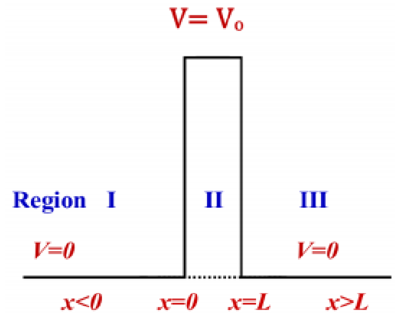
1. With a neat sketch explain the potential distribution associated with a barrier and formulate the Schrodinger's wave equation for valid regions.



$$\frac{\partial^2\psi_I(x)}{\partial x^2}+\frac{2m}{\hbar^2}E\psi_I(x)=0 \text{ Region I}$$

$$\frac{\partial^2\psi_{II}(x)}{\partial x^2}-\frac{2m}{\hbar^2}(E-V_0)\psi_{II}(x)=0 \text{ Region II}$$

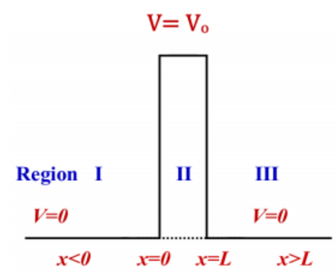
$$\frac{\partial^2\psi_{III}(x)}{\partial x^2}+\frac{2m}{\hbar^2}E\psi_{III}(x)=0 \text{ Region III}$$

2. Compare the behavior of allowed wave function in regions of zero potential and comment on the de-Broglie wavelength associated with a in regions of zero potential.

$\psi_I(x) = Ae^{ik_Ix} + Be^{-ik_Ix}$

$\psi_{II}(x) = De^{-\alpha x}$ → **an exponentially decaying function**

$\psi_{III}(x) = Ge^{ik_{III}x}$



- ***Region I***
- $\psi_I(x) = Ae^{ik_Ix} + Be^{-ik_Ix}$
- $k_I = \sqrt{\frac{2mE}{\hbar^2}}$
- $E = \frac{\hbar^2 k_I^2}{2m} = KE$
- $P_I = \hbar k_I$
- $\lambda_I = \frac{h}{\sqrt{2mE}}$

- ***Region II***
- $\psi_{II}(x) = De^{-\alpha x}$
- $\alpha = \sqrt{\frac{2m(V_0-E)}{\hbar^2}}$
- $\Delta x = \sqrt{\frac{\hbar^2}{2m(V_0-E)}}$
- $KE = E - V_0$ -ve

- ***Region III***
- $\psi_{III}(x) = Ge^{ik_{III}x}$
- $k_{III} = \sqrt{\frac{2mE}{\hbar^2}}$
- $E = \frac{\hbar^2 k_{III}^2}{2m} = KE$
- $P_{III} = \hbar k_{III}$
- $\lambda_{III} = \frac{h}{\sqrt{2mE}}$