

Government P G College, Ambala Cantt
Course File (Session 2023-24)
Name of Associate Professor: Dr. Deepak Sharma
Class: BPSC-I/1st Semester
Subject code and Name: B23-CHE-101/ CC-1/MCC-1/Chemistry I

SYLLABUS

Maximum Marks: 70

External: 50

Time: 3 hours

Internal: 20

Note: The examiner is requested to set nine questions in all, selecting two questions from each section and one question i.e. Question No.1, based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and nonprogrammable calculator is allowed.

UNIT-I

Atomic Structure

Dual behavior of matter and radiation, de Broglie's relation, Heisenberg's uncertainty principle, concept of atomic orbitals, significance of quantum numbers, radial and angular wave functions, normal and orthogonal wave functions, significance of Ψ and Ψ^2 , shapes of s, p, d, f orbitals, Rules for filling electrons in various orbitals, effective nuclear charge and Slater's rules

Periodic table and atomic properties

Classification of periodic table, definition of atomic and ionic radii, ionisation energy, electron affinity and electronegativity, trend in periodic table (in s and p-block elements), Pauling, Mulliken, Allred Rachow and Mulliken Jaffe's electronegativity scale Sanderen's electron density ratio.

UNIT-II

Gaseous State

Kinetic theory of gases, Maxwell distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity, and most probable velocity. Collision diameter, collision number, collision frequency and mean free path (Derivations excluded), Deviation of Real gases from ideal behaviour, Derivation of Van der Waal's equation of state, its application in the calculation of Boyle's temperature (Compression factor)

Critical Phenomenon

Concept of Critical temperature, critical pressure, critical volume, relationship between critical constants and Van der Waal's constants (derivation excluded)

UNIT- III

Structure and Bonding

Localized and delocalized chemical bond, Van der Waals interactions. Concept of resonance and its applications, hyperconjugation, inductive effect, Electromeric effect and their comparison.

Mechanism of Organic Reactions

Curved arrow notation, homolytic and heterolytic bond fission. Types of reagents: electrophiles and nucleophiles. Types of organic reactions: Substitution, Addition, Condensation, Elimination,

Rearrangement, Isomerization and Pericyclic reactions. Reactive intermediates: Carbocations, carbanions, free radicals, carbenes (structure & stability).

UNIT-IV

Liquid State

Structure of liquids, Properties of liquids surface tension, refractive index, viscosity, vapour pressure and optical rotation.

Solid State

Classification of solids, Law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry and symmetry elements, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Brag's Law, a simple account of Laue method, rotating crystal method and powder pattern method.

Text Books:

1. Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 1, 6 th Edition, McGraw Hill Education
2. Jauhar, S.P.; Modern Approach to Inorganic Chemistry, Vol I, Modern Publishers
3. Sehgal, J.M.; Modern Approach to Organic Chemistry, Vol I, Modern Publishers
4. Dhawan, S.N.; Pradeep's Organic Chemistry, Vol I, Pradeep Publications
5. Bhardwaj, R; R Chand's Physical Chemistry, Vol I R.Chand & CO. New Delhi

Reference Books:

1. Lee, J.D.; (2010), Concise Inorganic Chemistry, Wiley India.
2. Clayden, J.; Greeves, N.; Warren, S. (2012), Organic Chemistry, Oxford.
3. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Huheey, J.E.; Keiter, E.A.; Keiter; R. L.; Medhi, O.K. (2009), Inorganic Chemistry- Principles of Structure and Reactivity, Pearson ducation.
5. Atkins, P.W.; Paula, J.de. (2014), Atkin's Physical Chemistry Ed., 10th Edition, Oxford University Press.

COURSE OBJECTIVES

The Course Objectives are given below

- To have knowledge regarding particle and wave nature of electron.
- To study the concepts related to quantum mechanics.
- To have better understanding of various shapes of orbitals based on quantum mechanics.
- To have better understanding filling of various orbitals on the basis of Aufbau's principle and its justification on the basis of Slater's rule.
- To study the electronic configuration of cations, anions and calculation of effective nuclear charge.
- To learn various periodic properties such as atomic/ionic radii, ionization energy, electron affinity, electronegativity.
- To learn the role of temperature and pressure on gaseous state and liquefaction of various gases.
- To have better understanding of structure of various intermediates and their stability on the basis of resonance, hyperconjugation and inductive effect.
- To have the knowledge of properties of liquids.
- To have awareness regarding the morphology and properties of solids.

COURSE OUTCOMES

After the successful completion of the course, students will be able:

- To distinct various properties of electron on the basis of particle and wave nature.
- To understand and can differentiate characteristics, shapes of various orbitals on the basis of quantum mechanics.
- To understand the various quantum numbers.
- To understand and can justify the applicability of Slater's rule while loss as well as gain of electron by atom.
- To differentiate between electron affinity and electronegativity.
- To justify the existence of intermolecular forces of attraction among gaseous molecules.
- To understand the various types of velocities of gaseous molecules.
- To understand the role of temperature and pressure on gaseous state and liquefaction of various gases.
- To calculate critical temperature, pressure and volume of a gas.
- To differentiate between electrophile and nucleophile, nucleophile and a base, transition state and intermediate.
- To analyze the stability of various intermediates.
- To understand the morphology and properties of liquids and solids.

LESSON PLAN

Week No	Scheduled Dates	Topics to be covered
1	July 24, 2023- July 26, 2023	Kinetic theory of gases, Maxwell distribution of velocities and energies (derivation excluded)
2	July 31, 2023- Aug 02, 2023	Calculation of root mean square velocity, average velocity, and mostprobable velocity.
3	Aug 07, 2023- Aug 09, 2023	Collision diameter, collision number, collision frequency and mean free path (Derivations excluded)
4	Aug 14, 2023- Aug 16, 2023	Deviation of Real gases from ideal behaviour, Derivation of Van der Waal's equation of state
5	Aug 21, 2023- Aug 23, 2023	Application in the calculation of Boyle's temperature(Compression factor)
6	Aug 28, 2023- Aug 30, 2023	Concept of Critical temperature, critical pressure, critical volume.
7	Sept 04, 2023- Sept 06, 2023	relationship between critical constants and Van der Waal's constants (derivation excluded)
8	Sept 11, 2023- Sept 13, 2023	Dual behavior of matter and radiation, de Broglie's relation, Heisenberg's uncertainty principle
9	Sept 18, 2023- Sept 20, 2023	concept of atomic orbitals, significance of quantum numbers, radial and angular wave functions, normal and orthogonal wave functions, significance of Ψ and Ψ^2
10	Sept 25, 2023- Sept 37, 2023	shapes of s, p, d, f orbitals, Rules for filling electrons in various orbitals,
11	Oct 02, 2023- Oct 04, 2023	effective nuclear charge and Slater's rules, Classification of periodic table
12	Oct 09, 2023- Oct 11, 2023	definition of atomic and ionic radii, ionisation energy
13	Oct 16, 2023- Oct 18, 2023	electron affinity and electronegativity, trend in periodic table (in s and p-block elements)
14	Oct 23, 2023- Oct 25, 2023	Pauling, Mulliken, Allred Rachow and Mulliken Jaffe's electronegativity scale Sanderen's electron density ratio.

15	Oct 30, 2023- Nov 01, 2023	Localized and delocalized chemical bond, Van der Waals interactions.
16	Nov 06, 2023- Nov 08, 2023	Concept of resonance and its applications, hyperconjugation, inductive effect, Electromeric effect and their comparison.
17	Nov 20, 2023- Nov 22, 2023	Curved arrow notation, homolytic and heterolytic bond fission. Types of reagents: electrophiles and nucleophiles. Types of organic reactions: Substitution,
18	Nov 27, 2023- Nov 29, 2023	Addition, Condensation, Elimination, Rearrangement, Isomerization and Pericyclic reactions.
19	Dec 04, 2023- Dec 06, 2023	Reactive intermediates: Carbocations, carbanions, free radicals, carbenes (structure & stability).
20	Dec 11, 2023- Dec 13, 2023	Structure of liquids, Properties of liquids surface tension, refractive index
21	Dec 18, 2023- Dec 20, 2023	viscosity, vapour pressure and optical rotation. Classification of solids, Law of constancy of interfacial angles
22	Jan 01, 2024- Jan 03, 2024	law of rational indices, Miller indices, elementary ideas of symmetry and symmetry elements, seven crystal systems and fourteen Bravais lattices
23	Jan 08, 2024- Jan 10, 2024	X-ray diffraction, Bragg's Law, a simple account of Laue method, rotating crystal method and powder pattern method.