$$\psi(x) = a \sin \frac{2\pi}{\lambda} x$$

$$\therefore \frac{d\psi(x)}{dx} = a \cdot \cos \frac{2\pi}{\lambda} x \cdot \frac{2\pi}{\lambda}$$

$$\frac{d\psi(x)}{dx} = \frac{2\pi}{\lambda} \cdot a \cdot \cos \frac{2\pi}{\lambda} \cdot x$$

$$\frac{d^2\psi(x)}{dx^2} = \frac{2\pi}{\lambda} \cdot a \cdot \left(-\sin \frac{2\pi}{\lambda} \cdot x\right) \cdot \frac{2\pi}{\lambda}$$

$$= -\left(\frac{2\pi}{\lambda}\right)^2 \cdot a \cdot \sin \frac{2\pi}{\lambda} x \cdot$$

$$= -\frac{4\pi^2}{\lambda^2} \psi(x)$$

$\therefore$ ডি-ব্রগলি সম্পর্ক, $\lambda = \frac{h}{p}$

$$\therefore \frac{d^2\psi(x)}{dx^2} = -\frac{4\pi^2}{\left(\frac{h}{p}\right)^2} \cdot \psi(x)$$

$$\therefore = -\frac{p^2}{\left(\frac{h}{2\pi}\right)^2} \psi(x)$$

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

আমরা আবার জানি,

$$E = K.E + P.E$$

গতিশক্তি + স্থিতিশক্তি

$$= \frac{1}{2}mv^2 + U(x)$$

$$= \frac{m^2v^2}{2m} + U(x)$$

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

$$\therefore E - U(x) = \frac{p^2}{2m}$$

$$\therefore p^2 = 2m\left[E - U(x)\right]$$

$$\therefore \frac{d^2\psi(x)}{dx^2} = -\frac{2m}{\hbar^2}\left[E - U(x)\right]\psi(x)$$

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

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

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

$$\Rightarrow \boxed{\hat{H}\psi(x) = E\psi(x)}$$