

$$1) \quad \frac{mv^2}{2} = \frac{e^2}{4\pi\epsilon_0 r^2} \Rightarrow \frac{4\pi\epsilon_0}{e^2} = \frac{2}{r^2 mv^2}$$

$$\Rightarrow \frac{4\pi\epsilon_0}{e^2} = \frac{1}{\pi mv^2}$$

$$r \gg a_0 \Rightarrow r \gg \frac{4\pi\epsilon_0 \hbar^2}{e^2 m_e}$$

$$\Rightarrow r \gg \frac{\hbar^2}{\pi mv^2 m_e}$$

$$\Rightarrow r^2 \pi^2 v^2 \gg \hbar^2$$

(car $m = m_e$)

$$\Rightarrow r mv \gg \hbar$$

Ce qui implique que $L \gg \hbar$ lorsque $r \gg a_0$

2) Incertitude minimum :

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

or $\Delta x \approx \text{interatomique} \approx a$

$$\Delta p \geq \frac{\hbar}{2a}$$

$$\text{Energie cinétique : } E_c = \frac{p^2}{2m_e} = \frac{\hbar^2}{8a^2 m_e}$$

~~impulsion : $p = mv$~~

impulsion : $p = m v$

$$\Rightarrow v = \frac{p}{m}$$

$$\Rightarrow v = \frac{h}{2 a . m}$$

3) Radiation de longueur d'onde $\lambda = 97,24 \text{ nm}$



Transition électronique
de H

$$E_n = - \frac{E_0}{n^2}$$

$$\Delta E = \frac{hc}{\lambda} = 2,09 \times 10^{-18} \text{ J} = 12,76 \text{ eV}$$

$$E_0 = 13,6 \text{ eV}$$

$$\Delta E = E_n - E_0 = - \frac{E_0}{n^2} + \frac{E_0}{1^2} = E_0 \left(- \frac{1}{n^2} + 1 \right)$$

$$\Rightarrow \frac{\Delta E}{E_0} = - \frac{1}{n^2} + 1$$

$$\frac{\Delta E}{E_0} - 1 = - \frac{1}{n^2} \Rightarrow - \frac{1}{\frac{\Delta E}{E_0} - 1} = n^2 \Rightarrow n^2 = 16 \Rightarrow n = 4$$