

CHEMISTRY
DEGREE STANDARD

INORGANIC CHEMISTRY UNIT – I**A. ATOMIC STRUCTURE AND PERIODIC CLASSIFICATION**

- I) Atomic models: Rutherford, Bohr and Sommerfeld-Origin of hydrogen spectrum-Electromagnetic radiation- Dualism of light-Black body radiation- Planck's quantum theory-Photoelectric effect-Compton effect-de Broglie equation-Heisenberg uncertainty principle.
- II) Periodic properties of elements: Atomic ionic radii, Ionization potential, electron affinity, electronegativity (Pauling and Mulliken's scale) of elements along period and groups, -Effective nuclear charge, screening effect, Slater rule
- III) Postulates of quantum mechanics-operators: linear, non-linear, commutator- Schrodinger wave equation and derivation)-Significance of ψ and ψ^2 , wave mechanical concept of atomic orbitals.

B. CHEMICAL BONDING

- I) Ionic bond-Factors influencing the ionic bond-Lattice energy- Inert pair effect-Fajan's rules-Born-Haber cycle-Born-Lande equation (derivation not required)
- II) Covalent bond-Lewis theory-VSEPR theory-Shapes of BeF_2 , BCl_3 , SnCl_2 , CCl_4 , PF_5 , Valence bond theory- Coordinate bond-Hybridization: sp^3 , dsp^2 , sp^3d^2 , d^2sp^3
- III) Shapes of orbitals,-quantum numbers-Zeeman effect-Pauling's exclusion principle, Hund, rule, Aufbau Principle, Electronic configuration of elements- MO theory, MO diagrams of O_2 , N_2
- IV) Intermolecular forces: hydrogen bond, van der Waals forces
- V) Dipole moment

UNIT II**C. p-Block elements**

- i) General characteristic of p-block elements- Diborane-borax, borazine, Alums, alloys of aluminium, allotropes of carbon
- ii) Chemistry of oxides of carbon, silicon
- iii) Compound of N and P- $\text{NH}_2\text{-NH}_2$, NH_2OH , Fixation of N_2 , PH_3 , P_2O_5

D. d-BLOCK & f-BLOCK ELEMENTS

- i) General characteristics of d-block elements: Melting points, Ionization energies, oxidation states, magnetic properties
- ii) Alloys of iron, copper, Nickel, chromium- Gemstones: Ruby, Emerald, Sapphire
- iii) General characteristics of f-block elements
- iv) Lanthanide, actinide contraction- consequences- UV spectra
- v) Separation and applications of lanthanides and actinides

UNIT III**E. COORDINATION CHEMISTRY**

- i) Classification of ligands, Complexes- IUPAC nomenclature, Isomerism. Mono and bidentate ligands and their complexes- outer orbital inner orbital complexes
- ii) Theories of coordination compounds: Werner's theory, VB theory, Crystal field theory, EAN rule
- iii) Applications of coordination compounds

F. NUCLEAR CHEMISTRY

- i) Theory of nuclear reactions- alpha, beta and gamma rays- n/p ratio, isotopes. Isobars, isotones- Laws of radio activity- Radioactive equilibrium
- ii) Types of nuclear reactions: Fission, fusion and spallation-Nuclear reactors
- iii) Applications of radio isotopes in industry, medicine and agriculture

G. ANALYTICAL CHEMISTRY

Principles of volumetric analysis, gravimetric analysis, Separation and purification techniques- Redox titrations, complexometric titrations and Conductometric titrations.

PHYSICAL CHEMISTRY**UNIT-IV****H. GASEOUS STATE**

Gas laws: Boyle's law, Charles law, Avogadro's law- kinetic theory- ideal gas equation- deviation from ideal behaviour- Maxwell distribution of molecular velocities(no derivation)- mean, root mean square and most probable velocities- Calculation of molecular velocities-collision diameter- mean free path- collision number- behaviour of real gases-deviation from ideal behaviour--Inversion temperature-Liquefaction of gases

I. SOLID STATE

- i) Classification of solids, Isotropic and anisotropic crystals- Crystal systems- Laws of crystallography- Miller indices, Bravais lattices- Unit cell- Crystal symmetry- X-ray diffraction- Structures of NaCl, CsCl and ZnS-Bragg's equation-Radius ratio-Packing in crystals-defects in crystals
- ii) Semiconductors: n and p -type, intrinsic and extrinsic semiconductors

UNIT- V**J. THERMODYNAMICS**

- i) Definitions: System and surrounding, isolated, closed and open systems- state of the system-intensive and extensive properties-Thermo dynamic processes: reversible and irreversible, isothermal and adiabatic processes, state and path functions
- ii) First law of thermodynamics, Internal energy, enthalpy, heat capacity, Relationship between C_p and C_v , Hess's law of constant heat summation-Kirchoff's equation- Second law of thermodynamics-Carnot theorem, entropy and probability-free energy and chemical equilibrium-Third law-Gibb's & Helmholtz functions

K. CHEMICAL KINETICS

- i) Rate of reactions, rate law, Rate constant-order and molecularity of reactions- Derivation of first order rate constant, Zero order reaction, Effect of temperature on reaction rates- Half-life period, Activation energy- Arrhenius equation
- ii) Theory of reaction rates, failure of collision theory-Significance of entropy and free energy of activation

UNIT-VI**L. COLLOIDS AND SURFACE CHEMISTRY**

- i) Classification of colloids-Preparation and purification of colloids-Properties of colloids-Stability of colloids-Gold number, gels- emulsion-types, emulsifiers-Application of colloids
- ii) Adsorption-Physisorption, chemisorption, difference between them-Factors influencing adsorption-Adsorption isotherm, Langmuir isotherm(no derivation)

M. ELECTROCHEMISTRY

- i) Galvanic cells- Types of reversible and irreversible electrodes-conventional representation of electrochemical cells. Nernst equation- reference electrodes, Computation of cell emf, Calculation of thermodynamic parameters of cell reactions-Over potential, Hydrogen over voltage.
- ii) Arrhenius theory, Debye-Huckel equation- Kohlrausch law, Ostwald's dilution law – Determination of pH and pKa of acids by potentiometric methods-Corrosion- Types of corrosion-Prevention of corrosion

UNIT-VII**N. SPECTROSCOPY:**

- i) Electromagnetic spectrum-Different regions of spectra- Microwave spectra of diatomic molecules, rotational constants, selection rules-Infrared spectroscopy-Applications-Raman spectroscopy-Principles and applications
- ii) Principles, instrumentation and applications of UV Vis, NMR, ESR and Mass spectrometry.

ORGANIC CHEMISTRY UNIT-VIII**O. TYPES OF REACTIONS**

- i) Aliphatic nucleophilic substitution reactions –Aromatic electrophilic substitution reactions-Free radical reactions-Addition to C=C and C=O compounds – Elimination Reactions.
- ii) Reduction and oxidation reactions – Oxidation with osmium tetroxide, ozone- reduction with NaBH₄, LiAlH₄

P. ELECTRON DISPLACEMENT METHODS

Inductive effects- Mesomeric effects, Hyper conjugation- Steric effects in substitution, addition and elimination reactions

Q) NOMENCLATURE OF ORGANIC COMPOUNDS

Classification of organic compounds-IUPAC nomenclature:alkanes, alkenes, alkynes, alcohols, aldehydes and ketones.

UNIT- IX**R. NATURE OF BONDING**

- 1) Hybridization and geometry of simple organic compounds- Breaking of bonds- homolytic and heterolytic cleavage of C – C bonds-Reaction intermediates- free radicals : generation and stability- Carbocation and carbanion: formation and stability

S. STEREOCHEMISTRY

Stereoisomerism, definition and types- optical activity-asymmetric carbons, D and L notations, Enantiomerism, Diastereomerism- Racemization methods- Resolution methods-Walden inversion- Fisher, sawhorse and Newman projections-R and S notation of optical isomers: Cahn-Inhold and Prelog rules- Geometrical isomerism Z and E notations

UNIT X**T. MECHANISM IN AROMATIC SUBSTITUTION**

- i) Aromatic electrophilic substitution: Arenium ion mechanism: nitration, halogenation, sulphonation, Friedel Crafts reaction- Orientation and reactivity in monosubstituted benzene rings-Activating and deactivating groups-
- ii) Aromatic nucleophilic substitution: S_NAr mechanism, Benzyne mechanism

U. CARBOHYDRATES

Classification of carbohydrates-Monosaccharides-D family sugars-L family sugars-Epimers-Mutarotation- Interconversion of glucose to fructose and vice versa, Reactions of monosaccharides-Disaccharides – Lactose, Maltose, Gentiobiose, Sucrose, Manufacture of sucrose, properties and uses.

V. MATERIAL CHEMISTRY

- i) Polymers-Types of polymerization-Homopolymers- copolymers- Thermosetting and thermoplastic polymers-Vulcanization of rubber
- ii) Dyes: Classification and Properties of dyes, Chromophores, auxochromes, Preparation of methyl orange, congo red, malachite green, fluorescein, indigo.