$\sqrt{2}$ $\psi_1(x) = A \exp(-\lambda|x - \frac{a}{2}|)$; U_0

Нормируем ψ - ϕ - ω

$$|A|^2 \int_{-\infty}^{+\infty} \exp(-2\lambda|x - \frac{a}{2}|)\,dx = \left|x - \frac{a}{2}\right| = |t| \;\; |=1 \Rightarrow$$

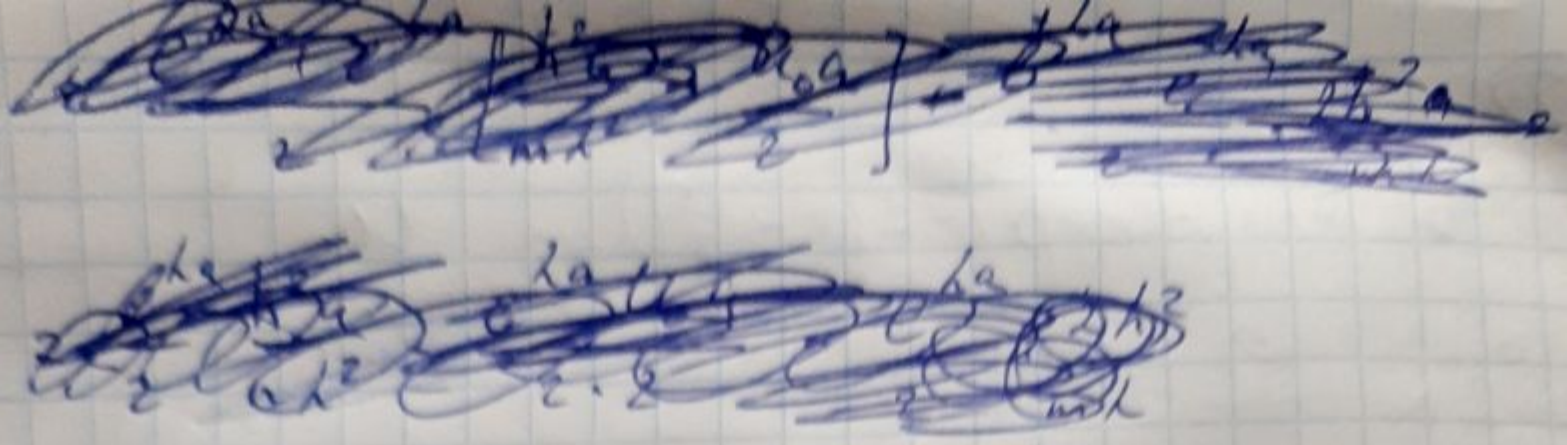
$$\Rightarrow |A|^2 \int_{-\infty}^{+\infty} \exp(-2\lambda|t|)\,dt = 2|A|^2 \int_0^{\infty} \exp(-2\lambda t)\,dt =$$

$$= 2|A|^2 \cdot \frac{1}{2\lambda} \Rightarrow |A| = \sqrt{\lambda}$$

$$J_\phi = \int_0^a \psi^* H \psi\,dx = \int_0^a \sqrt{\lambda}\, e^{-\lambda|x - \frac{a}{2}|} \left[U_0 \sqrt{\lambda}\, e^{-\lambda|x - \frac{a}{2}|} - \frac{\hbar^2}{2m} \frac{d^2}{dx^2} \sqrt{\lambda}\, e^{-\lambda|x - \frac{a}{2}|}\right] dx =$$

$$= 2U_0 \int_{-\frac{a}{2}}^{\frac{a}{2}} e^{-2\lambda|t|}\,dt - \left| \frac{\hbar^2 \lambda}{2m} \int_{-\frac{a}{2}}^{\frac{a}{2}} e^{-2\lambda|t|} \cdot \frac{1}{\lambda}\,dt \right| (=)$$

$= \ldots$



$$\Leftrightarrow \frac{\cancel{2\lambda} U_0}{-\cancel{2\lambda}} e^{-2\lambda|t|}\Big|_0^{\frac{a}{2}} + \frac{\hbar^2}{2m\lambda^2} e^{-2\lambda|t|}\Big|_0^{\frac{a}{2}} =$$

$$J_1 = -U_0\left[e^{-\lambda a} - 1\right] + \frac{\hbar^2}{2m\lambda^2}\left[e^{-\lambda a} - 1\right]$$

$$E_1 = \min J_1$$

$$\frac{d}{d\lambda}[J_1] = U_0 a e^{-\lambda a} + \frac{2\hbar^2}{2m\lambda} - \frac{\hbar^2 a}{2m\lambda^2} e^{-\lambda a} = 0$$

$$c = e^{-\lambda a} \neq 0$$

$$\lambda^2 U_0 a + \frac{\cancel{2}\hbar^2}{\cancel{2}mc}\lambda - \frac{\hbar^2 a}{2m} = 0$$

$$D = \frac{\hbar^4}{m^2c^2} - \overset{2}{\cancel{4}} U_0 a \frac{\hbar^2 a}{\cancel{2}m} = \frac{\hbar^2}{m}\left(\frac{\hbar^2}{mc^2} - 2U_0 a^2\right)$$

$$\lambda_{1,2} = \frac{-\hbar^2\left(\frac{1}{mc} \pm \sqrt{\frac{\hbar^2}{m^2c^2} - 2U_0 a^2}\right)}{2U_0 a}$$

Підставляючи в J_1 знайдемо E_1

$$V(x,t) = 2V(x)\cos\omega t = -Ax^2\cos\omega t \qquad \text{№ 3}$$

$$V(x) = -\frac{Ax^2}{2}$$

$$\psi(x) = \sqrt{\frac{2}{l}}\, e^{ik} \sin\frac{\pi n x}{l}$$ — всі ф-я частинки у нескінченно глибокій потенціальній ямі

$$W_{sm}(t>0) = \frac{2\pi t}{\hbar^2}|U_{sm}|^2\delta(\omega_{sm}\pm\omega) \qquad *$$

$$S\left(\frac{\omega_{sm}+\omega}{2}, t\right) = 2\pi t\,\delta(\omega_{sm}\pm\omega)$$

$$S\left(\frac{\omega_{sm}\pm\omega}{2}, t\right) = \frac{\sin^2\left(\frac{\omega_{sm}\pm\omega}{2}, t\right)}{\left(\frac{\omega_{sm}\pm\omega}{2}\right)^2} \Bigg| \Rightarrow$$

$$\Rightarrow \delta(\omega_{sm}\pm\omega) = \frac{\sin^2\left(\frac{\omega_{sm}\pm\omega}{2}, t\right)}{2\pi t\left(\frac{\omega_{sm}\pm\omega}{2}\right)^2}$$

$$U_{sm}(t) = \int \psi^*(x)\, V(x,t)\, \psi(x)\, dx =$$

$$= 2 - A\frac{2}{l} e^{ik-ik}\cdot\cos\omega t \int \sin^2\frac{n\pi x}{l}\, x^2\, dx =$$

$$= -A\frac{\cos\omega t}{l}\int\left(1-\cos\frac{2n\pi x}{l}\right)x^2\, dx =$$

$$= +A\frac{\cos\omega t}{l}\int\cos\frac{2\pi n x}{l}\, dx = \left|\frac{2\pi n x}{l} = t \Rightarrow dx = \frac{l}{2\pi n}\, dt\right| \Rightarrow$$

$$\Rightarrow A\frac{\cos(\omega t)}{l}\cdot\frac{l}{2\pi n}\int\cos t\, dt$$

$$|U_{sm}|^2 = A^2 \frac{\cos^2(\omega t)}{4\pi^2 h^2}$$

$$W_{sm} = \frac{2\pi t}{h^2} \cdot A^2 \frac{\cos(\omega t)}{4\pi^2 h^2} \cdot \frac{\sin^2\left(\frac{(\omega_{sm} \mp \omega)}{2} t\right)}{2\pi t \left(\frac{\omega_{sm} \pm \omega}{2}\right)^2}$$

$$= \frac{A^2}{h^2} \frac{\cos(\omega t)}{4\pi^2 h^2} \frac{\sin^2\left(\frac{(\omega_{sm} \mp \omega)}{2} t\right)}{\left(\frac{\omega_{sm} \pm \omega}{2}\right)^2}$$