

**INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY-I**

**UNIT – I (Inorganic Chemistry)**

**(15 Hours)**

1.1. VOLUMETRIC ANALYSIS:

Basic requirements of titration reaction – standard solutions – primary and secondary standards – types of titrimetric reactions – redox – precipitation titrations. Indicators – effect of change in pH - neutralisation - mixed and fluorescent indicators.

1.2. BORON FAMILY:

Comparative study of boron family elements. Compounds of boron – diborane structure discussion – borax, boron nitride, boron carbide and borazole.

1.3. CARBON FAMILY

1.3.1. Comparative study of carbon family elements and their compounds (hydrides, halides and oxides).

1.3.2. Chemistry of cyanogens, hydrocyanic acid, cyanic acid, thiocyanic acid, ammonium thiocyanate and carbon disulphide.

1.3.3. Structures of graphite, diamond and fullerene.

**UNIT –II (Inorganic Chemistry)**

**(15 Hours)**

CHEMICAL BONDING

2.1: Lattice energy and Born – Haber Cycle

2.2: Pauling and Mulliken's scales of electronegativity.

2.3: Polarising power and Polarisability – Partial ionic character from electronegativity – Transition from ionic to covalent character and vice-versa – Fajan's rules – concept of hard and soft acids and bases.

2.4: VSEPR Theory: Shapes of simple inorganic molecules ( $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{SiCl}_4$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{XeF}_6$ ) containing lone pair and bond pairs of electrons – Lewis structures .

2.5: Hydrogen bonding – Its nature, types, effect on properties.

2.6: Intermolecular forces – London forces and van der Waals forces.

**UNIT –III (Organic Chemistry)**

**(15 Hours)**

3.1: Basic concepts in organic chemistry - catenation

3.1.1: Hybridization and geometry of molecules – methane, ethane, ethylene and acetylene (sigma and pi bonds, bond lengths, bond angles, bond energy)

3.1.2 : Electron displacement effects – Inductive, inductometric, electromeric, mesomeric, resonance (localized and delocalized chemical bond), hyperconjugation and steric effects.

3.1.3: Cleavage of bonds – homolytic and heterolytic fission of carbon – carbon bonds.

3.1.4: Reaction intermediates – free radicals, carbocations and carbanions, carbenes, nitrenes and arynes – their stability.

**UNIT –IV (Organic Chemistry)**

**(15 Hours)**

4.1.: Nomenclature of organic compounds – IUPAC naming of simple and substituted aliphatic, aromatic and alicyclic compounds. Priorities of functional group suffixes in polyfunctional compounds.

4.2.: Alkanes

4.2.1. Mechanism of free radical substitution in alkanes.

4.3. Petroleum

4.3.1. Thermal and catalytic process of cracking.

- 4.3.2. Synthetic petrol – Fischer Tropsch’s process and Bergius process, flash point, fire point, smoke point, knocking, octane number and cetane number, antiknocking reagents, power alcohol.
- 4.4. Alkenes
- 4.4.1. Properties of alkenes – electrophilic and free radical addition, addition reactions with hydrogen bromide (peroxide effect), sulphuric acid, water, hydroboration, ozonolysis, hydroxylation with  $\text{KMnO}_4$  – allylic substitution by NBS (with mechanisms of all the above reactions)
- 4.4.2. Problems and conversions.

**UNIT –V (Physical Chemistry)**

**(18 Hours)**

- 5.1. Gaseous state.
- 5.1.1. The Gas constant “R” in different units - deviation from ideal behaviors - Van der Waal’s equation for real gases.
- 5.1.2. Critical Phenomena – PV isotherms of real gases, critical temperature, continuity of state- relation between critical constants and van der Waals constants- Determination of critical volume – the law of corresponding states – reduced equation of state.
- 5.1.3. Molecular velocities – Root mean square, average and most probable velocities (derivation from Maxwell-Boltzmann distribution equation)-Maxwell – Boltzmann distribution of molecular velocities (no derivation) - Collision number and mean free path - Collision diameter.

**UNIT –VI (Physical Chemistry)**

**(12 Hours)**

- 6.1. Liquid state.
- 6.1.1. Liquid crystals – classification, structure, properties and applications.
- 6.2. Colloidal state.
- 6.2.1. Size of colloidal particles – Peptization, stability of colloids, coagulation and protection. Reverse Osmosis and desalination of sea water. Donnan – Membrane equilibrium. Electrophoresis and separation of proteins.
- 6.2.2. Gels and emulsions.\* Numerical problems wherever possible ( all units )

**References:**

1. R.D.Madan, J.S.Tiwari and G.L.Mudhara – A text book of First Year B.Sc.Chemistry – S.Chand & Co.
2. G.S.Manku – Theoretical Principles of Inorganic Chemistry Tata McGraw Hill, New Delhi.
3. Paula Yurkanis Bruice- Organic Chemistry, Prentice Hall
4. J.D.Lee , “ Concise Inorganic Chemistry “. 5 th Edition., Blackwell Science Ltd, Oxford, 2002
5. B.S. Bahl and Arun Bahl, “ Advanced Organic Chemistry ,” S .Chand and Co New Delhi.
6. B.R Puri And Sharma , “ Principles of Physical Chemistry ,”