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. Lecture 1 hour. Lab 3 hours. Total 4 hours per week.

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

Required Materials

Textbook:
Experimental Organic Chemistry: A Miniscale and Microscale Approach. Gilbert, et al. 6th edition. Cengage Publishing. ISBN: 9781305080461

Goal of Course

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

Course Outcomes
Upon completing the course, the student will be able to:

Safety in the Organic Laboratory
- Use proper procedures and regulations for safe handling and use of chemicals in the organic chemistry laboratory

Lab notebook
- Maintain a lab notebook and demonstrate proper recording, organization, and interpretation of scientific data

Laboratory techniques
- 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.

Synthesis/Characterization

- 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.

Theoretical understanding

- Explain the theoretical basis of all techniques and state reasons for use of specific reagents.

Major Topics to be Included

Safety in the Organic Laboratory
Lab notebook
Laboratory techniques
Synthesis/Characterization
Theoretical understanding

Topical Description

Experiment # and Reading Assignments	Experiment Name
1. Melting point (Sect. 2.7; pp. 36-39) (Sect. 3.3; pp. 111-115) Exercises:1,2,7,10,11,14,15 (pp.120-122)	Determination of Capillary Tube Melting Points; pp. 116-117
2. Simple and Fractional Distillation (Sect. 2.13, 2.14; pp. 53-57) (Sect. 4.3; pp. 129-131) (Sect. 4.4; pp. 133-139) Exercises:1,4,5,6,7,8,10,13 (pp.141-142)	A. Simple Distillation Miniscale; pp. 131-132 B. Fractional Distillation of a Binary Mixture; pp. 139-141
3. Steam Distillation (Sect. 2.16; pp. 62-63) (Sect. 4.6; 145-147) Exercises:1,2,4,8,9 (pp.148-149)	Distillation Using An External Steam Source; Fig. 2.45, p. 63 Procedure: Steam Distillation of Citral from Lemon Grass Oil; pp. 147-148
4. Recrystallization (Sect. 3.2; pp. 92-99) Exercises:6,7,8,10,12,13,15,17,18,19,21,23,24 (pp.108-110)	A. Solvent Selection; pp. 99-101 B. Recrystallization of Impure Solids: 1) Benzoic acid; pp. 101-102
5. Extraction (Sect. 2.21; pp. 73-79) (Sect. 5.2, 5.3; pp. 156-163) Exercises:3,4,5,6,11,18,19,20 (pp. 169-172)	Experimental Procedure for Extraction: B) Two-Base Extraction; pp. 164-165
6. Chromatography (Sect. 6.1; pp. 179-180) (Sect. 6.3; pp. 189-192) Exercises:3,7,8,11,12,13,14,17 (pp. 195-196)	Column Chromatography; pp. 193-194
7. TWO WEEK LAB-Read Spectroscopy section and the alkynes information. Introduction to Spectroscopy; Infrared Spectroscopy (Chapter 8; pp. 235-257) **Reading assignment only; no lab report due** Alkynes (2-week lab) (Sect. 11.3; pp. 410-412) (Sect. 11.4; p. 417) (Sect. 2.22; pp. 79-81) Exercises:4,5 (p. 414) 2 (p. 418)	Preparation of 3-hydroxy-3-methyl-2-butanone; pp. 412-414 Formation of a Silver Acetylide and Its Decomposition; pp. 417-418

8. Nucleophilic Aliphatic Substitution (Sect. 14.1-14.4; pp. 459-465) Exercises:1,2,3,4,15 (pp. 468-469)	Preparation of 1-bromobutane; pp. 465-466
9. Nucleophilic Aliphatic Substitution (Sect. 14.1-14.3; pp. 459-463) (Sect. 14.5; pp. 471-473) Exercises:1,2,3,7,13,14 (pp. 475-477)	Preparation of 2-chloro-2-methylbutane; pp. 473-474
10. Dehydrohalogenation of Alkyl Halides (Sect. 10.2; pp. 332-334) Exercises:2,4,5,6,8 (p. 338)	Elimination with Alcoholic Potassium Hydroxide; pp. 335-336
11. Dehydration of Alcohols (Sect. 10.3; pp. 342-346) Exercises:2,3,4,5,9,10,14, (pp. 349-350)	Dehydration of 4-methyl-2-pentanol; pp. 346-347
12. Bromination: Selectivity of Hydrogen Atom Abstraction (Sect. 9.1; pp. 309-312) (Sect. 9.3; pp. 320-322) Exercises:1,2,3,4,8,9,13 (pp.324-325)	Relative Rates of Free Radical Chain Bromination; pp. 322-324
13. Organometallic Chemistry (Sect. 19.1-19.2; pp. 715-719) (Sect. 19.3-19.4; pp. 725-728) Exercises:24,25,27,29 (p.738)	A. Preparation of Grignard Reagent; pp. 719-721; using 1-bromobutane B. Preparation of 2-methyl-3-heptanol; pp. 734-736

Notes to Instructors

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

2. Each lab report is graded on a scale from 0 – 100. Pre-lab questions are worth approximately 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

ADA Statement (PDF)
Title IX Statement (PDF)