

Chemistry

Full Marks:100

Group A

40

hours

1. Analysis of organic compounds
 - a) Qualitative and quantitative analysis of carbon, hydrogen, nitrogen and halogens.
 - b) Determination of molecular weight of organic acid and bases
2. Properties of molecules
 - a) The electronic theory of valency
 - b) Atomic and molecular orbital, shape of molecules, orbital picture of benzene
 - c) Electronic displacements in a molecule
 - i) Inductive effect
 - ii) Electromeric effect
 - iii) Mesomeric effect (or resonance)
 - iv) Tautomerism
3. The general nature of organic reaction
 - a) Transition state theory of reaction, energy of activation
 - b) Homolytic and heterolytic fission of bonds
 - c) Reaction kinetics
 - d) Thermodynamic properties
 - e) Use of isotopes in organic chemistry
4. Different types of organic reactions
 - a) Substitution reaction in aliphatic and aromatic compounds
 - b) Polymerization reactions: Addition polymerization, condensation polymerization, and free radical polymerization
 - c) Condensation reaction: Aldol condensation and Casein condensation
 - d) Intermolecular reaction (1,2 shifts rearrangement involving bridged or non classical carbonium ion)
 - e) Biochemical reaction: Biological oxidation and reduction (ethyl alcohol to acetaldehyde and vice versa) , fermentation
5. Stereochemistry:
 - a) Chirality
 - b) Specification of absolute configuration

- c) Optical activity
- d) Optical activity of lactic and tartaric acid
- e) Geometric isomerism of malic and fumaric acids

Group B: Organic Chemistry

40 hours

- 6. Angelic Compounds: Nomenclature. Baeyer strain theory. Conformational analysis
- 7. Polynuclear hydrocarbons: General introduction and nomenclature, structure, preparation and properties of naphthalene and anthracene
- 8. Heterocyclic compounds: Nomenclature, preparation, Heterocyclic and molecular orbital picture of furan. Thiophene, pyrrole, furfural, and pyridine
- 9. Dyes and photochemistry: Colour and Constitution. Colour and dyes, classification. general studies on azodycs (methyl red. aniline yellow); phthaleins (phenolphthalein. fluorescein), triarylmethanedyes (crystal violet)
- 10. Alkaloids: Definition. Classification, extraction, general properties and structure and uses
- 11. Introduction to anthracynine, flavonoids, flavones and their uses
- 12. Carbohydrate: Introduction, classification, structure elucidation of (–) glucose, configuration. Ring structure determination
- 13. Protein: Classification and function, denaturation, structure of amino acid, isoelectric point, geometry of peptide linkage, analysis of amino acid from protein hydrolysates (C-terminal and N-terminal)-amino acid determination.

Group C: Physical Chemistry

40 hours

- 14. Atomic structure: Bohr's theory of atomic structure, derivations of equations for radius and energy of electron in hydrogen atom, explanation of hydrogen spectra, Limitations of Bohr's theory, Sommerfeld extension of Bohr's model.
- 15. Radioactivity: Types of radiation, types of radioactivity decay, the group displacement law, half life and average life, radioactive disintegration series of uranium. Artificial radioactivity
- 16. Ionic equilibrium: Auto ionization of water, pH and p^H scale, acid base indicators, theories or acid base indicators, choice of indicators in acid base titration, buffer solution, Henderson equation, hydrolysis of salt

17. Thermodynamics: Scope and limitations of thermodynamics, energy and its units, some thermodynamics terms, reversible and irreversible process, First law of thermodynamics, mathematical formulation, sign conversion of work and energy, isothermal reversible and irreversible expansion of ideal gas, enthalpy and entropy changes. Hess's law of constant heat summation, enthalpy change from bond energy, heat capacities, reactions between C_p and C_v , temperature dependence of heat capacities (Kirchoff's law). Calorific values of fuel and calorific values of food, Second law of thermodynamics, entropy, entropy and spontaneity of a process, entropy change for a non-spontaneous process, Third law of thermodynamics, evaluation of absolute entropy, free energy, work function, and their significance, criteria of spontaneity.

Practicals

Identification of functional groups (-COOH, -CHO, =CO, -NH₂, NO₂, and -phenol).

Organic preparation: Acetanilide or aspirin, benzoic acid. Isolation of lactose from milk, caffeine from tea, citric acid from lemon. Volumetric analysis involving redox reaction (use of permanganate, dichromate, and iodine), and use of EDTA.

Gravimetric analysis: Estimation of Ca, Fe, Ni, chloride and sulphate.

Text and reference books: -

1. R.T. Morrison and R.N. Boyd, *Organic Chemistry*, Prentice Hall of India.
2. I.L. Finar, *Organic Chemistry* Vol I and II, ELBS, Longman.
3. N.K. Visnoi, *Advanced Practical Organic Chemistry*, Vikash Pub Ltd, India.
4. B.S. Bahl, G.D. Tuli and Arun Bahl, *Essential of Physical Chemistry*, S. Chard & Company, New Delhi.
5. M.K. Sthapit, *Selected Topics in Physical Chemistry*, Taleju Prakashan, Kathmandu, Nepal.
6. M.K. Sthapit and R.R. Pradhananga, *Elementary Chemical Calculations*, 2nd edition, Taleju Prakashan, Kathmandu
7. S.H. Maron & F. Prutton, *Principle of Physical Chemistry*, Oxford & IBH Pub. Co.
8. *Vogel's Textbook of Quantitative Analysis* revised by G.H. Jeffry, J. Bassett, J. Mendham and R.C. Denney, ELBS with Longman.