



## CHEM 21 - Organic Chemistry I

## Catalog Description

**Transfer Status:** CSU/UC**Prerequisite:** CHEM 2**Unit(s):** 5.00**Lecture:** 51.00 Contact hours/102.00 Out of class hours/153.00 Total hours/3.00 Unit(s)**Lab:** 102.00 Contact hours/0.00 Out of class hours/102.00 Total hours/2.00 Unit(s)**Total:** 153.00 Contact hours/102.00 Out of class hours/255.00 Total hours/5.00 Unit(s)

**Course Description:** This is the first semester of a one-year course in organic chemistry intended for majors in the natural sciences (chemistry, biochemistry, biology, physics, and pre-medicine). It covers fundamental principles of organic chemistry including structure, nomenclature, conformational analysis and stereochemistry. The physical properties, reactions and reaction mechanisms of alkanes, alkyl halides, alcohols, ethers, alkenes, alkynes, and allylic systems are studied. Infrared spectroscopy and Nuclear Magnetic Resonance (NMR) spectroscopy are discussed in detail. Graded only. (C-ID CHEM 150/CHEM 160S).

## Objectives

Upon successful completion of this course, the student should be able to:

1. Use the vocabulary of organic chemistry.
2. Demonstrate a basic understanding of the fundamental principles and concepts of modern organic chemistry.
3. Demonstrate analytical and problem solving skills in predicting the structure of the products for an organic reaction.
4. Demonstrate an ability to develop the methods of synthesis of organic compounds.
5. Demonstrate laboratory skills or employ standard laboratory techniques toward the synthesis, analysis, and purification of organic compounds.

## Course Content

## Topic Titles / Suggested Time Topic

Lecture

| <u>Topics</u>                                                                                                                  | <u>Lec Hrs</u> |
|--------------------------------------------------------------------------------------------------------------------------------|----------------|
| Review of general chemistry concepts (Lewis structures, acid-base principles, intermolecular forces, kinetics and equilibrium) | 8.00           |
| Alkanes and Cycloalkanes                                                                                                       | 6.00           |
| Stereochemistry                                                                                                                | 4.00           |
| Nucleophilic Substitution Reactions of Alkyl Halides                                                                           | 6.00           |
| Elimination Reactions of Alkyl Halides                                                                                         | 4.00           |
| Alcohols, Ethers and Epoxides                                                                                                  | 5.00           |
| Infrared Spectroscopy, Hydrogen and Carbon NMR Spectroscopy                                                                    | 5.00           |
| Alkenes                                                                                                                        | 4.00           |
| Alkynes                                                                                                                        | 1.00           |
| Oxidation-Reduction Reactions                                                                                                  | 4.00           |
| Allylic Reactions                                                                                                              | 2.00           |
| Radical Reactions                                                                                                              | 2.00           |
|                                                                                                                                |                |
| <b>Total Hours:</b>                                                                                                            |                |
| <b>51.00</b>                                                                                                                   |                |

Lab

| <u>Topics</u>                                                                      | <u>Lab Hrs</u> |
|------------------------------------------------------------------------------------|----------------|
| Lab Exercises on Conformations, Isomerism, and Anti-Elimination with E2 reactions  | 15.00          |
| Lab Exercises on NMR Spectroscopy                                                  | 6.00           |
| Thin Layer Chromatography                                                          | 6.00           |
| Unknown Identification using Gas Chromatography (GS), Boiling Point and Solubility | 9.00           |
| Recrystallization                                                                  | 6.00           |
| Macroscale Distillation of Mixtures                                                | 9.00           |
| Liquid-Liquid Extraction                                                           | 9.00           |
| Synthesis and Analysis of the Products of Dehydration and Substitution Reactions   | 21.00          |
| Molecular Modeling to support IR Spectroscopy                                      | 3.00           |
| Steam Distillation                                                                 | 9.00           |

**Topics****Lab Hrs**

Analysis of Unknowns using Functional Group Tests and IR and H-NMR Spectroscopy

9.00

**Total Hours: 102.00****Methods of Instruction**

- A. Homework: Students are required to complete two hours of outside-of-class homework for each hour of lecture
- B. Instructor Demonstrations
- C. Laboratory Experiments
- D. Lecture
- E. Reading Assignments

**Methods of Evaluation**

- A. Quizzes
- B. Homework
- C. Written Examinations
- D. Laboratory reports, notebooks and exercises

**Examples of Assignments****Reading Assignments**

1. Read the section on alkane conformations and Newman projections in the textbook. Be prepared to relate these ideas to a lab activity involving rotational energy diagrams.
2. Read the section on tree diagrams in the textbook (for predicting splitting in H-NMR spectra) and be prepared to draw these in class and on exams.

**Writing Assignments**

1. For the experiment on distillation, create a properly formatted entry in your lab notebook (1-3 pages). The entry should include a title, date, introduction, detailed procedure in third person passive voice, data, observations, graphs and a conclusion. This entry will be graded along with your lab report.
2. Write a paragraph that explains why 2-bromobutane undergoes a slower SN2 reaction with cyanide ion than does bromomethane. Include appropriate drawings and diagrams with your answer.

**Out-of-Class Assignments**

1. Read the required sections in the laboratory technique book on thin layer chromatography (TLC), and complete the 1-page pre-lab assignment. You will be asked to perform calculations of retention factor (Rf) and explain why a filter paper is used inside the TLC chamber.
2. In order to prepare for the exam, complete the 7-page homework assignment on organic redox reactions involving alcohols and alkenes.

**Recommended Materials of Instruction**

Smith, J.G. (2020). Organic Chemistry. *McGraw-Hill, New York, 6th*. 9781260119107.

Pavia, D.L. (2017). A Microscale Approach to Organic Laboratory Techniques. *Cengage Learning, 6th*. 978-1305968349.

Nichols, L.M. (2021). CHEM 21 Laboratory Manual. *Butte College (publisher), Current*. Butte College bookstore.

**Other Learning Materials**

Laboratory Notebook with non-removable pages

Molecular Model Kit

**Minimum Qualifications**

Chemistry (Masters Required)

**Created/Revised by:** Nichols, Lisa

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