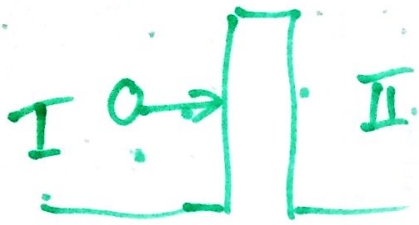


$E_k < U$

$U_0, \ell, x = 0$

$$\frac{\partial^2 \psi'}{\partial x^2} + \frac{2m}{\hbar^2}(E-U)\psi' = 0$$

$$\text{I}: \psi_1'(x) = A_1 e^{ik_1 x} + B_1 e^{-ik_1 x}$$

$$\text{III}: \psi_3'(x) = A_3 e^{ik_1 x}$$

$$\text{II}: \psi_2'(x) = A_2 e^{-kx} + B_2 e^{kx}$$

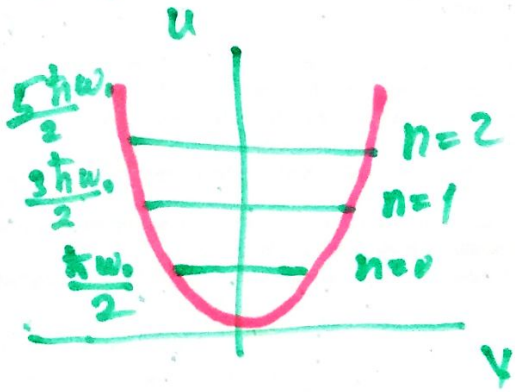
$$k_1 = \frac{\sqrt{2mE}}{\hbar}, \quad k = \frac{\sqrt{2m(E-U)}}{\hbar} = \frac{i\sqrt{2m(U-E)}}{\hbar}$$

$$U(x)_{max} = \frac{m\omega_0^2 x_0^2}{2}, \quad U(x) = \frac{m\omega_0^2 x^2}{2}$$

$$\frac{\partial^2\psi'}{\partial x^2} + \frac{2m}{\hbar}\left(E - \frac{m\omega_0^2 x^2}{2}\right)\psi' = 0$$

КГО $\quad E_n = \hbar\omega_0\left(n + \frac{1}{2}\right), \quad n = 0, 1, 2, 3, \ldots$

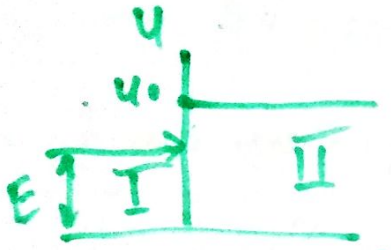
$n = 0 \quad E_0 = \frac{\hbar\omega_0}{2}$



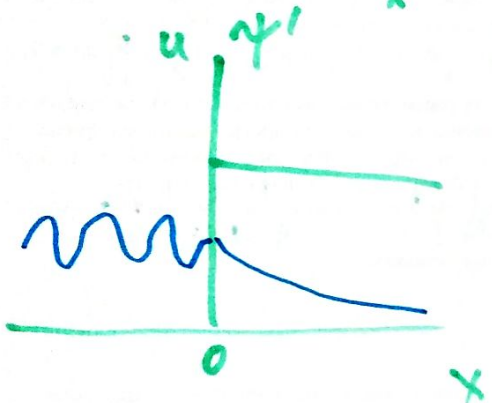
$$R = \frac{|B_1|^2}{|A_1|^2}, \quad D = \frac{|A_3|^2}{|A_1|^2}, \quad R + D = 1$$

$$D = e^{-\frac{2}{\hbar}\sqrt{2m(U_0 - E)}\,\ell}.$$

$$D = e^{-\frac{2}{\hbar}\int_0^{\ell}\sqrt{2m(U_0 - E)}\,dx}$$



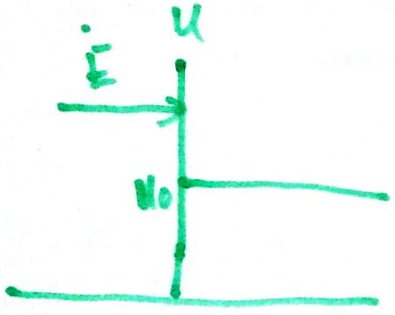
$D = 0$



$$|\psi_2'|^2 = \frac{4k_1^2}{k_1^2+\alpha^2} A_1^2 e^{-2\alpha x}$$

$$k_1 = \frac{\sqrt{2mE}}{\hbar}; \quad \alpha = \frac{\sqrt{2m(U_0-E)}}{\hbar}$$

$R \approx 0$, $D \approx 1$ $\qquad R + D = 1.$



$$R = \left|\frac{B_1}{A_1}\right|^2 = \left|\frac{k_1-k_2}{k_1+k_2}\right|^2$$

$$k_1 = \frac{\sqrt{2mE}}{\hbar}; \quad k_2 = \frac{2m\sqrt{E-U_0}}{\hbar}$$

Атомы и кристаллы.

Бальмер $\nu = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$, $n = 3, 4, 5, 6$

R – Ридберг $R = 3{,}29 \cdot 10^{15} c^{-1}$

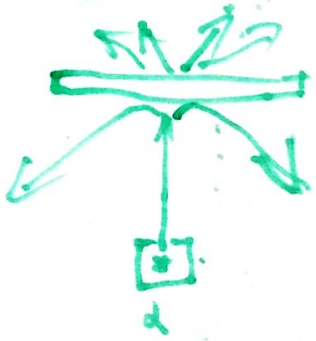
Лайман УФ $\nu = R\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$, $n = 2, 3, 4, 5, \ldots$

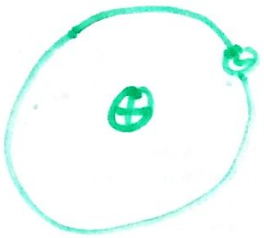
Пашен ИК $\nu = R\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$, $n = 4, 5, 6, \ldots$

1913 О спектрах атома водорода.

Томсон. Резерфорд $r_a \sim 10^{-15}$ м Окатава?

$r_a = 10^{-10}$ м

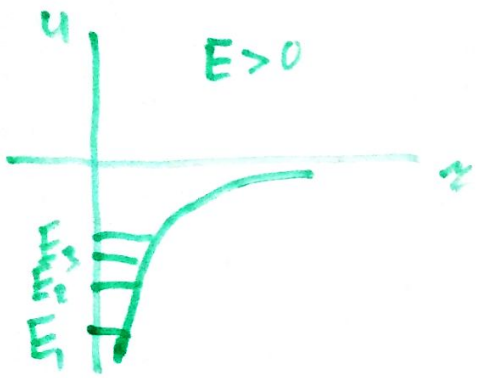




Нильс Бор. $h\nu = E_n - E_m$ Дис.с.

$mvr = n\hbar$

H, (He^+, Li^{2+}).



$$U(z) = -\frac{Ze^2}{4\pi\varepsilon_0 z} \quad (Z = 1, 2, 3)$$

$$\nabla^2\psi' + \frac{2m}{\hbar^2}\left(E + \frac{Ze^2}{4\pi\varepsilon_0 z}\right)\psi' = 0$$

$$E_n = -\frac{1}{n^2}\frac{Z^2 e^4 m}{\hbar^2 \varepsilon_0^2} \qquad n = 1, 2, 3, \ldots$$

$n = 1$

$E_n < 0$ –

$E > 0$ ионизация

$$E_i = -E_1 = 13{,}55 \text{ эВ}.$$