

Title	<b>Preparatory Chemistry -I</b>	Number	CH1XX0
Department	Chemistry	L-T-P [C]	3-1-0 [4]
Offered for	B.Tech.	Type	Compulsory
Prerequisite	Nil		

### Objectives

The Instructor will:

1. Provide basic understanding of all areas of chemistry: inorganic, organic, and physical
2. Impart depth of knowledge involving chemical principles for apply the concepts in any scientific discipline

### Learning Outcomes

The students are expected to have the ability to:

1. understand concepts involved in major chemical processes
2. will demonstrate the ability to access and interpret information to solve problems

### Contents

*Inorganic Chemistry:* periodic table and general trends, s-block, p-block and introduction to f-block, VSEPR, valence bond theory, electron deficient bonding, thermodynamics of reduction processes.

*Organic Chemistry:* Classification and nomenclature of organic compounds, hybridization, dipole moment and bond energy, Inductive effect, electromeric effect, resonance, mesomeric effect or conjugative effect, hyperconjugative effect, steric effect, H-bonding force etc, concept of organic acid and base, substitution and elimination reactions.

*Physical Chemistry:* Kinetic Theory, Thermodynamics and Chemical Kinetics: Idea of distribution functions, properties of gamma functions; transformation properties for Cartesian to polar coordinates. Maxwell's speed and energy distributions curves; different types of speeds and their significance, frequency of collisions against a surface; frequency of binary collisions; mean free path, System and surroundings, walls; reversible and irreversible processes; isothermal, adiabatic and other processes; work, partial and total derivatives; exact differentials and state functions, definitions of thermodynamic functions: zeroth law (T), first law (U) and second law (S); other functions like H, A and G. Carnot's cycle and theorems; changes of thermodynamic functions in irreversibility and entropy, importance of H in thermo-chemistry, Maxwell's relations, Order and molecularity of reactions, first and second order reactions, average life period, concept of Arrhenius activation energy

### Textbooks

1. J.D. Lee, Concise Inorganic Chemistry, (5th Edition), ELBS, 1996.
2. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990
3. G. Solomons and C. Fryhle, Organic Chemistry, John Wiley & Sons (Asia) Pvt. Ltd.
4. D. A. McQuarrie and J. D. Simons, Physical Chemistry 1<sup>st</sup> Edn, Viva Books Private Limited, New Delhi, 1998.
5. Irving M. Klotz and Robert M. Rosenberg, Chemical Thermodynamics: Basic Concepts and Methods, Wiley, 2008.

Title	<b>Preparatory Chemistry -II</b>	Number	PCHL1XX
Department	Chemistry	L-T-P [C]	3-1-0 [4]
Offered for	B.Tech.	Type	Compulsory
Prerequisite	Nil		

### Objectives

The Instructor will:

1. Provide basic understanding of all areas of chemistry: inorganic, organic, and physical
2. Impart depth of knowledge involving chemical principles for apply the concepts in any scientific discipline

### Learning Outcomes

The students are expected to have the ability to:

1. understand concepts involved in major chemical processes
2. will demonstrate the ability to access and interpret information to solve problems

### Contents

*Inorganic Chemistry:* Chemistry of d-block elements, crystal field theory, magnetism in transition metal compounds, valence bond theory for prediction of molecular geometry, magnetic properties, metal-carbonyl chemistry, important elements of catalysis by transition metal compounds, chemistry of f-block elements.

*Organic Chemistry:* Functional group inter-conversions, concept of stereochemistry, concept of aromaticity, aromatic electrophilic and nucleophilic substitution reactions.

*Physical Chemistry:* Quantum Mechanics, Idea of eigenvalue equation of the form  $\hat{A}\Psi = a\Psi$ , construction of Hamiltonian operator; solution of  $H\Psi = E\Psi$  for particle in a 1-d box: normalisation and orthogonality of  $\Psi$ , nodes in excited states, and calculation of average values like  $\langle x \rangle$ ,  $\langle x^2 \rangle$ ,  $\langle p \rangle$  and  $\langle p^2 \rangle$ , demonstration of the uncertainty product inequality,  $\Delta x \Delta p \geq h/4\pi$ , discussion on the uncertainty principle, The H atom problem: Hamiltonian in Cartesian and polar coordinates; separation of radial and angular parts; emergence of magnetic quantum number; mathematical forms of orbital functions (ns and np) and degeneracy; shapes of orbitals (s, p). Spectroscopy and photochemistry, Einstein's law; primary photophysical processes; potential energy diagram; Franck-Condon principle; fluorescence and phosphorescence; photochemical reactions, quantum yield; photosensitisation; photochemical equilibrium; dimerisation of anthracene. Alkali-metal spectra (S, P, D, F series): its origin, multiplicity of spectral lines, idea of spin quantum number; physical idea of spin-orbit coupling, rotational (rigid rotator model) and vibrational (harmonic oscillator model) spectra of diatomics: frequency expressions, applications to estimate molecular parameters, idea of  $n \rightarrow n^*$  and  $n \rightarrow n^*$  electronic spectra; conjugated polyenes and 1-d box model.

### Textbooks

1. J.D. Lee, Concise Inorganic Chemistry, (5th Edition), ELBS, 1996.
2. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990
3. G. Solomons and C. Fryhle, Organic Chemistry, John Wiley & Sons (Asia) Pte Ltd.
4. P.W. Atkins, Molecular Quantum Mechanics Oxford University Press, 1999.