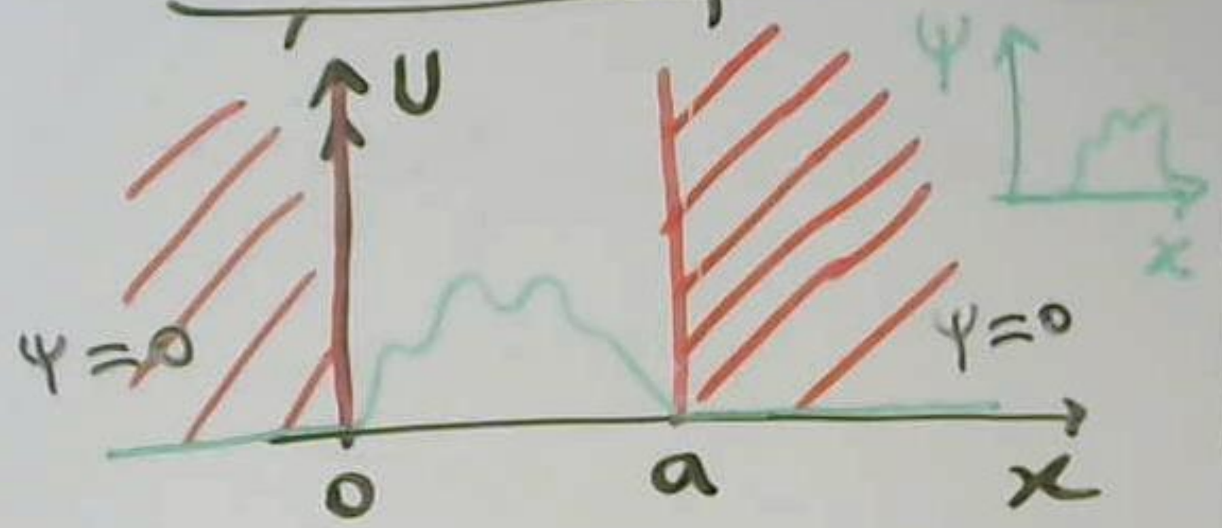
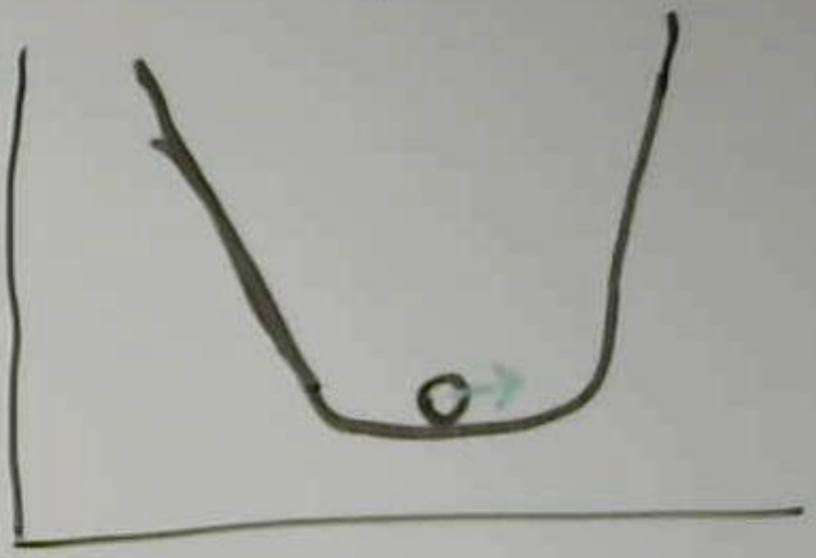
Poço de potencial (partícula numa caixa)



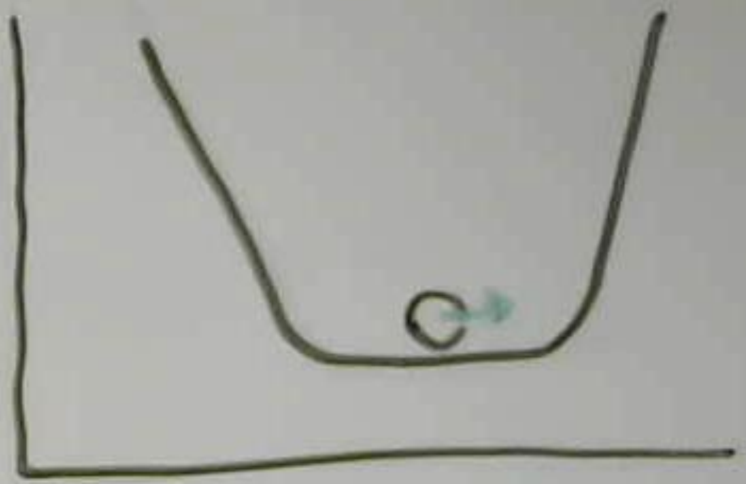


$U \equiv$ energia

$$\int_{-\infty}^{+\infty} |\psi|^2 \, dx = \int_0^a |\psi|^2 \, dx$$

$\psi(0) = \psi(a) = 0$ (condições de fronteira)

Poço de potencial (partícula numa caixa)



Energia

$$E_n = n^2 \frac{\pi^2 \hbar^2}{2ma^2}$$

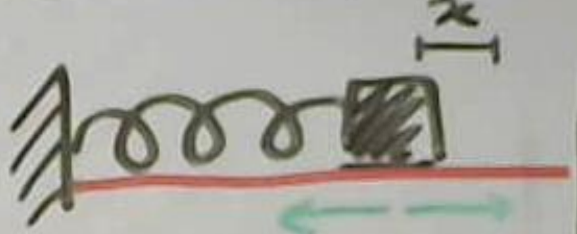
$m \equiv$ massa

$n = 1, 2, 3, \dots$

Energia quantizada

Oscilador harmônico simples

Clássico:



$$F = -Kx$$

$K \equiv$ const. elástica da mola

Energia potencial

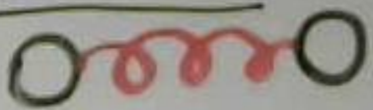
$$\boxed{V(x) = \frac{1}{2} K x^2}$$

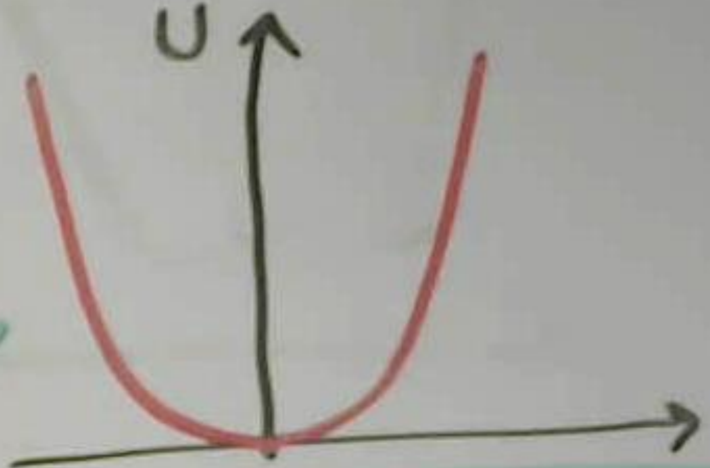
$$\omega = \sqrt{\frac{K}{m}} \, ,$$

$n = 0 \Rightarrow$

$E_0 = \frac{1}{2}\hbar\omega$ energia do ponto zero

Quântico





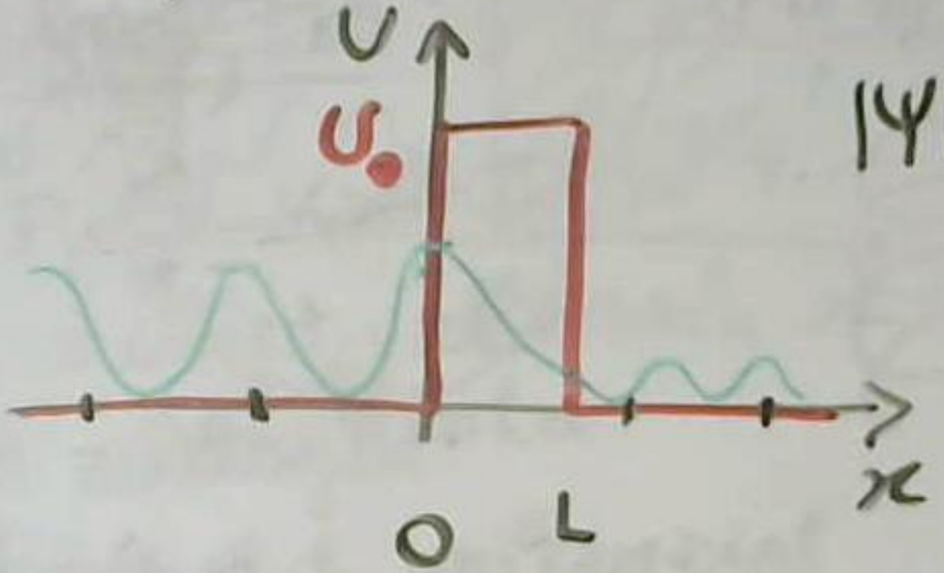
$$\boxed{E_n = \left(n + \frac{1}{2}\right)\hbar\omega}$$

$n = 0, 1, 2, \ldots$

$\omega \equiv$ freq. que um osc. clássico teria

Barreira de potencial

Efeito túnel



$|\psi|^2 \equiv$ dens. probabilidade

$$\boxed{P \approx e^{-2\alpha L}}$$

$$\alpha = \sqrt{\frac{2m(U_0 - E)}{\hbar^2}}$$

Átomo de hidrogénio

$F = K\,\frac{q_1 q_2}{r^2}$, $K = \frac{1}{4\pi\varepsilon_0}$, $\varepsilon_0 \equiv$ permitividade do vazio

$$\boxed{E_n = -\left(\frac{2\pi^2 K^2 m e^4}{h^2}\right)\frac{1}{n^2}}$$

$n = 1, 2, 3, \cdots$

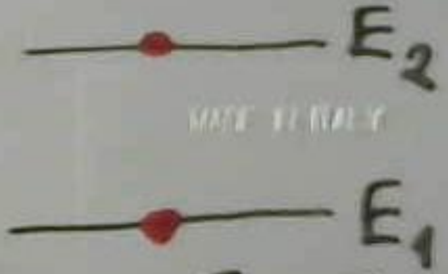
$$= -\frac{E_1}{n^2} \ , \quad E_1 = \frac{2\pi^2 K^2 m e^4}{h^2} \quad \text{estado fundamental}$$

$$= -13{,}6\ eV$$

$$\underbrace{1\ eV}_{\text{electrão-volt}} = 1{,}602 \times 10^{-19}\ J$$

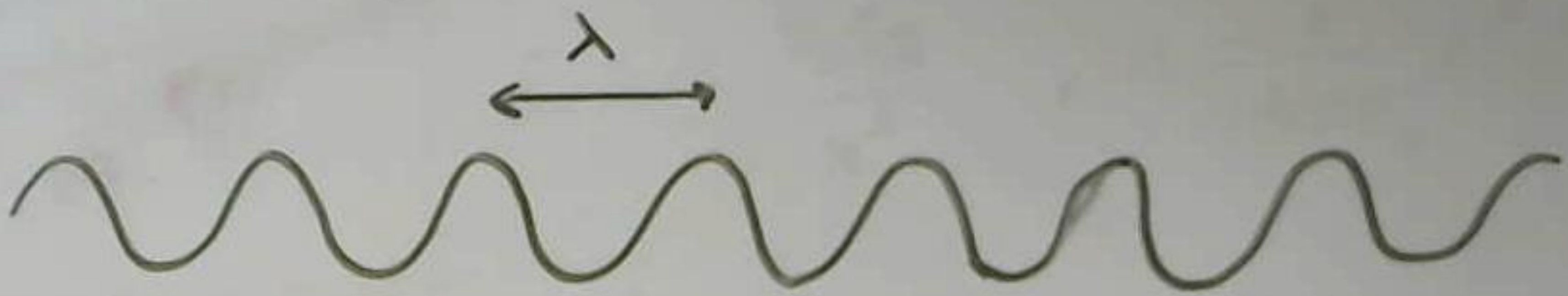
$E_2 = \frac{E_1}{4}$

$E_2 = \frac{E_1}{n^2}$ E_1



$E_{fotão} = E_i - E_f$

Relações de incerteza



de Broglie

$$\boxed{\lambda = \frac{h}{p}}$$

incerteza na posição

$$\boxed{(\Delta x).(\Delta p) \geq \frac{\hbar}{2}}$$

incerteza no momento

x e p são variáveis conjugadas