Atomic Structure (Formula Sheet)

1. $K = {}^{\circ}C + 273$

2. $\frac{{}^{\circ}C}{5} = \frac{{}^{\circ}F - 32}{9}$

3. $\text{Specific charge} = \frac{\text{Charge}}{\text{Mass}}$

4. Atomic Number = Z = No. of protons

5. Mass Number = A = No. of protons + No. of neutrons

6. $\text{No. of protons in molecule} = \Sigma[(\text{Z value of atom})(\text{Total no. of atoms})]$

7. $\text{No. of electrons in molecule} = \Sigma[(\text{Z value of atom})(\text{Total no. of atoms})]$

8. $\text{No. of neutrons in molecule} = \Sigma[(\text{(A - Z) value of atom})(\text{Total no. of atoms})]$

9. $\text{No. of protons in ions} = \Sigma[(\text{Z value of atom})(\text{Total no. of atoms})]$

10. $\text{No. of electrons in ions} = \left[\text{No. of protons} - \left(\text{Total positive charge}\right) + \left(\text{Total Negative charge}\right)\right]$

11. $\text{No. of neutrons in ions} = \Sigma[(\text{(A - Z) value of atom})(\text{Total no. of atoms})]$

12. $\left(\text{No. of } \alpha\text{-particles deflected}\right) \propto (\text{Thickness of Foil})$

13. $\left(\text{No. of } \alpha\text{-particles deflected}\right) \propto \frac{1}{(\text{Kinetic Energy})^2}$

14. $\left(\text{No. of } \alpha\text{-particles deflected}\right) \propto (\text{Atomic No (Z)})^2$

15. $\left(\text{No. of } \alpha\text{-particles deflected at diff. angle}\right) \propto \frac{1}{\left[\sin\left(\frac{\theta}{2}\right)\right]^4}$

(16) $F_a = \frac{K q_1 q_2}{r^2}$

(17) $F_c = \frac{mv^2}{r}$

(18) $KE = \frac{Ze^2K}{2r}$

(19) $PE = -\frac{Ze^2K}{r}$

(20) $TE = -\frac{Ze^2K}{2r}$

$$\left(\begin{array}{l} TE = -KE \\ PE = -2KE \\ PE = +2TE \end{array} \right)$$

(21) Distance of closest Approach $\Rightarrow r = \frac{4Ze^2K}{m_\alpha V_\alpha^2}$

(22) Radius of nucleus $= \left[1.33 \times A^{1/3}\right] \times 10^{-13}$ cm

(23) Time period $= \frac{1}{\text{Frequency}}$

(24) Wave Number $= \frac{1}{\text{Wave-Length}}$

(25) $C = \nu\lambda$

(26) Radio wave < Micro wave < I.R < Visible < U.V < X-Ray < Gamma Ray < Cosmic Ray

$\xrightarrow{\hspace{10em}}$

Energy / Frequency

(27) Energy of single photon $= \frac{hc}{\lambda}$ or $h\nu$

(28) Energy of multiple photons $= N\frac{hc}{\lambda}$ or $Nh\nu$

(29) $H.C \simeq 2 \times 10^{-25}$ Jm

(30) 1 mole $= 6.022 \times 10^{23}$

(31) $1\,eV = 1.6 \times 10^{-19} J$

(32) $E(eV) = \frac{1240}{\lambda(nm)} eV$

(33) $\text{Power} = \frac{\text{Energy}}{\text{Time}}$

(34) $L = mvr = \frac{nh}{2\pi} = n\hbar$

(35) $r = \frac{n^2 h^2}{4\pi^2 m Z e^2 K}$ $\quad r = 0.529 Å \frac{n^2}{Z}$ $\quad r = r_{H(1st)} \times \frac{n^2}{Z}$

(36) $V = \frac{2\pi Z e^2 K}{nh}$ $\quad V = 2.18 \times 10^6 \times \frac{Z}{n} m/s$ $\quad V = V_{H(1st)} \times \frac{Z}{n}$

(37) $TE = -\frac{2m\pi^2 Z^2 e^4 K^2}{n^2 h^2}$ $\quad TE = -13.6 \times \frac{Z^2}{n^2} eV$ $\quad TE = E_{H(1st)} \frac{Z^2}{n^2}$

(38) n^{th} Excited State = $(n+1)^{th}$ Orbit Number

(39) Ionization Energy $IE = 13.6 Z^2 eV$

(40) Separation Energy $SE_{n^{th}} = -E_{(n+1)^{th}}$

(41) Excitation Energy $EE_{n^{th}} = E_{(n+1)^{th}} - E_1$

(42) Rydberg's Equation $\Rightarrow$ $\frac{1}{\lambda} = R_H Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$R_H = 109677 \text{ cm}^{-1}$

$= 10967700 \text{ m}^{-1}$

n_1 = chota Orbit

n_2 = Bada Orbit