MINISTRY OF EDUCATION AND TRAINING CAN THO UNIVERSITY

SUBJECT OUTLINE DETAILS

1. Subject: Organic Chemistry I

- Code: CH251C
- Credits: 3
- Hours: 45 hours

2. Management Unit:

- Department: Chemistry

- Faculty: The Colledge of Natural Sciences

3. Prerequisites: CH151C Priciples of Chemistry I and CH152C Priciples of Chemistry II

4. Subject objectives:

4.1. Knowledge:

The chemistry of hydrocarbons: Alkanes, Cycloalkanes, Alkenes, Alkadienes, Alkynes and Arenes introduces the concept of structure, bonding, and reactivity of hydrocarbons, isomerism and stereochemistry, reaction mechanism and also their physical, chemical properties, nomenclature and preparations.

Use the modern spectroscopy methods: MS, NMR, UV-Vis, IR, ...to determine the structures of organic compounds in different fields such as: chemistry, biology, food, drugs, environment,...

Understanding about effects of organic chemistry to social and environment.

4.2. Skill:

4.2.1. Hard skills

Understanding of important role of organic chemistry to country's development.

Use the modern spectroscopy methods: MS, NMR, UV-Vis, IR, ...to analysis chemicals.

Suggest and build the research models in chemistry to support and solve the problems related to chemistry.

4.2.2. Soft skills

- Help students find their way to the chemical and biology library easily and their ability to refer or, and generally does indepth reasearch into the topic they are interested in.

Enable working independently or in team and self-study in their lives.

4.3. Attitude:

Construction students have a healthy and civilized lifestyle. To respect the law. Loyalty to the country always.

To have an inquiring mind, the will to work for progress,

Good team work, good attitude, cordial spirit, cooperation with colleagues in the work.

Strictly observe discipline and more dissemination on environmental issues, mobilization of citizen's contribution for and improvement of citizens' participation in environmental protection, increase the citizen's environmental awareness.

5. Brief description of subject content:

The chemistry of hydrocarbons: Alkanes, Cycloalkanes, Alkenes, Alkadienes, Alkynes and Arenes introduces the concept of structure, bonding, and reactivity of hydrocarbons,

isomerism and stereochemistry, reaction mechanism and also their physical, chemical properties, nomenclature and preparations.

Use the modern spectroscopy methods: MS, NMR, UV-Vis, IR, ...to determine the structures of organic compounds.

Understanding about effects of organic chemistry to social and environment.

6. Subject content structure:

6.1. Theory

| | Content | Hours | Objectives |
|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|
| Chapter 1. 1.1. 1.2. 1.3. 1.4. 1.5. 1.6. 1.7. | Alkanes and Their Stereochemistry Functional Groups Alkanes and Alkane Isomers Alkyl Groups Naming Alkanes Properties of Alkanes Conformations of Ethane Conformations of Other Alkanes | 3 | 4.1.1; |
| Chapter 2. | Cycloalkanes and Their Stereochemistry | 3 | 4.1.1; |
| 2.1. 2.2. 2.3. 2.4. 2.5. 2.6. 2.7. 2.8. 2.9. | Cis–Trans Isomerism in Cycloalkanes Stability of Cycloalkanes: Ring Strain Conformations of Cycloalkanes Conformations of Cyclohexane Axial and Equatorial Bonds in Cyclohexane Conformations of Monosubstituted Cyclohexanes Conformations of Disubstituted Cyclohexanes Conformations of Polycyclic Molecules | | |
| Chapter 3. 3.1. 3.2. 3.3. 3.4. 3.5. 3.6. 3.7. 3.8. 3.9. 3.10. 3.11. 3.12. | Stereochemistry at Tetrahedral Centers Enantiomers and the Tetrahedral Carbon The Reason for Handedness in Molecules: Chirality Optical Activity Pasteur's Discovery of Enantiomers Sequence Rules for Specifying Configuration Diastereomers Meso Compounds Racemic Mixtures and the Resolution of Enantiomers A Review of Isomerism Chirality at Nitrogen, Phosphorus, and Sulfur Prochirality Chirality in Nature and Chiral Environments | 3 | 4.1.1; |
| Chapter 4. 4.1. 4.2. 4.3. 4.4. 4.5. | An Overview of Organic Reactions Kinds of Organic Reactions How Organic Reactions Occur: Mechanisms Radical Reactions Polar Reactions An Example of a Polar Reaction: Addition of HBr to Ethylene | 3 | 4.1.1; |

| 4.6. | Using Curved Arrows in Polar Reaction | | |
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| 4.7. | Describing a Reaction: Equilibria, Rates, and Energy Changes | | |
| 4.8. | Describing a Reaction: Bond Dissociation Energies | | |
| 4.9. | Describing a Reaction: Energy Diagrams and Transition States | | |
| 4.10. | Describing a Reaction: Intermediates | | |
| 4.11. | A Comparison Between Biological Reactions and Laboratory Reactions | | |
| Chapter 5. | Alkenes: Structure and Reactivity | 3 | 4.1.1; |
| 5.1. | Industrial Preparation and Use of Alkenes | | |
| 5.2. | Calculating Degree of Unsaturation | | |
| 5.3. | Naming Alkenes | | |
| 5.4. | Cis–Trans Isomerism in Alkenes | | |
| 5.5. | Alkene Stereochemistry and the E,Z Designation | | |
| 5.6. | Stability of Alkenes | | |
| 5.7. | Electrophilic Addition Reactions of Alkenes | | |
| 5.8. | Orientation of Electrophilic Additions: | | |
| | Markovnikov's Rule | | |
| 5.9. | Carbocation Structure and Stability | | |
| 5.10. | The Hammond Postulate | | |
| 5.11. | Evidence for the Mechanism of Electrophilic | | |
| | Additions: Carbocation | | |
| | Rearrangements | | |
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| Chapter 6. | Alkenes: Reactions and Synthesis | 3 | 4.1.1; |
| Chapter 6. 6.1. | Preparing Alkenes: A Preview of Elimination | 3 | 4.1.1; |
| Chapter 6. 6.1. | Preparing Alkenes: A Preview of Elimination Reactions | 3 | 4.1.1; |
| Chapter 6. 6.1. 6.2. | Alkenes: Reactions and Synthesis Preparing Alkenes: A Preview of Elimination Reactions Halogenation of Alkenes: Addition of X ₂ | 3 | 4.1.1; |
| Chapter 6. 6.1. 6.2. 6.3. | Alkenes: Reactions and Synthesis Preparing Alkenes: A Preview of Elimination Reactions Halogenation of Alkenes: Addition of X ₂ Halohydrins from Alkenes: Addition of HOX | 3 | 4.1.1; |
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7.2. Preparation of Alkynes: Elimination Reactions of

| 7.3. 7.4. 7.5. 7.6. 7.7. 7.8. 7.9. | Dihalides Reactions of Alkynes: Addition of HX and X ₂ Hydration of Alkynes Reduction of Alkynes Oxidative Cleavage of Alkynes Alkyne Acidity: Formation of Acetylide Anions Alkylation of Acetylide Anions An Introduction to Organic Synthesis | | |
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| Chapter 8. | Organohalides | 3 | 4.1.1; |
| 8.1. | Names and Properties of Alkyl Halides | | |
| 8.2. | Preparing Alkyl Halides from Alkanes: Radical | | |
| 8.3. | Preparing Alkyl Halides from Alkenes: Allylic Bromination | | |
| 8.4. | Stability of the Allyl Radical: Resonance | | |
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| 8.5. | Preparing Alkyl Halides from Alcohols | | |
| 8.0. 8.7 | Organometallic Coupling Reactions | | |
| 8.8. | Oxidation and Reduction in Organic Chemistry | | |
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| Chapter 9. | Substitutions and Eliminations | 0 | 4.1.1, |
| 9.1. | The Discovery of Nucleophilic Substitution Reactions | | |
| 9.2. | The S _N 2 Reaction | | |
| 9.3. | Characteristics of the S _N 2 Reaction | | |
| 9.4. | The $S_N 1$ Reaction | | |
| 9.5. | Characteristics of the $S_N 1$ Reaction | | |
| 9.6. | Biological Substitution Reactions | | |
| 9.7. | Elimination Reactions: Zaitsev's Rule The E2 Protocol and the Douterium Isotope Effect | | |
| 9.8. Q Q | The E2 Reaction and Cyclohevane Conformation | | |
| 9.10 | The E1 and E1cB Reactions | | |
| 9.11. | Biological Elimination Reactions | | |
| 9.12. | A Summary of Reactivity: S_N1 , S_N2 , $E1$, $E1cB$, and $E2$ | | |
| Chapter 10. | Structure Determination: Mass Spectrometry | 3 | 4.1.2. |
| 10.1. | and Infrared Spectroscopy Mass Spectrometry of Small Molecules: Magnetic-Sector Instruments | | |
| 10.2 | Interpreting Mass Spectra | | |
| 10.2. | Mass Spectrometry of Some Common Functional | | |
| 10.5. | Groups | | |
| 10.4. | Mass Spectrometry in Biological Chemistry: Time- | | |
| | of-Flight (TOF) Instruments | | |
| 10.5. | Spectroscopy and the Electromagnetic Spectrum | | |
| 10.6. | Infrared Spectroscopy | | |
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| Chapter 11. | Structure Determination: Nuclear Magnetic | 3 | 4.1.2. |
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| | Resonance Spectroscopy | | |
| 11.1. | Nuclear Magnetic Resonance Spectroscopy | | |
| 11.2. | The Nature of NMR Absorptions | | |
| 11.3. | Chemical Shifts | | |
| 11.4. | 13C NMR Spectroscopy Signal Averaging and | | |
| | FT–NMR | | |
| 11.5. | Characteristics of ¹³ C NMR Spectroscopy | | |
| 11.6. | DEPT ¹³ C NMR Spectroscopy | | |
| 11.7. | Uses of ¹³ C NMR Spectroscopy | | |
| 11.8. | ¹ H NMR Spectroscopy and Proton Equivalence | | |
| 11.9. | Chemical Shifts in ¹ H NMR Spectroscopy | | |
| 11.10. | Integration of ¹ H NMR Absorptions: Proton | | |
| | Counting | | |
| 11.11. | Spin–Spin Splitting in ¹ H NMR Spectra | | |
| 11.12. | More Complex Spin–Spin Splitting Patterns | | |
| 11.13. | Uses of ¹ H NMR | | |
| Chapter 12 | Conjugated Compounds and Ultraviolet | 3 | 411 412 |
| Chapter 12. | Spectroscopy | 3 | 4.1.1., 4.1.2. |
| 12.1. | Stability of Conjugated Dienes: Molecular | | |
| | Orbital Theory | | |
| 12.2. | Electrophilic Additions to Conjugated Dienes: | | |
| | Allylic Carbocations | | |
| 12.3. | Kinetic versus Thermodynamic Control of | | |
| | Reactions | | |
| 12.4. | The Diels–Alder Cycloaddition Reaction | | |
| 12.5. | Characteristics of the Diels-Alder Reaction | | |
| 12.6. | Diene Polymers: Natural and Synthetic Rubbers | | |
| 12.7. | Structure Determination in Conjugated Systems: | | |
| | Ultraviolet Spectroscopy | | |
| 12.8. | Interpreting Ultraviolet Spectra: The Effect of | | |
| | Conjugation | | |
| 12.9. | Conjugation, Color, and the Chemistry | | |
| | of Vision | | |
| Chapter 13. | Benzene and Aromaticity | 3 | 4.1.1., 4.1.2. |
| 13.1. | Sources and Names of Aromatic Compounds | _ | · · · · · · · · · · · · · · · · · · · |
| 13.2. | Structure and Stability of Benzene | | |
| 13.3. | Aromaticity and the | | |
| | Hückel $4n + 2$ Rule | | |
| 13.4. | Aromatic Ions | | |
| 13.5. | Aromatic Heterocycles: Pyridine and Pyrrole | | |
| 13.6. | Polycyclic Aromatic | | |
| | Compounds | | |
| 13.7. | Spectroscopy of Aromatic Compounds | | |
| Chapton 14 | Chemistry of Benzene: Electrophilic Aromatic | | |
| Unapter 14. | Substitution | 3 | 4.1.1., |
| 14.1. | Electrophilic Aromatic Substitution Reactions: | | |
| | Bromination | | |
| 14.2. | Other Aromatic Substitutions | | |
| 14 3 | Alkylation and Acylation of Aromatic Rings: The | | |
| 17.3. | Friedel–Crafts Reaction | | |
| | | | |

- 14.4. Substituent Effects in Substituted Aromatic Rings
- 14.5. An Explanation of Substituent Effects
- 14.6. Trisubstituted Benzenes: Additivity of Effects
- 14.7. Nucleophilic Aromatic Substitution
- 14.8. Benzyne
- 14.9. Oxidation of Aromatic Compounds
- 14.10. Reduction of Aromatic Compounds
- 14.11. Synthesis of Polysubstituted Benzenes

7. Teaching method:

- Traditional teaching styles combined with learning, solving excercises and teaching activities

- Learner roles involve in researching on the real problems, discussing in group, generating new ideas, promote their ability and their soft-skill as communication skill, presentation skill, computer skill, etc.

- Teacher roles active teaching methods make students attracted into learning activities actively based on the organization and instruction of lecturers.

- The role of instructional materials: use multimedia, computer-assisted teaching are an approach to teaching and learning in which computer technology is used as an aid to the presentation, reinforcement, lecturer design,...

8. Duties of student:

Students have to do the following duties:

- present at least 80% theoretical hours
- finish the group and personal given exercises with accessing.
- take midterm exam
- take final exam
- organize and implemen self-study activities.

9. Assessment of student learning outcomes:

9.1. Assessment

Evaluating student's study following cumulative results of credits.

| No. | Point components | Rules and Requirement | Weights | Objectives |
|-----|--------------------|------------------------------------|---------|---------------|
| 1 | Present | Present/absent hours | 10% | 4.3 |
| 2 | Mark on solved | Solved/given exercises | 10% | 4.2.1; 4.2.4; |
| | exercises | | | 4.3 |
| 3 | Mark on solved | - Report/represent/ | 5% | 4.2.2; 4.2.5; |
| | exercises of group | - Contributed | | 4.2.6; 4.3. |
| 4 | Mark on midterm | - Writing/multiple choice/ (30 | 15% | 4.1.1 to |
| | exam | min) | | 4.1.4; 4.2.1 |
| 5 | Mark on final exam | - Writing/multiple choice/ (60 | 50% | 4.1; 4.3; |
| | | min) | | |
| | | - Present at least 80% theoretical | | |
| | | hours | | |
| | | - Compulsary to take exam | | |

9.2. Grading

- Grading components and final test scores will be marked on a scale of 10 (0 to 10), rounded to one decimal place.
- Subject score is the sum of all the components of the evaluation multiplied by the corresponding weight. The subject score is marked on a scale of 10 and rounded to one

decimal place, then is converted to A-B-C-D score and score on a scale of 4 under the academic provisions of the University.

10. Materials:

Materials information

Code number

[1] Organic chemistry / John McMurry.- 6th ed..- Belmont, CA.: Brooks/Cole-Thomson Learning, 2004.- xxix, [1758 p.] ; ill. (some

col.), 26 cm, 0534389996.- 547/ M168

Chi tiết

MFN: 116779

[2] Organic chemistry / Susan McMurry.- Australia: Thomson, 2004.- 868 p., 27 cm (Study guide and student solutions manual for

John McMurry's), 0534409342.- 547/ M979

Chi tiết

MFN: 100852

[3] Schaum's outline of theory and problems of **organic chemistry** / Herbert Meislich, Haward Nechamkin, Jacob Sharefkin.- 3rd ed..-New York: McGraw-Hill, 1999.- 469 p., 27 cm (Schaum's outline series), 007134165X.- 547/ M499 **Chi tiết**

MFN: 65533

11. Self-study Guide:

| Wee k | Content | Theo ry (hou rs) | Pract ice (hou rs) | Students' duties |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Chapter 1: Alkanes and Their Stereochemistry Chapter 1. 1.1. Functional Groups 1.2. Alkanes and Alkane Isomers 1.3. Alkyl Groups 1.4. Naming Alkanes 1.5. Properties of Alkanes 1.6. Conformations of Ethane 1.7. Conformations of Other Alkanes | 3 | 0 | Student will study the theory carefully at home before going to the class with the Sections: - in the reference book 1 from 3.1 to 3.7, Chapter 3, - in the reference book 3 from page 50 to page 68. Every chapter describes individual functional groups. As you study each functional group, make sure that you understand the structure and reactivity of that group. |
| 2 | | 3 | 0 | Review the previous studied chapter of the reference book 1 Student will study the theory carefully at home before going to the class with the Sections: in the reference book 1 from 4.1 to 4.9, Chapter 4 in the reference book 3 from page 162 to page 188. Group (4-5 students) working: students |

| | | | | have to solve the new excercises, 4-5 problems in Chapter 4 of the reference |
|---|------------------------------------------------------------------|---|---|------------------------------------------------------------------------------|
| | | | | book 1 |
| 3 | Chapter 3. | 3 | 0 | - Review the previous studied chapter of |
| | Stereochemistry at | | | the reference book 1 |
| | Tetrahedral Centers | | | - Student will study the theory carefully |
| | 3.1. Enantiomers and the | | | at home before going to the class with |
| | Tetrahedral Carbon | | | the Sections: |
| | 3.2. The Reason for | | | - in the reference book 1 from 5.1 to |
| | Handedness in Molecules: | | | 5.12, Chapter 5 |
| | Chirality | | | - in the reference book 3 from page 69 to |
| | 3.3. Optical Activity | | | page 86. |
| | 3.4. Pasteur's Discovery of | | | - Group (4-5 students) working: students |
| | Enantiomers | | | have to solve the new excercises, 4-5 |
| | 3.5. Sequence Rules for | | | problems of 5.1-5.25 in Chapter 5 of the |
| | Specifying Configuration | | | reference book 1 |
| | 3.6. Diastereomers | | | - This crucial topic, so important for |
| | 3.7. Meso Compounds | | | understanding biological chemistry |
| | 3.8. Racemic Mixtures and | | | |
| | the Resolution of | | | |
| | Enantiomers | | | |
| | 3.9. A Review of | | | |
| | Isomerism | | | |
| | 3.10. Chirality at Nitrogen, | | | |
| | Phosphorus, and Sulfur | | | |
| | 3.11. Prochirality | | | |
| | 3.12. Chirality in Nature | | | |
| | and Chiral Environments | - | | |
| 4 | Chapter 4. An Overview | 3 | | - Review the 5.1 - 5.5-7. sections of the |
| | of Organic Reactions | | | previous studied chapter of the reference |
| | 4.1. Kinds of Organic | | | book l |
| | Reactions | | | - Student will study the theory carefully |
| | 4.2. How Organic | | | at home before going to the class with |
| | Reactions Occur: | | | the Sections: |
| | Mechanisms | | | - in the reference book 1 from 6.1 to |
| | 4.3. Radical Reactions | | | 6.11, Chapter 6 |
| | 4.4. Polar Keacuons | | | - In the reference book 3 from page 31 to |
| | 4.3. All Example of a Polar Departion: Addition of ID- | | | Page 47. Group (1.5 students) working students |
| | to Ethylene | | | - Group (4-5 students) working: students |
| | 4.6 Using Curved Arrows | | | noblems of 6.1.6.12 in Chapter 6 of the |
| | in Polar Reaction | | | reference book 1 |
| | Mechanisms | | | |
| | 4.7 Describing a Reaction | | | |
| | Fauilibria Rates and | | | |
| | Equilibria, Kates, and Energy Changes | | | |
| | 1.8 Describing a Deaction | | | |
| | Bond Dissociation | | | |
| | Energies | | | |
| | 19 Describing a Deaction | | | |
| | Fnergy Diagrams and | | | |
| | Transition States | | | |
| | Transition States | | | |

| | 4.10. Describing a | | | |
|---|---------------------------------|---|---|-------------------------------------------|
| | Reaction: Intermediates | | | |
| | 4.11. A Comparison | | | |
| | Between Biological | | | |
| | Reactions and | | | |
| | Laboratory Deastions | | | |
| _ | Laboratory Reactions | 2 | 0 | |
| 5 | Chapter 5. | 3 | 0 | - Review the 6.1 - 6.6 sections of the |
| | Alkenes: Structure and | | | previous studied chapter of the reference |
| | Reactivity | | | book I |
| | 5.1. Industrial Preparation | | | - Student will study the theory carefully |
| | and Use of Alkenes | | | at home before going to the class with |
| | 5.2. Calculating Degree of | | | the Sections: |
| | Unsaturation | | | - in the reference book 1 from 7.1 to |
| | 5.3. Naming Alkenes | | | 7.11, Chapter 7 |
| | 5.4. Cis–Trans Isomerism | | | - in the reference book 3 from page 87 to |
| | in Alkenes | | | page 117. |
| | 5.5. Alkene | | | - Group (4-5 students) working: students |
| | Stereochemistry and the | | | have to solve the new excercises, 4-5 |
| | E,Z Designation | | | problems of 7.1-7.21 in Chapter 7 of the |
| | 5.6. Stability of Alkenes | | | reference book 1 |
| | 5.7. Electrophilic Addition | | | |
| | Reactions of Alkenes | | | |
| | 5.8. Orientation of | | | |
| | Electrophilic Additions: | | | |
| | Markovnikov's Rule | | | |
| | 5.9. Carbocation Structure | | | |
| | and Stability | | | |
| | 5.10. The Hammond | | | |
| | Postulate | | | |
| | 5.11. Evidence for the | | | |
| | Mechanism of | | | |
| | Electrophilic Additions: | | | |
| | Carbocation | | | |
| | Rearrangements | | | |
| | | | | |
| 6 | Chapter 6. Alkenes: | 3 | 0 | - Review the 7.3-7.9 sections of the |
| | Reactions and Synthesis | | | previous studied chapter of the reference |
| | 6.1. Preparing Alkenes: A | | | book 1 |
| | Preview of Elimination | | | - Student will study the theory carefully |
| | Reactions | | | at home before going to the class with |
| | 6.2. Halogenation of | | | the Sections: |
| | Alkenes: Addition of X_2 | | | - in the reference book 1 from 8.1 to |
| | 6.3. Halohydrins from | | | 8.13, Chapter 8 |
| | Alkenes: Addition of HOX | | | - in the reference book 3 from page 87 to |
| | 6.4. Hydration of Alkenes: | | | page 117. |
| | Addition of H ₂ O by | | | - Group (4-5 students) working: students |
| | Oxymercuration | | | have to solve the new excercises, 4-5 |
| | 6.5. Hydration of Alkenes: | | | problems of 8.1-8.21 in Chapter 8 of the |
| | Addition of H ₂ O by | | | reference book 1 |
| | Hydroboration | | | |
| | 6.6. Reduction of Alkenes: | | | |
| | Hydrogenation | | | |

| | 6.7. Oxidation of Alkenes: | | | |
|---|-----------------------------------------------|---|---|-----------------------------------------------------------|
| | Epoxidation and | | | |
| | Hydroxylation | | | |
| | 6.8. Oxidation of Alkenes: | | | |
| | Cleavage to Carbonyl | | | |
| | Compounds | | | |
| | 6.9. Addition of Carbenes | | | |
| | to Alkenes: Cyclopropane | | | |
| | Synthesis | | | |
| | 6 10 Radical Additions to | | | |
| | Alkenes: Chain Growth | | | |
| | Polymers | | | |
| | 6 11 Biological Additions | | | |
| | of Padicals to Alkanas | | | |
| | 6.12 Reaction | | | |
| | Staraachamistry: Addition | | | |
| | of IL O to on A chiral | | | |
| | Allenna | | | |
| | Alkelle 6.12 Deaction | | | |
| | 0.15. Reaction | | | |
| | of H O to a Chiral Allena | | | |
| | of H ₂ O to a Chiral Alkelle | | | |
| 7 | Chapter 7 Allernose An | 2 | 0 | Deview the 91912 sections of the |
| / | Introduction to Organia | 3 | 0 | - Review the 8.1-8.15 sections of the |
| | Synthesis | | | book 1 |
| | 7 1 Noming Alleunos | | | Student will study the theory corefully |
| | 7.1. Naming Alkylies | | | - Student will study the theory calefully |
| | Allument Elimination | | | at nome before going to the class with |
| | Aikynes: Einninauon Deactions of Dihalidas | | | in the reference book 1 from 0.1 to 0.0 |
| | 7.3 Reactions of Allumas | | | - In the reference book 1 from 9.1 to 9.9, |
| | Addition of UV and V | | | in the reference healt 2 from mass 140 |
| | Addition of Allyman | | | - In the reference book 5 from page 140 |
| | 7.4. Hydration of Allymas | | | to page 101. |
| | 7.5. Reduction of Alkynes | | | - Group (4-3 students) working: students |
| | Alluma | | | nave to solve the new excercises, 4-5 |
| | Alkylies | | | problems of 9.1-9.15 in Chapter 9 of the |
| | 7.7. Alkyne Acidity: | | | reference book 1 |
| | Formation of Acetyfide | | | |
| | Allouis | | | |
| | A cotulido A niona | | | |
| | 7.0 An Introduction to | | | |
| | 7.9. All inflocution to | | | |
| 0 | Chanter 8 | 2 | | Devices the 0100 sections of the |
| o | Organahalidag | 3 | | - NEVIEW LIE 9.1-9.9 Sections of the |
| | 8.1 Names and Properties | | | book 1 |
| | of Allyd Holides | | | book I Student will study the theory constally |
| | 8.2 Drongring Alley | | | - Student will study the theory carefully |
| | 0.2. Flepaling Alkyl Halidas from Alkanas | | | the Sections: |
| | Padical Haloganation | | | in the reference book 1 from 10.1 to |
| | 8.3 Droporing Alley | | | - In the reference book I from 10.1 to 10.8 Chapter 10 |
| | Halidas from Alkonas | | | in the reference book 2 from page 110 |
| | Allulia Dromination | | | - In the reference book 5 from page 118 |
| | | | | |

| | 8.4. Stability of the Allyl Radical: Resonance Revisited 8.5. Preparing Alkyl Halides from Alcohols 8.6. Reactions of Alkyl Halides: Grignard Reagents 8.7. Organometallic Coupling Reactions 8.8. Oxidation and Reduction in Organic Chemistry | | | - Group (4-5 students) working: students have to solve the new excercises, 4-5 problems of 10.1-10.13 in Chapter 10 of the reference book 1 |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9 | Chapter 9. Reactions of Alkyl Halides: Nucleophilic Substitutions and Eliminations 9.1. The Discovery of Nucleophilic Substitution Reactions 9.2. The S _N 2 Reaction 9.3. Characteristics of the S _N 2 Reaction 9.4. The S _N 1 Reaction 9.5. Characteristics of the S _N 1 Reaction 9.6. Biological Substitution Reactions 9.7. Elimination Reactions: Zaitsev's Rule 9.8. The E2 Reaction and the Deuterium Isotope Effect 9.9. The E2 Reaction and Cyclohexane Conformation 9.10. The E1 and E1cB Reactions 9.11. Biological Elimination Reactions 9.12. A Summary of Reactivity: S _N 1, S _N 2, E1, E1cB, and E2 | 6 | 0 | Review the 10.1-10.8 sections of the previous studied chapter of the reference book 1 Student will study the theory carefully at home before going to the class with the Sections: in the reference book 1 from 11.1 to 11.12, Chapter 11 in the reference book 3 from page 118 to page 139. Group (4-5 students) working: students have to solve the new excercises, 4-5 problems of 11.1-11.20 in Chapter 11 of the reference book 1 |
| 10 | Chapter 10. Structure | 3 | | - Review the 11.1-11.12 sections of the |
| | Determination: Mass Spectrometry and | | | previous studied chapter of the reference book 1 |
| | Infrared Spectroscopy | | | - Student will study the theory carefully |
| | 10.1. Mass Spectrometry | | | at home before going to the class with |
| | of Small Molecules: | | | the Sections: |
| | Magnetic-Sector | | | - in the reference book 1 from 12.1 to |

| Instruments10.2. Interpreting MassSpectra10.3. Mass Spectrometryof Some CommonFunctional Groups10.4. Mass Spectrometryin Biological Chemistry:Time-of-Flight (TOF)Instruments10.5. Spectroscopy andthe ElectromagneticSpectrum10.6. InfraredSpectroscopy10.7. Interpreting InfraredSpectra10.8. Infrared Spectra ofSome Common FunctionalGroups | 2 | 0 | 12.8, Chapter 12 in the reference book 3 from page 118 to page 139. Group (4-5 students) working: students have to solve the new excercises, 4-5 problems of 12.1-12.10 in Chapter 12 of the reference book 1 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11Chapter 11. Structure Determination: Nuclear Magnetic Resonance Spectroscopy 11.1. Nuclear Magnetic Resonance Spectroscopy 11.2. The Nature of NMR Absorptions 11.3. Chemical Shifts 11.4. 13C NMR Spectroscopy Signal Averaging and FT–NMR 11.5. Characteristics of 13 C NMR Spectroscopy 11.6. DEPT 13 C NMR Spectroscopy 11.7. Uses of 13 C NMR Spectroscopy 11.8. 1 H NMR Spectroscopy 11.8. 1 H NMR Spectroscopy 11.9. Chemical Shifts in 1 H NMR Spectroscopy 11.10. Integration of 1 H NMR Absorptions: Proton Counting 11.11. Spin–Spin Splitting in 1 H NMR Spectra 11.12. More Complex Spin–Spin Splitting Patterns | 3 | | Review the 12.1-12.8 sections of the previous studied chapter of the reference book 1 Student will study the theory carefully at home before going to the class with the Sections: in the reference book 1 from 13.1 to 13.12, Chapter 13 in the reference book 3 from page 230 to page 255. Group (4-5 students) working: students have to solve the new excercises, 4-5 problems of 13.1-13.23 in Chapter 13 of the reference book 1 |

| | 11.13. Uses of ¹ H NMR | | | |
|-----|-----------------------------------|---|---|-------------------------------------------|
| 12 | Chapter 12. Conjugated | 3 | 0 | - Review the 13.1-13.12 sections of the |
| | Compounds and | | | previous studied chapter of the reference |
| | Ultraviolet | | | book 1 |
| | Spectroscopy | | | - Student will study the theory carefully |
| | 12.1. Stability of | | | at home before going to the class with |
| | Conjugated Dienes: | | | the Sections: |
| | Molecular | | | in the reference book 1 from 14.1 to |
| | Orbital Theory | | | 14.0 Chapter 14 |
| | 12.2 Electrophilic | | | in the reference heals 2 from page 220 |
| | | | | - In the reference book 5 from page 250 |
| | Additions to Conjugated | | | to page 255. |
| | Dienes: Allylic | | | - Group (4-5 students) working: students |
| | Carbocations | | | have to solve the new excercises, 4-5 |
| | 12.3. Kinetic versus | | | problems of 14.1-14.15 in Chapter 14 of |
| | Thermodynamic Control | | | the reference book 1 |
| | of Reactions | | | |
| | 12.4. The Diels–Alder | | | |
| | Cycloaddition Reaction | | | |
| | 12.5. Characteristics of the | | | |
| | Diels–Alder Reaction | | | |
| | 12.6. Diene Polymers: | | | |
| | Natural and Synthetic | | | |
| | Rubbers | | | |
| | 12.7. Structure | | | |
| | Determination in | | | |
| | Conjugated Systems | | | |
| | Ultraviolet Spectroscopy | | | |
| | 12.8 Interpreting | | | |
| | 12.0. Interpreting | | | |
| | Effect of Conjugation | | | |
| | 12.0. Consistent from Color | | | |
| | 12.9. Conjugation, Color, | | | |
| | and the Chemistry | | | |
| | of Vision | - | - | |
| 13 | Chapter 13. Benzene and | 3 | 0 | - Review the 14.1-14.9 sections of the |
| | Aromaticity | | | previous studied chapter of the reference |
| | 13.1. Sources and Names | | | book 1 |
| | of Aromatic Compounds | | | - Student will study the theory carefully |
| | 13.2. Structure and | | | at home before going to the class with |
| | Stability of Benzene | | | the Sections: |
| | 13.3. Aromaticity and the | | | - in the reference book 1 from 15.1 to |
| | Hückel $4n + 2$ Rule | | | 15.7, Chapter 15 |
| | 13.4. Aromatic Ions | | | - in the reference book 3 from page 189 |
| | 13.5. Aromatic | | | to page 204. |
| | Heterocycles: Pyridine and | | | - Group (4-5 students) working: students |
| | Pyrrole | | | have to solve the new excercises. 4-5 |
| | 13.6. Polycyclic Aromatic | | | problems of 15.1-15.12 in Chapter 15 of |
| | Compounds | | | the reference book 1 |
| | 13.7 Spectroscopy of | | | |
| | Aromatic Compounds | | | |
| 1/ | Chanter 14 Chamistry | 3 | Ο | - Review the 151-157 sections of the |
| 1.4 | of Bonzono: Floatronhilia | 5 | U | - Review the 15.1-15.7 sections of the |
| | A romotic Substitution | | | book 1 |
| | Aromatic Substitution | | | DOOK I |

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| 14.1. Electrophilic | | - Student will study the theory carefully |
| Aromatic Substitution | | at home before going to the class with |
| Reactions: | | the Sections: |
| Bromination | | - in the reference book 1 from 16.1 to |
| 14.2. Other Aromatic | | 16.11, Chapter 16 |
| Substitutions | | - in the reference book 3 from page 205 |
| 14.3. Alkylation and | | to page 229. |
| Acylation of Aromatic | | - Group (4-5 students) working: students |
| Rings: The Friedel–Crafts | | have to solve the new excercises, 4-5 |
| Reaction | | problems of 16.1-16.23 in Chapter 16 of |
| 14.4. Substituent Effects in | | the reference book 1 |
| Substituted Aromatic | | |
| Rings | | |
| 14.5. An Explanation of | | |
| Substituent Effects | | |
| 14.6. Trisubstituted | | |
| Benzenes: Additivity of | | |
| Effects | | |
| 14.7. Nucleophilic | | |
| Aromatic Substitution | | |
| 14.8. Benzyne | | |
| 14.9. Oxidation of | | |
| Aromatic Compounds | | |
| 14.10. Reduction of | | |
| Aromatic Compounds | | |
| 14.11. Synthesis of | | |
| Polysubstituted Benzenes | | |
| | | |

ON BEHALF OF RECTOR DEAN/ DIRECTOR

Can Tho,/20... **HEAD OF DEPARTMENT**