



CBSE Class 12 Chemistry Formula Sheet

69 formulas across 10 chapters — 2025-26 CBSE board exams

Ch 1. Solutions

Molarity (mol/L)

$$M = (\text{moles of solute}) / (\text{volume of solution in L})$$

Molality (mol/kg)

$$m = (\text{moles of solute}) / (\text{mass of solvent in kg})$$

Mole fraction

$$\chi_A = n_A / (n_A + n_B)$$

Mass percentage

$$w/w\% = (\text{mass of solute} / \text{mass of solution}) \times 100$$

Raoult's Law

$$p_A = \chi_A \times p^\circ_A$$

Tip: For ideal solutions

Elevation in boiling point

$$\Delta T_b = K_b \times m$$

K_b = ebullioscopic constant, m = molality

Depression in freezing point

$$\Delta T_f = K_f \times m$$

K_f = cryoscopic constant

Osmotic pressure

$$\pi = CRT = (n/V)RT$$

$R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$

van't Hoff factor

i = observed colligative property / calculated value (assuming no association/dissociation)

Ch 2. Electrochemistry

Nernst Equation

$$E_{\text{cell}} = E^\circ_{\text{cell}} - (0.0592/n) \log Q \quad (\text{at } 25^\circ\text{C})$$

n = moles of electrons, Q = reaction quotient

Gibbs free energy and EMF

$$\Delta G^\circ = -nFE^\circ_{\text{cell}}$$

$F = 96485 \text{ C/mol}$ (Faraday constant)

Faraday's First Law

$$m = ZIt = (M/nF)It$$

Z = electrochemical equivalent, I = current, t = time

Conductance (S (Siemens))

$$G = 1/R = \kappa \times A/l$$

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Molar conductivity ($\text{S}\cdot\text{cm}^2/\text{mol}$)

$$\Lambda_m = \kappa \times 1000/C$$

C = concentration in mol/L

Kohlrausch's Law

$$\Lambda_m^\circ = \nu_+ \lambda_+^\circ + \nu_- \lambda_-^\circ$$

Relation between ΔG and K

$$\Delta G^\circ = -RT \ln K = -nFE^\circ_{\text{cell}}$$

Ch 3. Chemical Kinetics

Rate of reaction

$$\text{rate} = -(1/a) \frac{d[A]}{dt} = k[A]^n[B]^m$$

Tip: Overall order = $n + m$

First order rate constant (s^{-1})

$$k = (2.303/t) \log([A]_0/[A])$$

Half-life (first order)

$$t_{1/2} = 0.693/k$$

Tip: Independent of initial concentration

Arrhenius Equation

$$k = Ae^{(-E_a/RT)}$$

E_a = activation energy, A = frequency factor, R = $8.314 \text{ J/mol}\cdot\text{K}$

Arrhenius (log form)

$$\log(k_2/k_1) = (E_a/2.303R)(1/T_1 - 1/T_2)$$

Ch 4. d and f Block Elements

Spin-only magnetic moment

$$\mu = \sqrt{n(n+2)} \text{ BM}$$

n = number of unpaired electrons, BM = Bohr Magneton

Tip: Appears every year — memorise the $\sqrt{n(n+2)}$ formula

Lanthanide contraction

Atomic/ionic radius decreases from La to Lu due to poor shielding by 4f electrons

Tip: Consequence: similar atomic radii of 4d and 5d transition metals

Oxidation state of Mn in KMnO_4

$$\text{K: } +1, \text{ O: } -2 \rightarrow \text{Mn} = +7$$

Oxidation state of Cr in $\text{K}_2\text{Cr}_2\text{O}_7$

$$2\text{K: } +1, 7\text{O: } -2 \rightarrow 2\text{Cr} = +12 \rightarrow \text{Cr} = +6$$

MnO_4^- in acidic medium (oxidation)



Tip: Reduction half-reaction; used in titrations

$\text{Cr}_2\text{O}_7^{2-}$ in acidic medium (oxidation)



Ch 5. Coordination Compounds

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Oxidation state of central metal

Charge on complex = charge on metal + sum of charges of all ligands

Tip: For neutral complex: metal charge = $-(\text{sum of ligand charges})$

EAN (Effective Atomic Number)

$\text{EAN} = \text{atomic number} - \text{oxidation state} + 2 \times \text{coordination number}$

Tip: Secondary valence = coordination number

Crystal Field Splitting (octahedral)

$\Delta_o = \text{energy of } e_g - \text{energy of } t_{2g}$

Tip: Strong field ligands give large Δ_o (low spin); weak field give small Δ_o (high spin)

Spectrochemical series (abridged)

$\text{I}^- < \text{Br}^- < \text{Cl}^- < \text{F}^- < \text{OH}^- < \text{H}_2\text{O} < \text{NH}_3 < \text{en} < \text{CN}^- < \text{CO}$ (weak $\rightarrow$ strong field)

IUPAC naming rule

Anionic ligands end in -o; neutral: aqua, ammine, carbonyl; cationic: no change. Ligands named alphabetically

Tip: Metal in brackets; counter ion outside

Ch 6. Haloalkanes and Haloarenes

Rate of $\text{S}_\text{N}2$

$\text{rate} = k[\text{RX}][\text{Nu}^-]$

Tip: Bimolecular: inversion of configuration (Walden inversion). Order: $\text{CH}_3\text{X} > 1^\circ > 2^\circ > 3^\circ$

Rate of $\text{S}_\text{N}1$

$\text{rate} = k[\text{RX}]$

Tip: Unimolecular: racemisation. Order: $3^\circ > 2^\circ > 1^\circ > \text{CH}_3\text{X}$. Carbocation intermediate.

Optical rotation

R configuration: clockwise (+d); S configuration: anticlockwise (−l). Racemic mixture: zero rotation

Reactivity order (nucleophilic substitution)

$\text{RI} > \text{RBr} > \text{RCI} > \text{RF}$

Tip: C–I bond weakest (largest halogen), so most reactive

Bond polarity (C–X)

C–F most polar (highest electronegativity of F); C–I least polar but most reactive (weakest bond)

Tip: Polarity $\neq$ reactivity in haloalkanes

Ch 7. Alcohols, Phenols and Ethers

Lucas test reagent

Conc. HCl + anhydrous ZnCl_2

Tip: 3° alcohol: immediate turbidity; 2° : turbid in 5 min; 1° : no turbidity at room temperature

Acidity of phenol

$\text{PhOH} \rightarrow \text{PhO}^- + \text{H}^+$ ($\text{pK}_a \approx 10$)

Tip: More acidic than alcohols ($\text{pK}_a \sim 16$) due to resonance stabilisation of phenoxide ion

Williamson synthesis

$\text{R-O}^-\text{Na}^+ + \text{R}'\text{X} \rightarrow \text{R-O-R}' + \text{NaX}$

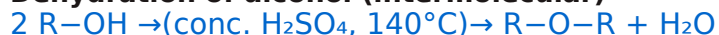
Tip: Best for unsymmetrical ethers; alkyl halide must be primary to avoid elimination

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Dehydration of alcohol (intramolecular)

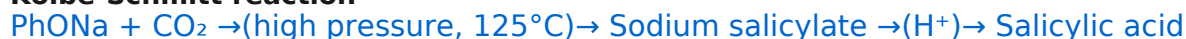


Dehydration of alcohol (intermolecular)



Tip: Lower temp gives ether; higher temp gives alkene

Kolbe-Schmitt reaction



Reimer-Tiemann reaction



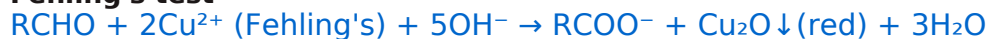
Ch 8. Aldehydes, Ketones and Carboxylic Acids

Tollens' test (silver mirror)



Tip: Positive for aldehydes only; ketones give no reaction

Fehling's test



Tip: Positive for aliphatic aldehydes; aromatic aldehydes and ketones give no reaction

Aldol condensation



Tip: Requires α -hydrogen; product: β -hydroxy carbonyl compound $\rightarrow$ α,β -unsaturated carbonyl on heating

Cannizzaro reaction



Tip: For aldehydes with no α -hydrogen ($HCHO$, $PhCHO$); disproportionation

Clemmensen reduction



Tip: Reduces carbonyl to methylene ($-CH_2-$); acidic medium; for acid-sensitive compounds use Wolff-Kishner

Wolff-Kishner reduction



Tip: Reduces carbonyl to methylene in basic medium

Rosenmund reduction



Tip: Converts acid chloride to aldehyde; Pd poisoned with $BaSO_4$ to prevent over-reduction

Etard reaction



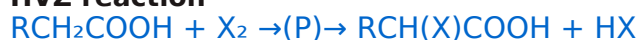
Tip: Oxidises $-CH_3$ on benzene ring selectively to $-CHO$

Gattermann-Koch reaction



Tip: Converts benzene directly to benzaldehyde using $CO + HCl$ as formylating agent

HVZ reaction



Tip: Halogenation at α -carbon of carboxylic acid using PCl_3 or P

Esterification



Tip: Reversible; equilibrium shifted right by excess alcohol or removal of water

Ch 9. Amines

Basicity order of amines (aliphatic)



Tip: 3° amine less basic than 2° in water due to solvation effect

Basicity: aliphatic vs aromatic



Tip: Lone pair on N delocalised into ring in aniline → less available for protonation

Hinsberg test



Gabriel synthesis



Tip: Gives only primary amines; cannot prepare 2° or 3°

Hofmann bromamide degradation



Tip: One carbon is lost; amide → primary amine with one fewer C

Diazotisation



Tip: Must keep temperature 0–5°C; diazonium salt decomposes above 5°C

Sandmeyer reaction



Tip: Replaces –NH₂ with –Cl, –Br, or –CN via diazonium salt

Balz-Schiemann reaction



Tip: Only reliable way to introduce –F into aromatic ring

Coupling reaction



Tip: Electrophilic aromatic substitution; diazonium ion attacks phenol/amine

Ch 10. Biomolecules

Chargaff's Rule



DNA base percentage from A%



H-bonds in DNA



Number of peptide bonds



Reducing vs non-reducing sugars

Reducing: free aldehyde or ketone group (glucose, fructose, maltose, lactose). Non-reducing: no free

Tip: Sucrose is non-reducing; positive Fehling's/Tollens' means reducing sugar