P2)

$$e\Phi = \frac{hc}{\lambda} = 2,07\,[eV]$$

$$P = I \cdot A = 1,3 \times 10^{-3}\,[W] \qquad P = \frac{E}{t} = \frac{ne}{t}$$

$$\frac{P}{e} = \frac{1,3 \times 10^{-3}\,[W]}{2,07\,[eV]}$$

$$= \underline{1,3 \times 10^{-3}\,[W]}$$

$$2,07 \cdot 1,6 \times 10^{-11}\,[J \cdot s]$$

$$\omega = \frac{v}{s}$$

$$\boxed{* \; e = 3,9 \times 10^{15}\,\frac{1}{s}}$$

$$\% = \frac{K_e^{max}}{e} = \frac{2,07 - 1,95}{2,07} \approx 6\%$$

P3)

$\Delta x = 0,12 \text{ nm}$

$\Delta p = 3,0 \times 10^{-25} \text{ kg m/s}$

$\Delta x \cdot \Delta p \geq \frac{\hbar}{2}$

$0,12 \times 10^{-9} \text{ m} \cdot 3,0 \times 10^{-25} \text{ kg m/s} \geq \frac{\hbar}{2}$

$0,12 \cdot 3 \times 10^{-34} \text{ kg m}$

$1,2 \cdot 3 \times 10^{-35}$

$3,6 \times 10^{-35} \geq \frac{\hbar}{2}$

$3,6$

$\hbar = \frac{1,05 \times 10^{-34}}{2}$

$= 5 \times 10^{-35}$

P4)

a) $\Delta x = 1{,}75$

b) $\Delta x \Delta p = \frac{\hbar}{2}$ incertidumbre mínima

$\Delta x \, m \, \Delta v = \frac{\hbar}{2}$

$\Delta v_{min} = \frac{\hbar}{2m\Delta x} = \frac{1{,}05 \times 10^{-34} \; [J \cdot s]}{2 \cdot 10g \cdot 1{,}75\,m}$

$= \frac{1{,}05 \times 10^{-34} \; [J \cdot s]}{2 \cdot 1{,}75[m] \cdot 0{,}01\,kg}$

$$\boxed{\Delta v = 3 \times 10^{-33} \, m/s}$$

distancia $\frac{1{,}75\,m}{v_{max}} = \frac{1{,}75\,m}{\frac{3 \times 10^{-33}}{2}\,m} = \frac{5 \times 10^{32}\,[s]}{2} = \frac{d}{\Delta v/2}$

$= \frac{\Delta v}{2}$

$= \frac{5 \times 10^{32}}{2} \cdot 3{,}1 \times 10^{-8}$ [años]

$= \frac{1{,}8 \times 10^{25}}{2}$ años!

P5)

$$f = \frac{V}{\text{Perimetro}} \qquad V = \frac{p}{m} = \frac{n\hbar}{R}$$

$$= \frac{n\hbar}{m n^2 a_B}$$

$$= \frac{\hbar}{m a_B \cdot n}$$

$$\rightarrow f = \frac{\frac{\hbar}{m a_B \cdot n}}{2\pi R} = \frac{\frac{\hbar}{m a_B \cdot n}}{2\pi \cdot n^2 a_B}$$

$$= \frac{\hbar}{2\pi \cdot m (a_B)^2 n^3}$$

$$= \frac{\hbar}{m \left(\frac{4\pi \hbar^2 \varepsilon_0}{m e^2}\right)^2 \cdot n^3}$$

$$= \frac{\hbar}{m \left(\frac{4\pi \hbar^2 \varepsilon_0}{m e^2}\right)^2 \cdot n^3} = \frac{\hbar}{m \frac{4\pi^2 \hbar^4 \varepsilon_0^2}{m^2 e^4} \cdot n^3} = \frac{m e^4}{4\pi \varepsilon_0^2 \hbar^3}$$

$$= \frac{\hbar \hbar}{m \cdot 2\pi a_B n^3}$$

$$= \frac{\hbar \hbar}{m \cdot \frac{4\pi \varepsilon_0 \hbar^2}{m e^2} \cdot n^3}$$

$hf = E_i - E_f$

$$E_i = \frac{-E_0}{(n+1)^2}$$

$$f = \frac{1}{h}\left(-\frac{E_0}{(n+1)^2} + \frac{E_0}{n^2}\right)$$

$$\vdots$$

$$= \frac{E_0}{h}\left(\frac{2n+1}{1}\right)$$

$$E_0 = \frac{e^2}{2a_B} \cdot \frac{1}{4\pi\varepsilon_0}$$

$$=$$

$$a_B = \frac{4\pi\varepsilon_0 \hbar^2}{me^2}$$

$$= \left(\frac{me^4}{4\cancel{8}\varepsilon_0^2 h^3}\right) \cdot \frac{2n}{h^3}$$

$$E_0 = \frac{e^2}{2\left(\frac{4\pi\varepsilon_0 \hbar^2}{me^2}\right) 4\pi\varepsilon_0}$$

$$= \frac{me^4}{2\cdot(4\pi\varepsilon_0)^2\hbar^2} = \frac{me^4}{2\cdot(2\varepsilon_0)^2 h^2}$$