

# OLYCHEM SYLLABUS 2024

(A total of 100 multiple-choice questions will be asked, each carrying one mark covering the entire syllabus. There will be a -1 mark for each wrong answer. The duration of the examination is 2 hours.)

## Unit I: Structure of Atom

Rutherford's Nuclear Model of Atom, its Defects. Hydrogen Spectrum. Different Spectral Series. Bohr's Model of Atom, Radius of Electron Orbits, Energy of Electron in Hydrogen and Hydrogen-Like Atoms, Speed of Electron in Different Orbits, Explanation of Hydrogen Spectra. Dual Nature of Matter and de Broglie Theory of Matter Waves. Heisenberg's Uncertainty Principle. Quantum Numbers and Shapes of s, p, d, f Orbitals. Pauli's Exclusion Principle and Hund's Rule of Maximum Multiplicity.

## Unit II: Periodic Classification and Chemical Bonding

Periodic Law, Classification of Elements into s, p, d, and f Block. Periodicity in Properties of Elements. Electrovalent, Covalent and Coordinate Covalent Bond, Lattice Energy, Born-Haber Cycle. Dipole Moment and Polarity of Covalent Bond. Hybridization ( $sp$ ,  $sp^2$ ,  $sp^3$ ,  $dsp^2$ ,  $dsp^3$ ,  $d^2sp^3$ ) of Covalent Molecules and Ions. VSEPR Theory and Shapes of Linear, Angular, Planar, Pyramidal, Tetrahedral, and Octahedral Molecules. Sigma and Pi Bonds.

## Unit III: Solid State

Classification of Solids Based on Different Binding Forces: Molecular, Ionic, Covalent and Metallic Solids, Amorphous and Crystalline Solids (Elementary Idea only). Unit Cell in Two Dimensional and Three Dimensional Lattices, Calculation of Density of Unit Cell, Packing in Solids, Packing Efficiency, Voids, Number of Atoms Per Unit Cell in a Cubic Unit Cell, Point Defects, Electrical, and Magnetic Properties. Band Theory of Metals, Conductors, Semiconductors, and insulators and N and P-Type Semiconductors.

## Unit IV: Solutions

Types of Solutions, Expression of Concentration of Solutions of Solids in Liquids, Solubility of Gases in Liquids, Solid Solutions, Colligative Properties - Relative Lowering of Vapour Pressure, Raoult's Law, Elevation of Boiling Point, Depression of Freezing Point, Osmotic Pressure, Determination of Molecular Masses Using Colligative Properties, Abnormal Molecular Mass, van't Hoff Factor.

## Unit V: Electrochemistry

Redox Reactions, Conductance in Electrolytic Solutions, Specific and Molar Conductivity, Variations of Conductivity with Concentration, Kohlrausch's Law, Electrolysis and Law of Electrolysis (Elementary Idea), Dry Cell - Electrolytic Cells and Galvanic Cells, Lead Accumulator, EMF of a Cell, Standard Electrode Potential, Nernst Equation and its Application to Chemical Cells, Relation Between Gibbs Energy Change and EMF of a Cell, Fuel Cells, Corrosion.

## Unit VI: Chemical Kinetics

Rate of a Reaction (Average and Instantaneous), Factors Affecting Rate of Reaction: Concentration, Temperature, Catalyst; Order and Molecularity of a Reaction, Rate Law and Specific Rate Constant, Integrated Rate Equations and Half-Life (only for Zero and First Order Reactions), Concept of Collision Theory (Elementary Idea, no Mathematical Treatment). Activation Energy, Arrhenius Equation.

## Unit VII: Surface Chemistry

Adsorption - Physisorption and Chemisorption, Factors Affecting Adsorption of Gases on Solids, Catalysis, Homogenous and Heterogeneous Activity, and Selectivity; Enzyme Catalysis Colloidal State Distinction Between True Solutions, Colloids, and Suspension; Lyophilic, Lyophobic Multimolecular, and Macromolecular Colloids; Properties of Colloids; Tyndall Effect, Brownian Movement, Electrophoresis, Coagulation, Emulsion - Types of Emulsions.

## Unit VIII: P - Block Elements

Group 15 Elements: General Introduction, Electronic Configuration, Occurrence, Oxidation States, Trends in Physical and Chemical Properties, Nitrogen Preparation Properties, and Uses. Compounds of Nitrogen, Preparation, and Properties of Ammonia and Nitric Acid, Oxides of Nitrogen (Structure only). Phosphorus - Allotropic Forms, Compounds of Phosphorus: Preparation and Properties of Phosphine, Halides  $\text{PCl}_3$ ,  $\text{PCl}_5$ , and Oxoacids (Elementary Idea only).

Group 16 Elements: General Introduction, Electronic Configuration, Oxidation States, Occurrence, Trends in Physical and Chemical Properties, Dioxygen: Preparation, Properties and Uses, Classification of Oxides, Ozone, Sulphur - Allotropic Forms; Compounds of Sulphur - Preparation Properties and Uses of Sulphur Dioxide. Sulphuric Acid: industrial Process of Manufacture, Properties and Uses; Oxoacids of Sulphur (Structures only).

Group 17 Elements: General Introduction, Electronic Configuration, Oxidation States, Occurrence, Trends in Physical and Chemical Properties; Compounds of Halogens, Preparation Properties and Uses of Chlorine and Hydrochloric Acid, Interhalogen Compounds, Oxoacids of Halogens (Structures only).

## Unit IX: d and f Block Elements

General introduction, Electronic Configuration, Occurrence and Characteristics of Transition Metals, General Trends in Properties of the First Row Transition Metals - Metallic Character, Ionization Enthalpy, Oxidation States, Ionic Radii, Colour, Catalytic Property, Magnetic Properties, Interstitial Compounds, Alloy Formation, Preparation and Properties of  $\text{K}_2\text{Cr}_2\text{O}_7$  and  $\text{KMnO}_4$ . Lanthanoids - Electronic Configuration, Oxidation States, Chemical Reactivity, and Lanthanide Contraction and Its Consequences. Actinoids - Electronic Configuration, Oxidation States, and Comparison with Lanthanoids.

## Unit X: Coordination Compounds

Coordination Compounds - Introduction, Ligands, Coordination Number, Color, Magnetic Properties and Shapes, IUPAC Nomenclature of Mononuclear Coordination Compounds. Bonding, Werner's Theory, VBT, and CFT; Structure and Stereo Isomerism, Importance of Coordination Compounds (in Qualitative Analysis, Extraction of Metals and Biological System).

## Unit XI: Haloalkanes and Haloarenes

Haloalkanes: Nomenclature, Nature of C-X Bond, Physical and Chemical Properties, Mechanism of Substitution Reactions, Optical Rotation. Haloarenes: Nature of C-X Bond, Substitution Reactions (Directive Influence of Halogen in Monosubstituted Compounds only). Uses and Environmental Effects of Dichloromethane, Trichloromethane, Tetrachloromethane, Iodoform, Freons, DDT.

## Unit XII: Alcohols, Phenols, and Ethers

Alcohols: Nomenclature, Methods of Preparation, Physical and Chemical Properties( of Primary Alcohols only), Identification of Primary, Secondary and Tertiary Alcohols, Mechanism of Dehydration, Uses with Special Reference to Methanol and Ethanol. Phenols: Nomenclature, Methods of Preparation, Physical and Chemical Properties, Acidic Nature of Phenol, Electrophilic Substitution Reactions, Uses of Phenols. Ethers: Nomenclature, Methods of Preparation, Physical and Chemical Properties, Uses.

## Unit XIII: Aldehydes, Ketones, and Carboxylic Acids

Aldehydes and Ketones: Nomenclature, Nature of Carbonyl Group, Methods of Preparation, Physical and Chemical Properties, Mechanism of Nucleophilic Addition, Reactivity of Alpha Hydrogen in Aldehydes: Uses. Carboxylic Acids: Nomenclature, Acidic Nature, Methods of Preparation, Physical and Chemical Properties; Uses.

#### **Unit XIV: Organic Compounds Containing Nitrogen**

Amines: Nomenclature, Classification, Structure, Methods of Preparation, Physical and Chemical Properties, Uses, Identification of Primary, Secondary and Tertiary Amines. Cyanides and Isocyanides (will be Mentioned at Relevant Places in Context). Diazonium Salts: Preparation, Chemical Reactions, and Importance in Synthetic Organic Chemistry.

#### **Unit XV: Biomolecules**

Carbohydrates - Classification (Aldoses and Ketoses), Monosaccharides (Glucose and Fructose), D-L Configuration, Oligosaccharides (Sucrose, Lactose, Maltose), Polysaccharides (Starch, Cellulose, Glycogen), Importance. Proteins - Elementary Idea of ( $\pm$ ) Amino Acids, Peptide Bond, Polypeptides, Proteins, Structure of Proteins - Primary, Secondary, Tertiary Structure, and Quaternary Structures (Qualitative Idea only), Denaturation of Proteins; Enzymes, Hormones - Elementary Idea Excluding Structure. Vitamins, Classification, and Functions. Nucleic Acids: DNA and RNA.

#### **Unit XVI: Chemistry in Everyday Life**

Chemicals in Medicines - Analgesics, Tranquilizers Antiseptics, Disinfectants, Antimicrobials, Antifertility Drugs, Antibiotics, Antacids, Antihistamines. Chemicals in Food - Preservations, Artificial Sweetening Agents, Elementary Idea of Antioxidants. Cleansing Agents - Soaps and Detergents, Cleansing Action.