SCRODINGER EQUATIONS

Time dependent equation

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Total energy of a moving particle is equal to sum of its kinetic energy and its potential energy.

$$E = \frac{p^2}{2m} + U \text{.........}(1)$$

multiply both sides by ψ

$$E\psi = \frac{p^2}{2m}\psi + U\psi \text{..............}(2)$$

$$\psi = Ae^{-\frac{i}{\eta}(Et - Px)}$$

Differenti ate this equation twice with respect to x, weget

$$\frac{\partial^2 \psi}{\partial x^2} = \frac{i^2}{\eta^2} p^2 \psi = \frac{-p^2}{\eta^2} \psi$$

$$-\eta^2 \frac{\partial^2 \psi}{\partial x^2} = p^2 \psi \;.....(3)$$

We know that

$$i\eta \frac{\partial \psi}{\partial t} = E\psi \;....(4)$$

on using equ (4) *and* (3) *in equ* (2

$$i\eta \frac{\partial \psi}{\partial t} = \frac{-\eta^2}{2m}\frac{\partial^2 \psi}{\partial x^2} + U\psi \;...(5)$$

This equ. is the one dimensional

time depedent Schrodinge r equation .

Three dimensional Time dependent Shrodinger equation

$$i\eta \frac{\partial \psi}{\partial t} = \frac{-\eta^2}{2m}\left[\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} + \frac{\partial^2 \psi}{\partial z^2}\right] + U\psi$$

here

$$\left[\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} + \frac{\partial^2 \psi}{\partial z^2}\right] = \nabla^2 \psi$$

$$i\eta \frac{\partial \psi}{\partial t} = \left[\frac{-\eta^2}{2m}\nabla^2 + U\right]\psi \quad ....(6)$$