# Formula Sheet
## Insta - Physics by Fr. M K Raj

### Atoms

1. Distance of closest approach,

$$r_0 = \frac{2kze^2}{\frac{1}{2}mv^2}$$

2. Impact Parameter, $b = \frac{kze^2 \cot \theta/2}{\frac{1}{2}mv^2}$

3. $F = \frac{-kze^2}{2r}$ } before using Bohr's postulates }

After using Bohr's postulates,

$$F = \frac{-13.6\, z^2}{n^2} \text{ eV}$$

K.E. $= -E$

P.E. $= 2E$

4. $F_c = F_e \Rightarrow \frac{mv^2}{r} = \frac{kze^2}{r^2}$

5. $mvr = \frac{nh}{2\pi}$

6. $$r = \frac{n^2h^2}{4\pi^2 mkze^2} = \frac{0.53\, n^2}{z} \text{ Å}$$

7. $$v = \frac{2\pi kze^2}{nh} = \frac{21.8 \times 10^5\, z}{n} \text{ m/s}$$

8. Time period,

$$T = \frac{2\pi r}{v} = 1.527 \times 10^{-16}\, n^3 \text{ Sec}$$

9. $$h\nu = E_2 - E_1 = 13.6\, Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \text{eV}$$

10. $$\frac{1}{\lambda} = \underset{\text{Rydberg's Constant}}{R} Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] m^{-1}$$ → Rydberg's formula

#. Some important points :-

(i) $1\ eV = 1.6 \times 10^{-19}\ J$

(ii) For hydrogen atom, $Z = 1$

(iii) $r \propto n^2$ ; $v \propto \frac{1}{n}$ ; $|E| \propto \frac{1}{n^2}$

(iv) With increase in 'n', 'E' decreases in negative that means in actual 'E' increases with the increase in 'n'.

(v) $R = 1.097 \times 10^7\ m^{-1}$ ; $1/R = 912\ \text{Å}$

(vi) In spectral series, for max. $\lambda$ and min. 'E' $\Rightarrow n_2 = n_1 + 1$ and for min. $\lambda$ and max. 'E' $\Rightarrow n_2 = \infty$.

(vii) Ground state energy $= -13.6\, z^2$ eV

(viii) Ionisation energy $= 13.6\, z^2$ eV

(ix) For,

Lyman series $\Rightarrow n_1 = 1$

Balmer " $\Rightarrow n_1 = 2$

Paschen " $\Rightarrow n_1 = 3$

Brackett " $\Rightarrow n_1 = 4$

P fund " $\Rightarrow n_1 = 5$