Schrodinger's Time Independent Equation.

We know that.

Total Energy $= K.E + P.E$ $\left\{ K.E = \frac{1}{2}mv^2 = \frac{1}{2}\frac{m^2v^2}{m} = \frac{p^2}{2m} \right\}$

$$E = \frac{p^2}{2m} + V(x)$$

Multiply by '$\psi(x)$' above equation,

$$E\psi(x) = \frac{p^2}{2m}\cdot\psi(x) + V(x)\cdot\psi(x) \quad \text{—— (1)}$$

General fun^n of $\psi(x)$ is

$$\psi(x) = e^{i(kx-\omega t)} \quad \text{—— (2)}$$

Differentiating eq^n (2) twice w.r.t 'x'

$$\therefore \frac{d}{dx}\psi(x) = i\cdot k\cdot e^{i(kx-\omega t)}$$

$$\therefore \frac{d^2}{dx^2}\psi(x) = i^2\cdot k^2\cdot e^{i(kx-\omega t)} = i^2\cdot k^2\cdot\psi(x)$$

Here, $k = \frac{p}{\hbar}$

$$\therefore \frac{d^2}{dx^2}\psi(x) = i^2\cdot\frac{p^2}{\hbar^2}\psi(x) = -\frac{p^2}{\hbar^2}\psi(x)$$

$$\therefore p^2\psi(x) = -\hbar^2\frac{d^2}{dx^2}\psi(x) \quad \text{—— (3)}$$

Put eq^n (3) in eq^n (1)

$$E\psi(x) = -\frac{\hbar^2}{2m}\cdot\frac{d^2}{dx^2}\psi(x) + V(x)\cdot\psi(x)$$

$$\therefore E\cdot\psi(x) - V(x)\cdot\psi(x) + \frac{\hbar^2}{2m}\cdot\frac{d^2}{dx^2}\psi(x) = 0$$

Multiply by '$2m$' and divide by $\hbar^2$ above equation,

$$\frac{2m}{\hbar^2} E \cdot \psi(x) - \frac{2m}{\hbar^2} V(x) \cdot \psi(x) + \frac{d^2}{dx^2} \psi(x) = 0$$

$$\boxed{\therefore \frac{d^2}{dx^2} \psi(x) + \frac{2m}{\hbar^2} \left[E \psi(x) - V(x) \cdot \psi(x)\right] = 0}$$

This equation is one dimensional

— x —

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