

Semester-II

CHE-151-T: Fundamentals of Chemistry-II

Course type: Major (Theory)

No. of Credits: 2

Course Outcomes

After the completion of this course, student will be able to-

CO1: recall and explain the fundamental principles and concepts from Photochemistry, Chemical Kinetics, Periodicity, Stereochemistry, and Chemical Bonding.

CO2: identify experimental key concepts involved in Photochemistry, Chemical Kinetics, Periodicity, Stereochemistry, and Chemical Bonding.

CO3: draw conclusions about reaction mechanisms, kinetics, periodic trends, stereochemical relationships, and bonding properties.

CO4: apply the principles of Photochemistry, Chemical Kinetics, Periodicity, Stereochemistry, and Chemical Bonding to solve complex problems and scenarios.

CO5: evaluate the significance of photochemical reactions, kinetic processes, periodicity, bonding theories like VBT and MOT and stereochemical structures.

CO6: propose solutions, and contribute to the advancement of scientific knowledge applications.

Course Content

Chapter 1: Photochemistry

[06 hours]

Introduction, Difference between thermal and photochemical processes. b. Laws of photochemistry i) Grothus - Draper law ii) Stark-Einstein law. c. Quantum yield, Reasons for high and low quantum yield. Factors affecting Quantum yield, Experimental method for the determination of quantum yield & Problems. d. Fluorescence, Phosphorescence, Chemiluminescence.

Chapter 2: Chemical Kinetics

[04 hours]

Recapitulation: Rate of a reaction (Average and instantaneous), order and Molecularity of a reaction, rate law and specific rate constant, First order and Pseudo molecular reaction (Without derivation).

Second order reaction expression, Numerical based on rate of reaction, half-life period and rate constant of First order reaction only.

Chapter 3: Periodicity

[07 hours]

The long form of periodic table. s, p, d, f block elements, Detailed discussion of the following properties of the elements, with reference to s & p-blocks. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van der Waals) (c) Ionic radii. (d) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (e) Electron gain enthalpy; trends of electron gain enthalpy. (f) Electronegativity, Pauling's/ Mullikan's electronegativity scales. (g) Oxidation states of elements

Chapter 4: Stereochemistry

[09 hours]

Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, Racemic mixture and resolution, Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature.

Chapter 5: Chemical bonding

[04 hours]

Atomic orbitals, multiple bonding (σ , π and delta bond approach) and bond lengths, the Valence Bond Theory (VBT), Concept of hybridization, hybrid orbitals and molecular geometry, Bent rule, Valence Shell Electron Pair Repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O , NH_3 , PCl_5 , SF_6 , SF_4 , ClF_3 , I_3^- , and H_3O^+ .

References

1. Essential of Physical Chemistry, Bahl and Tuli (S. Chand).
2. Principles of Physical Chemistry by Puri, Sharma, Pathania.
3. Physical Chemistry, Singh, N.B., et al. Volume 2, New Age International Ltd, 2000
4. Physical Chemistry by, R. A. Alberty, Wiley Eastern Ltd.
5. The Elements of Physical Chemistry by P. W. Atkins, Oxford
6. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
7. Stereochemistry of Organic Compounds: Principles and Applications Paperback – 7 January 2018 by D. Nasipuri
8. Stereochemistry : conformation and mechanism by Kalsi, P. S
9. Stereochemistry of Organic Compounds by VK Ahluwalia
10. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.

11. J. D. Lee. Concise Inorganic Chemistry, 5th Ed. Blackwell Science
12. CNR Rao. University general Chemistry, an introduction to chemical science, Macmillan.
13. Brian W. Pfennig. Principles of Inorganic Chemistry, 2015 John Wiley & Sons.
