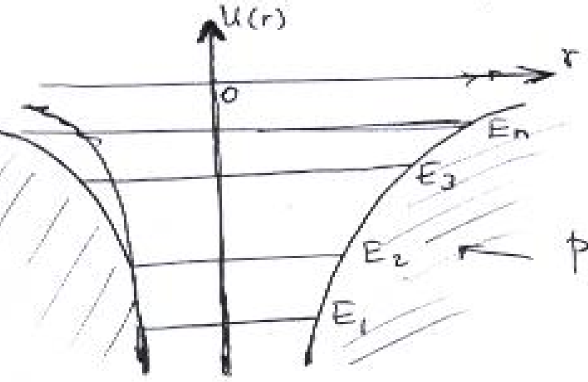
If $v = 3$ cm/s $\quad E = \frac{1}{2} m v^2 = 4.5 \times 10^{-10}$ J

$$n = \sqrt{\frac{8 m L^2 E}{h}} = 9.05 \times 10^{23}$$

n is very large. We are in the classical region.

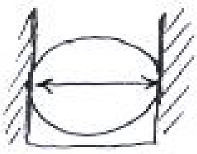
Ex 5.7 Model of an Atom



Coulombic attraction

← potential well that each e^- sees

Use the model of a particle in a box to estimate the energy (in eV) required to raise an atomic e^- from state n=1 to state n = 2. Assume the atom's radius = 0.1 nm = 1 Å



$L = 0.2$ nm

$m_e = 0.511 \frac{MeV}{c^2}$ $\quad \hbar c = 0.1973$ keV

$$E_1 = \frac{\pi^2 \hbar^2}{2 m_e L^2} = 9.40 \text{ eV}$$

$$E_2 = 4 E_1 = 37.6 \text{ eV}$$

$$\Delta E = E_2 - E_1 = 28.2 \text{ eV}$$

Calculate λ!

$$\Delta E = hf = h\frac{c}{\lambda} \Rightarrow \lambda = \frac{hc}{\Delta E} = \frac{12400}{28.2} = 440 \text{ Å}$$

in the far UV region.

This is just a model that is valid for low n but for high n it gets worse!