

University of Georgia
Modern Organic Chemistry I Laboratory
CHEM 2211L
Fall 2019

Lab Coordinator:	Dr. Richard Hubbard
Email:	chemburn@uga.edu (email will not be accepted via ELC)
Phone:	542-1974
Office:	Science Learning Center 119B
Office Hours:	Tuesday, Wednesday, Thursday 2:00 – 3:00 pm
Lab Manual:	CHEM 2211L Organic Chemistry I Laboratory Manual, Hubbard and Morrison (Hayden McNeil, Fall 2019 Edition only)
Lab Notebook:	A laboratory notebook will not be necessary for this class. All data and observations will be written on the tear-out sheets provided in the lab manual.
Safety Equipment:	Lab safety goggles (mandatory), Lab coat (mandatory)

General Info:

Each week you will report directly to your assigned laboratory (rooms 101, 102, 105, 106, 121, 125) for a pre-lab quiz and lecture given by your laboratory instructor. After the pre-lab lecture, you will begin your experimental work for the day.

Lab Check-In:

During your first lab meeting you will be checking into the communal lab drawer(s) that you will be using each week throughout the semester. It is imperative that your drawer(s) be fully equipped and organized following each lab experiment during the semester. If your drawer is missing any equipment during check-in, you will need to speak with your TA in order to replenish your supplies. Once you are satisfied that your drawer(s) are appropriately stocked, sign your lab safety contact and turn it in to your TA. Your lab check-in will then be complete. From that point forward, you and your partner will be held solely responsible for the condition of the glassware in your lab drawers following each experiment. At the end of each lab period, your TA will check you out of your drawer(s), making sure that all of your glassware is present and accounted for. If any of your glassware is broken or misplaced during the course of the semester, you and your partner are required to replace it in a timely manner. A record of all broken/misplaced glassware will be kept by the lab manager. If an item is broken/misplaced, it is up to you and your partner to obtain a temporary replacement item from the lab manager in the glassware room. You will then have one week to bring a permanent replacement item to the lab manager.

A complete glassware list is provided at the end of this syllabus.

Experiments:

The experiments in CHEM 2211L focus on teaching basic/essential organic laboratory techniques, in addition to exposing you to some of the commonly used analytical instruments. You will be working with a lab partner this semester, but your collaboration will only extend to your in-lab experiments. All labs write-ups are to be done independently. The following is a list of the techniques, instrumentation and support software that you will be introduced to this semester:

Laboratory Techniques:

Recrystallization
Melting Point Determination (Simple/Mixed)
Boiling Point Determination (Microscale)
Distillation (Simple/Fractional)
Extraction (Solid/Liquid, Liquid/Liquid, Acid/Base)
Reflux
Filtration (Gravity/Suction)
Thin Layer Chromatography

Instrumentation:

Gas Chromatography (GC)
Infrared Spectroscopy (IR)
Nuclear Magnetic Resonance Spectroscopy (NMR)

Computer Programs:

ChemDraw
Chem3D

Chemistry 2211L Schedule of Experiments Fall 2019

<u>Week Of</u>	<u>Experiment</u>
August 26	Check-In, Safety Lecture
September 2	No Lab [Due to Labor Day]
September 9	1. Recrystallization – Identification of an Impure Unknown
September 16	2. Simple and Fractional Distillation – Determination of Solution Composition
September 23	3. Extraction of Trimyristin from Nutmeg – Solid/Liquid Extraction
September 30	4. Thin Layer Chromatography (TLC) Identification of Unknown Component Mixtures
October 7	5. ChemDraw/Chem 3D Tutorial
October 14	6. Separation of a Multi-Component Heterogeneous Mixture Acid/Base Extraction
October 21	7. Transfer Hydrogenation – Reduction of Olive Oil
October 28	8. Preparation of Diphenylacetylene
November 4	9. Gas Chromatography Analysis of an Alkyl Halide Product Mixture
November 11	10. Diels-Alder Reaction
November 18	Lab Check-Out
December 3	Final Exam 7:00-8:30 pm

Lab Reports:

Lab reports are due at the beginning of lab each week and will be graded and returned to you the following week. If your lab reports are not being returned to you in a timely manner, arrange to meet with Dr. Hubbard as soon as possible so that the situation can be corrected. A set of general guidelines for writing proper organic lab reports is provided for you in this manual. Refer to the section entitled "How to write a lab report." Your TA will supplement this information with more specific details at the beginning of the semester. Make sure that your writing style and report layout carefully adheres to your individual TA's specific writing parameters.

Each report must be submitted with a cover sheet. A copy of the cover sheet is provided at the end of your course syllabus on ELC.

Each student must submit their own, individual lab report. You are expected to work independently. Plagiarism, in any form, will not be tolerated. If you are unclear as to what constitutes plagiarism, the following website is a valuable resource for information:

Plagiarism.org: <http://www.plagiarism.org/>

Absences:

In order for an absence to be considered excused, all appropriate documentation must be presented to Dr. Hubbard. **You have one week to turn in your documentation to Dr. Hubbard or your absence will be considered unexcused. You may not turn in your excused absence documentation to your TA.**

- Any missed experiments will be counted as a zero unless an excused experiment approval form is obtained from Dr. Hubbard.
- Any student with two or more excused absences will be assigned a grade of incomplete ("I") for the course. The student then has three semesters to complete their missed assignments in order to obtain a grade for the class. If the work is not completed by the end of the third semester, the incomplete will automatically change to an F.
- Any lab report due on the day of an excused absence must be turned in to your lab instructor by or before the beginning of your next regularly scheduled lab period.
- If an absence is unexcused, the lab report that was due the day of the absence will have 10pts deducted per day late.
- Any student who knows about an excused absence in advance must meet with Dr. Hubbard at least one week prior to the event to discuss their options.
- If a student is going to be absent due to an event/circumstance that is known in advance, they must make arrangements to turn in their lab report on the original day that it is due. In the event that they do not, the lab report will have 10pts deducted per day late.

Lab Check-Out

Lab check-out will occur following each experiment this semester. Your TA will go through your assigned, communal drawer(s) to ensure that all of your glassware is present and undamaged. You and your partner are required to replace any missing or broken glassware prior to attending lab the following week. Any student who does not properly check-out of their lab drawer each week will have their registration account frozen until all missing items are replaced.

Lab Final Exam:

The last week of lab, you will take a written final exam. The final exam will be based on the theories presented in your lab manual, the pre-lab lectures, and the experimental techniques learned during the course of the semester. Questions on lab technique, safety, reaction products, mechanisms and glassware/equipment comprise the bulk of the exam. The lab final is mandatory. There are no make-up exams given. If you miss the final exam due to an excused absence, you will be assigned an incomplete (“I”) for the course.

Lab Grade [Main Sequence Labs - 2211L]:

Your overall grade in CHEM 2211L will be derived from the following components:

- | | | |
|-------------------------------|-----|-----------------------------|
| • Lab Safety Quiz | 3% | [single quiz] |
| • Lab Reports and Lab Results | 77% | [10 individual experiments] |
| • Laboratory Final Exam | 20% | [100 point written exam] |

Withdrawing from lab:

The mid-point of the semester is October 7, 2019. The last day to withdraw from CHEM 2211 and 2211L is October 21, 2019. A grade of ‘W’ is assigned to all withdrawals made prior to the withdrawal deadline, irrespective of performance in the course. Withdrawal is accomplished via the **Athena** system. Go to the withdrawal section of **Athena** and follow the instructions. CHEM 2211 and CHEM 2211L are corequisite courses. You may not remain enrolled in CHEM 2211L if you withdraw from CHEM 2211 or vice versa. **There are no exceptions to this policy.** After the mid-semester withdrawal deadline, a student who withdraws from the course is assigned a grade of ‘F’ by the UGA registrar. If you have any questions, you will need to arrange a meeting with Dr. Hubbard during his posted office hours.

Organic Chemistry Laboratories Safety Rules

Organic chemistry laboratories are fraught with potential hazards. These hazards can be easily avoided if all of the students in the lab are mindful of the following set of safety guidelines. These rules must be adhered to at all times. The laboratory instructors are authorized to deduct discretionary points from lab grades or to expel from the laboratory anyone found in violation of these rules:

Medical Conditions:

If a student has a medical condition which might be adversely affected by working in a chemistry laboratory (ie. asthma, allergies) or which might affect their safe performance of laboratory work (ie. seizure disorders, fibromyalgia), it is essential that the student inform both the course instructor (Dr. Hubbard) and their individual TA before laboratory work begins for the semester. The instructional staff must know how to best aid the student in the event of a medical emergency.

If a student thinks or knows that she is pregnant, it is required that she contact the course instructor (Dr. Hubbard) before laboratory work begins. It may be necessary to defer her organic chemistry laboratory to a later semester in order to avoid any exposure to harsh chemical reagents or teratogens (chemicals which may cause birth defects). This conversation will be held in the strictest confidence. The primary goal is to protect the health of both mother and child.

Lab Supervision:

No laboratory work may be carried out without the direct supervision and authorization of a laboratory instructor. In addition, you may not enter any of the organic labs unless an instructor is present. Absolutely no unauthorized experiments are to be performed.

Safety Goggles/Lab Gloves:

Everyone who is present in the laboratory must wear safety glasses/goggles at all times, even if you are simply recording data. Only fully shielded safety glasses and goggles (ANSI Z87.1) qualify as acceptable protection for the organic laboratories

- No one (students or teachers) may wear contact lenses in the laboratory. This is strictly forbidden. No exceptions will be made to this rule.

Approved safety glasses/goggles for use in the organic labs are available for purchase in the Campus Scientific Supply Store (Room 300). You will not be permitted to enter or work in the lab if you do not have on approved eyewear.

Lab gloves must be worn at all times while in the lab. Disposable gloves of various sizes can be found on the central workbench in each laboratory. Do not let chemicals come in contact with your skin. If you get a hazardous chemical on your gloves, take them off, wash your hands and put on a new pair. Remember, gloves are not impervious; they simply prevent immediate exposure. If you leave the laboratory for any reason, make sure that you remove your gloves beforehand. If your lab runs out of gloves, inform your TA immediately so that he/she can replenish the supply in a timely manner.

Laboratory Dress Code:

There is a strict dress code in the laboratory. **A knee length/long sleeve lab coat is mandatory and must be worn at all times.** Lab coats are available in the Campus Scientific Supply Store (Chemistry Bldg Room 300), Tate bookstore, or online. In addition, closed-toe/backed shoes are required. No clogs/slip-ons, sandals, or bare feet are permitted in the laboratory. Your shoes must fully cover the entire top of your foot. Students must wear shirts without holes, deep v-necks or bare midriffs. Sleeves may be short (half sleeves) or longer (3/4 or full). No tank tops or quarter sleeves will be allowed. Students must wear full pants without holes or rolled up cuffs. No tights/leggings/yoga pants (tight fitting, stretch fabric) will be allowed in lab. Long hair must be tied back or covered.

In the event that you arrive to lab without the proper clothing, the Campus Scientific Supply Store sells scrub shirts/pants and temporary shoes coverings. The shirts/pants may be worn repeatedly, but the shoe coverings may only be used once per semester per student. Repeated use will result in discretionary point deductions.

Handling Chemicals/Lab Equipment:

- Never put anything in your mouth in the laboratory (ie. food, pens, chemicals). Eating, drinking, and chewing gum in the lab is forbidden. You may not bring food or drink containers into the lab unless they are safely stored in your backpack.
 - Flammable solvents such as diethyl ether, acetone, toluene, methylene chloride, isopropanol etc., must be kept well away from open flames. When working with a Bunsen burner or open heating element, make sure that your work area is clear of all flammable chemicals before proceeding with your experiment.
 - Use caution when handling chemicals in the lab and be sure to adhere to the following guidelines:
 - Read all chemical labels (reagent and waste) carefully, being sure to use only properly labeled reagents for your experiments.
 - Measure out only the amount of reagent necessary for the experiment. **Never pour unused chemicals back into the reagent bottles.** This can irreversibly contaminate the reagents. Any and all unused chemicals must be disposed of in the appropriate waste container.
 - Return all chemicals (solid and liquid) to their proper places immediately after using them. **In addition, you must replace the lids on all of the reagent bottles immediately after use.** Leaving these containers open increases the likelihood of chemical exposure, spills and also the possibility of reagent contamination (hygroscopic compounds reacting with atmospheric moisture).
- ❖ **10 discretionary points per experiment can be deducted by your laboratory instructor based on laboratory conduct, cleanliness and safety**
- If you spill a chemical, alert your laboratory instructor immediately. He/she will instruct you as to the proper clean up procedures. A spill must never go untended. You are required to clean up any spills that you create. This includes any spills on the laboratory balances.

- Each student must make sure to properly label all of the chemicals that they are currently using. This helps to avoid confusion. Make sure to keep your reagent containers covered to prevent contamination and/or exposure during the course of the experiment.
- Avoid breathing fumes of any kind. You should handle all volatile chemicals in either the laboratory's fume hood or under your individual snorkel stations. The constant draft of air prevents exposure to harmful fumes and vapors. Do not raise the sash of the fume hood above the safe level indicated on the side of the device. Raising the sash above this point will negate the hood's effectiveness and increase your risk of exposure.
- Only use equipment that is in good working condition. Any malfunctioning or nonfunctional equipment (ie. Meltemps, hot plates, heating mantles) must be reported to your instructor immediately so that they can be replaced. Exposed wires on heating mantles represent a fire hazard.
- Be very careful when using your glassware. It is inherently fragile and can break without notice if not handled (clamped) properly. Do not use broken or cracked glassware; you must replace it. All broken glassware must be cleaned up immediately and placed in the proper waste receptacle. Dispose of all broken glass, used pipets and capillaries in the blue and white broken glass containers (cardboard). These are the only designated broken glass storage containers in the laboratory. **Do not place broken glass in the regular trash cans.**
- Dispose of all chemical waste in the proper manner described by the laboratory instructor. **Only dispose of chemical waste in containers labeled for hazardous waste collection.** Always make sure that the waste that you are disposing of matches the hazardous waste label on your receptacle. **Waste must never be poured down the sinks.** Do not put any chemical waste in the trash or in any container not labeled as hazardous waste.

Accidents:

- You are required to familiarize yourself with the locations of all fire extinguishers, safety showers, fire blankets, and eye wash stations in the laboratory. Be prepared and know how to use this equipment in case of an emergency. You will also need to familiarize yourself with the locations of all laboratory and building exits.
- Safety showers are to be used in the event that a student spills a large amount of a hazardous chemical on themselves and must be cleansed immediately to avoid additional contamination and injury. Disrobe, stand under the nozzle, and pull the handle down firmly to activate the shower.
- Eyewash stations are to be used if a chemical has come in contact with a student's face and eyes. You will need to place your face between the two nozzles and press the lever to activate the water. Try to keep your eyes open as much as possible as the water flows. This will allow the water to flush your eyes much more effectively.

- **Report any laboratory accident or injury to your TA immediately.** The laboratory instructor (Dr. Hubbard) will arrange transportation to the University Health Center for treatment of injuries if this deemed necessary. Minor injuries can be treated on site using the first aid kit located in your laboratory.
- In the event of a fire, alert your instructor immediately and exit the laboratory with your fellow students in an orderly fashion. **Never attempt to extinguish a fire by yourself.**

Working Safely and Efficiently:

- Make sure you have the necessary clean glassware and functional equipment prior to starting your experiment. Know your experimental plan before you come to the laboratory. Never begin an experiment without having read the complete procedure first.
- Keep aisles and work areas clear and your lab drawers closed. All book bags and backpacks must be placed either at the front or rear of the laboratory so that they do not impede the flow of traffic within the room.
- Keep your laboratory bench and all other working areas clean at all times. You should not have any items not related to the lab (cell phones, magazines, textbooks, etc.) on your bench during the course of the experiment.
- The laboratory balances must be kept clean at all times. Do not place any chemicals directly on the balance pans. This will cause the balances to corrode and malfunction over time. Use either a watch glass or a beaker to hold your sample as it is weighed.
- At the end of each laboratory session, make sure that your glassware is clean and place everything neatly back in your lab drawer. You are responsible for cleaning your bench top and all other work areas.

Miscellaneous Information:

- Never take any chemicals or equipment from the lab.
- Report any unsafe laboratory condition or situation to your instructor immediately.
- Put things back where you found them. This includes reagents, boxes of gloves, special equipment and anything non-disposable.
- Make sure that your hot plates and Meltemps are turned off and unplugged prior to leaving the laboratory each week. Stack them neatly on the shelf above your lab station.
- Make sure you thoroughly clean and organize your lab drawer(s) at the end of each lab session. Remember: You will be charged for any items missing from your drawer at the end of the lab each week.

Important Point Deductions: The following is a list of the most commonly encountered point deductions in the organic laboratories. These situations are easy to avoid if you are conscientious and take your responsibilities in the lab seriously. If you have any questions about the specifics of these violations, please feel free to make an appointment with Dr. Hubbard.

<u>Violation</u>	<u>Point Deduction</u>
Missing pre-lab lecture/quiz:	12 pts
Late for lab (over 30 mins):	Sent home, given a zero for lab
Late lab reports:	10 pts deducted per day late (this includes turning your lab report in late the day that it is due)
Reagent bottles left uncapped:	10 pts
Failure to properly clean up a chemical spill:	10 pts
Cell phones:	10 pts per incident (they must be silenced and placed out of sight for the duration of the lab)
Improper dress:	Students are given 15 mins (after the prelab lecture ends) to acquire appropriate clothing. After 15 mins they will be sent home and given a zero for lab. If proper clothing is acquired within the 15 min timeframe, the student will be allowed to perform the lab, but there will be a 10 pt deduction to their lab report for the week.
Failure to wear goggles:	10 pts (1 st Offense) Sent home, given a zero for lab (2 nd Offense)

Point Breakdown for CHEM 2211L Lab Reports

The lab reports for this course are divided into three parts: Pre-lab, In-lab, and Post-lab. The point content for each of these components is delineated below:

Pre-lab (38-50 points) (**typed**)

The pre-lab section of the report must be completed before coming to lab. This material will be turned in to your TA at the beginning of the lab. The pre-lab write-up points are broken down as follows:

Title & Introduction	(10-22 points total)
• Balanced Equation (when appropriate)	(6 points)
• Reaction Mechanism (when appropriate)	(6 points)
Table of Reagents	(5 points)
Safety Information	(5 points)
Experimental Procedure	(6 points)
Prelab Quiz	(12 points)

In-lab (10 points) (**recorded in lab manual and then typed in post-lab write-up**)

The in-lab section is to be completed in the laboratory as the experiment is being performed. This information must be turned in to your TA before you leave lab each week.

Data and Observations	(10 points)
• Properly formatted and recorded data	

Post-lab (34-40 points) (**see below**)

The post-lab section of your lab report can only be completed after the experiment has been performed. The post-lab section must be typed (the only exception to this rule is the questions subsection). The post-lab write-up points are broken down as follows:

Results (typed)	(10 points)
• Data Calculations	
▪ Percent yield/recovery	
▪ Limiting Reagent	
▪ Rf Values (TLC)	
▪ Data Graphs, etc	
Discussion and Conclusions (typed)	(12-18 points)
• Identification of an experimental unknown (when appropriate)	(6 points)
Answers to Questions (written on tear-out pages)	(12 points)

The pre-lab, in-lab, and post-lab sections of the report are to be typed (the only exception to this rule are the post-lab questions, which must be completed on the provided tear-out sheets in the lab manual). Make sure that your questions are answered legibly. If your TA cannot decipher what is written, he/she is not required to grade the material.

CHEM 2211L

Lab Report Cover Sheet

Student Name: _____

TA Name: _____

Date: _____

Experiment: _____

Prelab (38-50 points)

Title and Introduction	_____	(10-22 points)
Table of Reagents	_____	(5 points)
Safety Information	_____	(5 points)
Experimental Procedure	_____	(6 points)
Prelab Quiz	_____	(12 points)

Inlab (10 points)

Data and Observations	_____	(10 points)
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Postlab (34-40 points)

Results	_____	(10 points)
Discussion and Conclusions	_____	(12-18 points)
Answers to Questions	_____	(12 points)
Discretionary Points Deducted	_____	(0-10 points)

Total _____ (82-100 points)

TA Comments:

Basic Glassware
[Replaced by Department]

Quantity	Item	Size
2	Erlenmeyer Flask	50 mL
4	Erlenmeyer Flask	125 mL
2	Erlenmeyer Flask	250 mL
2	Filter Flask	250 mL
2	Beaker	100 mL
2	Beaker	250 mL
2	Beaker	400 mL
2	Powder Funnel	
4	Watch Glass	
2	Metal Spatula	
2	Stirring Rod	
2	Rubber Policeman	
2	Neoprene Adapter	37x22
20	Test Tubes	13x100
4	Pipet Bulbs	
2	MicroSyringe	1 mL

Research Quality Glassware
[Replaced by Student]

Quantity	Item	Size
2	Separatory Funnel	125 mL
2	with Stopcock	
2	and Stopper	
2	Buchner Funnel	
2	Short-Stem Funnel	
2	Graduated Cylinder	10 mL
2	Graduated Cylinder	100 mL
2	Round-Bottom Flask	50 mL
2	Round-Bottom Flask	100 mL
2	Still Head	"24/40"
2	Condenser	"24/40"
2	Thermometer (non-Hg)	"10/18"
<u>Microscale Kit</u>		
2	Hickman Still Head	"14/10"
2	Condenser	"14/10"
2	Claisen Adapter	"14/10"
2	Side Arm Adapter	"14/10"
2	Drying Tube	"14/10"
2	Round-bottom Flask	"14/10"
2	Conical Vial	3 mL
2	Conical Vial	5 mL
2	Spin Vane	
2	Forceps	