

# Organic Chemistry I Laboratory

The University of Toledo  
Department of Chemistry and Biochemistry  
College of Natural Sciences and Mathematics  
CHEM 2460-050

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<b>Instructor:</b>	Dr. Zin-Min Tun	<b>Term:</b>	Spring 2021
<b>Email:</b>	zinmin.tun@utoledo.edu	<b>Lab Location/Times:</b>	Blackboard/Online
<b>Office Hours:</b>	Virtual through Blackboard Collaborate Ultra by appointment	<b>Course Website:</b>	<a href="http://dl.utoledo.edu">http://dl.utoledo.edu</a>
		<b>Credit Hours:</b>	1

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## COURSE OVERVIEW

Welcome to Organic Chemistry! The purpose of this laboratory course is to introduce students to the techniques that organic chemists (as well as biochemists, physical chemists, etc.) use in their daily routines. After learning and understanding those techniques, students will apply their knowledge to new situations to understand synthesis reactions, molecular structure determination, and analysis of (un)known compounds.

Organic chemistry laboratory is important for several reasons. It introduces students to many different laboratory practices and concepts that will be used in subsequent chemistry laboratory classes (CHEM 2460 and beyond) and in other laboratory situations in biology, pharmacy, and chemical engineering (just to name a few!). It is anticipated that by the completion of this course, students will be familiar with all of the following topics and techniques:

- Safety in the laboratory
- Interpreting and following scientific directions
- Keeping a proper lab notebook
- Names and proper usage of lab instruments
- Understanding of general properties of compounds (including solubility, miscibility, acid/base chemistry, etc.)
- Proper usage of glassware
- Isolation and purification techniques [including filtration, solvent removal, drying solutions, distillations, chromatography (thin-layer, column, and gas) and crystallization/recrystallization]
- Characterization techniques including spectroscopy and melting point determination
- Interpretation of scientific results including percent yield and recovery, melting point, boiling point, IR and NMR spectra, and  $R_f$  values

## COURSE OBJECTIVES & LEARNING OUTCOMES

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

1. Demonstrate their knowledge of departmental safety rules through their laboratory practice, including the ability to dispose of waste properly.
2. Apply basic stoichiometric algorithms (calculating limiting reagents, theoretical yield, mole ratios) in the context of organic chemistry.
3. Demonstrate a command of the rules for assigning significant figures in their work, specifically in calculations and laboratory measurements and calculations.
4. Understand and be able to use the basic operations of an organic chemistry laboratory including gravity and vacuum filtration, liquid-liquid extraction, simple and fractional

distillation, reflux, recrystallization, thin-layer chromatography, gas chromatography, column chromatography, drying of solids and solutions, and the theories behind these techniques.

5. Know the significance of  $pK_a$  values in experimental steps.
6. Identify and assess the purity of organic compounds using analytical techniques, including melting point, thin-layer chromatography, IR, and gas chromatography.
7. Deduce organic structures using spectroscopic methods, including infrared (IR),  $^1\text{H}$ - and  $^{13}\text{C}$ -nuclear magnetic resonance spectroscopy, and mass spectrometry
8. Determine molecular formulas from a mass spectrum by using the Rule of 13 and other techniques
9. Deduce hydrogen deficiency from a molecular formula and use this information to help deduce a structure
10. Be able to follow a detailed experimental procedure and construct a flow diagram to illustrate it.
11. Depict and explain detailed chemical mechanisms for all laboratory reactions (and their related reactions)
12. Demonstrate the ability to properly maintain a laboratory notebook
13. Construct a lab report that includes an analysis of the data collected, and discussion of the outcomes and answers to open questions associated with the experiment.

## TEACHING STRATEGIES

This is an asynchronous class with no required weekly meetings. This course is designed to stimulate student learning through the delivery of readings, videos of laboratory techniques, and virtual labs.

## PREREQUISITES AND COREQUISITES

Students must have completed the General Chemistry sequence before enrolling in this course (CHEM 1230/1240, 1280/1290) with a grade of D- or better. Students also are required to be concurrently enrolled in (or have successfully passed) Organic Chemistry I lecture (CHEM 2410). Please note that *withdrawal from CHEM 2410 during the semester will necessitate withdrawal from CHEM 2460.*

## REQUIRED TEXTS AND MATERIALS

The following materials are **required** for this course:

- **CHEM 2460: Organic Chemistry Lab I** by D. L. Pavia, UT Custom Edition, published by Cengage  
**ISBN:** 978-1-337-92830-4

## GENERAL TECHNOLOGY REQUIREMENTS

Browser Check Page: Students need to have access to a properly functioning computer throughout the semester. The Browser Check Page (<http://www.utoledo.edu/dl/helpdesk/browser-check.html>) will enable you to perform a systems check on your browser, and to ensure that your browser settings are compatible with Blackboard (<https://blackboard.utdl.edu/webapps/login/>), the learning management system that hosts this course.

Software: Student computers need to be capable of running the latest versions of plug-ins, recent software and have the necessary tools to be kept free of viruses and spyware. The computer needs to run the following software, available in the UT Online Download Center (<https://www.utoledo.edu/dl/main/downloads.html>). • Word Processing Software • Adobe Acrobat Reader • Java Plugin Console • Adobe Flash Player • Adobe Shockwave Player • Google Chrome Browser – Recommended

Internet Service: High-speed Internet access is recommended, as dial-up may be slow and limited in downloading information and completing online tests. This course does contain streaming audio and video content.

Use of Public Computers: If using a public library or other public access computer, please check to ensure that you will have access for the length of time required to complete tasks and tests. A list and schedule for on-campus computer labs is available on the Open Lab for Students webpage.

UT Virtual Labs: Traditionally, on-campus labs have offered students the use of computer hardware and software they might not otherwise have access to. With UT's Virtual Lab, students can now access virtual machines loaded with all of the software they need to be successful using nothing more than a broadband Internet connection and a web browser. The virtual lab is open 24/7 and 365 days a year at VLAB: The University of Toledo's Virtual Labs.

Learner Technical Support can be found here <http://www.utoledo.edu/dl/students/learnersupport.html>

## **TECHNOLOGY REQUIREMENTS FOR EXAMS**

### **LockDown Browser + Webcam Requirement**

This course requires the use of LockDown Browser and a webcam for online exams. The webcam can be the type that's built into your computer or one that plugs in with a USB cable.

Watch this brief video to get a basic understanding of LockDown Browser and the webcam feature.

<https://www.respondus.com/products/lockdown-browser/student-movie.shtml>

### **Download Instructions**

Download and install LockDown Browser from this link:

<https://download.respondus.com/lockdown/download.php?id=213815819>

If you have any issues with the Webcam requirement, please contact Dr. Tun asap to arrange for alternate proctoring arrangements for the exams.

## **ACADEMIC POLICIES**

All students at the University of Toledo are expected to read, understand, and follow the academic policies that govern their attendance at the University. These policies include, but are not limited to, academic dishonesty, academic forgiveness, adding and dropping a course, grades and grading, and the missed class policy. Please use the following URL to read a comprehensive list of academic policies that pertain to you in this class and throughout your academic journey:

<http://www.utoledo.edu/policies/academic/undergraduate/>. If you have any questions after reading through the policies, please let me know.

## **COURSE POLICIES**

**Subject to Change:** Any changes to the Syllabus will be announced through Blackboard or your rockets email

### **Student Responsibilities:**

1. Read the laboratory assignment and techniques, and watch related video prior to each laboratory assignment
2. Turn in all work as assigned

**Academic Dishonesty:** The academic honesty policies, as stated in the 2016-2017 UT Catalogue will be STRICTLY ENFORCED. Any student found violating the UT academic honesty policies – including (but not limited to) copying from someone else’s lab report or worksheet, committing plagiarism, or cheating on quizzes or final exam, will be penalized in accordance with these policies.

**Communication:** You are urged to communicate with me about any aspect of the course with concerns you or which might limit your success. Please allow for 24-48 hours, not including weekends or holidays, for a reply from Dr. Tun or your TA. Please also make sure that you include your course number and section number (e.g. CHEM2460-001) either in the subject line or in the body of the email to facilitate the communication. We want you to be successful in this course so let’s work together!

**Drop, Withdrawal, and Incomplete Grades:** Course drop and withdrawal procedures have been set by the University faculty. Pay attention to those add/drop dates as they pass very quickly during the semester! For both dropping the course or withdrawing you should go to Rocket Solution Central in Rocket Hall. You do not need your instructor’s permission for either process. Please note that course registration changes might change your financial aid. A course grade of *incomplete* is given only to those who have completed all but a small percentage of course requirements for an acceptable reason. Remember that if you drop CHEM 2410, you must drop CHEM 2460.

## GRADING POLICIES

The grade for this course is based upon the following components:

Safety Quiz	10 points
Safety Discussion	5 points
Lab Reports (5 @ 50 pts each)	250 points
Virtual Lab Report (1 @ 50 points each)	50 points
Worksheets (7 @ 20 points each)	140 points
Quizzes (2 @ 20 points each)	40 points
Final Examination	<u>100 points</u>
Total Points	595 points

The grading scale for this class is:

A	=	100 – 92%	A-	=	91 - 89%	B+	=	88 -86%
B	=	85 – 81%	B-	=	80 - 78%	C+	=	77 - 75%
C	=	74 - 70%	C-	=	69 - 67%	D+	=	65 - 63%
D	=	62 - 58%	D-	=	57 - 55%	F	=	54 - 0%

In order to complete this course with a grade of C+ or higher, you will need to:

- Achieve a score of 50% or higher on the comprehensive lab final examination.
- Achieve at least 75% of the total points for the course.

Please note that *extra credit will NOT* be given in this class. In order to compensate for differences in grading among TAs, different grading scales or grading adjustments may be used in order to ensure that fair grade assignments are made for each lab section.

**Re-grading:** If you have any questions or concerns about your grade or want to contest a grade for a certain assignment, you need to present the assignment directly to the laboratory coordinator, Dr. Tun, and she will re-grade the assignment – not your TA. There is only a one-week window (one week after your assignment was graded by the TA) in which you can contest the grading of an assignment, lab report, or quiz, so please check your graded assignments as soon as the assignment grades are posted in the grace center by your TA.

**Lab Report:** The lab report consists of the information you will be normally including in your lab notebook. The report can be typed up or you can simply scan in your lab notebook pages. The purpose of the lab reports following the lab notebook format is to teach you good notebook keeping skills. A handout entailing what is expected in the laboratory notebook will be available on Blackboard. Lab reports' due dates are listed in the course schedule. Late assignments will receive a 5 point grade deduction for each day late. Any assignment 1 week late or later will receive a zero (0) grade.

**Worksheets:** Spectroscopy worksheet can be found on Blackboard. Worksheets' due dates are listed in the course schedule. Late assignments will receive a 2 point grade deduction for each day late. Any assignment 1 week late or later will receive a zero (0) grade.

**Quizzes and Final Examination:** There will be two quizzes and one final examination, and the dates are as follows:

<b>Quiz 1</b>	March 3 <sup>rd</sup> (Wednesday)
<b>Quiz 2</b>	April 7 <sup>th</sup> (Wednesday)
<b>Final Examination</b>	April 28 <sup>th</sup> (Wednesday)

Quizzes and the final exam are timed and they will be available from 6:00 am to 11:59 pm on the scheduled date, and you can take it at a time that works best for you during that window. **You are required to use of LockDown Browser and a webcam to take the quizzes and the final exam.** **Questions will be displayed one at a time, and back-tracking will not be allowed.**

Quizzes and the final exam will consist primarily of multiple choice, true/false, matching, or fill in the blank questions. Safety procedures, techniques, historical background and overall concepts of experiments, mechanisms, yield calculations, and any spectral methods are potential quiz and final exam material. The final examination will be *cumulative*. In order to complete this course with a grade of C+ or higher, you will need to achieve a score of 50% or higher on the comprehensive lab final examination.

### **Midterm Grading**

Midterm grades are assigned the 8<sup>th</sup> week of class and are used to assist students with determining their academic standing. Attendance is also recorded during the 8<sup>th</sup> week to meet state and federal laws regarding financial aid disbursement. Please note, if you are not attending class it could affect your financial aid (scholarships, grants, loans or Federal Work Study). If you decide you are not going to attend this class (or any other class you have registered for), you must formally withdraw(drop) from the course. You can do this by logging on to the myUT portal, clicking on the "Student" tab, and then under "My Toolkit" click on Register/Drop/Withdraw.

### **Final Grading**

Your final grades will be calculated based on a total of 595 points.

### **UNIVERSITY POLICIES**

Your safety and well-being as a University of Toledo student is important to the faculty, staff, and administration; as such please take a minute to review the following university policies that apply to you as a student of the University:

- <https://www.utoledo.edu/title-ix/policies.html>
- The University of Toledo's Title IX (Sexual Misconduct) Policy - 3364-50-01

- Nondiscrimination 3364-50-02
- Nondiscrimination on the basis of disability - Americans with Disability Act compliance 3354-50- 03
- Consensual romantic and/or sexual relationships - Policy 3364-25-65
- Student Code of Conduct 3364-30-04

Please use this URL to view a more comprehensive list of student policies:

<https://www.utoledo.edu/policies/audience.html/#students>

**Academic Accommodations** The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the [Student Disability Services Office](http://www.utoledo.edu/offices/student-disability-services/) (<http://www.utoledo.edu/offices/student-disability-services/>) by phone: 419.530.4981 or email at [StudentDisability@utoledo.edu](mailto:StudentDisability@utoledo.edu).

#### **ACADEMIC AND SUPPORT SERVICES**

Please follow this link to view a comprehensive list of [Student Academic and Support Services](http://www.utoledo.edu/studentaffairs/departments.html) (<http://www.utoledo.edu/studentaffairs/departments.html>) available to you as a student

#### **SAFETY AND HEALTH SERVICES FOR UT STUDENTS**

Please use the following link to view a comprehensive list [Campus Health and Safety Services](#) available to you as a student.

#### **STUDENT SUPPORT SERVICES**

**Course scheduling assistance:** Chemistry Department Secretary, Ms. Samples, is in Room BO 2022, telephone 419-530-2698. She takes care of all scheduling changes.

**Chemistry Help Center, Virtual/Online**, is where the teaching assistants hold their office hours so it is a great place to receive assistance. The spring semester virtual help center link is <https://us.bbcollab.com/guest/80670d8c3ff9469dbb520091a0612503>. The Help Center hours are MW 9-12, 1-4, 5-8; TR 9-8 and F 9-4, from January 25 until the end of classes. No appointment is necessary.

**Tutoring support. Virtual/Online** for all UT students is available through the **Learning Enhancement Center** located in the Carlson Library.

#### **INCLUSIVE CLASSROOM STATEMENT**

In this class, we will work together to develop a learning community that is inclusive and respectful. Our diversity may be reflected by differences in race, culture, age, religion, sexual orientation, gender identity/expression, socioeconomic background, and a myriad of other social identities and life experiences. We will encourage and appreciate expressions of different ideas, opinions, and beliefs so that conversations and interactions that could potentially be divisive turn, instead, into opportunities for intellectual and personal development.

#### **OTHER SPECIAL NOTES**

It is important to note that, based on the unpredictability of the COVID-19 virus, things can change at any time so please be patient and understanding as we move through the semester.

# CHEM 2460:050 – Organic Chemistry Laboratory I

## Lab Schedule

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Please note that this schedule is tentative, and the lab coordinator may adjust it as needed.

<u>Week</u>	<u>Activities</u>	<u>Techniques</u> <u>(Assigned Reading)</u>	<u>Assignment</u> <u>Due Date</u>
1	Safety Quiz and Discussion (Blackboard)	1	1/26
2	UV-Vis Worksheet (Blackboard)		2/2
3	Exp. 1A: "Intro. To Microscale Lab" & Exp. 2A-D: "Solubility" (Pages: 1-21)	3, 4, 5 10	2/9
4	GC worksheet (Blackboard)	22	2/16
5	Exp. 3A, 3C, 3D: "Crystallization" (Pages: 22-33)	6, 8, 9, 11	2/23
6	Functional Groups worksheet (Blackboard)		3/2
7	<b>Quiz 1 (Available from 6:00 AM to 11:59 PM)</b> Essay: "Identification of Drugs" and Exp. 12: "TLC Analysis of Analgesic Drugs" (Pages: 57-64)	19, 20	3/9
8	IR worksheet (Blackboard)	25	3/16
9	Proton NMR worksheet (Blackboard)	26	3/23
10	Exp. 4A, 4C, 4D: "Extraction" (Pages: 34-43)	12	3/30
11	C-13 NMR worksheet (Blackboard)	27	4/6
12	<b>Quiz 2 (Available from 6:00 AM to 11:59 PM)</b> Exp. 8B: "Simple and Fractional Distillation" (Pages: 48-55)	7, 14, 15	4/13
13	Mass Spectrometry Worksheet (Blackboard)	28	4/20
14	S <sub>N</sub> 2 Reactions of Alkyl Halides (Virtual Lab on Blackboard)		4/27
15	<b>FINAL EXAMINATION (Available from 6:00 AM to 11:59 PM)</b>		