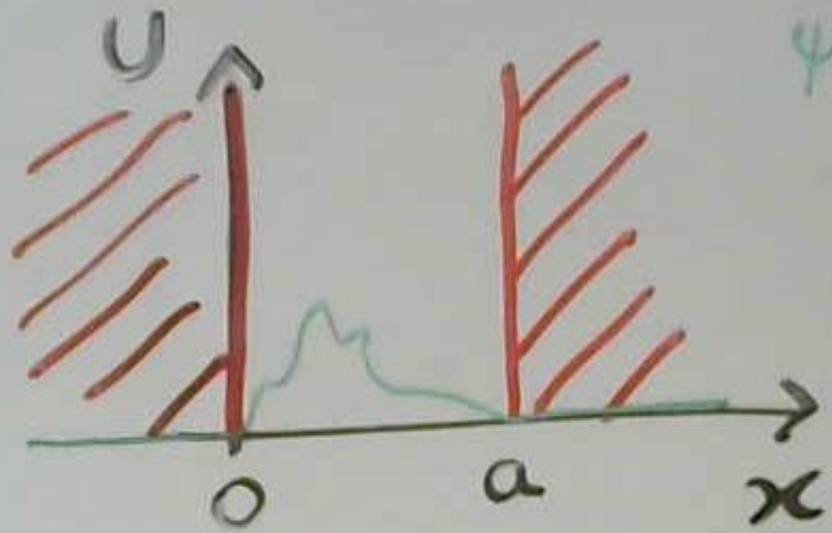
Poço de potencial (partícula numa caixa)

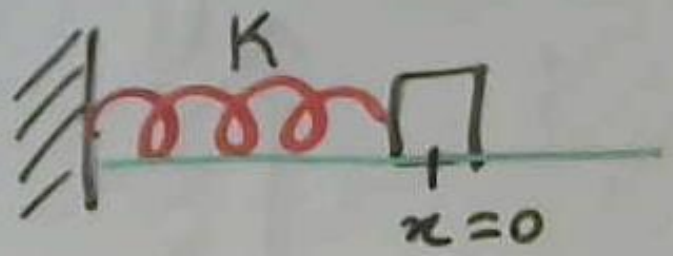


$U \equiv$ energia potencial

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

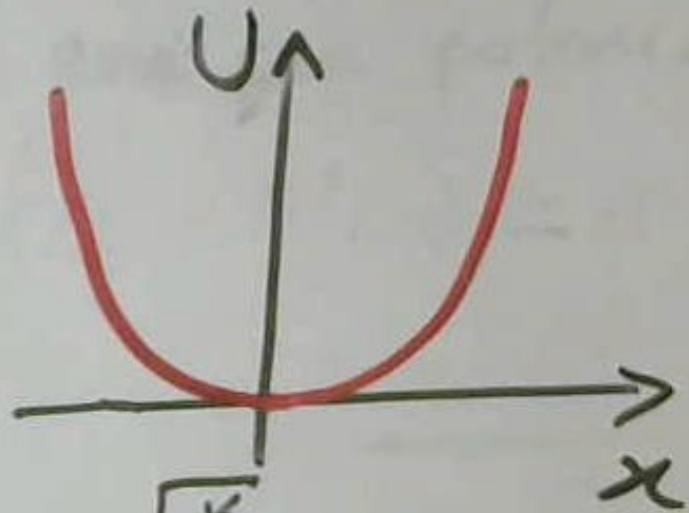
$E_n = n \dfrac{2\pi^2\hbar^2}{2ma^2}$, $n = 1, 2, 3, \ldots$

Oscilador harmónico



$$F = -Kx$$

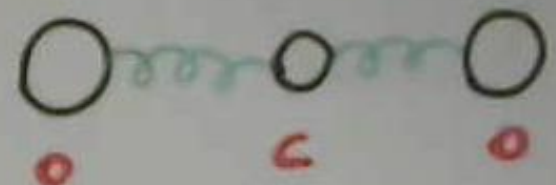
$$U(x) = \frac{1}{2}Kx^2$$



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

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

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

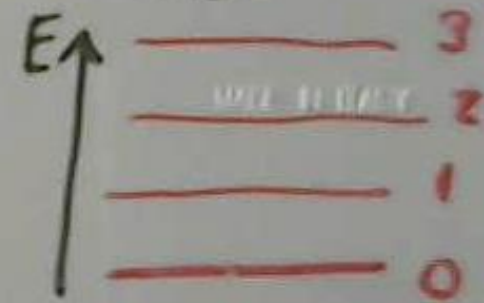


$$E_0 = \frac{1}{2}\hbar\omega$$

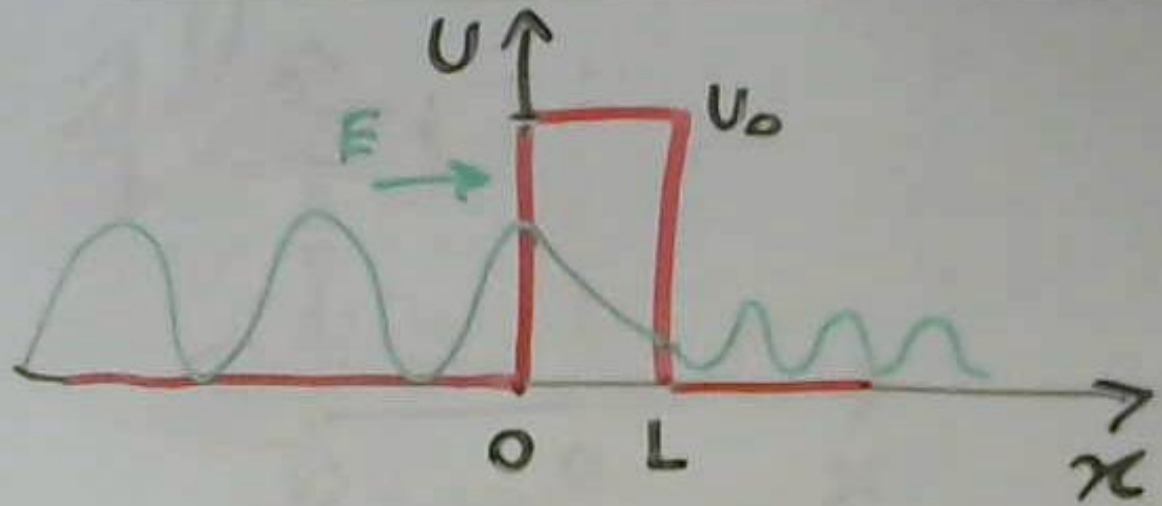
Energia do ponto zero

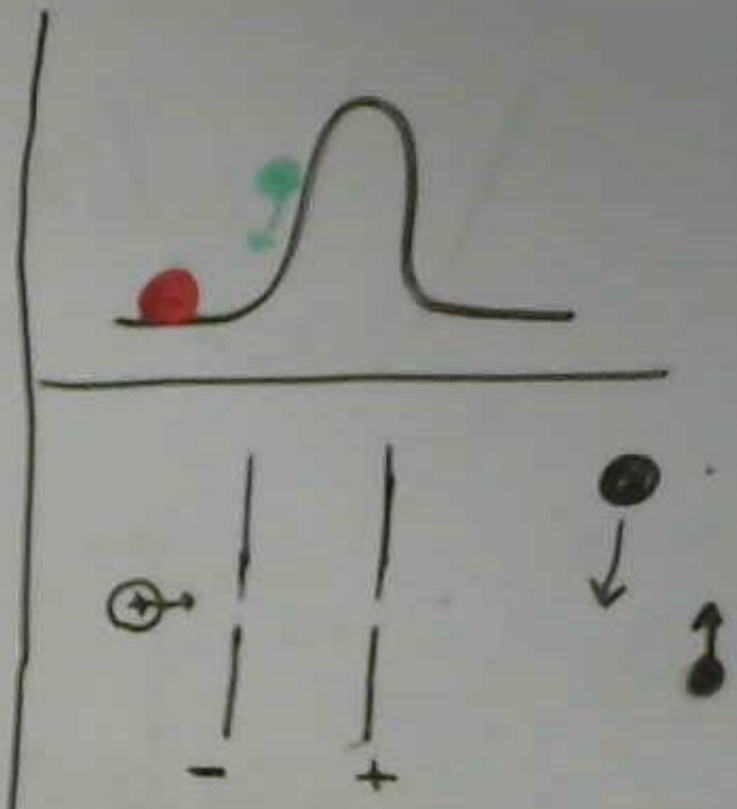
$$E_1 = \frac{3}{2}\hbar\omega$$

$$E_2 = \frac{5}{2}\hbar\omega$$



Barreira de potencial: efeito túnel



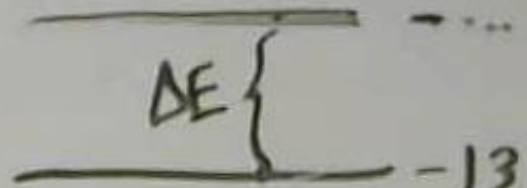


$$P \approx e^{-2\alpha L}$$

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

probabilidade da partícula atravessar a barreira de potencial

Átomo de hidrogénio



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

E_1 → estado fundamental

$$E_1 = -\frac{2\pi^2 K^2 m e^4}{h^2} = -13{,}6\ eV$$

$1\ eV = 1{,}602 \times 10^{-19}\ J$

1 eV: electrão-volt

$$\boxed{E_n = \frac{E_1}{n^2}}$$

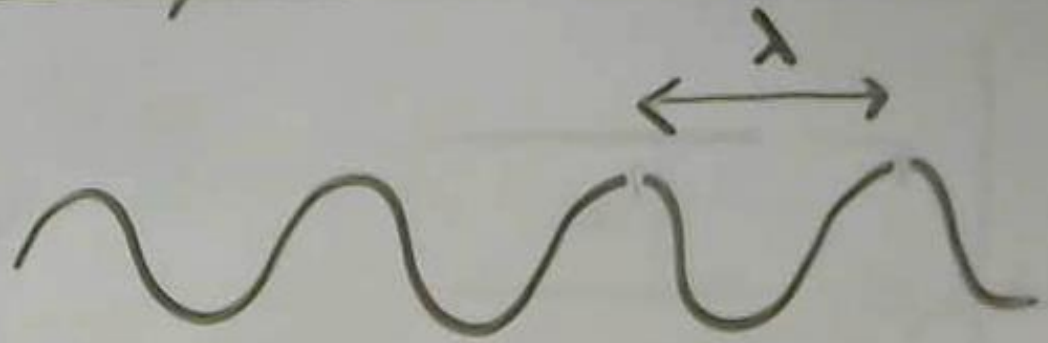
Lei de Coulomb

$$F = K\frac{q_1 q_2}{r^2}, \quad K = \frac{1}{4\pi\varepsilon_0}$$

ε_0 ≡ permitividade eléctrica

$E_{total} = E_i - E_f$

Relações de incerteza



incerteza em x

$$(\Delta x)(\Delta p) \geq \frac{h}{2}$$

incerteza em p

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

$p \equiv$ momento linear

$p = mv$

x e p são variáveis conjugadas