

Government Degree College Baramulla

SEMESTER 1st

MAJOR/MINOR COURSE

Subject: Chemistry

Title: CHEMISTRY-I

Code: BCH22C101

CREDIT: (4+2) THEORY: 04; PRACTICAL: 02

CONTACT HOURS: 64 (T) + 64 (L)

Part 1: Theory (4 Credits)

Course Objectives:

The aim of the course is make students aware about

- i. Basic concepts of chemical bonding;*
- ii. Fundamental aspects of s-block elements and acid-base theories;*
- iii. Basic concepts of organic chemistry, like electron displacement effects, stereochemistry and reaction intermediates; and*
- iv. Structural and behavioural aspects of gases, liquids and liquid crystals.*

Learning outcomes:

On completion of the course, the student should be able to understand the:

- Nature and strength of different types of bonds and resulting shapes of molecules;*
- Concepts of acids and bases and properties of alkali and alkaline earth metals different theories of chemical bonding;*
- Key electron displacement effects, intermediates generated in organic reactions, and basic aspects of stereochemistry; and*
- Structural and behavioural aspects of gases, liquids and liquid crystals. .*

UNIT I: Theories of Chemical Bonding and Molecular Structure

(16 Contact hours)

Types of bonding: Ionic and Covalent bonding- Factors affecting ionic and covalent bonding. Lattice energy and Born Haber cycle. Solvation energy and solubility of ionic solids. Covalent character of ionic bond, Fajan's rules, Percentage ionic character of a polar covalent bond. Dipole moment and its applications.

Valence bond theory: Directional characteristics of covalent bond, types of hybridization and limitations of VB theory.

VSEPR theory: Recapitulation of assumptions; Shapes of molecules /ions. (VO_3^{-1} , SF_6 , IF_7 , SnCl_2 , XeF_2 , XeF_6 , XeOF_4); Molecular orbital theory: MO treatment of homo & hetero nuclear diatomic molecules (N_2 , O_2 , CO & NO). Energy level diagrams, Bond order and its applications.

Unit II: Acid Base theories and s-Block Elements

(16 Contact hours)

Acid-Base Theories: Arrhenius, Brønsted-Lowry, Lewis, Lux-Flood and Usanovich. Hard soft acid base principle.

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Periodic Properties (atomic/ionic radii, ionization energy, electron affinity and electronegativity) and their trends. Electronegativity scales and applications. Effective nuclear charge and its calculation by Slater rules.

Chemical Reactivity towards Water, Oxygen, Hydrogen, Nitrogen and Halogens. Anomalous behaviour and diagonal relationships (Lithium, Beryllium, Magnesium and Aluminum). Chemical characteristics of oxides and hydroxides of alkali and alkaline earth metals. Hydrides: Classification and general properties.

Unit III: Fundamentals of Organic Chemistry

(16 Contact Hours)

Electron displacement effects and their applications - Inductive, electrometric, Resonance and hyperconjugation.

Reaction intermediates: Structure, generation and stability of carbocations, carbanions, free-radicals and carbenes.

Stereochemistry

Concept of chirality, CIP rule, Wedge, Newmann, Sawhorse and Fischer representations and their interconversions; Optical isomerism: enantiomers, diastereomers and Meso compounds. Threo and erythro; D/L, R/S (upto 2 chiral carbon atoms); Geometrical isomerism: cis – trans, E / Z nomenclature (up to two C=C systems). Conformational analysis of ethane, butane and cyclohexane.

UNIT IV: States of matter

(16 Contact Hours)

Gaseous State: Ideal Gas equation, Deviation of gases from ideal behavior, van der Waal's equation of state. PV isotherms of real gases, continuity of states, the isotherms of van der Waal's equation. Relationship between critical constants and van der Waal's constants, the law of corresponding states, reduced equation of state.

Molecular velocities: qualitative discussion of the Maxwell's distribution of molecular velocities, Root mean square, average and most probable velocities (basic concepts only), Collision number, collision frequency, mean free path and collision diameter.

Liquid State:

Viscosity and Surface tension, Factors affecting viscosity and surface tension of liquids, liquid crystals and its types.

Books Recommended:

1. Concise Inorganic Chemistry; J.D. Lee; 5thEdn., OUP/Wiley India Pvt. Limited, 2008
2. Chemistry of the Elements; N. N. Greenwood, A. Earnshaw; 2nd Edn., Elsevier India, 2010.

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- Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33rd Edn., Milestone Publishers & Distributors/ Vishal Publishing Co., 2017
- Advanced General Organic Chemistry: A Modern Approach; S.K. Ghosh; 3rd Revised Edn., New Central, 2010.
- Organic Chemistry; R.T. Morrison, R.N. Boyd, S. K. Bhattacharjee; 7th Edn., Pearson India, 2011.
- Organic Chemistry; P.Y. Bruice; 8th Edn., Pearson Education, 2017.
- Advanced Organic Chemistry; Dr. Jagdamba Singh and LDS Yadav; Pragati edition, 2017.
- Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 48th Edn., Vishal Pubs & Co, 2021.
- Physical Chemistry; T. Engel, P. Reid,; 3rd Edn., Pearson India, 2013.

Part 2: Laboratory Course (2 Credits)

Course Objectives:

- To prepare solutions of different concentrations.
- To detect and purify organic compounds by different methods.
- To determine surface tension and viscosity of different liquids.

Learning outcomes:

On completion of the course, the student should be able to:

- Prepare and standardize different solutions.
- Learn techniques of purification.
- Learn methods for determination of surface tension and viscosity of liquids.
- Learn methods for determination of elements present in organic compounds

Section A: Inorganic Chemistry

(22 Contact Hours)

- Preparation of solutions of different concentrations; Standardization of solutions (acids and bases).
- Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
- Volumetric estimation of oxalic acid by titrating it with KMnO_4 .

Section B: Organic Chemistry

(22 Contact Hours)

- Purification of organic compounds by crystallization (from water and alcohol) and sublimation.
- Detection of N, S and halogens in organic compounds.
- Separation and Identification of two components in a given mixture of amino acids by paper chromatography

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Section C: Physical Chemistry

(20 Contact Hours)

1. Determination of density and relative density of various liquids using pycnometer/density bottle.
2. Determination of viscosity of given liquids using Ostwald Viscometer.
3. Determination of surface tension of given liquids using stalagmometer.

Books Recommended:

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
3. Comprehensive Practical Organic Chemistry: Qualitative analysis Ahluwalia, V.K. & Sunita Dhingra; Universities Press, India, 2004.
4. Advanced Practical Organic Chemistry; N. K. Vishnoi; 3rd Edn; Vikas Publishing, 2009.
5. Advanced Practical Physical Chemistry; J.B. Yadav; Krishna Prakashan Media (P) Limited, 2015.
6. Advanced Physical Chemistry Experiments; J. N. Gurtu, A. Gurtu, Pragati Prakashan, 2008.