

CHEMISTRY – SYLLABUS

INTERMEDIATE COURSE – FIRST YEAR

1. ATOMIC STRUCTURE

12 Periods

- 1.1 Types of Electromagnetic radiation – wave nature and photon concept – Electromagnetic radiation. Simple description of Emission, Absorption, Line and Band spectra – Atomic spectrum of Hydrogen (simple description).
- 1.2 Bohr's Model of Atom.
Expressions for the Energy and radius of the Hydrogen atomic orbits with derivations – Explanation of the atomic spectrum of hydrogen.
- 1.3 Wave nature of matter – De – Broglie relation – Heisenberg Uncertainty principle with simple calculations/problems.
- 1.4 Sommerfeld's Theory. Quantum numbers. Pauli's exclusion Principle.
- 1.5 Schrodinger's wave equation (elementary treatment) – shapes of s, p and d atomic orbitals with emphasis on nodal planes.
- 1.6 Stability and magnetic behaviour of atoms – Based on concepts of electronic configuration.

II. PERIODIC TABLE

10 Periods

- 2.1 Modern periodic table – s, p, d & f block elements.
- 2.2 Periodicity of properties with respect to atomic size, ionic radius, oxidation state – Ionization potential, electron affinity and electronegativity in groups and periods.

III. CHEMICAL BOND

12 Periods

- 3.1 Effect of Ionization potential, electron affinity and electronegativity on the nature of chemical bond.
- 3.2 Characteristics of crystalline ionic compounds – Lattice energy.
- 3.3 Born-Haber cycle – Crystal structure of NaCl and CsCl.
- 3.4 Covalent compounds – BeCl_2 , BF_3 , CO_2 , NH_3 , H_2O , PCl_5 , SF_6 , CH_4 , C_2H_4 , C_2H_2 .
- 3.5 Valence Bond theory of covalent bond – overlap of orbitals – Sigma and Pi bonds and multiple bonds. Bond length, bond angle and bond energy.
- 3.6 Types of Hybridization SP , SP^2 , SP^3 , dsp^3 , d^2sp^3 and shapes of molecules. VSEPR Theory.
- 3.7 Polarity of covalent bond concept of dipole moment – Dipole moments of HCl , H_2O , SO_2 , NH_3 , CH_4 , CCl_4 .
- 3.8 Hydrogen bond – intra molecular and inter molecular Hydrogen bonding.
- 3.9 Metallic Bond (elementary treatment).

IV. GASEOUS STATE

8 Periods

- 4.1 Derivation of ideal gas equation.
- 4.2 Graham's law of diffusion – Dalton's law of partial pressure – simple numerical problems.
- 4.3 Kinetic theory of gases – Postulates – Derivation of the expression $PV = \frac{1}{3} mnc^2$.
- 4.4 Deduction of gas laws (Boyle's law. Charles's law. Dalton's law and Graham's law) from $PV = \frac{1}{3} mnc^2$.
- 4.5 Distribution of molecular velocities RMS velocity and its variation with temperature – average velocity, most probable velocity, average kinetic energy of the molecules.

V. STOICHIOMETRY

8 Periods

- 5.1 Mole concept, Oxidation numbers.
- 5.2 Balancing of Redox reactions by ion-electron (half-reaction) methods.
- 5.3 Balancing of Redox reactions by Oxidation number method.
- 5.4 Numerical calculations based on equations relating to all types of chemical reactions. (Excluding problems based on molarity, normality and energy changes).
- 5.5 Calculation of empirical and molecular formulae of carbon compounds.

VI. HYDROGEN AND ITS COMPOUNDS

6 Periods

- 6.1 Position of Hydrogen in periodic table.
- 6.2 Hardness of Water and its removal.
- 6.3 Heavy water and its properties and uses.
- 6.4 Preparation, properties and uses of H_2O_2 and structure.

VII. ALKALI AND ALKALINE EARTH METALS

8 Periods

- 7.1 General characteristics of alkali metals, chemical properties with reference to Oxides, halides, carbonates.
- 7.2 Occurrence, extraction, properties and uses of Sodium and Magnesium.
- 7.3 Preparation, properties and uses of the following compounds, Sodium Hydroxide, Sodium Carbonate, Sodium bicarbonate, Plaster of Paris, Lime Mortar and Gypsum.

VIII – III - GROUP ELEMENTS

5 Periods

- 8.1 General discussion of the III Group elements.
Chemical properties with reference to oxides, Halides and Hydroxides.

- 8.2 Extraction, properties and uses of Aluminium.
- 8.3 Preparation, properties and uses of potash Alum.
- 8.4 Preparation, properties and structure of Diborane.

IX – IV - GROUP ELEMENTS

5 Periods

- 9.1 General discussion of 4th Group elements – structure and uses of diamond and graphite with emphasis on hybridisation of carbon atom.
- 9.2 Preparation, properties and uses of Silicon Dioxide, comparison of SiO₂ with CO₂.
- 9.3 Manufacture and uses of producer gas and water gas.

X. CHEMISTRY OF CARBON COMPOUNDS

10 Periods

- 10.1 Classification of Hydrocarbons.
- 10.2 Homologous series, nomenclature of aliphatic hydrocarbons.
- 10.3 Structural Isomerism.
- 10.4 Preparation, properties, structure and uses of Methane, Ethane, Ethylene, Acetylene.
- 10.5 Preparation properties and structure of Benzene.

XI. NOBLE GASES

6 Periods

- 11.1 Discovery, occurrence, isolation and uses of noble gases.
- 11.2 Structural aspects of Xenon compounds (Oxides & Fluorides).

XII. ENVIRONMENTAL CHEMISTRY

6 Periods

- 12.1 Environment, Terminology – Pollutant, contaminant, Receptor, sink, speciation, dissolved oxygen, Threshold limit.

12.2 AIR POLLUTION : Common air pollutions CO and Oxides of N & S acid rains and green house effect.

12.3 Water pollutions : Common Water pollutants, Organic Pollutant Biological oxygen demand, Inorganic pollutants, Water treatment with respect to flourine content, Ozone layer and effect of freons.

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