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 $= \dfrac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$
- Atomic mass $= \dfrac{\text{Mass of one atom of the element}}{\frac{1}{12} \times \text{Mass of an atom of C–12}}$
  $= \text{Eq. mass} \times \text{Valency}$
- Atomic mass $= \dfrac{\text{Molecular mass}}{\text{Atomicity}} = \dfrac{6.4}{\text{Specific heat (cal/g)}}$
- Molecular mass $= 2 \times$ Vapour density
- Number of gram atoms $= \dfrac{w\text{ (g)}}{\text{Gram atomic mass (GAM)}}$
- Number of gram molecules $= \dfrac{w\text{ (g)}}{\text{Gram molecular mass (GMM)}}$
- Number of gram equivalents $= \dfrac{w\text{ (g)}}{\text{Gram equivalent mass (GEM)}}$
- Equivalent mass of an element $= \dfrac{\text{Atomic mass}}{\text{Valency}}$
- Equivalent mass of an acid $= \dfrac{\text{Molecular mass of acid}}{\text{Basicity}}$
- Equivalent mass of a base $= \dfrac{\text{Molecular mass of base}}{\text{Acidity}}$
- Percentage composition $= \dfrac{\text{Mass of the element}}{\text{Molar mass of compound}} \times 100$
- Mass % $= \dfrac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$
- Molarity $(M) = \dfrac{W_B \times 1000}{M_B \times V\text{ (in mL)}}$
- Normality $(N) = \dfrac{W_B \times 1000}{EM_B \times V\text{ (in mL)}}$
- Molality $(m) = \dfrac{W_B \times 1000}{M_B \times W_A\text{ (in g)}}$
  where, W_B = Mass of solute, M_B = Molecular mass of solute
  W_A = Mass of solvent
- Mole fraction, $x_B = \dfrac{n_B}{n_A + n_B}$ and $x_A = \dfrac{n_A}{n_A + n_B}$
- $M_1V_1/n_1 = M_2V_2/n_2$ or $N_1V_1 = N_2V_2$
- $M_3(V_1 + V_2) = M_1V_1 + M_2V_2$
- $\dfrac{1}{x_B} = 1 - \dfrac{M_B}{M_A} + \dfrac{1000d}{M_A \times M} = 1 + \dfrac{1000}{m \times M_A}$
- Number of moles = Molarity × Volume
- Number of equivalents = Normality × Volume
- Molecular formula $= n \times$ Empirical formula
- $n = \dfrac{\text{Molecular formula mass}}{\text{Empirical formula mass}}$

Structure of Atom

- Radius of nucleus $(R) = R_0A^{1/3}$
  R_0 = Constant $(= 1.33 \times 10^{-13}$ cm)
  A = Mass number of atom
- $\bar{\upsilon} = \dfrac{1}{\lambda} = \dfrac{\upsilon}{c}$; $E = \dfrac{hc}{\lambda} = h\upsilon = h\upsilon_0 + \dfrac{1}{2}mv^2$
- $\bar{\upsilon} = 109{,}677\left(\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2}\right)$ cm^{-1}; $\upsilon = 3.29 \times 10^{15}\left(\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2}\right)$ s^{-1}
- $mvr = \dfrac{nh}{2\pi}$; $r_n = \dfrac{n^2 a_0}{Z}$ or $\dfrac{52.9n^2}{Z}$ pm
- $E_n = -R_H\left(\dfrac{Z^2}{n^2}\right) = -2.18 \times 10^{-18}\left(\dfrac{Z^2}{n^2}\right)$ J/atom
  or $\dfrac{-Z^2}{n^2} \times 1312$ kJ/mol or $\dfrac{-Z^2}{n^2} \times 13.6$ eV/atom
- $v_n = \dfrac{2.19 \times 10^6 \times Z}{n}$ m s^{-1}
- $\Delta E = R_H\left(\dfrac{1}{n_i^2} - \dfrac{1}{n_f^2}\right) = 2.18 \times 10^{-18}\left(\dfrac{1}{n_i^2} - \dfrac{1}{n_f^2}\right)$
- $\lambda = \dfrac{h}{mv} = \dfrac{h}{p} = \dfrac{h}{\sqrt{2mE_k}} = \dfrac{h}{\sqrt{2mqV}}$
- $\Delta x \cdot \Delta p \geq \dfrac{h}{4\pi}$ or $\Delta x \cdot \Delta v \geq \dfrac{h}{4\pi m}$
- Schrödinger wave equation:
  $\nabla^2\psi + \dfrac{8\pi^2 m}{h^2}(E - V)\psi = 0$; ∇ = Laplacian operator
- Maximum no. of spectral lines produced when an electron jumps from $n \to 1 = \dfrac{n(n-1)}{2}$
- No. of lines in the spectrum when an electron returns from $n_2 \to n_1 = \dfrac{(n_2 - n_1)(n_2 - n_1 + 1)}{2}$
- $I.E. = E_\infty - E_n = 2.18 \times 10^{-18} \times \dfrac{Z^2}{n^2}$ J/atom
  or $13.6 \times \dfrac{Z^2}{n^2}$ eV/atom
- Orbital angular momentum $= \sqrt{l(l+1)}\,\dfrac{h}{2\pi}$
- Magnetic moment $= \sqrt{n(n+2)}$ B.M.
- Spin angular momentum $= \sqrt{s(s+1)}\,\dfrac{h}{2\pi}$
- Spin multiplicity $= 2S + 1$;
  S = Sum of spin quantum numbers.
- Radial nodes $= n - l - 1$; Angular nodes $= l$
- Total no. of nodes $= n - 1$