

CONCEPT MAP

CLASS XI

ESSENTIAL CONCEPTS OF PHYSICAL CHEMISTRY

Get well-prepared for exams with quick revision of important formulae of physical chemistry.

Some Basic Concepts of Chemistry

- Percentage yield = $\frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$
- Atomic mass = $\frac{\text{Mass of one atom of the element}}{\frac{1}{12} \times \text{Mass of an atom of } C-12}$
= Eq. mass \times Valency
- Atomic mass = $\frac{\text{Molecular mass}}{\text{Atomicity}} = \frac{6.4}{\text{Specific heat (cal/g)}}$
- Molecular mass = $2 \times$ Vapour density
- Number of gram atoms = $\frac{w \text{ (g)}}{\text{Gram atomic mass (GAM)}}$
- Number of gram molecules = $\frac{w \text{ (g)}}{\text{Gram molecular mass (GMM)}}$
- Number of gram equivalents = $\frac{w \text{ (g)}}{\text{Gram equivalent mass (GEM)}}$
- Equivalent mass of an element = $\frac{\text{Atomic mass}}{\text{Valency}}$
- Equivalent mass of an acid = $\frac{\text{Molecular mass of acid}}{\text{Basicity}}$
- Equivalent mass of a base = $\frac{\text{Molecular mass of base}}{\text{Acidity}}$
- Percentage composition = $\frac{\text{Mass of the element}}{\text{Molar mass of compound}} \times 100$
- Mass % = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$
- Molarity (M) = $\frac{W_B \times 1000}{M_B \times V \text{ (in mL)}}$
- Normality (N) = $\frac{W_B \times 1000}{EM_B \times V \text{ (in mL)}}$
- Molality (m) = $\frac{W_B \times 1000}{M_B \times W_A \text{ (in g)}}$
where, W_B = Mass of solute, M_B = Molecular mass of solute
 W_A = Mass of solvent
- Mole fraction, $x_B = \frac{n_B}{n_A + n_B}$ and $x_A = \frac{n_A}{n_A + n_B}$
- $M_1 V_1/n_1 = M_2 V_2/n_2$ or $N_1 V_1 = N_2 V_2$
- $M_3(V_1 + V_2) = M_1 V_1 + M_2 V_2$
- $\frac{1}{x_B} = 1 + \frac{M_B}{M_A} + \frac{1000d}{M_A \times M} = 1 + \frac{1000}{m \times M_A}$
- Number of moles = Molarity \times Volume
- Number of equivalents = Normality \times Volume
- Molecular formula = $n \times$ Empirical formula
- $n = \frac{\text{Molecular formula mass}}{\text{Empirical formula mass}}$

Structure of Atom

- Radius of nucleus (R) = $R_0 A^{1/3}$
 R_0 - Constant ($\approx 1.33 \times 10^{-13}$ cm)
 A = Mass number of atom
- $\bar{v} = \frac{1}{\lambda} = \frac{v}{c}$; $E = \frac{hc}{\lambda} = h\nu = h\nu_0 + \frac{1}{2} m v^2$
- $\bar{v} = 109,677 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{ cm}^{-1}$; $\nu = 3.29 \times 10^{15} \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{ s}^{-1}$
- $mvr = \frac{nh}{2\pi}$; $r_n = \frac{n^2 a_0}{Z}$ or $\frac{52.9n^2}{Z} \text{ pm}$
- $E_n = -R_H \left(\frac{Z^2}{n^2} \right) = -2.18 \times 10^{-18} \left(\frac{Z^2}{n^2} \right) \text{ J/atom}$
or $\frac{-Z^2}{n^2} \times 1312 \text{ kJ/mol}$ or $\frac{-Z^2}{n^2} \times 13.6 \text{ eV/atom}$
- $\nu_n = \frac{2.19 \times 10^8 \times Z}{n} \text{ m s}^{-1}$
- $\Delta E = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) = 2.18 \times 10^{-18} \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$
- $\lambda = \frac{h}{mv} = \frac{h}{p} = \frac{h}{\sqrt{2mE_k}} = \frac{h}{\sqrt{2mqV}}$
- $\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$ or $\Delta x \cdot \Delta v \geq \frac{h}{4\pi m}$
- Schrödinger wave equation:
 $\nabla^2 \psi - \frac{8\pi^2 m}{h^2} (E - V) \psi = 0$; ∇ = Laplacian operator
- Maximum no. of spectral lines produced when an electron jumps from $n \rightarrow 1 = \frac{n(n-1)}{2}$
- No. of lines in the spectrum when an electron returns from $n_2 \rightarrow n_1 = \frac{(n_2 - n_1)(n_2 - n_1 + 1)}{2}$
- I.E. = $E_\infty - E_n = 2.18 \times 10^{-18} \times \frac{Z^2}{n^2} \text{ J/atom}$
or $13.6 \times \frac{Z^2}{n^2} \text{ eV/atom}$
- Orbital angular momentum = $\sqrt{l(l+1)} \frac{h}{2\pi}$
- Magnetic moment = $\sqrt{n(n+2)} \text{ B.M.}$
- Spin angular momentum = $\sqrt{s(s+1)} \frac{h}{2\pi}$
- Spin multiplicity = $2S + 1$;
 S = Sum of spin quantum numbers.
- Radial nodes = $n - l - 1$; Angular nodes = l
- Total no. of nodes = $n - 1$