CHEM2500 Organic Chemistry I Laboratory

The University of Toledo
Department of Chemistry & Biochemistry
College of Natural Sciences
CRN: 11161 (Sect. 1) and 15894 (Sect. 2)

Instructor: Dr. Emily Dzurka
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Office Hours: In-Person: Tuesday 10 – 11 am, Wednesday 10 am – 12pm
Virtual: Monday 3 – 4 pm, Wednesday, 9 – 10 am, or by appointment
Office Location: WO 2268B
Office Phone: (419) 530-4934
Term: Spring 2022
Class Location: Memorial Field House 1100
Class Day/Time: Thursday: 11:30 am - 12:25 pm
Lab Location: Bowman Oddy Laboratories 3097
Lab Day/Time: TR 1:00 – 3:50 pm
Credit Hours: 2

CATALOG/COURSE DESCRIPTION

Practice of organic laboratory techniques. Three hours of laboratory per lab session, twice a week. Approved chemical safety goggles meeting the American National Standard Z87.1-1968 must be worn by every student during every laboratory class meeting.

REQUIRED COURSE ACCESS

We will predominately work through Blackboard. Blackboard is a course management system provided by the University of Toledo and can be accessed at https://blackboard.utdl.edu/ . Your access code is your UTAD username and password. You should consult the site regularly for news and announcements. Handouts, lecture notes, and lab experiments will be posted. The system also permits you to check your grades at any time and to email your instructor or other students in the class.

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 2500 and beyond) and in other laboratory situations in biology, pharmacy, and chemical engineering (just to name a few!).

STUDENT LEARNING OUTCOMES

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

- *Demonstrate their knowledge of departmental safety rules through their laboratory practice, including the ability to dispose of waste properly.*
- *Apply basic stoichiometric algorithms (calculating limiting reagents, theoretical yield, mole ratios) in the context of organic chemistry.*
- *Demonstrate a command of the rules for assigning significant figures in their work, specifically in calculations and laboratory measurements and calculations.*
- *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.*
- *Know the significance of pK_a values in experimental steps.*
- *Identify and assess the purity of organic compounds using analytical techniques, including melting point, thin-layer chromatography, IR, and gas chromatography.*
- *Deduce organic structures using spectroscopic methods, including infrared (IR), ^{1}H-and ^{13}C-nuclear magnetic resonance spectroscopy, and mass spectrometry*
- *Determine molecular formulas from a mass spectrum by using the Rule of 13 and other techniques*
- *Deduce hydrogen deficiency from a molecular formula and use this information to help deduce a structure*
- *Be able to follow a detailed experimental procedure and construct a flow diagram to illustrate it.*
- *Depict and explain detailed chemical mechanisms for all laboratory reactions (and their related reactions)*
- *Demonstrate the ability to maintain a properly laboratory notebook*
- *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.*

PREREQUISITES AND COREQUISITES

This course is for students who have the equivalent of CHEM 2420 and CHEM 2470 with a minimum of D- in both.

REQUIRED INSTRUCTIONAL MATERIALS (TEXTS AND ANCILLARY MATERIALS)

- A laboratory notebook to write down observations, etc. This does not have to be a carbonless notebook; a normal notebook will work.
- Approved safety goggles (can be purchased from the UT bookstore or from the UT-ACS group)
- *There is no required textbook for this class!* All materials will be provided

COMMUNICATION

You are urged to communicate with Emily Dzurka or the Teaching Assistant about any aspect of the course which concerns you or which might limit your success. We want you to be successful in this course, so let's work together!

STUDENT RESPONSIBILITIES

1. Be on time and be prepared. ***If you are more than 20 minutes late for a laboratory session, you will not be permitted to attend that session.***
2. Read the laboratory assignment and appropriate lecture material prior to each laboratory session. It is required that a laboratory notebook be kept to record pre-lab, notes and observations, experimental results and discussions.
3. Follow lab safety rules and COVID-19 specific rules.
4. Turn in all work as assigned.
    - Pre-labs are due at the start of your lab experiment. Have this ready to hand into your TA each week. ***You will not be allowed to perform the experiment without completing the pre-lab for it.***
    - Lab reports and worksheets are due at the start of your lab period on the week they are due. Due dates are listed in the course schedule.
5. ***Clean up***: Be certain that your area of the laboratory table is properly cleaned after use. Wash and return all glassware and other instruments and equipment to their proper areas. Check the sink to be sure that it is clear of all glassware and trash.

Safety Requirements: There will be another document that will go over specific safety policies and procedures, but here are the basic rules of the lab:

1. Eating, drinking, and smoking are NOT PERMITTED in the laboratory.
2. Non-registered persons are not permitted in the laboratory.
3. Appropriate laboratory apparel including footwear is required (i.e.: jeans, cotton shirts, no loose clothing, etc.). Students who are wearing clothing inappropriate for lab will be asked to leave the lab. The students may be allowed to come back in the lab (a) if they changed into clothing appropriate for lab and (b) if they are back no later than 20 minutes from the beginning of the lab period.
4. Safety goggles MUST BE WORN BY EVERYONE while experiments are being conducted. Your TA will determine and announce when goggles may be removed. The appropriate eyewear must be splash goggles, which are available for purchase from the UT bookstore.
5. Masks must be worn at ALL TIMES and must cover both your nose and mouth.

Students should consult the safety handout concerning additional rules and guidelines for laboratory work. ANY violation of the safety rules/guidelines will result in a loss of technique points. **If a student repeatedly violates these safety rules the laboratory coordinator has the right to remove the student from the laboratory room.**

COURSE EXPECTATIONS

You are expected to come to both the lectures and labs on time. Failure to attend the prelab lecture will lead to your being excluded from the lab that the prelab lecture was detailing. You are expected to come to each lab, and there will be pre-lab assignments which must be complete before you will be allowed to participate in the lab.

COURSE STRUCTURE

Lecture

- Lecture sessions are designed to clarify the concepts covered in the lab, as well as give an overview of techniques that will be used in the lab.
- Attendance is expected: The labs are only 3 hours in duration, so these lectures will be where you learn everything that you'll need.
- Lab exercises will be available on Blackboard for each week.
- Please be considerate of your fellow students during the lecture period. Disruptions of any kind will not be tolerated and may result in expulsion from the classroom.

Laboratory, Prelabs, & Postlabs

- Labs will be principally conducted by your TA, with assistance from myself (Emily Dzurka), as well a Dr. Yong-Wah Kim.
- You will be required to have appropriate clothing, including safety goggles and masks before being allowed to enter the lab.
- You will be expected to adhere to all of the lab safety rules.
- Have your pre-lab ready to turn into your TA when you come to lab. Your TA will not allow you to enter if this is not turned in on time. All prelabs will be submitted as a paper copy.
- All post-labs are due at the beginning laboratory section on the due date listed in the course schedule below. All postlabs will be submitted as a paper copy.

Unknown Lab

Details about this lab will be posted to Blackboard with the experiment information.

Worksheets

There will be 2 worksheets this semester and will be found on Blackboard under the "Worksheets" tab. All the worksheets are due at the appointed time at the beginning of lab, and will be handed in as a paper copy. The due dates are in the course schedule below.

Technique & Cleanliness

Technique points are determined by the TA and laboratory coordinator. These are earned during each lab period. Components of the technique score include laboratory safety, attitude, demonstration of competent lab techniques, ability to perform routine tasks in a timely manner, and neatness of lab drawer, work area, shared equipment, and chemicals. If the lab is found to be messy at the end of the lab period, either by the laboratory coordinator, TA, or the chemistry stockroom, the entire class will lose cleanliness points.

OVERVIEW OF COURSE GRADE ASSIGNMENT

Course Points:

The following is the distribution of possible points in the course:

Safety Video/Signed "Policies and Procedures" Form	10 pts
Lab Reports (7 @ 50 pts each)	350 pts
Library Training and Worksheet	35 pts
NMR Training Worksheet	25 pts
Lab Technique & Cleanliness (Starts at 100 pts, deducted as necessary)	100 pts
Unknown Identification Report	200 pts
Unknown Presentation	100 pts
Total:	**820 pts**

Grade Scale: These are the minimum percentages (points) needed to receive the indicated grade:

A	90%	A–	87%	B+	84%	B	81%
B–	78%	C+	75%	C	72%	C–	69%
D+	66%	D	63%	D–	60%		

Midterm Grading

Midterm grading serves as a point in the term where the instructor of record may provide a midterm grade assessment and may identify any student who has never attended, has stopped attending, or who is not actively participating in the course. In addition, students may use midterm grades to help make a decision in regards to withdrawing from the course.

LATE WORK POLICY

Any documents that are **not** handed in to your TA on the due date will count as late.

Lab Reports: 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: Worksheets can be found on Blackboard. Late assignments will receive a 3-point grade deduction for each day late. Any assignment over 1 week late will receive a zero (0) grade.

FORMAT FOR LABORATORY NOTEBOOK REPORTS

Keeping an accurate laboratory notebook is essential to your success in this class. Some guidelines are given below:

- Use permanent blue or black ink only (ballpoint pen, NO red ink!).
- Other textbooks, lab manuals, loose sheets of paper, iPads or cellphones are not allowed in the laboratory. The complete outline of procedures must be written in your laboratory notebook prior to performing the experiment.
- **Copies** of your lab notebook pages are required for grading. The assigned notebooks are designed so that the carbon copies can be removed and handed in to your TA.
- Your TA may periodically inspect your notebook.

YOUR LAB REPORT CONSISTS OF THREE (3) PARTS

Part I - Prelab Report. A copy of your lab notebook pages containing the lab write-up and answers to any prelab questions. This is due at the ***start*** of each experiment.

Part II - Results. A copy of your notebook pages containing observations notes during the lab experiment. This is due with **Part III**. Due dates are listed in the schedule.

Part III - Postlab Report. A summary of results and answers to postlab questions. This can be written on separate loose-leaf paper. This is due with **Part II**, and due dates are listed in the schedule.

I. PRELAB REPORT (30% of the report grade)

The initial part of your lab report must be written in your laboratory notebook. A copy of the original pages of this report will be collected prior to the experiment and will be returned to you after the whole lab is graded. It will consist of:

- Objectives. This should include hypotheses about the outcome of the lab, which you will test by experiment. ***It is your responsibility to propose what you expect to determine from each experiment.***
- Prelab question/answers. These will always require an analysis of the hazards and risks associated with the experiment. It will also include the list of chemicals: masses or volumes, structures, and amounts. Look up molecular masses and calculate the material amount in moles (if appropriate), boiling/melting points (bp/mp, if appropriate) and density (if appropriate). Your prelab will suggest what is needed in the *Reagent Table*.
- List of equipment (sketch complex apparatus).
- Outline of procedure. This must be sufficiently detailed to allow you to perform the experiment. Make sure you note any necessary safety precautions.

The pages of this report must be handed in BEFORE you begin the experiment.

II. RESULTS (10% of the report grade)

This section should be started on a fresh page of your notebook, after the prelab report. A combined copy of the Results/Postlab report will be stapled and turned in to your TA after the experiment is complete.

This section should be completed ***during*** the lab session and consists of:

- Results: Date, times, measured masses and volumes used in the experiment (if you use different amounts from the procedure, note this), measured mp/bp of your products and any other observations (color changes, etc) recorded during the lab session.
- Characterization materials: include copies of spectra, etc., recorded during the lab session.

III. POSTLAB REPORT (60% of the report grade)

This section does not need to be written in your lab notebook - it can be written on separate loose leaf sheets and stapled to your results copy pages. It is to be completed **after** the lab period at home, and consists of:

- Analysis of results: In 5-10 sentences, comment on the outcome of your experiment, notably the quality of your results. Describe problems that may have occurred and possible solutions. If there was any deviation from what you expected, explain how and why did the outcome differ from that predicted in your prelab report? What was learned from the experiment?
- Answers to postlab questions, including labelling of spectral characterization.

POLICY ON REGRADING

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, Emily Dzurka, and she will re-grade the assignment – not your TA. There is only a one-week window (after you have received your graded assignment back) 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.

LAB ATTENDANCE POLICY

Attendance is mandatory unless you have a valid excuse. You are expected to be on time and ready for lab at the beginning of each lab period. You will not be allowed into the lab if you are substantially late (20 minutes or more), or if your pre-lab is incomplete. During the first 20 minutes, your TA will cover the basic information necessary to complete that day's experiment, safety issues, precautions, and locations of chemicals and other materials. After the experiment has begun, for safety purposes, your TA needs to be working with all students, not covering the information for those students who are late. Therefore, if you are more than 20 minutes late, you will not be permitted to attend the laboratory and it will be counted as an unexcused absence.

EXCUSED ABSENCE POLICY

Excused absences will be given only to students who miss a lab under the conditions listed below. A student will be excused from **no more than two absences** during the semester. Students who will not be able to attend lab at the scheduled time due to an irresolvable conflict with a major responsibility must provide some written documentation to verify the conflict. This situation may occur for students on official university business, including athletes. Approval must be obtained before the scheduled lab period. Students who do not attend lab due to illness, car accident, and death in the family or similar extreme circumstance should inform their instructor of their difficulties **within 7 days** of the missed lab period. These difficulties must also be documented by a physician's note, an accident report, pastor's note, etc. Contact information for the police department, pastor, etc. must be included on the note or report.

You must submit to the lab coordinator the supporting document within **7 days** of missing a lab experiment by emailing me at Emily.dzurka@utoledo.edu. Excused Absence requests received after 7 days and those with no supporting documentation will not be approved. If an excuse is deemed as acceptable by the lab coordinator, your final course grade will be computed accordingly.

In all other circumstances, a missed lab experiment will result in a grade of 0. You will not be excused from lab for personal reasons. Examples of missing a lab due to personal issues include, but are not limited to: oversleeping, transportation problems, vacation plans, work schedule conflicts, fire alarms in adjacent buildings, etc. If you know in advance that you will miss a lab session, and if you let laboratory coordinator

know well in advance of the absence, every effort will be made to find an alternative lab section for you to attend. Your postlab report will **not** be graded if you do not attend the experiment the week it is scheduled.

IMPORTANT COVID-19 SPECIFIC RULES

Due to the current additional requirements implemented to prevent the spread of COVID-19, the following summary outlines some important changes to this semester's lab course.

- There will be **no loaner goggles** supplied by the Chemistry Stockroom. You must own your own goggles. You must arrive appropriately dressed (no exposed skin except for arms shoulders down, closed toe shoes that will not be penetrated by a simple spill) and with approved goggles.
- We recommend that you bring **a spare mask** to lab in case yours gets exposed to chemicals by accidental touching etc.
- If you show any kinds of symptoms – do not attend lab and reach out to Emily Dzurka immediately. Virtual materials can be made available, and you will be able to finish work that you would otherwise miss due to the quarantine.
- 50% of the labs must be done in-person, otherwise an incomplete with be issued and the labs must be made up in a future semester

UNIVERSITY POLICIES

Policy Statement on Non-Discrimination on the basis of Disability (ADA): The University is an equal opportunity educational institution. Please read The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

ACADEMIC ACCOMODATIONS

The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office.

ACADEMIC POLICIES

As a student at The University of Toledo you should be familiar with the policies that govern the institution's academic processes, for example, academic dishonesty, enrollment status, grades and grading. Please read through the undergraduate academic policies. Students are expected to attend every class meeting of courses in which they are registered. Please read the missed class policy. Undergraduate Policies: http://www.utoledo.edu/policies/academic/undergraduate/

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.

Inclement Weather Policy

If classes are cancelled on a lab day, lab **WILL PROCEED** at the next scheduled lab meeting. We will adjust the experiments to account for the reduced availability of lab time.

LAB COURSE SCHEDULE

The following table will be used as our schedule for this semester. This is subject change as needed. All due dates are listed, and all materials will be handed into your TA at the **BEGINNING** of your scheduled lab period as a paper copy. Remember, for the lab report for each experiment this includes the data/calculations/observations, graphs (if needed), and the postlab questions. Hand in all pages of the lab report to your TA.

Week/Day	**Lab Exercise**	**Due Dates & Notes**
Week 1 – Jan 18th	No Lab	
Week 1 – Jan 20th	Library Meeting with Wade Lee-Smith (Room CL1205)	• Safety Video & Signed "Policies & Procedures" Form
Week 2 – Jan 25th	Check In & IR Training	
Week 2 – Jan 27th	NMR Training with Dr. Yong-Wah Kim	
Week 3 – Feb 1st	Exp 1: NMR of Organic Compounds	
Week 3 – Feb 3rd	Exp 1: NMR of Organic Compounds	• Library Worksheet & NMR Worksheet Due
Week 4 – Feb 8th	Exp 2: Suzuki Cross-Coupling Reaction	
Week 4 – Feb 10th	Exp 2: Suzuki Cross-Coupling Reaction	• Postlab 1 Due
Week 5 – Feb 15th	Exp 3: Solid State Reactions	
Week 5 – Feb 17th	Exp 4: When Reactions Go Awry	
Week 6 – Feb 22nd	Exp 4: When Reactions Go Awry	• Postlab 2 Due
Week 6 – Feb 24th	Exp 5: Guest Binding in a Self-Assembled Capsule	
Week 7 – March 1st	Exp 5: Guest Binding in a Self-Assembled Capsule	• Postlab 4 Due

Week 7 – March 3rd	Exp 5: Guest Binding in a Self-Assembled Capsule	
Spring Break (3/7 – 3/11)		
Week 8 – March 15th	Exp 3: Solid State Reactions Continued	
Week 8 – March 17th	Exp 6: Epoxidation	• Postlab 5 Due
Week 9 – March 22nd	Exp 6: Epoxidation	• Postlab 3 Due
Week 9 – March 24th	Exp 7: Chiral Resolution	
Week 10 – March 29th	Exp 7: Chiral Resolution	• Postlab 6 Due
Week 10 – March 31st	Unknowns	
Week 11 – April 5th	Unknowns	• Postlab 7 Due
Week 11 – April 7th	Unknowns	
Week 12 – April 12th	Unknowns	
Week 12 – April 14th	Unknowns	
Week 13 – April 19th	Unknowns	
Week 13 – April 21st	Unknowns	
Week 14 – April 26th	Unknown Presentation	• Unknown Report Due
Week 14 – April 28th	Unknown Presentation Continued (if needed)	

SPECIAL COURSE EXPECTATIONS DURING COVID-19

Maintaining a safe campus during the ongoing COVID-19 pandemic remains a top priority. UToledo continues to follow the guidance of the U.S. Centers for Disease Control and Prevention and Ohio Department of Health to keep our campus safe.

ATTENDANCE

The University of Toledo has a missed class policy. It is important that students and instructors discuss attendance requirements for the course. Before coming to campus each day, students should take their temperature and complete a self-assessment for symptoms of COVID-19, such as cough, chills, fatigue or shortness of breath. Anyone with a temperature at or above 100.0 degrees Fahrenheit or who is experiencing symptoms consistent with COVID-19 should not come to campus and should contact their primary care physician or the Main Campus Health Center at 419.530.3451 or Health Science Campus Student Health and Wellness Center at 419.383.5000. For more information on the symptoms of COVID-19, please go to https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

COVID-19 testing for sick students is available on both Main Campus and Health Science Campus. Call 419.383.4545 for an appointment. Absences due to COVID-19 quarantine or isolation requirements **are** considered excused absences. Students should notify their instructors and follow the protocols summarized in this document on Navigating COVID-Related Course Concerns.

In the event that you have tested positive for COVID-19 or have been diagnosed as a probable case, please review the CDC guidance on self-isolation and symptom monitoring, and report the disclosure to the Division of Student Affairs by emailing StudentAffairs@utoledo.edu or by connecting with their on-call representative at 419.343.9946. Disclosure is voluntary and will only be shared on a need to know basis with staff such as in the Office of Student Advocacy and Support, The Office of Residence Life, and/or the Office of Accessibility and Disability Resources to coordinate supportive measures and meet contact tracing requirements.

FACE COVERINGS

Face coverings are required while on campus, except while eating, alone in an enclosed space, or outdoors practicing social distancing. Students will not be permitted in class without a face covering. If you have a medical reason preventing you from wearing a face covering due to a health condition deemed high-risk by the CDC, submit an online application to request an accommodation through the Office of Accessibility and Disability Resources. Students will need to provide documentation that verifies their health condition or disability and supports the need for accommodations. Students already affiliated with the Office of Accessibility and Disability Resources who would like to request additional accommodations due to the impact of COVID-19, should contact their accessibility specialist to discuss their specific needs. You may connect with the office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

VACCINATION

Doctors and other health care professionals agree that the best way to protect ourselves and each other is to get vaccinated. Case data clearly show that vaccines remain highly effective at preventing serious illness from COVID, including the highly contagious delta variant. If you have not yet received your COVID vaccine, the University encourages you do so as soon as possible. No appointment is needed to get the shot at the UTMC Outpatient Pharmacy, University Health Clinic or Main Campus Pharmacy. Once you receive the COVID vaccination, please register on the COVID Vaccine Registry site at: https://utvaccinereg.utoledo.edu/.

SPECIAL NOTES

It's 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. Please refer to https://www.utoledo.edu/coronavirus/ on a regular basis for updates to current requirements or mandates. I also ask that you keep me informed of concerns you may have about class, completing course work/assignments timely and/or health concerns related to COVID.