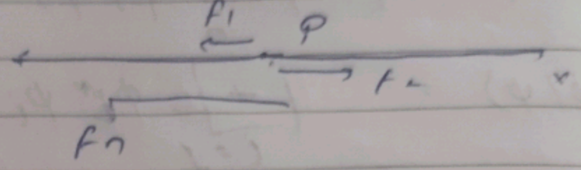
DAY-7 TASK

Schrodinger's Equation



Newton's 2nd Law:-

$\vec{F}_{net} = \sum \vec{F}_i(x,t) = m\vec{a}$ → acceleration

$m\frac{d^2x}{dt^2} = \sum_{i=1}^{n} F_i(x,t)$ (Equation of motion)

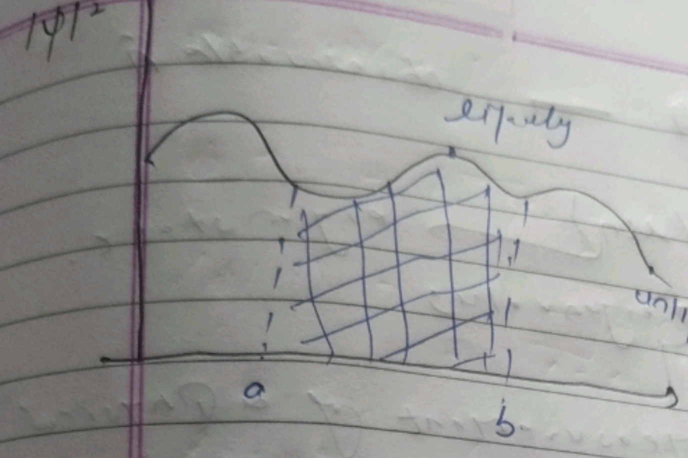
Schrodinger equation:

$$i\hbar \frac{\partial \psi}{\partial t} = \underbrace{\frac{-\hbar^2}{2m}\frac{\partial^2 \psi}{\partial x^2}}_{\text{Kinetic energy operator}} + \underbrace{V\psi}_{\text{Potential energy operator}}$$

ψ → wave function.

Wave function (ψ) = Represents state of the system. $|\psi|^2$ represents Probability density function of system.

$$\int_{-\infty}^{\infty} |\psi|^2 dx = 1$$ → normalization condition.



Probability of finding particle at state ψ b/w a & b

$$= \int_a^b |\psi|^2 dx$$

Time evoluting operator

$$\hat{U}(t)|\psi\rangle = |\psi(t)\rangle$$

$$\hat{U}(0) = I$$

Time evolution invertible.

$$\hat{U}^{-1}(t)$$

Total probability should be conserved

$$\langle \hat{U}(t)\psi | \hat{U}(t)\psi\rangle = \langle\psi|\psi\rangle = 1$$

change in time

Conserves probability ← $i\hbar \frac{d}{dt}|\psi\rangle = \hat{H}|\psi\rangle$

units

energy generates time evolution

Physical quantity A $\longrightarrow$ observable $\hat{A}$

$$\hat{A}|u_n\rangle = \underbrace{\lambda_n}_{\text{eigenvalue}}\underbrace{|u_n\rangle}_{\text{eigenstate}}$$

The result of a measurement of a physical quantity is one of the eigenvalues of the associated observable.

$\hat{A}$: $\lambda_1 \; \lambda_2 \; \lambda_3 \; -- \; \lambda_n$.

Measure $\hat{A}$ in state $|\psi\rangle$: which eigenvalue will we get.

The measurement of A in a system in normalized state $|\psi\rangle$ gives eigen value λ_n with probability :

$$P(\lambda_n) = |\langle u_n|\psi\rangle|^2$$

$\hat{A}$: $\lambda_1 \quad \lambda_2 \quad \lambda_3 \; -- \; \lambda_n$.

$\quad |u_1\rangle \; |u_2\rangle \; |u_3\rangle \; .. \; |u_n\rangle$.

$$|\psi\rangle = \; |\langle u_1|\psi\rangle|^2 \quad |\langle u_2|\psi\rangle|^2 \; --- \; |\langle u_n|\psi\rangle|^2$$

$$\boxed{\hat{A}|u_n\rangle = \lambda_n|u_n\rangle \longrightarrow P(\lambda_n) = |\langle u_n|\psi\rangle|^2}$$