

הגובה של הפוטנציאל V_0 ורוחבו d . אנרגיית הקוונטום E היא $E < V_0$.

הגובה של הפוטנציאל V_0 ורוחבו d .

$$V(x) = \begin{cases} 0 & x < 0 \\ V_0 & 0 < x < d \\ 0 & d < x \end{cases}$$

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

$V(x) = 0$ $x < 0$, $x > d$

$0 < x < d$ $E < V_0$

$$E \psi(x) = -\frac{\hbar^2}{2m} \psi''(x)$$

$$E \cdot \psi(x) = -\frac{\hbar^2}{2m} \psi''(x) + V_0 \cdot \psi(x)$$

$$\psi''(x) = -\frac{2mE}{\hbar^2} \psi(x)$$

$$\psi''(x) = -\frac{2m(V_0 - E)}{\hbar^2} \psi(x)$$

$$\psi''(x) = -\alpha^2 \psi(x)$$

$$\psi''(x) = -k^2 \psi(x)$$

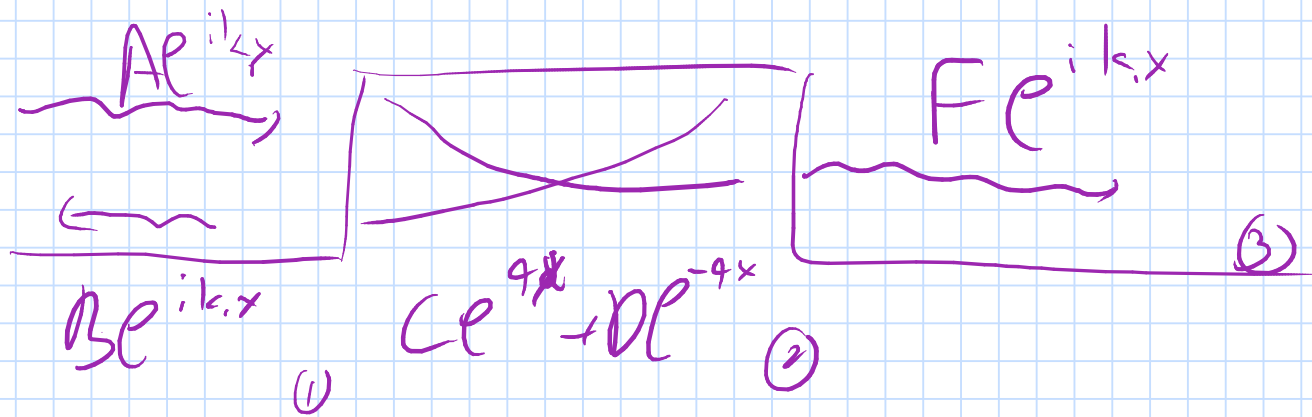
$$\alpha^2 = \frac{2m(V_0 - E)}{\hbar^2}$$

$$\psi(x) = A e^{ik_1 x} + B e^{-ik_1 x}$$

$$\psi(x) = C e^{\alpha x} + D e^{-\alpha x} \quad (\text{ג})$$

הגובה של הפוטנציאל V_0 ורוחבו d .

הגובה של הפוטנציאל V_0 ורוחבו d .



$$\frac{|\psi_{\text{tr}}|^2 \cdot \frac{v_3}{v_1}}{|\psi_{\text{in}}|^2} = \frac{|\psi_{\text{tr}}|^2}{|\psi_{\text{in}}|^2} = \frac{(Ae^{ik_1 x})(Ae^{-ik_1 x})}{A(e^{ik_1 x})(Ae^{-ik_1 x})} = \frac{|F|^2}{|A|^2}$$

$$A - F = \psi'(0^-) - \psi'(0^+) = -E$$

$$\psi(0^-) = \psi(0^+) \quad \psi(d^-) = \psi(d^+)$$

$$A + B = C + D$$

$$Ce^{\alpha d} + De^{-\alpha d} = Fe^{ik_1 d}$$

$$\psi'(0^-) = \psi'(0^+)$$

$$\psi'(d^-) = \psi'(d^+)$$

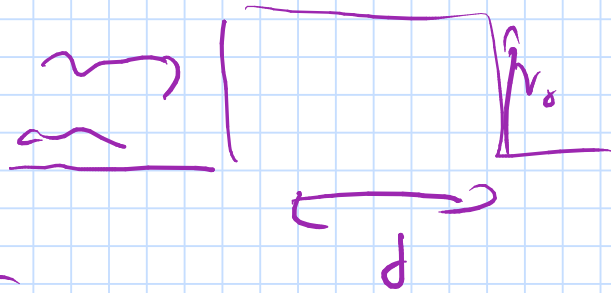
$$ik_1 A - ik_1 B = \alpha C - \alpha D$$

$$C\alpha e^{\alpha d} - \alpha D e^{-\alpha d} = ik_1 F e^{ik_1 d}$$

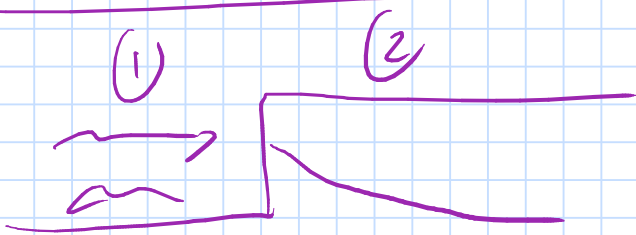
$$\psi_{\text{in}}(x) \rightarrow \psi(x) \text{ SI} \quad \frac{|F|^2}{|A|^2} \rightarrow \psi$$

$$\frac{|F|^2}{|A|^2} \propto e^{-2\alpha d}$$

$$E < V_0$$



$$\alpha = \sqrt{\frac{2m(V_0 - E)}{\hbar^2}}$$



$$\frac{|A_{\text{ref}}|^2}{|A_{\text{in}}|^2} \cdot \frac{V_2}{V_1} = \frac{|A_{\text{ref}}|^2 \hbar^2}{|A_{\text{in}}|^2 \hbar^2} \frac{k_2}{k_1}$$

$$V = \frac{\partial \omega}{\partial k} = \frac{\partial}{\partial k} \left(\frac{E}{\hbar} \right) = \frac{\partial}{\partial k} \frac{1}{\hbar} \left(\frac{\hbar^2 k^2}{2m} \right) = \frac{2k \hbar^2}{2m \hbar} =$$

$$v = \frac{\hbar k}{m}$$

$$\frac{v_2}{v_1} = \frac{k_2}{k_1}$$

$$\boxed{1 \text{ (100\%)}}$$

ע"כ $\rho(x) = \psi \psi''$ (2)

הפונקציה ψ היא פונקציית גראדנט

$$\psi \psi'' = \frac{1}{2} (\psi^2)''$$

$$(\psi \psi'')' = \psi' \psi'' + \psi (\psi''')'$$



	$0 < x < d$	$x > d$	
$\psi \psi''$	$ D ^2 e^{-2ax}$	$ F ^2$	$\psi \psi''$
$(\psi \psi'')'$	$ D ^2 (-2a) e^{-2ax}$	0	$(\psi \psi'')'$

בנקודה $x=d$ התנאי

$$|D|^2 \cdot e^{-2ad} = |F|^2$$

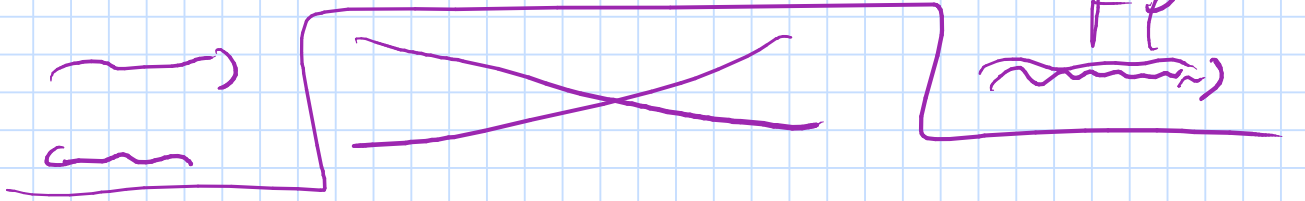
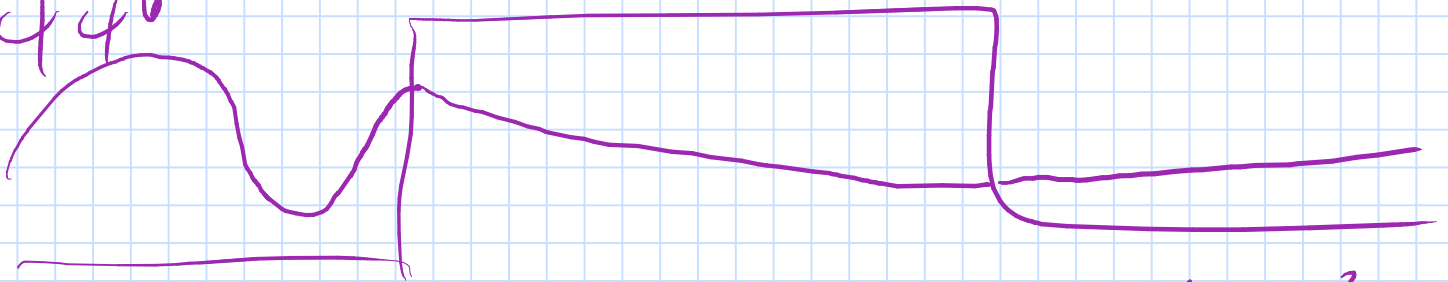
$$|D|^2 (-2a) e^{-2ad} = 0$$

התנאי $D=0$ $d \rightarrow \infty$

$$E < V_0$$

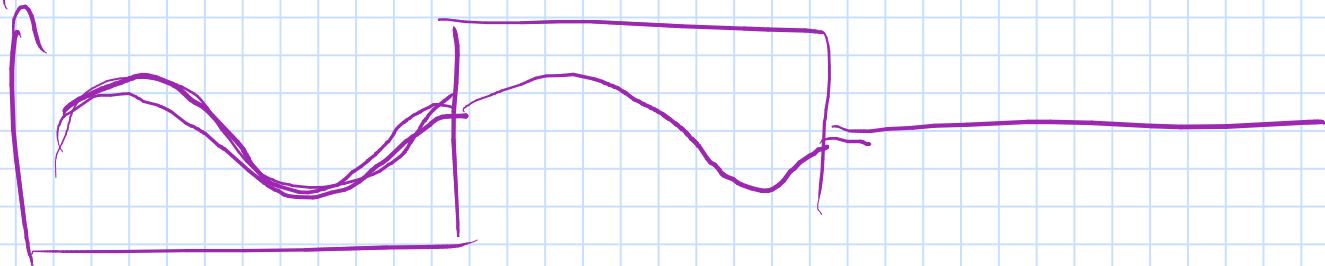
$$E > V_0 \quad \odot$$

$$E < V_0$$

 $\psi(x)$  $\psi\psi^*$ 

$$\psi\psi^* = |F|^2$$

$$E > V_0$$

 $\psi(x)$  $\psi\psi^* = |\psi|^2$ 

$$\psi(x) = A e^{ikx} + B e^{-ikx}$$

$$\psi\psi^* = \left(A e^{ikx} + B e^{-ikx} \right) \left(A e^{-ikx} + B e^{ikx} \right) =$$

$$A^2 + B^2 + AB e^{2ikx} + AB e^{-2ikx} =$$

$$A^2 + B^2 + \underbrace{2AB \cos(2kx)}$$