CLASS 12 CHEMISTRY — FORMULA SHEET

Chapter 1 : Solutions (NCERT)

1.1 Types of Solutions & Concentration Terms

Concentration Term	Formula
Mass percentage (w/w)	= (mass of solute ÷ mass of solution) × 100
Volume percentage (v/v)	= (volume of solute ÷ volume of solution) × 100
Mass by volume (w/v)	= (mass of solute ÷ volume of solution) × 100
Parts per million (ppm)	= (mass of solute ÷ mass of solution) × 10^6
Mole fraction (x)	$x_A = n_A \div (n_A + n_B)$; $x_A + x_B = 1$
Molarity (M)	= moles of solute ÷ volume of solution (L)
Molality (m)	= moles of solute ÷ mass of solvent (kg)
Normality (N)	= gram equivalents of solute ÷ volume (L)

1.2 Molarity vs Molality

Concept	Detail
Molarity depends on temperature	Volume changes with temperature (M is temperature-dependent)
Molality is temperature-independent	Uses mass, which does not change with temperature
Relation	Molarity = (molality × density × 1000) ÷ (1000 + molality × M_{solute})
Dilution formula	$M_1V_1 = M_2V_2$

1.3 Solubility & Henry's Law

Concept	Formula / Statement
Henry's law	$p = K_H x$ (partial pressure ∝ mole fraction of gas)
K_H meaning	Higher K_H → lower solubility of the gas
Effect of temperature	Solubility of gas DECREASES with rise in temperature
Effect of pressure (gas)	Solubility of gas INCREASES with pressure
Applications	Soda bottles, scuba diving (bends), high-altitude breathing

1.4 Raoult's Law & Vapour Pressure

Concept	Formula
Raoult's law (volatile solute)	$p_A = p°_A x_A$; $p_B = p°_B x_B$
Total vapour pressure	$p_{total} = p°_A x_A + p°_B x_B$
Raoult's law (non-volatile solute)	$p_{solution} = p°_{solvent} \times x_{solvent}$
Relative lowering of VP	$(p° - p) \div p° = x_{solute}$
Ideal solution	Obeys Raoult's law ; $\Delta H_{mix} = 0$, $\Delta V_{mix} = 0$

Concept	Formula
Positive deviation	p > Raoult ; weaker A-B forces (e.g. ethanol + acetone)
Negative deviation	p < Raoult ; stronger A-B forces (e.g. HNO_3 + water)
Azeotropes	Constant boiling mixtures (minimum or maximum boiling)

1.5 Colligative Properties

Property	Formula
Relative lowering of VP	$(p^\circ - p)/p^\circ = x_{solute} = (n_2)/(n_1 + n_2)$
Elevation of boiling point	$\Delta T_b = K_b \times m$
Depression of freezing point	$\Delta T_f = K_f \times m$
Molal elevation constant	K_b (ebullioscopic constant)
Molal depression constant	K_f (cryoscopic constant)
Osmotic pressure	$\Pi = C\ R\ T = (n/V)\ R\ T$
Molar mass from osmotic pressure	$M = (w\ R\ T) \div (\Pi\ V)$
Isotonic solutions	Same osmotic pressure ($\Pi_1 = \Pi_2$)

1.6 Van't Hoff Factor (i)

Concept	Formula
Van't Hoff factor	i = (observed colligative property) ÷ (calculated)
In terms of particles	i = (actual particles after dissociation) ÷ (particles before)
Modified formulas	$\Delta T_b = i\ K_b\ m$; $\Delta T_f = i\ K_f\ m$; $\Pi = i\ C\ R\ T$
Dissociation (i > 1)	Electrolytes split (e.g. NaCl → i ≈ 2)
Association (i < 1)	Molecules combine (e.g. benzoic acid in benzene → i ≈ 0.5)
Degree of dissociation (α)	$\alpha = (i - 1) \div (n - 1)$
Degree of association (α)	$\alpha = (1 - i) \div (1 - 1/n)$

★ QUICK MEMORY AIDS & TRICKS

Molarity vs molality	Molarity uses solution VOLUME (temp-dependent) ; molality uses solvent MASS (temp-independent).
Henry's law	p = K_H x. High K_H → low solubility. Gas solubility falls as temperature rises.
Raoult's law	p = p°x. Relative lowering of VP = mole fraction of solute.
Deviations	Positive: weaker forces, p higher (ethanol+acetone). Negative: stronger, p lower (HNO_3+water).
Colligative properties	Depend on NUMBER of particles, not their nature.
The four colligatives	VP lowering, boiling pt elevation, freezing pt depression, osmotic pressure.
Van't Hoff i	i > 1 dissociation (NaCl ≈ 2) ; i < 1 association (benzoic acid ≈ 0.5).

Osmotic pressure	Π = CRT. Best method for finding molar mass of large molecules (polymers).