



# CHEM 223

## Organic Chemistry Laboratory I

**VERY IMPORTANT: STUDENTS REGISTERED FOR THIS LABORATORY COURSE MUST ALSO BE REGISTERED FOR THE ACCOMPANYING RECITATION – CHEM 22301!**

Recitation class attendance is mandatory for any student enrolled in the lab and a significant portion of the CHEM 22300 lab grade comes from exams & quizzes given in the recitation class!

Course Coordinator: Dr. Manashi Chatterjee

email: [chatterjeehunterchemistry@gmail.com](mailto:chatterjeehunterchemistry@gmail.com) or [mc1373@hunter.cuny.edu](mailto:mc1373@hunter.cuny.edu)

phone: (212) 772-5377

office: 1319 HN

## Welcome to CHEM 22300 Lab – Introduction & Common Policies

### COURSE DESCRIPTION & GRADING OVERVIEW

In this course, you will first learn how to separate and purify organic compounds. You will then synthesize a number of them yourself and employ the techniques that you have learned earlier (as well as learn some new ones) to separate, purify, and study your reaction products.

Your grade will be assigned on a 1,350-point schedule (see below for projected letter grade cut-offs). Your point totals will be based on pre-lab quizzes, your lab performance, written lab reports and recitation class assessments. Keep in mind that good execution of laboratory techniques, adherence to safe laboratory practices (including cleanliness and proper disposal), the quality & quantity of the products you hand in, the organization of your work (including how well you have planned your work beforehand) and how well you understand the chemical processes that occur are all factored into your grade!

**Projected letter grade cut-offs:** Grades will be based on the Hunter College grading scale.

A+:	97.5 - 100% (1316 - 1350 points)
A:	92.5 - 97.4 % ( 1248 - 1315 points)
A-:	90 - 92.4 % (1215 - 1247 points)
B+:	87.5 - 89.9% (1181 - 1214 points)
B:	82.5 - 87.4% ( 1114 - 1180 points)
B-:	80 - 82.4% ( 1080 - 1113 points)
C+:	77.5 - 79.9% ( 1046 - 1079 points)
C:	70 - 77.4% ( 945 - 1045 points)
D:	60 - 69.9% ( 810 - 944 points)
F:	0.0 - 59.9 (0- 809 points)

**REQUIRED TEXT:** Pavia, Kriz, Lampman, and Engel, *A Small Scale Approach to Organic Laboratory Techniques*, 4rd Ed., Brooks Cole. (This lab manual will refer to this textbook as “Pavia”)

**LEARNING OUTCOMES:** Students will gain practical experience in the preparation, purification and analysis of organic compounds. The accompanying recitation provides the theoretical foundation that supports and complements the practical learning outcomes below.

At the end of the course, students will be able to:

1. Analyze and characterize organic compounds by physical (eg. melting point), chromatographic (eg. TLC), and spectroscopic methods (eg. IR and NMR)
2. Purify organic compounds by simple distillation, fractional distillation, recrystallization, and column chromatography
3. Design and execute the separation of organic compounds by acid-base extraction
4. Build three-dimensional structures of organic compounds using modeling kits and manipulate the models for conformational analysis
5. Perform simple organic reactions, specifically qualitatively and quantitatively measure the extent of organic reactions, record observations, and prepare laboratory reports
6. Employ safe practices in the laboratory

## **PLANNING AND EXECUTION**

In the Organic Chemistry laboratory, you will plan and execute your work independently. You must do a lot of preparation work before you work on an experiment. In addition to reading the text, you must attend the lab recitation class. Take good notes in the lab recitation and review them carefully when planning each experiment. **The pre-laboratory assignments for each experiment must be completed BEFORE you come to class!**

Many of the experiments that you will complete this semester are not taken directly from the Pavia textbook though you may find many similarities. Part Six of the Pavia textbook (starting on page 546) should be especially helpful to you as it contains descriptions of the techniques you will use throughout the term. The importance of studying the recitation material and applying what you have learned cannot be exaggerated. The key to success is planning your work carefully before you enter the laboratory!

It is essential that you start working promptly, rather than socialize with other students. You will be so busy in some experiments that you probably won't have time to talk at length to anyone. Sometimes, you will need to work on different parts of an experiment at the same time in order to finish on time. It is very important that you finish all work within the scheduled class time and within the total time allotted for the experiment (if more than one class session is dedicated for an experiment). **No work will be allowed outside the scheduled class time, including washing glassware and taking melting points.** **Everybody must physically leave the laboratory by the scheduled end of class time!** No additional time will be given to any student who falls behind on work.

You will work individually on some procedures, but there are also some procedures in an experiment that you will perform in pairs or as a small group. Your instructor will let you know about the working arrangement on the day of the experiment. One set of equipment will be issued to a pair of students – you and your assigned partner will be responsible for keeping them in good condition throughout the semester (even if the two of you don't necessarily work together on any experiment).

When you hold a flask in front of your instructor to ask a question about the contents, you must be able to describe exactly what you put in the flask, and the exact sequence of operations you have carried out in arriving at that point. Your lab instructor will not simply provide answers! You should always be prepared to intelligently discuss what you are doing and try to arrive at a solution to your own problem rather than rely on your instructor to solve all of your problems.

## **LABORATORY SAFETY**

**For safety reasons, ALL STUDENTS must wait outside the laboratory until their instructor has entered and has given everyone permission to enter the room.**

Every student is **REQUIRED** to attend the first meeting of their lab section for the semester. During that session, all students will be acquainted with safe laboratory practices, the safety features of the laboratory and the procedures to be followed in the case of an emergency. Students will also be provided with a copy of laboratory rules. Appendix I of this lab manual contains additional information on the hazardous properties of chemicals used in CHEM 223. You will not be allowed to proceed with the lab course until you are familiar with the rules and safety procedures.

If you miss the first meeting due to registration delays, you should contact the Chemistry Lab Stockroom (Room 1414, Hunter North building) immediately to schedule a make-up time to perform the check-in procedure and go through the safety protocols.

**\*\*\* REMEMBER THAT SAFETY GOGGLES MUST BE WORN AT ALL TIMES IN THE LABORATORY! \*\*\*** Failure to comply with this regulation will result in deduction of points and/or ejection from the laboratory.

**WARNING:** If you are pregnant or intend to become pregnant during the semester, you are not allowed to work in the Organic Chemistry Lab for reasons significant to the safety of the unborn child!

## **LAB CLEANLINESS**

1. Make sure that the area around your workspace is clean while you're working on your experiment AND before you leave the laboratory. Your instructor will not clean up after you!
2. If you spill something or otherwise make a mess during a procedure, you must clean it up.
3. There are designated disposal containers for broken glass, chemicals (solid and liquid), gloves, etc. located throughout the room. If you are not sure where to dispose something, ask your lab instructor.

## **MAKING UP A LAB** *(Fall & Spring Semesters ONLY)*

**In the Fall & Spring semesters, you may make-up for a missed lab session ONLY ONCE FOR THE ENTIRE SEMESTER AND ONLY WITH THE PERMISSION OF THE PROFESSOR COORDINATING THE LABS ("lab coordinator"). The absence must be due to a proven emergency or a documented reason that the lab coordinator deems legitimate.**

First, contact your lab instructor and the lab coordinator as soon as possible after your absence (or before your absence, if it is anticipated in advance). Then, obtain a Make-Up Permission Form from the Chemistry Lab Stockroom (Room 1414, Hunter North) and confirm (day/time) for the make-up section with the Stockroom staff. Arrange to meet with the lab coordinator (Dr. Manashi Chatterjee). Be prepared to explain the reason for your absence, provide documentation and select times on when you would be able to make up for the missed lab based on the schedule of experiments. Obtain the signature of the lab coordinator on the make-up form for final approval and attend the authorized make-up section. Only one lab make up will be allowed provided you have proper documentation. You will be asked to withdraw from lab if you miss more than one lab.

**\*\* STUDENTS MAY NOT ATTEND ANY SECTION THEY'RE NOT REGISTERED IN WITHOUT A MAKE-UP PERMISSION FORM SIGNED BY THE LAB COORDINATOR! \*\***

Every effort **MUST** be made to schedule makeup sessions during a time when that same experiment is being done by another section. Please make every attempt to complete all experiments during your regular lab session and reserve make-ups for emergencies only. **Permission for make-up will not be granted in cases of student misconduct (e.g.: thrown out of lab for violating rules), negligence (e.g.: slept in, forgot about class, etc.) or failure to complete an experiment on time.**

## **THE LABORATORY NOTEBOOK**

**All your lab reports and the answers to assigned questions are to be written in a dedicated laboratory notebook. The notebook must have numbered, duplicate pages so that you can keep one copy of your lab report and turn in the second copy for grading. Suitable Organic Chemistry Laboratory Notebooks are sold at the Hunter College Bookstore.**

The notebook is to be sufficiently complete and well organized so that anyone who reads it can know what has been done in each experiment and can repeat the procedures from what's written in it. This laboratory notebook has essentially the same requirements as a notebook used to record data in a research laboratory. All data are to be recorded at the time they are observed or obtained. This includes weights, boiling and melting points, observations of physical changes, results, and conclusions. Separate pieces of copy/loose leaf paper are **NOT** to be used for recording data to be transcribed later. Your laboratory instructor may check your notebooks at the end of each laboratory session to ensure that your data was properly recorded at the time when you conducted the experiment.

The notebook should be neat but this is less important than having it be a complete, original record. Copying data is a waste of time and leads to copying errors. The record made at the time of the observation is the important record. If changes or corrections are to be made, the material considered wrong is to be cancelled by drawing a line through it. The revised material is then to be added. It may be necessary to refer to the record to determine how an experiment might best be revised or interpreted.

You should have a Table of Contents on the first page of the notebook and all of the pages should be numbered. Start every experiment on a new page. Make all records in ink (**DO NOT WRITE WITH A PENCIL!**). Instead of copying details of a procedure verbatim, refer to the page in the lab manual (or other sources) where the procedure is started. The notebook is a log of your work and should be dated regularly. As you conduct the experiment, you must write a short description of the actual procedure that you followed including all observations. The preliminary write-up, as indicated in each experiment, must be in your notebook **before** you begin the experiment. All preliminary write-ups must include a list of hazards and toxicities of the compounds involved.

Experiments designed to develop familiarity of techniques can be recorded in terms of an introduction which states the objective; a description of the procedure, which may be identified by a reference to the manual; the observations; the conclusions (identify the unknown and state the supporting data and reasoning); answers to the question, and a discussion of the theory behind the experiment and its relationship to the observed results. If your own procedure is at all different from that in these notes (or manual), tell exactly how it differs. Data tables will also be used for the later preparative experiments (from Experiment 6 onward) and you will need to know how to carefully and accurately tabulate data to include all your results.

We must emphasize that your notebook should be up to date at all times during the laboratory period and your instructor will periodically examine it to ensure this. We repeat: **you must only use indelible ink and you are NOT permitted to use corrective fluid (“white-out”) or tape.**

- *You will upload a typed report on BB (safe assign) and also hand in the printed copy with prelab attached to your lab instructor.*
- *Use chemdraw to draw structures and mechanisms. Download Chemdraw for free from Hunter library website.*

## **THE RECITATION**

Please remember that the recitation is the equivalent of a challenging one-credit course. Don't let yourself become one of the many students who receive a low grade for the entire course due to low scores on their recitation examinations! It is essential from a viewpoint of safety alone to attend all the recitations and attendance will be taken for that reason. However, the Recitation is also critical from the standpoint of your grade since your exam scores from that portion of the course will account for about 19% of the total possible points.

We would like to stress again the importance of studying and planning your work before you start the experiment! Students who really understand what they are doing in the lab will enjoy the work and might even look back on their organic chemistry laboratory as a really pleasurable learning experience. Those who do not understand the experiments will experience frustration and likely failure in addition to exposing themselves and others to the risk of a serious accident.

We will do our best to help you enjoy the course and achieve successful results, but if you don't do your homework and planning, no one will be able to help you. If an instructor determines that a student has not adequately prepared for an experiment, the student will be sent away from the laboratory and will not be allowed to do make-up work in another section.

## **LIST OF EXPERIMENTS**

<b>Experiment #</b>	<b>Title of Experiment</b>
1	Melting Point
2	Crystallization
3	Distillation
4	Chromatography (2 lab secs.)
5	Acid-Base Extraction (2 lab secs. )
6	Molecular Modeling
7	Oxidation of Cyclohexanol

8	Nucleophilic Substitution (2 lab secs.)
9	Elimination – Alkenes