

Structure of Atom III

- Coulombic force = $\frac{kZe^2}{r^2}$

$k = \frac{1}{4\pi\epsilon_0}$, $\epsilon_0 =$ permittivity in free space.

$k = 9 \times 10^9 \text{ Nm/C}^2$
 $= 1 \text{ (esu)}^{-2}$

- For stable electron orbit.

$$\frac{mv^2}{r} = \frac{kze^2}{r^2} \Rightarrow v^2 = \frac{kze^2}{mr}$$

$$r = \frac{n^2 h^2}{4\pi^2 m k z e^2}$$

$$r_n^{\text{at.}} = 0.529 \times \frac{n^2}{z} \text{ \AA}$$

- $K.E = \frac{1}{2}mv^2$, $P.E = -\frac{kze^2}{r}$

$$\text{Total Energy} = \frac{1}{2}mv^2 - \frac{kze^2}{r}$$

$$= -\frac{kze^2}{2r}$$

$$T.E = -13.6 \frac{z^2}{n^2} \text{ (Important)}$$

- For an Hydrogen Atom,

$$\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$
$$= 109678 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{ cm}^{-1}$$

- velocity, $v = 2.18 \times 10^8 \frac{z}{n} \text{ cm/sec}$.

- According to Maxwell Theory, EM waves can be produced by oscillating charged particles.

- Black body \rightarrow Perfectly Absorbs/emits.

- $E_{\text{photon}} = hf = \frac{hc}{\lambda}$.

- $K \cdot E_{\text{max}} = hf - \phi = \frac{hc}{\lambda} - \phi \rightarrow$ work function
 $= qeV_s$, $V_s =$ stopping potential.

(*) $v_n \propto \frac{z}{n}$ T , is time period.

$T \propto \frac{n^3}{z^2}$

$r \propto \frac{z^2}{n^3}$

$E \propto \frac{z^2}{n^2}$

(*) Total Energy is negative