



Department of Chemistry
University of Lucknow
Lucknow
B.Sc. Syllabus

Inorganic Chemistry

Semester IV

Paper 5

Max Marks: 100 (80 + 20)

UNIT I

- I. Chemistry of Elements of First Transition Series: Characteristic properties of d-block elements. Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and complexes with respect to relative stability of their oxidation states, coordination number and geometry.
- II. Chemistry of Elements of Second and Third Transition series: General characteristics, comparative treatment of Zr/Hf, Nb/Ta, Mo/W in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

Unit - II

- III. Coordination Compounds and double salts: Werner's coordination theory and its experimental verification, Sidgwick's concept of effective atomic number, EAN concept, Polydentate ligands or chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes, Inner and outer orbital complexes, Limitations of VBT.

UNIT III

- IV. Chemistry of Lanthanide Elements: Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, ceric ammonium sulphate and its analytical uses.
- V. Chemistry of Actinides: Electronic conformation, oxidation states and magnetic properties, chemistry of separation of Np, Pu and Am from U.

Unit IV

- VI. Oxidation and Reduction: Electrode potential, electrochemical series and its applications. Principles involved in the extraction of the elements.
- VII. Acids and Bases : Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concept of acids and bases.
- VIII. Non-aqueous Solvents: Physical properties of a solvent, types of solvents and their general characteristics, Reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2 .

Text Books (Theory Courses):

- a. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science Ltd.
- b. Inorganic Chemistry, Puri, Sharma, Kalia and Kaushal.
- c. Pradeep's Inorganic Chemistry, K.K. Bhasin, Pradeep Publication.
- d. Chemistry for degree students, R. L. Madan



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Reference Books:

- a. Inorganic Chemistry, J.E.Huheey, Ellen A. Keiter, Richard L. Keiter, Addison Wesley Longman (Singapore) Pvt. Ltd.
- b. Inorganic Chemistry, D.E.Shriver, P W. Atkins and C.H.L. Langford, Oxford.
- c. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.
- d. Concepts of Models of Inorganic Chemistry, B.Douglas, D.McDaniel and J Alexander, John Wiley.
- e. Inorganic Chemistry, W.W. Porterfield, Addison - Wesley.
- f. Inorganic Chemistry, A.G. Sharpe, ELBS
- g. Inorganic Chemistry, G.L. Meissler and D.A. Tarr, Prentice-Hall.



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Paper 6

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UNIT I

I. Alcohols:

Monohydric alcohols - Methods of formation by reduction of aldehydes, Ketones, Carboxylic acids and Esters, Hydrogen bonding, Acidic nature, Reactions of alcohols.

Dihydric alcohols - Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$\text{Pb}(\text{OAc})_4$ and HIO_4] and pinacole-pinacolone rearrangement.

Trihydric alcohols - Nomenclature and methods of formation, chemical reactions of glycerol.

II. Ethers and Epoxides: Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions - cleavage and autoxidation, Ziesel's method. Synthesis of epoxides, Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening by Grignard and organolithium reagents.

UNIT II

III. Phenols:- Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols - electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

IV. Aldehydes and Ketones: synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitrites and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Use of acetals as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, LiAlH_4 and NaBH_4 reductions. Halogenation of enolizable ketones. An introduction to , -unsaturated aldehydes and ketones.

UNIT III

V. Carboxylic Acids: physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction, Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids, Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids,



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VI. Hydroxy acids: Preparation and reactions. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: Methods of formation and effect of heat and dehydrating agents.

VII. Carboxylic Acid Derivatives: Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

UNIT IV

VIII. Organic Compounds of Nitrogen: Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media.

IX. Amines: Preparation, physical properties, stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel -phthalimide reaction, Hoffmann bromamide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

Books Suggested (Theory Courses)

- a. Organic Chemistry, Morrison and Boyd, Prentice Hall.
- b. Organic Chemistry, L.G. Wade Jr. Prentice Hall
- c. Fundamentals of Organic Chemistry Solomons, John Wiley.
- d. Organic Chemistry, Vol. I, II, III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
- e. Organic Chemistry, F.A. Carey, McGraw-Hill Inc.
- f. Introduction to Organic Chemistry, Streitwieser, Hathcock and Kosover, Macmillan.
- g. Organic Chemistry, Vol. I, II, I.L. Finar
- h. Spectrometric Identification of organic compounds. Robert M. Silverstein, Clayton G. Bassler, Terence C. Morrill, John Wiley.