Virginia Western Community College
CHM 245
Organic Chemistry Laboratory I

Prerequisites
CHM 112 with a grade of C or better.

Corequisites
CHM 241

Course Description

Introduces various methods and procedures used in present day organic laboratories. Covers the general techniques, organic synthesis, and the use of common spectroscopic instrumentation; synthesizing a variety of compounds; and analyzing the products through physical properties and spectroscopy. Part I of II. Intended audience: chemistry majors as well as science, chemical engineering, and pre-professional health students.

Semester Credits: 2 **Lecture Hours: 1** **Laboratory Hours: 3**

Required Materials

Textbook:
Experimental Organic Chemistry: A Miniscale and Microscale Approach. Gilbert, et al. 5th edition. Cengage Publishing. ISBN: 9781439049143

Goal of Course

Explores the physical properties and reactivity of organic compounds including common methods of separation, purification, and instrumental analysis.

Course Outcomes

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

- Use proper procedures and regulations for safe handling and use of chemicals in the organic chemistry laboratory
- Maintain a lab notebook and demonstrate proper recording, organization, and interpretation of scientific data
- Perform physical property analyses, such as melting point and boiling point determinations, density, recrystallization, etc.
- Perform various separation techniques, such as extraction, distillation, chromatography (TLC, column chromatography, GC), sublimation, etc.
- Use and/or interpret spectra from laboratory instruments, such as a gas chromatograph, refractometer, IR, and UV-Vis spectrometer, mass spectrometer, polarimeter.
- Prepare and analyze organic compounds, with potential syntheses that could include SN1, SN2, E2, E1

reactions, green chemistry, alcohol dehydration, electrophilic addition reactions, and/or bromination.
- Students will explain the theoretical basis of all techniques and state reasons for use of specific reagents.
- Prepare formal written lab reports to hone analytical writing skills.

Topical Description

Experiment # and Reading Assignments	Experiment Name
1. Melting Point (Sect. 2.7; page 38-41) (Sec. 3.3; page 113-117) Exercises: 1, 2, 7, 10, 11, 14, 15 (page 119-121)	Determination of Capillary Tube Melting Points (page 118-119)
2. Simple and Fractional Distillation (Sect. 2.13, 2.14; page 55-59) (Sec. 4.3; page 131-133) (Sec. 4.4; page 135-141) Exercises: 1, 4, 5, 6, 7, 8, 10, 13 (page 143-144)	A. Simple Distillation Miniscale (page 133-134) Fractional Distillation of a Binary Mixture (page 141-143)
3. Steam Distillation (Sect. 2.16; page 64-65) (Sect. 4.5; page 141-143) (Sect. 4.6; page 147-149) Exercises: 1, 2, 4, 8, 9 (page 150-151)	Distillation Using an External Steam Source (Figure 2.45; page 65) Procedure: Steam Dist'n of Citral from Lemon Grass Oil (page 149-150)
4. Recrystallization (Sect. 3.2; page 94-101) Exercises: 6, 7, 8, 10, 12, 13, 15, 17, 18, 19, 21, 23, 24 (page 110-112)	A. Solvent Selection (page 101-103) B. Recrystallization of Impure Solids 1) Benzoic acid (page 103-104)
5. Extraction (Sect. 2.21; page 75-81) (Sect. 5.2, 5.3; page 154-161) Exercises: 3, 4, 5, 6, 11, 18, 19, 20 (page 167-170)	Experimental Procedure for Extraction (B) Two-Base Extraction (page 162-163)
6. Chromatography (Sect. 6.1; page 179-180) (Sect. 6.3; page 188-192) Exercises: 3, 7, 8, 11, 12, 13, 14, 17 (page 194-195)	Column Chromatography (Page 192-194)
7. Aklynes (2 week lab) (Sect. 11.3; page 410-412) (Sect. 11.4; page 416-417) Exercises: 4, 5 (page 414) Exercise: 2 (page 418)	Preparation of 3-hydroxyl-3-methyl-2-butanone (page 412-413) Formation of a Silver Acetylide and Its Decomposition (page 417)
8. Nucleophilic Aliphatic Substitution (Sect. 14.4; page 465-467) Exercises: 1, 2, 3, 4, 15 (page 470-471)	Preparation of 1-Bromobutane (page 467-468)

9. Nucleophilic Aliphatic Substitution (Sect. 14.1-14.3; page 461-465) (Sect. 14.5; page 473-475) Exercises: 1, 2, 3, 7, 13, 14 (page 477-479)	A. Preparation of 2-chloro-2-methylbutane (page 475-476)
10. Dehydrohalogenation of Alkyl Halides (Sect. 10.2; page 338-340) Exercises: 2, 4, 5, 6, 8 (page 344)	A. Elimination of Alcoholic Potassium Hydroxide (page 341-343)
11. Dehydration of Alcohols (Sect. 10.3; page 348-352) Exercises: 2, 3, 4, 5, 6, 7, 13, 16 (page 355-357)	A. Dehydration of 4-Methyl-2-Pentanol (page 352-353)
12. Bromination: Hydrogen Abstraction Selectivity (Sect. 9.3; page 324-326) Exercises: 1, 2, 3, 4, 8, 9, 13 (page 328-329)	Relative Rates of Free-Radical Chain Bromination (page 326-328)
13. Organometallic Chemistry (Sect. 19.1-19.2; page 639-643) (Sect. 19.3-19.4; page 649-652) Exercises 24, 25, 27, 29 (Page 662)	A. Preparation of Grignard Reagent (page 643-645) (use n-butyl bromide) D. Preparation of 2-methyl-3-heptanol (page 658-660)

Notes to Instructors

1. Approved safety goggles are required to be worn in the laboratory. The laboratory working area also includes the weighing room and the sinks. ***NO GOGGLES—NO LAB***.

2. Each lab report is grade on a scale from 0 – 100. Pre-lab questions are worth approximate 10 percent and post-lab questions, if any, are worth approximately 15 percent of each lab grade. Lab reports are due one week from the date of completion. These reports must be typed on 8 ½ x 11 letter-size paper. The format for writing lab reports will be explained in the class before each lab. Five points will be taken off per school day for each late lab report.

3. The final grade for CHM 245 will be based on the following:

Lab Reports	=	75%
Final Exam	=	25%

Grading Scale		
100% - 90%	=	A
89.9% - 80%	=	B
79.9% - 70%	=	C
69.9% - 60%	=	D
Less than 60%	=	F