

- viii Noble gases:** Structures of Xe compounds: XeF_2 , XeF_4 , XeF_6 , XeO_3 , XeO_2F_2 , XeOF_4 , XeO_4 , XeO_3F_2 and $[\text{XeO}_6]^{4-}$.

Suggested Readings:

1. *Basic Inorganic Chemistry*, **F. A. Cotton, G. Wilkinson, and Paul L. Gaus**, 3rd Edition (1995), John Wiley & Sons, New York.
2. *Concise Inorganic Chemistry*, **J. D. Lee**, 5th Edition (1996), Chapman & Hall, London.

Section (B) – Physical Chemistry-I

(Credits 2)

1. Gaseous and Liquid States: Kinetic theory of gases and ideal gas laws, collisions in a gas: collision number, collision diameter and mean free path, behaviour of real gases: van der Waals equation and its applicability, the critical state: critical constants and their determination, law of corresponding states, Surface tension of liquids: capillary action, measurement of surface tension, viscosity of liquids and its measurement, temperature effect on surface tension and viscosity.

2. Thermodynamics: Thermodynamic quantities (w , q , ΔU and ΔH) for isothermal and adiabatic reversible expansion of ideal gases, variation of heat of reaction with temperature (Kirchhoff's equation), Joule-Thomson effect, Joule-Thomson coefficient of real (van der Waals) gases, Second Law of Thermodynamics: entropy, entropy changes for an ideal gas, entropy changes at constant pressure and volume, entropy change in spontaneous processes, physical significance of entropy, Carnot cycle, free energy and maximum work functions, conditions for spontaneous changes and equilibrium, Maxwell relations, Gibbs-Helmholtz equation, van't Hoff equation, reaction isotherm.

3. Chemical Kinetics: Zero, first and second order kinetics, determination of rate constant and order of reactions, effect of temperature on rate constant, Arrhenius equation, collision and activated complex (transition state) theories of rate of reactions.

Suggested Readings:

1. Physical Chemistry, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
2. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma and M. S. Pathania, 44th Edition (2009), Vishal Publishing Co., Jalandhar.
3. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, (1999) Houghton Mifflin Comp., New York, International Edition.

BSC-02A Ancillary Chemistry-I (BASIC ASPECTS OF CHEMISTRY)

Credits: 2

- 1. Molecules and Materials:** Electronic basis of union of atoms leading to formation of molecules. Modes of atomic union (Ionic and Covalent bonding and their subsequent partial transformation into each other), Types of binding forces. Molecular association leading to formation of materials.
- 2. Chemical reactions:** Thermodynamic basis of chemical changes. Enthalpy, Entropy and free energy change during a chemical change. Types of chemical reactions with special reference to redox reactions. The concept of oxidation number, Reducing and oxidizing agents.
- 3. Laboratory techniques in Chemistry:** Distillation, fractional distillation, Reflux, Recrystallization, melting point as purity criterion of a crystalline substance. Determination of melting point of a compound, Chromatography and its few applications.
- 4. Chemistry in service of mankind:**
 - i. Reagents and catalysts: Fehling's, Tollen's, Benedict's, and Nessler's reagents and their applications.
 - ii. Natural and man-made catalysts:
 - a. Natural catalysts: Enzymes and their types, Co-enzymes, Co-factor and Prosthetic group. Denaturation of enzymes.
 - b. Man-made catalysts: Raney nickel, vanadium peroxide

iii. Polymers: Natural and Synthesis

Natural polymers: Carbohydrates, Proteins and rubber

Synthetic polymers: Synthetic rubber, Nylon, Polyethylene, Polytetrafluoroethylene, Polyester, Rayon

iv Metals and Metallurgy: Role of metals in our life with special mention of Iron, Recovery of Iron from its ores, Stainless Steel, Rusting of Iron and its prevention.

Suggested Readings:

1. William R. Robinson, Jerome D. Odom and Henry F. Holtzclaw, Jr., 10th Edition 1998,
2. A.I.T.B.S. Publishers & Distributors (Regd.) J-5/6 Krishna Nagar, Delhi- 110051 (INDIA).
3. Darrell D. Ebbing and Mark S. Wrighton, 5th Edition 1998, A.I.T.B.S. Publishers & Distributors (Regd.) J-5/6 Krishna Nagar, Delhi-110051 (INDIA)
4. Abraham Mazur and Benzamin Harrow, W.B. Sannders Company, Philadelphia 1971, Toppan Company, Ltd. Tokyo, Japan.

CHB-202/102 Practicals

Credits: 2

Practicals-I Quantitative Analysis & (Physical and Volumetric)

1. Kinetics of First Order reaction.
2. Redox titration: (a) Iodometry (b) Fe^{2+} / $\text{K}_2\text{Cr}_2\text{O}_7$
3. Determination of water equivalent of a calorimeter (cooling curve).
4. Heat of neutralization (strong acid-strong base).
5. Heat of dissociation of weak acid.
6. Heat of solution (NH_4NO_3 , CaCl_2).
7. Basicity of an acid by thermochemical method.

Practicals-II Qualitative Analysis & (Organic and Inorganic)

1. Detection of the elements(N, S and halogens) and functional groups: PhOH , - COOH , $\text{RR}'\text{C}=\text{O}$, - CHO , Ar-NH_2 , Ar-NO_2 , - CONH_2
2. Qualitative Inorganic Mixture Analysis: Two anions (including an interfering
3. anion) and two cations.

Note: Experiments may be added/ deleted subject to availability of time and facilities.

Semester-III

CHB-301

Credits : 4

Section (A): Organic Chemistry-II

Credits: 2

1. **Aromaticity:** A general concept of aromaticity. Molecular orbital picture of benzene.
2. **Polarity of bonds:** Electronic, steric effects, hyperconjugation and their influence on acidity and basicity of organic compounds.
3. **Aromatic electrophilic substitution:** Mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts (alkylation and acylation) reactions. Effects of substituents on orientation and reactivity.
4. **Aryl halogen compounds:** Halobenzene - nucleophilic substitution, side chain chlorination of toluene, DDT and BHC.
5. **Chemistry of Carbonyl compounds:** Preparations and reactions - addition and condensation reactions, Knoevenagel, Cannizzaro, Perkin, Aldol, Benzoin, haloform, Mannich, oxidation, reduction and Beckmann rearrangement reactions. Important reactions of acids, HVZ reaction, relative reactivity of acid chlorides, acid anhydrides, amides, and esters. Comparative acidity of carboxylic and sulphonic acids. Hofmann rearrangement.