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Alabama
Department of
Postsecondary Education

Representing Alabama's Public Two-Year College System

Jefferson State Community College

CHM 105

Introduction to Organic Chemistry

I. CHM 105, Introduction to Organic Chemistry, 4 Semester Hours

Core Area III, ASCI TSCI (Lec 3 hrs, Lab 2 hrs) (**State guide has 3HR Labs)

II. Course Description

This is a survey course of organic chemistry and biochemistry for students who do not intend to major in science or engineering. Topics will include basic nomenclature, classification of organic compounds, typical organic reactions, reactions involved in life processes, function of biomolecules, and the handling and disposal of organic compounds. Laboratory is required.

III. Prerequisite CHM 104 or CHM 111

IV. Textbook

Organic & Biological Chemistry, 6th ed., Stephen Stoker, Brooks/Cole

Lab Manual SAFETY-SCALE LAB EXPERIMENTS FOR CHEMISTRY FOR TODAY: GENERAL ORGANIC AND BIOCHEMISTRY, SEAGER-SLABAUGH.

V. Course Objectives

At the end of the course the student will be able to:

- A. Understand the relationship of the hybridization of the carbon atom to the various types of carbon bonds.
- B. Apply the concepts of carbon bonding to distinguish and identify types of organic compounds.
- C. Apply the concepts of the versatility of carbon bonds in naming organic compounds using the IUPAC System of nomenclature and in drawing the structural formulas.
- D. Apply the concepts of the wide versatility of carbon compounds in understanding the preparation and the chemical reactions of these compounds.
- E. Understand the relationship of the structure of organic molecules to the physical properties.
- F. Possess an appreciation of the wide economic implications of organic compounds by knowing the source and use of these varied structures.
- G. Apply the concepts and knowledge of simple organic molecules to understanding and recognizing the more complicated polymers.
- H. Understand stereochemistry and its relationship to rotation of light and the implications in studying biomolecules such as enzymes.
- I. Discuss basic structure and function of carbohydrates, lipids, amino acids, proteins and nucleic acids.

VI. Course Outline of Topics

Lecture Topics Stated in Performance Terms

- A. The student will be able to understand the relationship of the hybridization of the carbon atom to the various types of carbon bonds.
 1. Describe the sp^3 , sp^2 , and sp hybridization of the carbon atom using the electronic configuration and orbital sketches.
 2. Relate each of the types of hybridization to single, double, and triple bonds.
 3. Distinguish between a sigma and a pi bond.
 4. Distinguish between a molecular formula, structural formula and condensed structural formula.

- B. The student will be able to apply the concepts of carbon bonding to distinguish and identify types of organic compounds.
1. Using structural formulas, the student will be able to
 2. Name and give the general formula for at least nine classes of organic compounds.
 3. Identify an alkyl group and an alkyl halide.
 4. Define an isomer and give three isomers when given the molecular formula.
 5. Distinguish between cis and trans isomers using structural formulas.
 6. Distinguish between a primary, secondary, and tertiary alcohol.
 7. Name four classes of carboxylic acids and give an example of each.
 8. Identify glycerol.
 9. Identify a triglyceride.
 10. Distinguish between primary, secondary, and tertiary amines.
 11. Distinguish between fats and oils (structural formula not needed here).
 12. Distinguish between a soap and syndet.
- C. The student will be able to apply the concepts of the versatility of carbon bonds in naming organic compounds using the IUPAC System of nomenclature and in drawing the structural formulas.
1. Name any one of the alkanes, alkenes, alkynes, cycloalkanes, aromatic compounds, alcohols, aldehydes, ketones, ethers, carboxylic acids, esters, amines and amides when given the structural formula.
 2. Draw the structural formulas for any of the groups listed above when given the name.
- D. The student will apply the concepts of the wide versatility of carbon compounds in understanding the preparation and the chemical reactions of these compounds.
1. Halogenation, dehydrogenation and combustion of alkanes.
 2. Addition and oxidation of alkenes and alkynes.
 3. Oxidation of primary, secondary, and tertiary alcohols.
 4. Addition reactions that illustrate an understanding of "Markovnikov's Rule."
 5. Intermolecular and intramolecular dehydration of alcohols.
 6. Esterification of alcohols.
 7. Oxidation and reduction of aldehydes and ketones.
 8. Tollens' test and the Benedict's test used to distinguish between aldehydes and ketones.
 9. Aldol condensation of aldehydes and ketones.
 10. Preparation of the Grignard reagent.
 11. Grignard reaction that will produce a given alcohol.

12. Preparation of carboxylic acids by oxidation of alcohols, hydrolysis of esters and fats, oxidation of aromatic hydrocarbons, and hydrolysis of nitriles.
 13. Formation of esters, amides, and acid chlorides using carboxylic acid.
 14. Preparation of esters.
 15. Preparation of a quaternary ammonium salt.
 16. Illustration of the basic properties of amines.
- E. The student will be able to understand the relationship of the structure of organic molecules to the physical properties.
1. Relate the physical state of the hydrocarbons to the length of the carbon chain.
 2. List the physical properties of aromatic hydrocarbons.
 3. Relate the solubility and boiling point of the alcohols, ethers, and carboxylic acids to their chemical structure.
 4. List two physical properties of formaldehyde, acetaldehyde, paraldehyde, and benzaldehyde.
 5. List the acidic properties of carbocyclics.
 6. List four physical properties of esters.
 7. Give the major physical difference in fats and oils and state the reason for this difference.
 8. Describe the cleaning action of soap.
 9. List two physical properties of amines.
- F. To gain and appreciation of the economic implications of organic compounds by knowing the source and use of these varied structures.
1. List the major source and uses of the hydrocarbons, alcohols, ethers, aldehydes, ketones, esters, carboxylic acids, amines and amino acids.
 2. Discuss the physiology of alcohol as a food, drug, and poison.
- G. The student will be able to apply the concepts and knowledge of simple organic molecules to understanding and recognizing the more complicated polymers.
1. Define the terms polymer, monomer and polymerization.
 2. Name and describe both physically and chemically the two general types of polymers.
 3. List six general groups of synthetic polymers.
 4. Give the three basic steps in the formation of an addition polymer.
 5. Define a copolymer.
 6. Identify specific polymers such as styrene, polyurethane and polyvinyl chloride.
- H. The student will be able to understand stereochemistry and its relation to rotation of light and the implications in studying biomolecules such as enzymes.

1. Define stereoisomerism and chirality.
 2. List two types of stereoisomers.
 3. Describe plane-polarized light
 4. Describe optical activity and specific rotation.
 5. Use sequence rules for specifying configuration of optical isomers.
 6. Describe the difference between enantiomers, diastereomers, meso compounds, and racemic mixtures.
 7. Describe and give examples of chirality in nature and, particularly, for enzymes.
- I. Discuss basic structure and function of carbohydrates, lipids, amino acids, proteins and nucleic acids.
1. Discuss basic structure and function of carbohydrates, lipids, amino acids, proteins and nucleic acids.
 2. Demonstrate an understanding of the classification system for carbohydrates.
 3. Draw glucose as both a Fischer structure and a Haworth structure.
 4. List four disaccharides and their alternate names.
 5. Describe the monosaccharides combinations that compose the four disaccharides, the enzymes needed to cleave the disaccharides, and the types of linkages used to form the disaccharides.
 6. Describe the difference between the 2 common polysaccharides.
 7. Describe the general structure of an α -amino acid and give three specific examples.
 8. Show how α -amino acids form peptide linkages.
 9. Define "isoelectric point".
 10. List the different classifications of proteins.
 11. Define "lipids".

Laboratory Topics

- A. Safety Procedures; rules and regulations
- B. Ball and Stick Models of Compounds Representing Various Functional Groups
- C. Melting point determination
- D. Preparation of Aspirin
- E. Purification by Recrystallization
- F. Characteristic Reactions of Alkenes
- G. Characteristic Reactions of Alcohols
- H. Characteristic Reactions of Aldehydes
- I. Characteristic Reactions of Ketones
- J. Characteristic Reactions of Amines
- K. Preparation of Esters
- L. Optical Activity and Polarimetry
- M. Thin Layer Chromatography of Analgesics

VII. Evaluation and Assessment

The student will have demonstrated attainment of the general course objectives if he accumulates a minimum of 70 percent of the points possible.

Grades will be composed of tests, lab work, a comprehensive final exam, and may include other assignments. Lecture will count for 75 – 80% and the laboratory component will count for 20-25% of the student's grade. A minimum of three lecture exams and a comprehensive final exam will be given. In lab a minimum of one exam and a final exam will be given.

Grades will be earned based upon the traditional scale:

A = 90 – 100%, B = 80 – 89%, C = 70 – 79%, D = 60 – 69%, and F = below 60%.

VIII. Attendance

Students are expected to attend all classes for which they are registered. Students who are unable to attend class regularly, regardless of the reason or circumstance, should withdraw from that class before poor attendance interferes with the student's ability to achieve the objectives required in the course. Withdrawal from class can affect eligibility for federal financial aid.

IX. Statement on Discrimination/Harassment

The College and the Alabama State Board of Education are committed to providing both employment and educational environments free of harassment or discrimination related to an individual's race, color, gender, religion, national origin, age, or disability. Such harassment is a violation of State Board of Education policy. Any practice or behavior that constitutes harassment or discrimination will not be tolerated.

X. Americans with Disabilities

The Rehabilitation Act of 1973 (Section 504) and the Americans with Disabilities Act of 1990 state that qualified students with disabilities who meet the essential functions and academic requirements are entitled to reasonable accommodations. It is the student's responsibility to provide appropriate disability documentation to the College. The ADA Accommodations office is located in FSC 300 (205-856-7731).