CLASS 12 CHEMISTRY REVISION NOTES

Revision Notes: Class 12 Chemistry Chapter 2 Solutions

A condensed, formula-first recap of every key definition and result in Chapter 2: Solutions — ideal for last-minute board exam revision.

Contents

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Revision Notes: Class 12 Chemistry Chapter 2 – Solutions

Solution = homogeneous mixture of two or more non-reacting substances; solute (lesser amount) + solvent (greater amount).

9 types of solutions based on physical state of solute/solvent: gas–gas, gas–liquid, gas–solid, liquid–gas, liquid–liquid, liquid–solid, solid–gas, solid–liquid, solid–solid.

Mass percentage (w/w %) = (mass of component ÷ total mass of solution) × 100.

Volume percentage (v/v %) = (volume of component ÷ total volume of solution) × 100.

Mass by volume percentage (w/v %) = (mass of solute in g ÷ volume of solution in mL) × 100.

Parts per million (ppm) = (mass/moles/volume of component ÷ total mass/moles/volume) × 10^6.

Mole fraction, x_A = n_A ÷ (n_A+n_B); sum of all mole fractions in a solution = 1.

Molarity (M) = moles of solute ÷ volume of solution (L); unit mol L−1; temperature-dependent (volume changes with T).

Molality (m) = moles of solute ÷ mass of solvent (kg); unit mol kg−1; temperature-independent.

Solubility of a solid in a liquid depends on temperature and, per Le Chatelier's principle, increases with T if dissolution is endothermic and decreases if exothermic.

Solubility of a gas in a liquid decreases with increasing temperature (dissolution of gases is exothermic) and increases with increasing pressure.

Henry's law: p = K_H · x, where p = partial pressure of gas, x = mole fraction of gas in solution, K_H = Henry's law constant (depends on gas, solvent, and temperature); higher K_H = lower solubility at a given pressure.

Applications of Henry's law: carbonated drinks (CO_2 solubility under pressure), scuba diving (N_2 narcosis / decompression sickness), high-altitude anoxia (low O_2 partial pressure).

Raoult's law (volatile solute): p1 = x1 p°1, p2 = x2 p°2; total pressure p_total = x1 p°1 + x2 p°2.

Raoult's law (non-volatile solute): relative lowering of vapour pressure (p°−p)/p° = x2 (mole fraction of solute); for dilute solutions, x2 ≈ n2/n1.

Ideal solutions: obey Raoult's law at all concentrations; ΔmixH = 0, ΔmixV = 0 (e.g., benzene + toluene, n-hexane + n-heptane).

Non-ideal solutions show deviation from Raoult's law: **positive deviation** (A–B forces weaker than A–A/B–B; ΔmixH > 0; p_total > ideal; e.g. ethanol+acetone, water+ethanol) and **negative deviation** (A–B forces stronger; ΔmixH < 0; p_total < ideal; e.g. chloroform+acetone,

HNO_3+water).

Azeotropes: constant-boiling mixtures with the same composition in liquid and vapour phases; cannot be separated by simple distillation. Minimum-boiling azeotropes form from solutions with positive deviation; maximum-boiling azeotropes from negative deviation.

Colligative properties depend only on the number of solute particles, not their identity: relative lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure.

Elevation of boiling point: $\Delta T_b = i \cdot K_b \cdot m$, where K_b = molal elevation (ebullioscopic) constant, m = molality.

Depression of freezing point: $\Delta T_f = i \cdot K_f \cdot m$, where K_f = molal depression (cryoscopic) constant.

K_b and K_f are solvent-specific constants with units K kg mol^{-1}; for water, K_f = 1.86 K kg mol^{-1} (standard/commonly used value).

Osmosis: spontaneous flow of solvent from a region of lower solute concentration to higher solute concentration through a semi-permeable membrane.

Osmotic pressure: $\pi = CRT$ (van't Hoff equation for dilute solutions), where C = molar concentration, R = gas constant, T = temperature (K); equivalently $\pi = (n/V)RT$; for an ionising/associating solute, $\pi = iCRT$.

Isotonic solutions have equal osmotic pressure at a given temperature; a solution is hypertonic/hypotonic relative to another if its osmotic pressure is higher/lower.

Reverse osmosis: applying pressure greater than osmotic pressure forces solvent to flow from concentrated to dilute solution through a semi-permeable membrane (used in seawater desalination).

Van't Hoff factor, i = normal molar mass ÷ observed (abnormal) molar mass = observed colligative property ÷ calculated (normal) colligative property = (total number of moles of particles after dissociation/association) ÷ (number of moles of formula units dissolved).

Dissociation (solute breaks into n ions): $i = 1 + (n-1)\alpha$, where α = degree of dissociation; $i > 1$ (e.g. NaCl, KCl, electrolytes).

Association (n solute units combine into one aggregate): $i = 1 - \alpha + \alpha/n = 1 - \alpha(1-1/n)$; $i < 1$ (e.g. carboxylic acids dimerising in benzene).

Modified colligative-property equations with van't Hoff factor: $\Delta T_b = i\, K_b\, m$; $\Delta T_f = i\, K_f\, m$; $\pi = i\, CRT$; $(p^\circ - p)/p^\circ = i$ x2.