CHEM-2300: ORGANIC CHEMISTRY I

Cuyahoga Community College

Viewing: CHEM-2300 : Organic Chemistry I

Board of Trustees:
2015-05-28

Academic Term:
Fall 2020

Subject Code
CHEM - Chemistry

Course Number:
2300

Title:
Organic Chemistry I

Catalog Description:
Functional group chemistry of aliphatic compounds covering nomenclature, structural-reactivity, and synthetic reactions. Theoretical concepts, structural bonding, stereochemistry and reaction mechanisms emphasized. Use of various spectrometric techniques for identification of compounds introduced.

Credit Hour(s):
5

Lecture Hour(s):
3

Lab Hour(s):
6

Other Hour(s):
0

Requisites

Prerequisite and Corequisite
CHEM-1310 General Chemistry II, and CHEM-131L General Chemistry Laboratory II; or CHEM-131H Honors General Chemistry II; or departmental approval: equivalent knowledge or skills.

Outcomes

Course Outcome(s):
Apply the mechanics of Organic Chemistry reactions to the synthesis of hydrocarbon molecules of biological, pharmacological, and industrial relevance.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Relate physical and chemical properties to structure and bonding of various types of molecules.
2. Know basic reactions of aromatic systems.
3. Apply chemical kinetics and thermodynamics and their relationships to chemical reactions.
4. Apply basic reaction mechanisms to a variety of compounds: free radical halogenation, nucleophilic substitution, elimination, and addition.

Course Outcome(s):

Correlate the fundamental properties of atoms, molecules, ions and bonding with the reactivity of Organic Chemistry molecules.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Relate physical and chemical properties to structure and bonding of various types of molecules.
2. Know basic reactions of aromatic systems.
3. Apply basic rules of IUPAC nomenclature system.
4. Distinguish various structures both by name and drawing, including conformations, configuration isomers, geometric isomers and optical isomers.
5. Use knowledge of bond polarity to predict chemical reactivity.
6. Demonstrate use of safety in a laboratory environment.
7. Distinguish between aromatic, nonaromatic, and antiaromatic systems.

Course Outcome(s):

Interpret experimental laboratory data for presentation as results.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

Objective(s):

1. Distinguish various structures both by name and drawing, including conformations, configuration isomers, geometric isomers and optical isomers.
2. Use various laboratory techniques and instruments.
3. Distinguish between aromatic, nonaromatic, and antiaromatic systems.

Course Outcome(s):

Write structured, concise lab reports with factual reporting of student results and methodology utilized, which can be applied to repeat the experiment with a similar outcome.

Essential Learning Outcome Mapping:

Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

Objective(s):

1. Apply basic rules of IUPAC nomenclature system.
2. Demonstrate use of safety in a laboratory environment.
3. Use various laboratory techniques and instruments.

Course Outcome(s):

Adapt understanding of Organic Chemistry and laboratory skills to novel synthetic challenges.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Relate physical and chemical properties to structure and bonding of various types of molecules.
2. Apply chemical kinetics and thermodynamics and their relationships to chemical reactions.
3. Use knowledge of bond polarity to predict chemical reactivity.
4. Apply basic reaction mechanisms to a variety of compounds: free radical halogenation, nucleophilic substitution, elimination, and addition.

Methods of Evaluation:

1. Lecture written examinations
2. Lecture quizzes/homework
3. Laboratory reports on lab experiments and procedures
4. Laboratory tests/quizzes
5. American Chemical Society - First Term Organic Chemistry Exam

Course Content Outline:

1. This is a test of outline formatting.
    a. This is a subtopic
1. A Review of General Chemistry
    a. Electrons
    b. Bonds
    c. Molecular Properties
2. Molecular Representations
    a. Bond-Line Structures
    b. Identifying Functional Groups
    c. Identifying and Representing Lone Pairs
    d. Introduction to Resonance
    e. Introduction to Mechanistics
    f. Curved Arrows
3. Acids and Bases
    a. Brönsted-Lowry Acids and Bases
    b. Flow of Electron Density
    c. Quantitative Acidity
    d. Qualitative Perspective
    e. Equilibrium and Choice of Reagents
    f. Solvating Effects
    g. Lewis Acids and Bases
4. Alkanes and Cycloalkanes
    a. Nomenclature
    b. Isomers
    c. Stability
    d. Sources and Uses
    e. Newman Projections
    f. Conformational Analysis
    g. Cycloalkanes
    h. Drawing Chair Conformations
    i. Substituted Alkanes
    j. Stereochemistry
5. Stereoisomerism
    a. Overview
    b. Cahn-Ingold-Prelog System
    c. Optical Activity
    d. Chirality
    e. Fischer Projections
6. Chemical Reactivity and Mechanisms
    a. Thermodynamics
    b. Equilibria
    c. Kinetics
    d. Mechanistic Terminology
    e. Overview of Mechanism types
7. Substitution Reactions
    a. Alkyl Halides
    b. SN2 and SN1
    c. Drawing Mechanisms
    d. Selecting Reagents
8. Alkenes and Elimination Reactions

   a. Sources and Uses of Alkenes
   b. Nomenclature
   c. Stereochemistry
   d. Elimination mechanisms E2 and E1
9. Addition Reactions of Alkenes
   a. Addition vs. Elimination
   b. Addition Reaction types
   c. Stereochemistry
   d. Predicting Products
   e. Synthetic Strategies
10. Alkynes
   a. Nomenclature
   b. Acidity and Reactivity
   c. Preparation
   d. Reactions of Alkynes
11. Radical Reactions
   a. Patterns in Radical Mechanisms
   b. Thermodynamics
   c. Stereochemistry
   d. Reactions examples
   e. Radical Polymerization
12. Synthesis
   a. One-Step Syntheses
   b. Functional Group Transformations
   c. Carbon bond breaking and forming reactions
   d. Retrosynthetic Analysis

Resources

Carey, Francis and Robert Giuliano. *Organic Chemistry.* 9th ed. New York: McGraw-Hill, 2013.

McMurry, John E. *Organic Chemistry.* 8th ed. Cengage Learning, 2011.

Bruice, Paula Yurankis. *Organic Chemistry.* 6th ed. Upper Saddle River, NJ: Prentice Hall, 2010.

Wade, L.G. Jr. *Organic Chemistry.* 8th ed. Upper Saddle River, NJ: Prentice Hall, 2012.

Mayo, Dana W. and Ronald M. Pike and David. C Forbes. *Microscale Organic Laboratory: With Multistep and Multiscale Syntheses.* 5th ed. New York: Wiley Sons, 2010.

Pavia, Donald L. and Gary M. Lampman and George S. Kriz and Randall G. Engel. *A Small Scale Approach to Organic Laboratory Techniques.* 3rd ed. Cengage Learning, 2010.

Vollhardt, Peter and Neil E. Schore. *Organic Chemistry.* 7th ed. W.H. Freeman Company, 2014.

Klein, David R. *Organic Chemistry.* 2nd ed. New York: Wiley Sons, 2013.

Resources Other

1. Chemistry molecular model kit, such as CHEM-TUDOR; Z22, 249-6. Aldrich Chemical Company.
2. Eubanks, I. Dwaine. *Preparing for Your ACS Examination in Organic Chemistry: The Official Guide*. Milwaukee: American Chemical Society, Division of Chemical Education Examinations Institute, 2002.

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