$$U_n = \frac{(Ze)(-e)}{4\pi\epsilon_0 r} \Rightarrow \frac{-Ze^2}{4\pi\epsilon_0 r}$$

$$U_n = \frac{-Ze^2}{4\cancel{\pi}\epsilon_0\left(\frac{\epsilon_0 n^2 h^2}{\cancel{\pi} m Z e^2}\right)} = \frac{-Ze^2 \times mZe^2}{4\epsilon_0^2 n^2 h^2}$$

$$\boxed{U_n \Rightarrow \frac{-me^4}{4\epsilon_0 h^2} \times \frac{Z^2}{n^2}}$$

$$= \frac{-(9.1\times10^{-31})(1.6\times10^{-19})^4}{4(8.854\times10^{-12})^2(6.6\times10^{-34})^2} \times \frac{Z^2}{n^2}\ J$$

$$= -27.2 \times 1.6 \times 10^{-19}\ \frac{Z^2}{n^2}\ J.$$

$1.6\times10^{-19}\ J = 1eV$

$$\therefore\ \boxed{U_n = -27.2\ \frac{Z^2}{n^2}\ eV}$$

Mechainical energy of $\bar{e}$ in n^{th} orbit :-

$$E_n = K.E + P.E$$

$$E_n = K.E + U_n$$

$$= \frac{mz^2e^4}{8\epsilon_0^2 n^2 h} - \frac{mz^2e^4}{4\epsilon_0^2 n^2 h^2}$$

$$= \frac{mz^2e^4}{4\epsilon_0^2 n^2 h^2}\left(\frac{1}{2} - 1\right) = \frac{mz^2e^4}{4\epsilon_0^2 n^2 h^2}\left(-\frac{1}{2}\right)$$

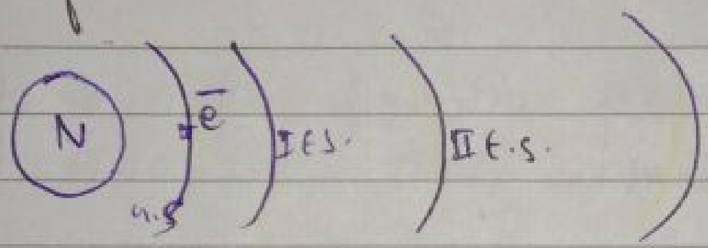
$$\boxed{E_n = \frac{-mz^2e^4}{8\epsilon_0^2 n^2 h^2}}$$

(1) Calculate energy of ē in 2nd orbit of helium^{+} ion.

$$E_2 = -13.6 \times \frac{Z^2}{n^2} \Rightarrow -13.6 \times \frac{\cancel{4}}{\cancel{4}}$$

$$= \boxed{-13.6 \text{ e.V}}$$

(2) Calculate energy of ē in 2nd excited state of Li^{2+} ion.



Li atom = 3ē. Li^{2+} ion = 1ē

$$E_n = -13.6 \times \frac{3^2}{3^2} \Rightarrow \boxed{-13.6 \text{ e.V}}$$

(3) As long as ē move in same orbit its energy is constant. Orbit are called stationary orbit.
But when it jumps from one orbit to other, its energy change.

(i) When it goes from inner to outer orbit, then it <u>absorbs</u> energy.

(ii) When it comes from outer to inner orbit, then it <u>releases</u> energy in form of electromagnetic waves. (light waves).