

**DEPARTMENT OF CHEMISTRY**

**Common Course Outline**

**CHEM 203 – Organic Chemistry I**

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**Course Description**

This course focuses on fundamental concepts of organic chemistry with emphasis on aliphatic hydrocarbons, alkyl halides, and alcohols. This course covers bonding theories, structures, nomenclature, physical properties, synthesis, and mechanisms of reactions. Laboratory work involves the preparation, analysis, and purification of organic compounds including spectroscopic techniques.

**Prerequisite:** *A grade of C or better in CHEM 132 within the last five years, or consent of department chair, course coordinator, or designated member of Chemistry faculty.*

**Credits:** 5 semester hours; three hours lecture, one hour discussion, four hours laboratory each week

**Course scheduling**

Sections offered at all campuses every Fall and Spring semesters. Offered in the Summer I session at the Rockville and Takoma Park campuses and in the Summer II session at the Germantown campus.

**Broad Course Outcomes**

*Upon successful course completion, a student will be able to:*

- Recognize, name and represent organic compounds and functional groups
- Describe relationships between structure, chemical reactivity and physical properties
- Analyze three-dimensional conformations and configurations of organic structures
- Investigate chemical properties of organic molecules through reactions and synthesis
- Illustrate and investigate organic reactions through kinetics and reaction mechanisms
- Safely work in an organic laboratory environment including the proper waste disposal
- Synthesize, isolate and purify liquid and solid organic products by appropriate methods including recrystallization (solids) and distillation (liquids)
- Characterize organic compounds by physical and chemical properties and analytical methods including IR and NMR spectroscopy.

**Specific Course Objectives**

*Upon completion of this course, students should be able to:*

- Recognize, name and represent organic compounds and functional groups
- Identify acidic and basic properties of organic compounds
- Identify stereo centers in organic compounds and assign configurations
- Understand three main classifications of organic reactions: substitution, elimination and addition. Gain detailed knowledge of each of these reaction mechanisms
- Understand various functional group in terms of nomenclature, physical properties, reactions and synthesis

- Learn to measure physical properties such as boiling point, refractive index, density and melting points
- Learn to purify organic solids and liquids through distillation and recrystallization
- Learn to separate organic compounds by acid-base extraction, thin layer chromatography and gas chromatography
- Characterize organic compounds by physical and chemical properties and analytical methods including IR and NMR spectroscopy.
- Perform simple substitution and elimination reactions and apply techniques learned so far to separate, purify and characterize the products.

### **Major Lecture Topics**

Representation of 3D organic molecules in 2D by various methods; functional groups; acids and bases; Intermolecular forces; alkanes and conformational analysis; stereochemistry; reaction mechanisms; substitution and elimination reactions; alkenes and alkynes; oxidation and reduction reactions

### **Major Laboratory Topics**

Measurement of physical properties like boiling point, melting point, density and refractive index; acid-base extraction, recrystallization, stereochemistry and model building, IR spectroscopy,  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectroscopy; Gas and Thin Layer Chromatography, distillation, extraction of natural product; substitution reaction; elimination reaction.

### **Course Requirements**

Grading procedures will be determined by the individual faculty instructor of each section, but will include the following minimum criteria:

*Lecture component (75% of overall course grade)*

- Minimum of three examinations
- Homework, quizzes, other assignments or projects as assigned by the instructor
- Comprehensive final exam – American Chemical Society First-term Organic Chemistry Examination

*Laboratory component (25% of overall course grade)*

- Laboratory Safety Assessment
- Pre-laboratory assignments
- Post-laboratory assignments/reports
- Laboratory final examination

***Attendance in laboratory is mandatory. Unexcused absence of three or more lab meetings will result in automatic failure. Students must pass lecture and lab components separately to receive a passing final course grade.***

### **Grading Policy**

The following letter grade policy will be used to determine final course grade.

**A** 100 - 90%      **B** 89 - 80%      **C** 79 - 70%      **D** 69 - 60%      **F** < 60%

## **Required Course Materials**

- Textbook – *Organic Chemistry*, Smith, 5<sup>th</sup> Ed. McGraw-Hill Publisher
- Laboratory safety goggles
- Laboratory notebook

## **Textbook Chapter Coverage**

- Chapter 1 Structure and Bonding
- Chapter 2 Acids and Bases
- Chapter 3 Introduction to Organic Molecules and Functional Groups
- Chapter 4 Alkanes
- Chapter 5 Stereochemistry
- Chapter 6 Understanding Organic Reactions
- Chapter 7 Alkyl Halides and Nucleophilic Substitution
- Chapter 8 Alkyl Halides and Elimination Reactions
- Chapter 9 Alcohols, Ethers and Epoxides
- Chapter 10 Alkenes
- Chapter 11 Alkynes
- Chapter 12 Oxidation and Reduction

*Additional chapters may be included at the discretion of the individual faculty instructor.*

## **Example Laboratory Experiments (subject to change)**

1. Safety in the Chemical Laboratory / Physical Constants of Organic Compounds
2. Physical Properties of Organic Compounds – Identification of an Unknown Liquid Part I
3. IR Spectroscopy - Identification of an Unknown Liquid Part II
4. Acid and Base Extraction and Solubility
5. Recrystallization and Cooperative Identification of an Unknown Solid
6. Stereochemistry and Molecular Models
7. Introduction to <sup>1</sup>H NMR Spectroscopy
8. Identification of an Unknown Liquid by IR and <sup>1</sup>H NMR Spectroscopy
9. Separation of a Binary Mixture by Simple and Fractional Distillation and GC Analysis
10. Isolation and Purification of a Natural Product - Caffeine
11. Thin-Layer Chromatography – Analysis of Analgesics
12. Synthesis of Bromobutane
13. Dehydration of an Alcohol
14. Introduction to <sup>13</sup>C NMR Spectroscopy

## **MC Student Code of Conduct and Academic Honesty**

## **Montgomery College Syllabus Information**