

# CHEM 12AL: ORGANIC CHEMISTRY LABORATORY

## Foothill College Course Outline of Record

Heading	Value
<b>Units:</b>	2
<b>Hours:</b>	6 laboratory per week (72 total per quarter)
<b>Corequisite:</b>	Completion of or concurrent enrollment in CHEM 12A.
<b>Advisory:</b>	Not open to students with credit in CHEM 13AH.
<b>Degree &amp; Credit Status:</b>	Degree-Applicable Credit Course
<b>Foothill GE:</b>	Non-GE
<b>Transferable:</b>	CSU/UC
<b>Grade Type:</b>	Letter Grade Only
<b>Repeatability:</b>	Not Repeatable

## Student Learning Outcomes

- Interpret experimental data through application of theoretical models
- Safely handle Organic Chemicals
- Gain skill with common synthetic chemistry techniques

## Description

Laboratory course to accompany CHEM 12A. Intended to introduce students to laboratory techniques common in modern synthetic organic chemistry. Students will work on both standard preparative scale and microscale to synthesize, isolate, purify and characterize organic compounds.

## Course Objectives

The student will be able to:

- Safely handle and dispose of hazardous chemicals
- Execute techniques common to chemical researchers in order to synthesize, isolate, purify and characterize organic compounds
- Provide a rationale for each step in an experimental design
- Analyze data to draw conclusions about chemical system
- Communicate effectively using the language of organic chemistry
- Work constructively and collaboratively in groups

## Course Content

- Safely handle and dispose of hazardous chemicals
  - Research, extract relevant information and report published MSDS (Material Safety Data Sheets)
  - Categorize and segregate hazardous waste according to compatibility
  - Apply care and skill in the safe handling of hazardous compounds
- Practice common laboratory techniques through guided inquiry labs that include the following or equivalent alternative:
  - Simple and fractional distillation of ethanol produced from fermentation of sucrose
  - Steam distillation of limonene extracted from orange peel
  - Polarimetry of limonene extract
  - Thin-layer chromatography to characterize and assess the purity of an unknown compound

- Column chromatography to separate a mixture (ferrocene and acetylferrocene, or another similar mixture of organic solids)
  - Acid-base extraction of a mixture containing two unknowns (carboxylic acid and neutral solids)
  - Identification of organic compounds by melting point and mixed melting point analysis
  - Recrystallization from single and mixed solvents
  - Microscale distillation in the acid catalyzed rearrangement of an alcohol
  - Microscale extraction and recrystallization
- Analyze data published in primary literature
    - Deduce whether or not data supports a hypothesis
    - Relate graphical displays to current theoretical models
    - Evaluate and discuss experimental results
    - Present and justify deductive reasoning to support experimental results
  - Analysis of experimental design
    - Hypothesis, deduction and isolation of variables
    - Data analysis and precision/error assessment
  - Effective communication using the language of organic chemistry
    - Laboratory notebook preparation
    - Presentation of problem solving strategy
  - Work constructively and collaboratively in groups

## Lab Content

- Safely handle and dispose of hazardous chemicals
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  - Identification of organic compounds by melting point and mixed melting point analysis
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  - Microscale distillation in the acid catalyzed rearrangement of an alcohol
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  - Laboratory notebook preparation
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F. Work constructively and collaboratively in groups

## Special Facilities and/or Equipment

Standard and microscale chemistry glassware, melting point apparatus, analytical balance, gas chromatograph, FT NMR instrument, FT IR instrument, and library resources including access to research publications in chemistry.

## Method(s) of Evaluation

The student will demonstrate proficiency by:

- A. Writing laboratory reports
- B. Demonstrating skill in safe handling of organic chemicals
- C. Written examination on course content
- D. Presenting research into chemical hazards
- E. Presenting solutions to problems

## Method(s) of Instruction

During periods of instruction the student will be:

- A. Engaged in the preparation, isolation and purification of organic compounds
- B. Working with partner(s) to analyze experimental data
- C. Actively participating in lecture/discussion of experimental design

## Representative Text(s) and Other Materials

Mohrig, Jerry R. Laboratory Techniques in Organic Chemistry: Supporting Inquiry-driven Experiments. New York, NY: W.H. Freeman, 2014.

Pavia, D., G. Kriz, and G. Lampman. A Microscale Approach to Organic Laboratory Techniques. Boston, MA: Cengage Learning, 2018.

## Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

- A. Preparation of notebooks with preliminary experimental analysis
- B. Research and presentation on Material Safety Data Sheets
- C. Data analysis and written interpretation of resulting conclusions

## Discipline(s)

Chemistry