Problema 1 (1)

Representa a su estado de energía mas bajo posible; la energía del estado fundamental se conoce tambien como la energía de punto cero del sistema.

Problema 2 (0.75) L = 0.849 nm

$$E = \frac{hc}{\lambda} = \left(\frac{h^2}{8m_eL^2}\right) n^2 \Rightarrow \frac{hc}{\lambda} = \left(\frac{h^2}{8m_eL^2}\right)[2^2 - 1^2] = \frac{3h^2}{8m_eL^2}$$

$$\Rightarrow \frac{hc}{\lambda} = \frac{3h^2}{8m_eL^2} \Rightarrow 8m_eL^2 hc = 3h^2\lambda \Rightarrow L^2 = \frac{3h^{\cancel{2}}\lambda}{8m_e\cancel{h}c}$$

$$\Rightarrow L = \sqrt{\frac{3h\lambda}{8m_ec}} = \sqrt{\frac{3(6.626\times10^{-34})(794\times10^{-9})}{8(9.10\times10^{-31}kg)(3\times10^{8}m/s)}} = 7.93\times10^{-10}m$$

$$= 0.793\,nm$$

(1)

Problema 3

$T = e^{-2CL}$

$C = \frac{\sqrt{2 m_e (U-E)}}{\hbar}$

$C = \frac{\sqrt{2(9.10\times10^{-31})(8\times10^{-20})}}{1.055\times10^{-34}} = 3.62\times10^{9}\ m^{-1}$

$2CL = 2(3.62\times10^{9})(9.5\times10^{-10})$

$2CL = 6.878$

$\Rightarrow T = e^{-6.878} = 1.03\times10^{-3}$

$(U-E) = (5-4.5)$

$\boxed{U-E = 5\,eV(1.60\times10^{-19})}$

$U-E = 8\times10^{-20}\ J$

$m_e = 9.10\times10^{-31}$

$\hbar = 1.055\times10^{-34}$

$9.5\ \mathring{A} = 9.5\times10^{-10}\ m$

(0.75) La respuesta es correcta, pero no se observa el proceso de derivar y reducir.

Problema 4

Reorganizando la ec. de Schrödinger para aislar la energía potencial tenemos:

$$U(x) = \frac{\hbar^2}{2m}\frac{1}{\psi}\frac{d^2\psi}{dx^2}$$

Como: $\psi(x) = Axe^{-x^2/L^2}$

$$\Rightarrow \frac{d^2\psi}{dx^2} = (4Ax^2 - 6AxL^2)\frac{e^{-x^2/L^2}}{L^4}$$

$$= \frac{4x^2-6L^2}{L^4}\psi(x) = \frac{1}{L^2}\left(\frac{4x^2-6L^2}{L^2}\right)$$

$$\Rightarrow U(x) = \frac{\hbar^2}{2mL^2}\left(\frac{4x^2}{L^2}-6\right)$$

(1) - Bien derivado, solo hace falta considerar que U = 0 para que
E = Energia Cinetica

Problema 5

$$\psi(x) = A e^{ikx} \quad , \quad \frac{d\psi}{dx} = ik\psi \quad , \quad \frac{d^2\psi}{dx^2} = -k^2\psi$$

Sust. en ec. Schrödinger $\rightarrow -\frac{h^2}{2m}\frac{d^2}{dx^2}\psi + U\psi = E\psi$

$$\frac{d^2\psi}{dx^2} = -k^2\psi = \frac{2m}{h^2}(E-U)\psi$$

Como $k^2 = \frac{(2\pi)^2}{\lambda^2} = \frac{(2\pi p)^2}{h^2} = \frac{p^2}{h^2} \Rightarrow \frac{\cancel{h^2}}{2m}\frac{p^2}{\cancel{h^2}} = (E-U)$

$$\Rightarrow E - U = \frac{p^2}{2m}$$