

**Spring 2008**  
**Organic Chemistry I; CHE 312-01**  
**Lecture: MWF 9:30-10:20 pm in BL 312**  
**Recitation: Tuesdays 1:30-2:20 pm**  
**Lab: Thursdays 1:30-5:20 pm in BL 312 then BL 425/432**

**Instructor:** Dr. Edie J. Banner

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**Office Hours:** 10:30 – 11:30 MTWF; or by appointment; and if the door's open – stop in!

**I. Title:** Organic Chemistry I (5 cr. hrs.)

**II. Catalog Description:** Introduction to organic chemistry, including structure, properties, methods of preparation, and selected reactions of aliphatic hydrocarbons and halides. Stereochemistry and basic reaction mechanisms are also included. An introduction to the theory of modern instrumental techniques (GC, IR, NMR, GC/MS) used in the identification of organic species is also taught. An introduction to the theory and practice of organic chemical laboratory procedures and manipulations which include the preparation, separation, purification and identification of typical compounds that provides hands-on experience. Three hours of lecture one hour of recitation and four hours of lab per week.

**III. Purpose:** To introduce the student to the chemistry of aliphatic compounds, including nomenclature, physical properties, stereochemistry, reactions and methods of preparation, structure and reactivity, and reaction mechanisms.

**IV. Course Objectives:** The student will become proficient in identifying, naming, and predicting the reactions of aliphatic compounds. They will be able to interpret gas chromatographic, infrared, nuclear magnetic resonance and mass spectra as related to the compounds studied in the course. Students will become skilled in general laboratory procedures and techniques required of organic chemists.

**V. Content Outline:** Scheduled dates are tentative and listed for general guidance.

**Laboratory Portion: Thursdays 1:30 – 5:30 p.m.**

**Safety:** To comply with safety regulations all students are required to wear approved safety goggles during lab periods. Shorts and open toe shoes cannot be worn in the labs.

*Students are expected to work individually on each laboratory experiment, except where noted below. All work to be turned in, including notebooks, should be exclusively the work of the individual.*

**Dates are tentative, but the order of the schedule will be followed.**

**Date**                      **Schedule** (Note: “**Miniscale Technique**” will be used in all experiments.)

<b>Jan. 17</b>	<b>Check-in</b>	Meet in BL 312 for pre-lab instruction and then to BL425/432 Labs.
	Read:	pp 1-25 (Introduction, Recordkeeping and Safety)
	<b>Experiment 1: Melting Point Determination</b>	
	Read:	pp 113-117, Sect. 3.3 Physical Constants: Melting Points pp 38-41, Sect. 2.7 Melting Point Methods and Apparatus

Experiment: pp 118-119: Melting Points:  
Part B: Determining capillary-Tube Melting Points  
1. Pure compounds  
2. Unknown compound.

**Jan. 24**

**Experiment 2: Recrystallization**

Read: pp 93-101: Recrystallization and Melting Points.  
pp 66-69, Sect. 2.17 Filtration Apparatus and Techniques  
Turn in: Prelab exercises for Recrystallization (PL 1,2 and PL 3,4) and Melting Point Determination (PL 7,8).  
Experiment: pp 101-105: Sect. 3.2: Recrystallization:  
Part A: Solvent selection  
Part B: Recrystallization of an impure solid  
1. Benzoic Acid  
2. Unknown Compound  
Analysis: Determine the melting point of the crude and recrystallized unknown. Weigh the recrystallized material and calculate percent recovery. Confirm the identity of the recrystallized unknown by the mixed melting point technique on page 119, part 3. Mixed Melting Points.

**Jan. 31**

**Experiment 3: Simple and Fractional Distillation (work in pairs)**

Read: pp 127-128, Sect. 4.3 Simple Distillation  
pp 131-136, Sect. 4.4 Fractional Distillation  
pp 55-59, Sect. 2.13 and 2.14: Simple and Fractional Distillation  
Turn In: Prelab exercises for Simple and Fractional Distillation (PL 13,14).  
Complete: Experiment 2.  
Experiment: pp 129-131: Simple Distillation and pp 137-138: Fractional Distillation  
**Note:** For both distillations, use a mixture of 10 mL cyclohexane and 20 mL toluene and record the temperature at 1 mL intervals. Plot temperature vs. mL distilled in your notebook write-up.  
**Note:** Save samples for GC analysis (**Experiment 4**) from the fractional distillation only.  
Collect fraction A between 81-83 °C  
Collect fraction B between 84-107 °C  
Collect fraction C above 107 °C.

**Feb. 7**

**Experiment 4: Gas Chromatography (work in pairs)**

Read: pp 192-202, Sect. 6.4 Gas-Liquid Chromatography  
Turn In: Prelab exercises for Gas Chromatography part A (PL 35,36).  
Complete: Experiment 3.  
Experiment: Gas chromatographic analysis of your distillates.

**Feb. 14**

**Experiment 5: Extractions**

Read: pp 149-157: Extraction  
pp 75-78, Sect. 2.21 Extraction  
Turn In: Prelab exercises for Two Base Extractions (PL 21,22).  
Experiment: pp 158-159 Part B: Two-base extraction

**Feb. 21**

**First Hour Exam on Experiments 1-4**

## EXPERIMENTAL RESULTS and NOTEBOOK DUE FOR EXP. 1,2,3

Continue: Experiment 5

- Feb. 28**      **Experiment 6: Relative Rates of Free Radical Bromination**  
Read: pp 309-310, Alkanes and 320-322, Sect.9.3 Free Radical Bromination  
Turn in: Prelab exercises for Selective Bromination (PL 51,52).  
Experiment: pp 322-323: Relative Rates of Free Radical Bromination
- Mar. 6**      **Experiment 7: Resolution of Racemic 1-Phenylethanamine**  
Read: pp 223-226, Sect. 7.5 Polarimetry  
Turn In: Prelab exercises for Resolution-Racemic Phenylethanamine (PL 45,46).  
Experiment: pp 2226-228: Resolution of 1 Phenethanamine
- Mar. 13**      **Complete Experiment 7.**  
**EXPERIMENTAL RESULTS and NOTEBOOK DUE FOR EXP. 4,5,6**
- Mar. 20**      **Spring Break – No Lab!**
- Mar. 27**      **Experiment 8: Dehydration of Alcohols**  
Read: pp 344-348, Sect. 10.3 Dehydration of Alcohols.  
pp 81-83, Sect. 2.22 Heating Under Reflux  
Turn In: Prelab Exercises for Dehydration of Alcohols (PL 57,58).  
Experiment: pp, 349-350, Part B: Dehydration of Cyclohexanol
- Apr. 3**      **Experiment 9: Nucleophilic Aliphatic Substitution**  
Read: pp 451-457 and 463-465: Nucleophilic Aliphatic Substitution  
Turn In: Prelab exercises for Preparation of 1-Bromobutane, (PL 83,84)  
Preparation of 2-Chloro-2-methylbutane (PL 85,86).  
Complete: Experiment 8  
Experiment: pp 457-458: Preparation of 1-Bromobutane  
pp 465-466: Preparation of 2-Chloro-2-methylbutane
- Apr. 10**      **Complete Experiments 8 & 9.**
- Apr. 17**      **Experiment 10: Identification of an Unknown Alcohol**  
Read: pp 817-829 Identifying Organic Compounds  
pp 861-862 Classification Tests of Alcohols  
Experiment: Perform the appropriate tests for the identification of an unknown alcohol. **Note:** These alcohols tend to contain dissolved water and should be purified by distillation before further analysis.
  - Preliminary Examination and Physical Constants: pp 819-820.
  - Solubility tests: (in water): pp 824-825
  - Classification tests:
    - Chromic Acid Test, pp 861
    - Lucas Test, pp 862
  - Derivatives: Urethane pp 862-863 (works only if alcohol is dry!)  
3,5-Dinitrobenzoate, pp 864-865
  - Record IR spectrum

Each of the above tests should be carried out and the results reported in your notebook. You must prepare at least one solid derivative of your unknown.

**Apr. 24      Complete Experiment 10.**

**May 1      Second Hour Exam and Check Out**

**EXPERIMENTAL RESULTS and NOTEBOOK DUE FOR EXP. 7,8,9,10**

**Note: a \$25.00 fee will be charged to students who do not check out of the lab on the last day of lab.**