WBJEE Chemistry Master Syllabus

Complete Chapter-wise Breakdown & Exam Pattern

> **Exam Blueprint Summary:** Chemistry is part of Paper 2 (alongside Physics). It contains a total of **40 questions** carrying **50 marks**. The exam is OMR-based and features three categories of questions: Category 1 (+1 mark, -0.25 negative), Category 2 (+2 marks, -0.5 negative), and Category 3 (+2 marks, multi-correct, no negative marking).

1. Physical Chemistry

Atoms, Molecules, and Chemical Arithmetic

- Dalton's atomic theory, Mole concept, Percentage composition, Empirical and molecular formulae.
- Chemical equations and stoichiometry, Limiting reagent calculations.

Atomic Structure

- Bohr's model and its limitations, Dual nature of matter, Heisenberg's uncertainty principle.
- Quantum numbers, Shapes of s, p, and d orbitals.
- Aufbau principle, Pauli's exclusion principle, and Hund's rule, Electronic configuration of atoms.

Chemical Bonding and Molecular Structure

- Ionic bond, Covalent bond, Born-Haber cycle, Valence Bond Theory (VBT).
- Hybridization involving s, p, and d orbitals, Shapes of simple molecules.
- Molecular Orbital Theory (MOT) of homonuclear diatomic molecules (bond order, magnetic property).
- Hydrogen bonding and dipole moment.

Gaseous and Liquid States

- Gas laws, Ideal gas equation, Kinetic theory of gases, Deviation from ideal behavior, Van der Waals equation.
- Liquefaction of gases, Critical constants.
- Liquid state: Vapor pressure, viscosity, and surface tension.

Chemical Thermodynamics and Energetics

- First law of thermodynamics, Internal energy, Enthalpy, Heat capacity, Hess's law.
- Second law of thermodynamics, Entropy, Gibbs free energy, Spontaneity of criteria.

Chemical and Ionic Equilibrium

- Law of mass action, Equilibrium constant (Kp, Kc), Le Chatelier's principle.
- Ionic equilibrium: Acids, bases, and salts, pH scale, Buffer solutions, Solubility product, Common ion effect.

Electrochemistry

- Conductance in electrolytic solutions, Kohlrausch's law.
- Galvanic cells, EMF, Nernst equation, Gibbs energy change and EMF of a cell.

Chemical Kinetics

- Rate of reaction, Factors affecting rates, Order and molecularity of a reaction.
- Rate laws and integrated rate equations for zero and first-order reactions.
- Collision theory, Arrhenius equation, Activation energy.

Solid State & Surface Chemistry

- Classification of solids, Unit cell, Bragg's law, Packing efficiency, Defects in solids.
- Adsorption: Physisorption and chemisorption, Colloids, Emulsions, Catalysis.

2. Organic Chemistry

General Organic Chemistry (GOC) & Stereochemistry

- Inductive effect, Electromeric effect, Resonance, Hyperconjugation.
- Homolytic and heterolytic bond cleavages, Carbocations, Carbanions, Free radicals.
- Isomerism: Structural and stereoisomerism (geometrical and optical).

Hydrocarbons

- Alkanes, Alkenes, and Alkynes: IUPAC nomenclature, preparation, and key chemical reactions (Ozonolysis, Markovnikov addition).
- Aromatic hydrocarbons: Benzene, electrophilic substitution reactions (Nitration, Friedel-Crafts).

Organic Functional Groups I (Haloalkanes, Haloarenes, Alcohols, Phenols, Ethers)

- Mechanisms of nucleophilic substitution (SN1, SN2).
- Preparation and properties of Alcohols, Phenols, and Ethers. Lucas test, Reimer-Tiemann reaction.

Organic Functional Groups II (Aldehydes, Ketones, Carboxylic Acids)

- Nucleophilic addition reactions. Name reactions: Aldol condensation, Cannizzaro reaction, Clemmensen reduction.
- Acidity of carboxylic acids and functional derivatives.

Nitrogen-Containing Compounds

- Amines: Preparation, properties, and basic character. Diazonium salts and their synthetic applications.

Polymers & Biomolecules

- Classification, Addition and condensation polymerization (Nylon, Polyester, Bakelite, Rubber).
- Carbohydrates, Proteins, Nucleic acids (DNA, RNA).

3. Inorganic Chemistry

Periodic Table and Periodic Properties

- Modern periodic law, Periodic trends in atomic radii, ionization enthalpy, electron gain enthalpy, electronegativity, and valency.

s-Block & p-Block Elements

- General trends, electronic configurations, and anomalous properties of Group 1, 2, 13, 14, 15, 16, 17, and 18 elements.
- Important compounds: Borax, Silicates, Ammonia, Nitric Acid, Phosphine, Ozone, Sulfur Dioxide.

d-Block and f-Block Elements

- General electronic configuration, characteristics of transition metals, oxidation states, color, and catalytic properties.
- Preparation and properties of K2Cr2O7 and KMnO4.

Coordination Compounds

- Werner's theory, IUPAC nomenclature, Isomerism in coordination compounds.
- Valence Bond Theory (VBT) and Crystal Field Theory (CFT) (magnetic properties, color, shapes).

Extraction of Metals (Metallurgy)

- Principles of metallurgy: Concentration, roasting, calcination, smelting, refining.
- Extraction protocols for Al, Cu, Zn, and Fe.