Chemistry-JEE-Mains-Formulas

October 20, 2025

Class	Lesson	Concept	Formula / Key Point	Explanation
11	Some Basic Concepts of Chemistry	Mole concept	[$n = \frac{\text{mass}}{\text{molar mass}}$, $N = n \times N_A$]	n = number of moles, N = number of particles, N_A = Avogadro's number
		Concentration units	[Molarity: $M = \frac{\text{moles of solute}}{\text{volume of solution (L)}}$]	Molarity measures moles per liter solution
		Percentage / fraction	[% by mass = $\frac{\text{mass of component}}{\text{mass of compound}} \times 100$]	Percent mass of component in mixture
11	Structure of Atom	Atomic number & mass number	Atomic number = number of protons = number of electrons; Mass number = protons + neutrons	Basic atomic structure definitions
		Electron configuration	[Example: $1s^2 2s^2 2p^6 3s^2 3p^4$ for Sulphur]	Distribution of electrons in shells
11	Classification of Elements & Periodicity	Periodic trends	Atomic radius ↓ across period, ↑ down group; Ionisation energy ↑ across period, ↓ down group	Trends in periodic table properties
		Valency / oxidation state	Main group elements: valency = group number or [$8 - $ group number]	Valency based on group in periodic table
11	Chemical Bonding & Molecular Structure	Ionic bond	Electrostatic attraction between cation and anion; lattice energy ↑ with charge ↑ and radius ↓	Ionic bond characteristics
		Covalent bond & hybridisation	[sp → linear, sp^2 → trigonal planar, sp^3 → tetrahedral]	Hybridisation shapes and bond angles

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11	States of Matter	Ideal Gas Law	[$PV = nRT$]	Relation between pressure, volume, moles and temperature
		Real Gas & van der Waals	[$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$]	Correction to ideal gas equation
11	Thermodynamics	First Law of Thermo-dynamics	[$\Delta U = Q - W$]	Change in internal energy equals heat added minus work done
		Enthalpy	[$H = U + PV$, $\Delta H = \Delta U + \Delta(PV)$]	Relation between enthalpy, internal energy and pressure-volume work
11	Equilibrium	Chemical Equilib-rium	[$K_c = \frac{[\text{products}]^p}{[\text{reactants}]^r}$]	Equilibrium constant expression
		Ionic Equilib-rium / pH	[$\text{pH} = -\log[\text{H}^+]$]	pH definition
11	Redox Reactions	Oxidation & Reduc-tion	Oxidation: increase in oxidation state; Reduction: decrease in oxidation state	Redox process definitions
		Balancing redox in acidic/alkaline media	Use half-reaction method	Method to balance redox equations
11	Hydrogen	Hydrides, isotopes	Example: Heavy water: D_2O	Isotopes and hydrides examples
		Water as solvent	[Auto-ionisation: $2H_2O \rightleftharpoons H_3O^+ + OH^-$]	Water self-ionization equilibrium
11	s-Block Elements & Their Com-pounds	Alkali & Alkaline Earth be-haviour	[Reaction with water: $2M + 2H_2O \rightarrow 2MOH + H_2$]	Reaction producing hydroxides and hydrogen gas
		Oxides & hydrox-ides	[Basic oxides: MO for alkali metals]	Basic nature of metal oxides
11	p-Block Elements	Group proper-ties	Trends in acidic oxides, basic oxides	Acid-base nature trends in oxides
		Allotropy	Example: Oxygen: O_2, O_3	Different forms of an element

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11	Organic Chemistry – Some Basic Principles & Techniques	Hydrocarbons	[Alkanes: general formula C_nH_{2n+2}, Alkenes: C_nH_{2n}]	General formulas for hydrocarbons
		Isomerism	Structural isomers, stereoisomers	Types of isomers
11	Hydrocarbons	Alkane reactions	Substitution, halogenation	Types of reactions in alkanes
		Alkyne & Alkene reactions	Addition, polymerisation	Reactions of unsaturated hydrocarbons
11	Environmental Chemistry	Pollution concepts	Air pollution: primary vs secondary pollutants	Types of pollutants
		Green chemistry basics	Example: use of catalytic converter	Application of green chemistry
12	Solid State	Crystal systems & lattices	[Number of atoms in unit cell: SC = 1, BCC = 2, FCC = 4]	Atoms per unit cell in different lattices
		Packing efficiency	[FCC/CCP: 74%]	Maximum packing in close-packed lattices
12	Solutions	Colligative Properties	[$\Delta T_f = K_f \cdot m$], [$\Delta T_b = K_b \cdot m$]	Freezing point depression and boiling point elevation
		Osmotic pressure	[$\Pi = MRT$]	Osmotic pressure relation
12	Electrochemistry	Galvanic cell	[$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$], [$\Delta G^\circ = -nFE^\circ_{\text{cell}}$]	Cell potential and Gibbs free energy relation
		Electrolysis quantities	[$m = \frac{Q \times (\text{equivalent weight})}{F}$]	Mass deposited proportional to charge and equivalent weight
12	Chemical Kinetics	Rate laws	[Rate $= k[A]^m[B]^n$]	Reaction rate expression
		First-order half-life	[$t_{1/2} = \frac{0.693}{k}$]	Half-life formula for first order reaction
12	Surface Chemistry	Adsorption Isotherm	[Freundlich: $x/m = kP^{1/n}$]	Adsorption amount vs pressure relation
		Colloids	Tyndall effect, Brownian motion	Properties of colloidal systems

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12	General Principles & Processes of Isolation of Metals	Metallurgy	[$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$]	Reduction of iron ore in blast furnace
		Refining of metals	Electrolytic refining: Anode → impure metal, Cathode → pure metal	Metal purification method
12	p-Block Elements	Group trends & compounds	[$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$]	Nitric acid production reaction
		Allotropic forms	Example: Phosphorus (white, red, black)	Different allotropes of phosphorus
12	d- & f-Block Elements	Electronic configuration	[[Ar] $3d^{10}4s^2$ for Zn]	Electron configuration example
		Coordination compounds	[$[Co(NH_3)_6]^{3+}$]	Example coordination compound
12	Coordination Compounds	Isomerism in coordination	Optical and geometrical isomerism	Types of isomerism in coordination complexes
		Valence & bonding	[$\lambda = \frac{\text{magnetic moment}}{\mu_B}$]	Magnetic moment calculation
12	Haloalkanes & Haloarenes	Nucleophilic substitution	[SN1: Rate [R–X]; SN2: Rate [R–X][Nu–]]	Mechanisms of nucleophilic substitution
		Elimination reactions	[E2: Concerted elimination]	E2 reaction mechanism
12	Alcohols, Phenols & Ethers	Acidity of phenol	[Resorcinol > phenol > o-cresol > p-cresol]	Relative acidity order
		Williamson ether synthesis	[$R–O^- + R'–X \rightarrow R–O–R' + X^-$]	Ether synthesis reaction
12	Aldehydes, Ketones & Carboxylic Acids	Nucleophilic addition to C=O	[$C=O + H^- \rightarrow C–O^-$]	Nucleophile addition to carbonyl

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		Acid derivatives	[–COCl → –COOR transformations]	Conversion of acid chlorides to esters
12	Amines	Basicity order in water	[Tertiary > secondary > primary > ammonia (aqueous)]	Basicity trend of amines
		Diazonium salts	[$ArN_2^+Cl^-$ formed from aromatic amine + $NaNO_2$ + HCl at 0–5 °C]	Formation of diazonium salts
12	Biomolecules & Polymers	Carbohydrates	[Approximate formula: $C_n(H_2O)_n$]	Empirical formula for carbohydrates
		Proteins & amino acids	Zwitterions, isoelectric point	Molecular forms with both charges
		Polymers	[Polyethylene: $-[CH_2–CH_2]_n-$]	Repeating units of polymer chains
12	Chemistry in Everyday Life	Chemicals in medicine & industry	Examples: Antiseptics (Phenol), Preservatives (Na_2SO_3)	Common chemicals used in daily life
		Environment & green chemistry	Example: Biodegradable polymers	Environmentally friendly polymers