

VITEEE – 2022 - CHEMISTRY

1. Atomic Structure

Bohr's atomic model-Sommerfeld's extension of atomic structure; Electronic configuration and Quantum numbers; Shapes of s, p, d, f orbitals - Pauli's exclusion principle - Hund's Rule of maximum multiplicity- Aufbau principle. Emission and absorption spectra, line and band spectra; Hydrogen spectrum – Lyman, Balmer, Paschen, Brackett and Pfund series; de Broglie's theory; Heisenberg's uncertainty principle – wave nature of electron – Schrodinger wave equation (No derivation). Eigen values and eigen functions. Hybridization of atomic orbitals involving s, p and d orbitals.

2. s, p, d and f – Block Elements

The s-block elements – properties and chemical reactivity of alkali and alkaline earth metals; p-block elements – Phosphorous compounds; PCl_3 , PCl_5 – Oxides. Hydrogen halides, Inter halogen compounds. Xenon fluoride compounds. General Characteristics of d – block elements – Electronic Configuration – Oxidation states of first row transition elements and their colours. Occurrence and principles of extraction: Copper, Silver, Gold and Zinc. Preparation and properties of CuSO_4 , AgNO_3 and $\text{K}_2\text{Cr}_2\text{O}_7$.

Lanthanides – Introduction, electronic configuration, general characteristics, oxidation state – lanthanide contraction, uses, brief comparison of Lanthanides and Actinides.

3. Coordination Chemistry and Solid-State Chemistry

Introduction – Terminology in coordination chemistry – IUPAC nomenclature of mononuclear coordination compounds. Isomerism, Geometrical isomerism in 4-coordinate, 6-coordinate complexes. Theories on coordination compounds – Werner's theory (brief), Valence Bond theory. Uses of coordination compounds. Bioinorganic compounds (Haemoglobin and chlorophyll).

Lattice – unit cell, systems, types of crystals, packing in solids; Ionic crystals – Imperfections in solids – point defects. X-Ray diffraction – Electrical Property, Amorphous solids (elementary ideas only).

4. Thermodynamics, Chemical Equilibrium and Chemical Kinetics

I and II Laws of thermodynamics – spontaneous and non-spontaneous processes, entropy, Gibb's free energy – Free energy change and chemical equilibrium – significance of entropy. Law of mass action – Le Chatelier's principle, applications of chemical equilibrium. Rate expression, order, and molecularity of reactions, zero order, first order and pseudo first order reaction – half-life period. Determination of rate constant and order of reaction. Temperature dependence of rate constant – Arrhenius equation and activation energy.

5. Electrochemistry

Theory of electrical conductance; metallic and electrolytic conductance. Faraday's laws – theory of strong electrolytes – Specific resistance, specific conductance, equivalent and molar conductance – Variation of conductance with dilution – Kohlrausch's Law – Ionic product of water, pH, and pH– buffer solutions – use of pH values. Cells – Electrodes and electrode potentials – construction of cell and EMF values, Fuel cells, Corrosion, and its prevention.

6. Isomerism in Organic Compounds

Definition, Classification – structural isomerism, stereo isomerism – geometrical and optical isomerism. Optical activity- chirality – compounds containing chiral centres – R, S notation, D, L notation.

7. Alcohols and Ethers

Nomenclature of alcohols – Classification of alcohols - distinction between 1°, 2° and 3° alcohols – General methods of preparation of primary alcohols, properties. Methods of preparation of dihydric alcohols: Glycol – Properties – Uses. Methods of preparation of trihydric alcohols - Properties – Uses. Aromatic alcohols – preparation and properties of phenols and benzyl alcohol.

Ethers – Nomenclature of ethers – general methods of preparation of aliphatic ethers - Properties – Uses. Aromatic ethers – Preparation of Anisole – Uses.

8. Carbonyl Compounds

Nomenclature of carbonyl compounds – Comparison of aldehydes and ketones. General methods of preparation of aldehydes – Properties – Uses. Aromatic aldehydes – Preparation of benzaldehyde – Properties and Uses. Ketones – general methods of preparation of aliphatic ketones (acetone) – Properties – Uses. Aromatic ketones – preparation of acetophenone – Properties – Uses, preparation of benzophenone – Properties. Name reactions; Clemmensen reduction, Wolff – Kishner reduction, Cannizzaro reaction, Claisen Schmidt reaction, Benzoin Condensation, Aldol Condensation. Preparation and applications of Grignard reagents.

9. Carboxylic Acids and their derivatives

Nomenclature – Preparation of aliphatic monocarboxylic acids – formic acid – Properties – Uses. Monohydroxy mono carboxylic acids; Lactic acid – Synthesis of lactic acid. Aliphatic dicarboxylic acids; Preparation of oxalic and succinic acids. Aromatic acids: Benzoic and Salicylic acids – Properties – Uses. Derivatives of carboxylic acids; acetyl chloride (CH₃COCl) – Preparation – Properties – Uses. Preparation of acetamide, Properties – acetic anhydride – Preparation, Properties. Preparation of esters – methyl acetate – Properties.

10. Organic Nitrogen Compounds and Biomolecules

Aliphatic nitro compounds – Preparation of aliphatic nitroalkanes – Properties – Uses. Aromatic nitro compounds – Preparation – Properties – Uses. Distinction between aliphatic and aromatic nitro compounds. Amines; aliphatic amines – General methods of preparation – Properties – Distinction between 1°, 2° and 3° amines. Aromatic amines – Synthesis of benzylamine – Properties, Aniline – Preparation – Properties – Uses. Differences between aliphatic and aromatic amines. Aliphatic nitriles – Preparation – properties – Uses. Diazonium salts – Preparation of benzene diazonium chloride – Properties.

Carbohydrates – **Distinction** between sugars and non-sugars, structural formulae of glucose, fructose, and sucrose, with their linkages, invert sugar – definition, examples of oligo and polysaccharides,

Amino acids – Classification with examples, Peptides-properties of peptide bond,

Lipids - Definition, classification with examples, difference between fats, oils, and waxes.

