

SEMESTER – III

PAPER-7

Marks: 150

THEORY

SECTION A-ORGANIC: CARBONYL COMPOUNDS AND CARBOXYLIC ACIDS

Unit I: Carbonyl Compounds

Aldehydes and Ketones: Preparations, physical properties and reactions.

Nucleophilic addition: Mechanism and relative reactivity of aldehydes and ketones. Test for aldehydes & ketones.

Nucleophilic addition- elimination: reaction with ammonia derivatives.

Mechanisms of Aldol, Claisen Schmidt, Benzoin and Perkin condensations, Cannizzaro, Wittig, Knoevenegel and Reformatsky reactions, Beckmann and Benzil-Benzilic acid rearrangements.

Oxidation (including Baeyer Villiger oxidation) and Reduction.

α,β -Unsaturated Carbonyl Compounds: Electrophilic and nucleophilic addition reactions including Michael addition.

Unit II: Carboxylic Acids and their Derivatives

Monocarboxylic acids: Preparation, physical properties and reactions. Conversion into functional derivatives, Hell-Volhard-Zelinsky reaction.

Acidity of carboxylic acids, effect of substitution on acid strength of aliphatic and aromatic acids, ortho effect.

Acid chlorides, Anhydrides, Esters and Amides: Preparation and reactions, ester hydrolysis, transesterification, Claisen, Dieckmann, and Darzens Glycedic ester condensations.

Relative reactivities of acid derivatives towards nucleophiles.

Dicarboxylic acids, Unsaturated acids (maleic and fumaric acid) **and Hydroxy acids:** Typical reactions and uses.

Recommended Texts:

1. Morrison, Robert Thornton & Boyd, Robert Neilson *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Sixth Edition, 2003.
2. Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Sixth Edition, 2003.
3. Graham Solomons, T.W., Craig B. Fryhle *Organic Chemistry*, Ninth edition John Wiley & Sons, Inc. 2008.

SECTION B- PHYSICAL: CHEMICAL KINETICS & CATALYSIS

Unit I: Chemical Kinetics

Order and molecularity of a reaction. Differential and integrated form of rate expressions up to second order reactions. Experimental methods of the determination of order of a reaction, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions.

Temperature dependence of reaction rates; Arrhenius equation; activation energy, Lindemann mechanism. Collision theory of reaction rates, qualitative treatment of the theory of absolute reaction rates.

Unit II: Catalysis

Types of catalysts, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Recommended Texts:

1. Atkins, P. W. & Paula, J. de Atkins *Physical Chemistry 9th Ed.*, Oxford University Press 2011.
2. Ball, D. W. *Physical Chemistry, 3rd Ed.*, Cengage India.2012.
3. Castellan, G. W. *Physical Chemistry 4th Ed.*, Narosa 2004.
4. Laidler, K. J. *Chemical Kinetics*, Pearson Education: New Delhi 2004.
5. Rogers, D. W. *Concise Physical Chemistry* Wiley 2010.
6. Thomas, E. & Philip, R. *Thermodynamics: Statistical Thermodynamics and Kinetics, 1st Ed.*, Pearson Education 2007.
7. Zumdahl, S.S. *Chemistry concepts and applications* Cengage India 2011.

PRACTICAL

SECTION A-ORGANIC: FUNCTION GROUPS DETECTION AND ORGANIC PREPARATION

1. Functional group test for carbonyl group and carboxylic acid group.
2. Organic preparations:
 - i. Hydrolysis of amides and esters.
 - ii. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
 - iii. *S*-Benzylisothiuronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).
 - iv. Aldol condensation using either conventional or green method.
 - v. Benzil-Benzilic acid rearrangement.

The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may used for recrystallization, melting point and TLC.

Recommended Texts:

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)
3. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, University Press (2000).
4. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis*, University Press (2000).

SECTION B- PHYSICAL: KINETICS OF SELECTED REACTIONS**Study the kinetics of the following reactions.**

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
 - a. Acid hydrolysis of methyl acetate with hydrochloric acid.
 - b. Saponification of ethyl acetate.
 - c. Iodide-persulphate reaction.
3. Compare the strengths of HCl and H₂SO₄ by kinetics of hydrolysis of methyl acetate.

Recommended Texts:

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi 2011.
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York 2003.
3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York 2003.
4. Sindhu, P.S. *Practicals in Physical Chemistry 1st Ed.* Macmillan: India 2006.