BOHR'S MODEL

$$E = K + V$$

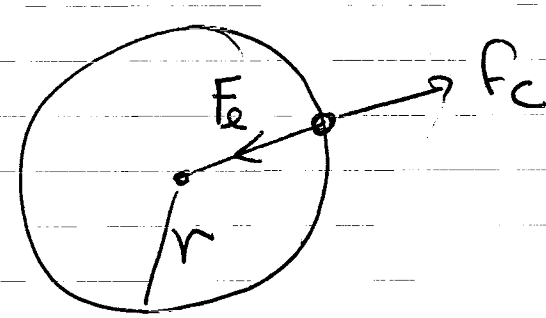
$$E = \frac{1}{2} m v^2 - \frac{Z e^2}{4\pi \epsilon_0 r}$$

$$F = -\frac{\partial V}{\partial r} = -\frac{Z e^2}{4\pi \epsilon_0 r^2}$$

FOR A CIRCULAR TRAJECTORY

ELECTROSTATIC FORCE = CENTRIPETAL FORCE

$$F_e = + \frac{Z e^2}{4\pi \epsilon_0 r^2} = \frac{m v^2}{r} \equiv f_c$$



BOHR'S ASSUMPTION:

ANGULAR MOMENTUM IS QUATIZED

$$\boxed{L = m v r = n \frac{h}{2\pi}}, \quad n \in \mathbb{N}$$

a) $2\pi r = n \frac{h}{mv}$

b) $v = \frac{nh}{2\pi r m}$

$$\Rightarrow \frac{Ze^2}{\cancel{4\pi}\epsilon_0 \cancel{r^2}} = \frac{\cancel{m}}{r} \frac{n^2 h^2}{\cancel{4}\pi^{\cancel{2}} \cancel{r^2} m^{\cancel{2}}}$$

$$r_n = \frac{n^2 h^2 \epsilon_0}{\pi m Z e^2} \equiv \frac{n^2}{Z} a_0$$

$$\boxed{a_0 = 5.29 \times 10^{-10} \text{ m}}$$

$$E = \frac{1}{2} m \left(\frac{nh}{2\pi r m}\right)^2 - \frac{Ze^2}{4\pi\epsilon_0} \frac{1}{r}$$

$$= \frac{n^2 h^2}{8\pi^2 m} \frac{1}{r^2} - \frac{Ze^2}{4\pi\epsilon_0} \frac{1}{r}$$

$$= \frac{n^2 h^2}{8\pi^2 m} \left(\frac{\pi m Z e^2}{n^2 h^2 \epsilon_0}\right)^2 - \frac{Ze^2}{4\pi\epsilon_0} \left(\frac{\pi m Z e^2}{n^2 h^2 \epsilon_0}\right)$$

$$= \frac{\cancel{n^2} \cancel{h^2}}{8 \cancel{\pi^2} \cancel{m}} \frac{\cancel{\pi^2} m^{\cancel{2}} Z^2 e^4}{n^{\cancel{4}2} h^{\cancel{4}2} \epsilon_0^2} - \frac{Ze^2}{4\cancel{\pi}\epsilon_0} \frac{\cancel{\pi} m Z e^2}{n^2 h^2 \epsilon_0}$$

$$E = \frac{z^2 e^4 m}{8h^2 n^2 \epsilon_0^2} - \frac{z^2 e^4 m}{4h^2 \epsilon_0^2 n^2}$$

$$\boxed{E_n = -\left(\frac{me^4}{8\epsilon_0^2 h^2}\right)\frac{z^2}{n^2}}$$

FOR THE ORBITS CHARACTERIZED BY r_n, THE e^- DOES NOT RADIATE EVENTHOUGH IT IS UNDER THE CENTRIPETAL ACELERATION.

$\boxed{\text{de Broglie}}$

Particles have WAVE PROPERTIES WITH WAVE LENGTH

$$\boxed{\lambda = \frac{h}{mv}}$$

$$p = mv$$

HEISEMBERG UNCERTAINTY PRINCIPLE

$$\Delta x \, \Delta P_x \geq \frac{\hbar}{2}$$

$$\hbar \equiv \frac{h}{2\pi}$$

LIMITATION IN OUR ABILITY TO MEASURE THE VALUES OF THE OBSERVABLES x AND P_x AT THE SAME INSTAT IN TIME.

THEREFORE THE BOHR MODEL DOES NOT SATISFYES THIS PRINCIPLE!