1) KVANTNI HARMONIČNI OSCILATOR

$$V = \frac{1}{2} k x^2 = \frac{1}{2} m \omega_0^2 x^2$$

$$\omega_0 = \sqrt{\frac{k}{m}}$$

$$-\frac{\hbar^2}{2m} \varphi''(x) + \frac{1}{2} m \omega_0^2 x^2 \varphi(x) = E \varphi(x)$$

$\hbar\omega_0$

$$-\frac{\hbar}{2m\omega_0} \varphi'' + \frac{1}{2} \frac{m\omega_0}{\hbar} x^2 \varphi = \frac{E}{\hbar\omega_0} \varphi$$

$\frac{d^2\varphi}{dx^2}$ ←

$$\xi = \sqrt{\frac{m\omega_0}{\hbar}}\, x \qquad \xi^2 = \frac{m\omega_0}{\hbar} x^2$$

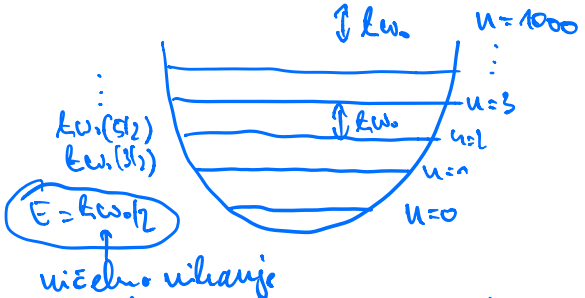
$$d\xi = \sqrt{\frac{m\omega_0}{\hbar}}\, dx$$

$$-\frac{1}{2} \frac{d^2\varphi}{d\xi^2} + \frac{1}{2} \xi^2 \varphi = \frac{E}{\hbar\omega_0} \varphi \qquad \varphi = \varphi(\xi)$$

$$\varphi_n(\xi) = A e^{-\xi^2/2} H_n(\xi) \qquad n = 0, 1, 2, \ldots$$

Hermitovi polinomi $H_0(\xi) = 1$ $H_1(\xi) = 2\xi$ $H_2(\xi) = 4\xi^2 - 2$

$$\frac{E}{\hbar\omega_0} = n + \frac{1}{2} \Rightarrow \boxed{E = \hbar\omega_0 \left(n + \frac{1}{2}\right)}$$



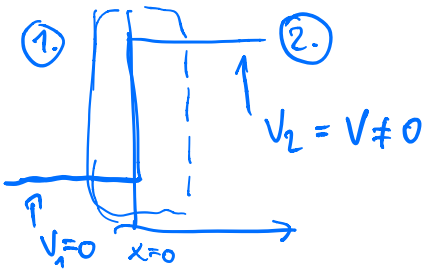
Harmonični oscilator:

$$\Delta E = \hbar\omega_0$$

Načelo korespondence: klasični in kvantni sistemi postanejo ekvivalentni za velik n.

2) GIBANJE ELEKTRONOV SKOZI PREPREKE

A) Potencialna skok



$$\varphi_1 = A_1 e^{ik_1 x} + B_1 e^{-ik_1 x} \qquad k_1 = \frac{\sqrt{2mE}}{\hbar}$$

$$\varphi_2 = A_2 e^{ik_2 x} + B_2 e^{-ik_2 x} \qquad k_2 = \frac{\sqrt{2m(E-V)}}{\hbar} \leftarrow$$

a) A_1 $B_2 = 0$ upadno valovanje + loče

$$\varphi_1 = \varphi_2 \,|_{x=0} \qquad A_1 + B_1 = A_2$$

$$\varphi_1' = \varphi_2' \,|_{x=0} \qquad k_1 A_1 - k_1 B_1 = k_2 A_2$$

$$2k_1 A_1 = (k_1 + k_2) A_2 \rightarrow \boxed{A_2 = \frac{2k_1}{k_1 + k_2} A_1}$$

$V \propto k \propto p$

$$-2k_1 B_1 = (k_2 - k_1) A_2 \qquad B_1 = \frac{k_2 - k_1}{-2k_1} A_2$$

$$= -\frac{k_2 - k_1}{k_1 + k_2} A_1$$

$$\boxed{B_1 = \frac{k_1 - k_2}{k_1 + k_2} A_1}$$

$j = v\,|A|^2$

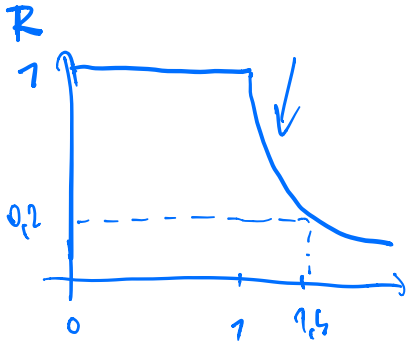
$$T = \frac{j_{prepuščeno}}{j_{vpadeno}} = \frac{k_2 |A_2|^2}{k_1 |A_1|^2}$$

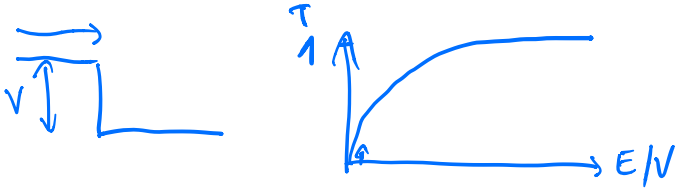
$$R = \frac{j_{odbito}}{j_{vpadno}} = \frac{k_1 |B_1|^2}{k_1 |A_1|^2}$$

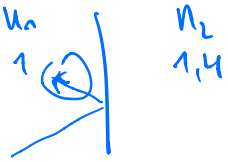
$$T = \frac{k_2 (k_1 - k_2)^2}{k_1 (k_1 + k_2)^2} \qquad R = \frac{4k_1}{(k_1 + k_2)^2}$$

$$T = \frac{k_2}{k_1} \frac{4k_1^2}{(k_1 + k_2)^2} \qquad R = \frac{(k_1 - k_2)^2}{(k_1 + k_2)^2}$$

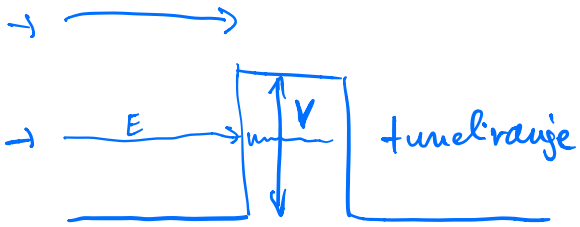
$$T + R = 1 = \frac{4k_1k_2 + k_1^2 + k_2^2 - 2k_1k_2}{(k_1+k_2)^2} = \frac{k_1^2 + k^2 + 2k_1k_2}{(k_1+k_2)^2} = 1 \checkmark$$

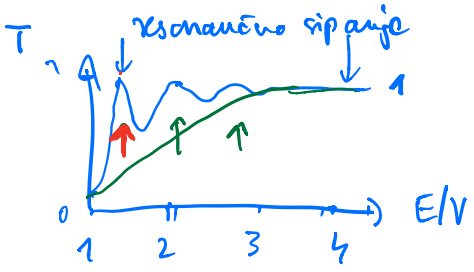


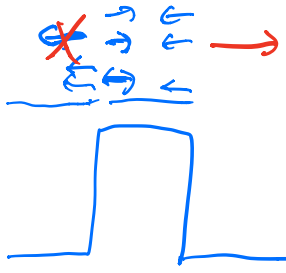




B) POTENCIJALNA BARIJERA, PREGRADA







Fegnmanovi diagrami