

Academic Year 2018-19



Dr. Chandrashekar Malba

Dr. Chandrashekar Malba received his B.Sc. and M.Sc. degrees from Udaygiri Mahavidyalaya Dlggr. Later, he joined Natural and Biodegradable Polymers Group at CSIR-NCI, Pune and worked on a CSIR sponsored project dealt with bioethanol production. In 2010, he received "Italian Ministry of Education, University and Research (MIUR) fellowship" award to pursue Ph.D at Ca' Foscari University of Venice, Italy (a university ranked among top 500 in the World University Ranking (2016) by the Times Higher Education [THE]). His doctoral research focussed on luminescent (nano)materials. After obtaining his Ph.D. degree in 2013, he started his research career as a Research Associate at CSIR-National Chemical Laboratory, Pune. He has several international, peer reviewed, high impact research publications to his credit.

Presently, he is working as an Assistant Professor of chemistry in Kai. Rasika Mahavidyalaya Deoni, Dist. Latur.



Mr. Bhaskar Ankush

Mr. Bhaskar Ankush is working as an Assistant Professor in Chemistry at Kai. Rasika Mahavidyalaya, Deoni, Dist. Latur. He has completed M.Sc. in Organic Chemistry from Department of Chemistry, Dayanand Science College, Latur and qualified CSIR-NET examination twice in 2012. He has worked as an Assistant Professor in Chemistry (Core Teacher) for Post-Graduate at Department of Chemistry, Dayanand Science College, Latur during 2011-2013.

He is pursuing Ph.D. under the guidance of Dr. N.Y. Shitole, Department of Chemistry, Shivaji Mahavidyalaya, Parbhani.



Dr. Vijaykumar More

Dr. Vijaykumar S. More is working as an Assistant Professor of Chemistry and Head of the Department in Kai. Rasika Mahavidyalaya Deoni. He did his M.Sc. in Organic Chemistry from Yashwantrao Mahavidyalaya Nanded. After completion of M. Sc. he did research for four years at National Chemical Laboratory, Pune.

He received Ph.D. degree in Organic & Medicinal Chemistry in 2017 from University of Salerno, Italy (a university ranked among top 500 in the World University Ranking (2017) by the Times Higher Education [THE]). He awarded one year research Associate Scientist Fellowship from ITQB, New University of Lisbon, Portugal.

He has been also awarded two years Post-doctoral research Associate Scientist Fellowship from Japanese ministry of education, University and research fellowship and completed his post-doctoral research from Kyoto Pharmaceutical University, Japan and Kwansai Gakuin University, Japan.

His area of interest in research is Organic & Medicinal Chemistry. He has published 15 papers in international reputed journals with high impact factor. He also published 5 papers in National journals. He has authored 4 books based on B.Sc. syllabus. He has presented papers & posters at several national, international conferences & seminars.



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A Text Book of Organic Chemistry

Dr. Chandrashekar Malba • Mr. Bhaskar Ankush • Dr. Vijaykumar More

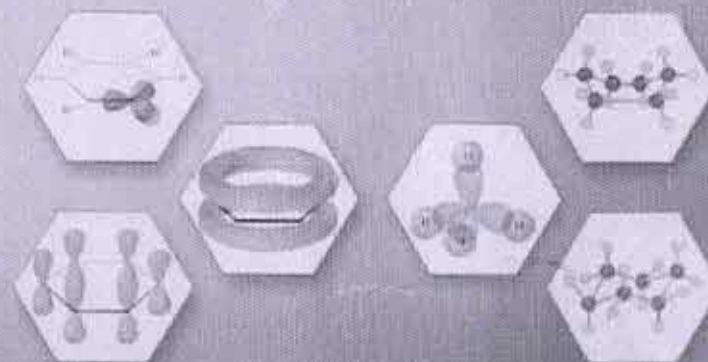
A Text Book of Organic Chemistry

B.Sc. First Year
(Semester I and II)

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According to the revised syllabus of the Swami Ramanand Teerth Marathwada University,
Nanded (in force from June 2019)

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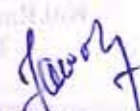
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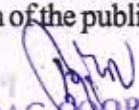
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CONTENTS

1. Nomenclature of Organic Compounds

Functional groups and types of organic compounds, Basic rules of IUPAC Nomenclature, Nomenclature of mono and bi- functional compounds on the basis of priority order of following classes of organic compounds: alkanes, alkenes, alkynes, alcohols, ethers, aldehydes, ketones, carboxylic acid, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), amines; Nomenclature of aromatic compounds: Mono, di and polysubstituted benzene (with not more than two functional groups)

2. Basic Concepts in Organic Chemistry

Basic terms: Substrate and Reagents, types of reagents (Electrophilic and Nucleophilic). Notation of arrows: curved arrow, half headed arrow, double headed arrow, straight arrow. Bond fission: Homolytic and heterolytic fission. Reaction intermediates: Carbocation, Carbanion, Free radical, (Introduction, structure & Stability), carbene, nitrene & benzyne (only introduction). Electron mobility: Inductive effect (effect on acidic strength of alpha substituted acetic acid and α -chloroacetic acid), Mesomeric effect (Aniline and Nitrobenzene), Hyperconjugation (toluene).

3. Alkanes Alkenes and alkynes

3.1 Alkanes: Introduction, Preparation of alkanes from a) Hydrolysis of Grignard reagent b) Kolbe's synthesis. Chemical reaction: a) Pyrolysis (mechanism), b) aromatization.

3.2 Alkenes: Introduction, Preparation methods a) But-1-ene from but-1-yne b) But-2-ene from butan-2-ol. Chemical reactions with mechanism: a) Electrophilic addition of Br_2 to ethene b) Electrophilic addition of HBr to propene c) Free radical addition of HBr to propene (Peroxide effect).

3.3 Alkynes: Introduction, Preparation of ethyne from a) Iodoform, b) Hydrolysis of calcium carbide. Chemical reactions: Electrophilic addition of HBr and Br_2 to ethyne (with mechanism)

4. Cycloalkanes, Cycloalkenes and Dienes

4.1 Cycloalkanes: Introduction, Preparation of cycloalkanes from a) Adipic acid b) Aromatic hydrocarbon. Baeyer strain theory and Saches Mohr theory. Ring opening reaction with H_2 and HI .



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4.2 Cycloalkenes: Introduction, preparation methods: a) Dehydration of cyclohexanol, b) Dehydrohalogenation of halocyclohexane. Chemical reactions: a) Epoxidation of cyclohexene, b) Allylic halogenations.

4.3 Dienes: Introduction, classification & Resonance structures. Preparation methods of 1,3-butadiene from- a) 1,4-dibromobutane, b) 1,4-butanediol. Chemical reactions: a) addition of Br_2 and HBr to 1,3-butadiene, b) addition of ethene to 1,3-butadiene (Diels-Alder reaction).

5. Aromatic Hydrocarbons and Aromaticity

Introduction, Nomenclature, Kekulé and resonance structure of benzene, stability, Orbital picture of benzene. Aromaticity and antiaromaticity by Huckel's Rule (Benzene, Naphthalene, Anthracene, Pyrrole, Furan, Thiophene, Pyridine, Cyclopentadienyl cation and anion, Cyclopropenyl cation). Electrophilic Substitution reaction of benzene (with mechanism): Nitration, Halogenation, Friedel-Craft alkylation and acylation. Orientation effect: Effect of activating and deactivating groups ($-\text{OH}$, NO_2 , CH_3 , Cl) on aromatic electrophilic (Nitration) substitution reaction (with mechanism)

6. Phenols

Introduction, classification and acidic character of phenol (compare with ethanol). Chemical reactions with mechanism: Reimer-Tiemann reaction, Acetylation, Fries rearrangement, Kolbe's carboxylation reaction.

7. Haloalkenes and Haloarenes


7.1 Haloalkenes

a) **Vinyl Chloride:** synthesis of vinyl chloride from 1) 1, 2-dichloroethane 2) ethene. Chemical reactions: Addition reaction with HBr , polymerization reaction.

b) **Allyl Iodide:** synthesis of allyl iodide from 1) allyl chloride 2) glycerol and HI . Chemical reactions: reaction with NaOH , KCN , & Br_2

7.2 Haloarenes:

Introduction. Synthesis of halobenzene from 1) Hunsdiecker reaction 2) Gattermann reaction. Chemical reactions (with mechanism): Ullmann biaryl


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synthesis. Resonance & Relative reactivity of alkyl halides v/s vinyl and aryl halides towards nucleophilic substitution reactions.

8. Carboxylic acid derivatives

8.1 Acid Chlorides

Introduction, preparation methods: 1) From acetic acid and thionyl chloride, 2) From acetic acid and phosphorous pentachloride. Chemical reactions: (Hydrolysis, Action with alcohol, Action with amines).

8.2 Acid anhydrides

Introduction, preparation methods: 1) From acetyl chloride and carboxylic acid, 2) From acetyl chloride and sodium acetate. Chemical reactions: (Hydrolysis, Action with alcohol, Action with amines).

8.3 Esters

Introduction, preparation methods: 1) From ethyl alcohol and acetic acid, 2) From ethyl alcohol and acetyl chloride. Chemical reactions: (Hydrolysis, Action of amines, Reduction).

8.4 Amides

Introduction, preparation methods: 1) From ammonia and acetyl chloride 2) From ammonia and acetic anhydride. Chemical reaction: (Hydrolysis, Action of nitrous acid).

9. Alcohols and epoxides

9.1 Alcohols

Introduction and Classification

- Dihydric alcohol (ethylene glycol):** Preparation methods: (Hydroxylation of alkene and From 1,2-dihaloalkane). Chemical reactions: [Reaction of ethylene glycol with, 1) $\text{Pb}(\text{OAc})_4$, 2) $\text{P}_2\text{O}_5/\text{ZnCl}_2$].
- Trihydric alcohol (Glycerol):** Preparation methods from: 1) Oils and fats 2) Propene. Chemical reactions: [Reactions of glycerol with, 1) Nitric acid, 2) Acetyl chloride].

9.2 Epoxides


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Introduction and nomenclature. Preparation methods: a) Oxidation of ethene in presence of Ag catalyst , b) Oxidation of ethene with per acetic acid. Chemical reactions: (Ring opening reactions of propylene oxide a) in acidic b) and basic medium/reagent.


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