CHEM 2451/ CHEM 2452 Experimental Organic Chemistry Summer 2022 Syllabus

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Welcome to Experimental Organic Chemistry A (CHEM 2451) and B (CHEM 2452). Organic chemistry is performed in a laboratory, and up to this point, you are taking or have taken organic chemistry in a classroom setting. While this is good for learning theory and concepts, paper chemistry is different from doing actual experiments in the lab. We will start with emphasis on basic lab skills and techniques and end with more advanced experiments like a multiple lab synthesis. We will also delve into how organic chemistry journal articles are written. All these facets will culminate in a multistep synthesis and writing of a lab report in the format of an organic chemistry article.

Here are a few things to keep in mind as you proceed through the course. The most fundamental lab technique is properly keeping a lab notebook. As Adam Savage from Myth Busters said, "The only difference between screwing around and science is writing it down." Firstly, write everything down so experiments can be repeated by anyone reading the lab notebook. Secondly, think about what the purpose of each procedure is and relate it back to some fundamental chemical concept. The worst thing you can do in this course is follow a lab procedure blindly and without context. Thirdly, utilize my expertise because I am here to help, and I want all of you to succeed.

Office hours

TBA (a survey will be sent out)

Corequisite

The corequisite for CHEM 2451 is CHEM 2410 (CHEM 241).
The corequisite for CHEM 2452 is CHEM 2420 (CHEM 242).
LPS students may take CHEM 2410 and CHEM 2420 as corequisites or prerequisites to CHEM 2451 and CHEM 2452, respectively.

Communication

Email is the best method to contact me. Please write your emails in a professional manner with a proper subject, heading, body, and sign off with your name. Allow me 24-hours to get back to you. Sometimes responses will immediate, but other times I may be busy or need to do some research to find an appropriate response.

Learning Objectives

The purpose of this course is to give students real-life applications to the organic chemistry learned in the lecture course (CHEM 2410/ CHEM 2420). You will learn how to purify compounds to differing degrees through extraction, distillation, and chromatography; analysis techniques, such as IR and NMR spectroscopy; and how to properly set up reactions to synthesize more complicated organic molecules.

Texts and supplies

- Textbook: Experimental Organic Chemistry A Miniscale and Microscale Approach (Sixth Edition) by John C. Gilbert and Stephen F. Martin
- A carbonless copy notebook (can purchase through the Chemistry Department)
- Scientific calculator
- Safety Glasses (provided by the Chemistry department)
- Lab coats (general use among all lab sections)

Attendance Policy

Attendance is mandatory for every lecture and lab. Unexcused absences from lab will result in a zero for the experiment. Missing more than two labs in CHEM 2451 or CHEM 2452 will result in a failing grade. If you are unable to attend the lab session and have a legitimate reason (illness, interview, work, religious holiday, family emergency, etc.), email Dr. Tong. There will be a makeup day towards the end each summer session to makeup a single missed experiment. To attend the makeup lab, you must notify Dr. Tong in advance and provide relevant documentation. All experiments must be completed by the end of each summer session.

Students arriving 30 minutes or more after the start of the lab cannot start the experiment.

Grading

Your grade will be based on notebook keeping, lab reports, and conduct during the experiment. Notebook keeping involves doing a prelab before performing an experiment and making observations during the experiment. Lab reports will involve answering questions at the end of the experimental worksheet. Lab conduct involves the use of laboratory techniques, following safety procedures, and keeping a tidy lab area. Each lab will be worth the same number of points and will be the same percentage of your total grade. The course totals and letter grades for CHEM 2451 and CHEM 2452 will be calculated independently of each other.

Experiment Breakdown

Lab conduct, Safety, and technique:	10%
Notebook:	20%
Lab reports:	70%

Graded Lab Components

- **Lecture:** Lectures will be used to introduce the material and cover the concepts behind the labs.
- **Notebook: Everything must be written in pen. Crossed out mistakes with a single line. No scribbles or white out.**

  Before lab: Prior to performing an experiment, you will do a prelab assignment posted to Canvas. This is to ensure you have read the procedure, have a plan for completing the experiment, and understand the experiment. Prelab assignments are to be done in your lab notebook and a copy is due at the beginning of your lab section.

  Prelabs will involve writing out an experimental plan on how you will be approaching the experiment. This experimental plan should not be a word for word copy of the procedure but a summary that is in your own words. There is no specific format as long as it is in your own words. You can write in the procedure as a paragraph, numbered list, sketches, pictures, or as a flow chart.

  In the laboratory, you will also be working with numerous different compounds and chemicals. You will need to include physical data such as the molecular weights, structures, melting points, densities. The compounds can also be potentially hazardous. It will be important for you to understand what you are working with, so you will also need to list safety information, such as the type of hazard and what to do if exposed to the chemical.

  During the experiment: You are required to detail the procedure as you carry them out. You should not be writing in experimental details at the end of lab to "catch up." Some key things to note are masses, volumes, glassware size, rate of addition, physical phase of compounds, and color of compounds. Observations during the reaction are also important. If bubbling occurs after adding something, take note of that. If a step is exothermic or endothermic, take note of that. If there is a color change, take note of that. If you make a mistake, cross it out with just one line. Overall, err on the side of taking too many notes. If they are actual observations, you cannot be penalized writing too much. A copy of your notebook observations are due at the end of the experiment.

- **Lab:** Experiments will be performed in person in Chemistry 1958 room 300. Be there on time and be ready to hand in your prelab assignment to your teaching assistant. Each hood can accommodate two students. To the left and right of the hoods are general use glassware for experiments.

  Safety: **No food or drinks in the lab.** You will be supplied safety glasses. Safety glasses must remain on at all times when in the lab. If they get foggy, you may step out of the lab to wipe them off. Removal of safety glasses for any reason during the lab session will result in a zero for the lab. Always wear gloves when handling organic compounds. There will be disposable gloves in the lab. Perform procedures in the hoods. They are designed to minimize exposure to compounds. No unauthorized experiments. DO NOT heat a closed system. Do not use damaged glassware.

  Lab attire: Lab coats will be provided by the laboratory and a lab coat must be worn while in the lab. You may wish to purchase your own lab coat if you do not want to share lab coats. The lab coat will cover your shoulders and torso. For the lower half of your body, clothing must extend all the way to your shoes. **NO skin below your waist can be showing.** Natural fibers such as cotton and wool are highly recommended. Synthetic fibers such as polyester and nylon are not appropriate for lab. Tights and leggings are not proper legwear. Jeans are recommended. Closed toed shoes must be worn while in the lab. If you come to lab dressed inappropriately, you will be sent home to change. No additional time will be given for the experiment.

Electronics: Electronics, such as phones, tablets, and laptops, are to be shut off during lab. Being distracted during lab can result in accidents. Shut off electronic devices to reduce the level of distractions. If you are expecting an important call, notify your teaching assistant. Students observed to be distracted on electronic devices will receive zeros as lab conduct grades for that experiment. Multiple offenses will result in further deductions in grades.

Housekeeping: Keep your work area neat and tidy. This will lead to few accidents and when there are accidents, it will be easier to clean up. Clean up spills immediately. Keep the floors and benches free of bags, coats, books, or other obstacles. There will be lockers for you to temporarily store your belongings.

- **Emergency Procedures:** If there is an emergency, contact your teaching assistant or instructor immediately. For chemical exposure, cuts, or punctures, clean the area with soap and water and continuously rinse for 15 minutes. For eye exposure, use the emergency eyewash and flush eyes for 15 minutes. For large chemical exposure, use the safety shower and rinse thoroughly for 15 minutes.
- **Lab conduct, Safety, and Technique:** This portion of the grade will reflect how well you follow lab rules and are prepared for lab. Coming to lab prepared, staying safe, being properly dressed, and cleaning up after yourselves will result in a positive lab conduct grade. Teaching assistants and I will be observing you throughout the experiment.
- **Lab Reports:** Lab reports will typically involve answering the questions at the end of the lab procedure worksheet. Lab reports will be due the Friday after the next experiment. Lab reports are to be submitted through Canvas.

Re-grade Policy

Students will have one week from the day they first receive a graded lab report to request a re-grade. If the re-grade request involves an error in adding partial credit points, the instructor or teaching assistant will record the new total. If the re-grade request involves a possible error in assigning points to a student's work, the instructor or teaching assistant will re-grade the entire quiz or lab report. Note that this procedure may result in a lower total score than before the re-grade.

Support for Students

If you are experiencing undue personal or academic stress at any time during the semester or need to talk with someone about a personal problem or situation, I encourage you to seek support as soon as possible. I am available to talk with you about stresses related to your work in my class. Additionally, other university resources that can be found here.

Disability-related Equal Access Accommodations

University of Pennsylvania provides reasonable accommodations to students with disabilities who have self-identified and been approved by Student Disabilities Services (SDS). If you have not yet contacted SDS and would like to request accommodations or have questions, you can make an appointment by calling SDS at 215-573-9235. The office is located in the Weingarten Learning Resources Center at Stouffer Commons 3702 Spruce Street, Suite 300. All services are confidential.

Academic Integrity

University of Pennsylvania provides explicit guidelines in the Code of Academic Integrity. Unless specified otherwise in the syllabus, I expect the work you submit for grading to be yours and yours alone. Not acknowledging another's work with proper references, taking credit for someone else's work, letting your work appear in another student's paper, fabricating "results", or using unapproved resources during assessments are grounds for failing the course. If you have any questions about what constitutes plagiarism or cheating, please ask me.

Important dates

	CHEM 2451	**CHEM 2452**
Add/drop deadline with no financial obligation	Tuesday, May 31st, 2022	Thursday, July 7th, 2022
Last day to drop a class (50% financial obligation)	Wednesday, June 8th, 2022	Friday, July 15th, 2022
Grade type change deadline	Wednesday, June 8th, 2022	Friday, July 15th, 2022
Withdrawal deadline	Wednesday, June 22nd, 2022	Friday, July 29th, 2022

Course Schedule for CHEM 2451

Week	Date	Experiment	Prelab Due	Lab Report Due
1 (Tues)	May 24th	Introduction, Lab Notebook, Glassware, and Tour	-	-
1 (Thurs)	May 26th	Recrystallization (Part 1)	May 26th	May 31st
2 (Tues)	May 31st	Recrystallization (Part 2)	May 31st	June 5th
2 (Thurs)	June 2nd	Extraction	June 2nd	June 7th
3 (Tues)	June 7th	Distillation	June 7th	June 12th
3 (Thurs)	June 9th	TLC (Thin Layer Chromatography)	June 9th	June 14th
4 (Tues)	June 14th	Column Chromatography	June 14th	June 19th
4 (Thurs)	June 16th	IR (Infrared) Spectroscopy	June 16th	June 21st
5 (Tues)	June 21st	NMR (Nuclear Magnetic Resonance) Spectroscopy	June 21st	June 26th
5 (Thurs)	June 23rd	Caffeine	June 23rd	June 28th
6 (Tues)	June 28th	Dehydration of Alcohols	June 28th	July 1st

Course Schedule for CHEM 2452

Week	Date	Experiment	Prelab Due	Lab Report Due
1 (Thurs)	June 30th	Introduction/ Make up from CHEM 2451	-	July 5th
1 (Tues)	July 5th	Diels-Alder Week 1	July 5th	July 10th
2 (Thurs)	July 7th	Diels-Alder Week 2	July 7th	July 12th
2 (Tues)	July 12th	Aldol	July 12th	July 17th
3 (Thurs)	July 14th	Multistep Synthesis Part 1	July 14th	July 19th
3 (Tues)	July 19th	Multistep Synthesis Part 2	July 19th	July 24th
4 (Thurs)	July 21st	Multistep Synthesis Part 3	July 21st	July 26th
4 (Tues)	July 26th	Multistep Synthesis Part 4	July 26th	July 31st
5 (Thurs)	July 28th	Multistep Synthesis Part 5	July 28th	August 2nd
5 (Tues)	August 2nd	Paper workshop (Meet in lab)	August 2nd	August 7th
6 (Thurs)	August 4th	Make up from CHEM 2452	August 4th	August 7th