

# ORGANIC CHEMISTRY LABORATORY 221 L

## Fall 2002

<b>Instructor</b>	Ms. Brenda Harmon 220A Pierce Hall 4-8341	<b>Office Hours</b> Tues., Wed., Thurs 10:30-12:00 and by appointment. ***Drop-in Mon., Tue., Wed & Thur. during labs
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### Laboratory Text

- Microscale and Miniscale Organic Chemistry Laboratory Experiments  
*Schoffstall, Gaddis, & Druelinger*
- \*Carbon-copy notebook and instructor approved safety glasses required.

### Course Objectives

*Students can benefit in many ways from taking the organic laboratory course. Some of the student objectives are to:*

- Learn to *think like a chemist*.
- Develop new laboratory skills.
- Build organizational, problem solving, and critical thinking skills.
- Develop scientific writing and record keeping skills.
- Develop the ability to observe closely and use scientific insight.
- Understand and describe chemical phenomena on both a microscopic and macroscopic scale.
- Understand the need for safe laboratory practices involving chemicals and their conditions for use.
- Understand the need for “green chemistry” practices and the complexity of issues involved in sustainability as it applies to the chemical industry and consumers.

### Content Objectives

*Students will be expected to master the following techniques of experimental organic chemistry and to understand the chemistry involved in each technique:*

- *Separation and Purification*
  - Recrystallization
  - Extraction
  - Chromatography
  - Distillation
- *Identification*
  - Melting points
  - Chromatography

- Infrared Spectroscopy (FTIR)

## Grading Methods and Course Requirements

15%	Quizzes (pre-lab & post-lab)
20%	Laboratory notebook ( <i>notebook quizzes and carbon copies</i> )
10%	Partial scientific papers
15%	Complete scientific papers
15%	Written exam
15%	Lab practical
5%	Responses to green chemistry readings (3 or 4)
5%	Instructor evaluation

Grades are based on percentages and usually assigned as follows:

93 - 100% A	78 - 80% C+
90 - 92% A-	74 - 77% C
88 - 90% B+	70 - 73% C-
84 - 87% B	68 - 70% D+
80 - 83% B-	60 - 67% D
	Below 60% F

## Quizzes

### *Pre-lab Quizzes*

A 5-10 minute quiz will be given at the beginning of each lab period to determine your level of preparation. The questions will be very general in nature and easily answered by someone who has done adequate preparation for lab. The quizzes will be followed by a brief discussion of the quiz questions and a 30-45 minute lecture about the concepts, techniques, and procedures to be followed for that lab session.

### *Post-lab Quizzes*

A 15-20 minute quiz will be given at the end of selected laboratory sessions. These quizzes will cover the concepts behind the experiments or techniques just completed and may include concepts from previous experiments. Much of the information learned in this lab class is cumulative, therefore you will be held responsible for these thematic concepts throughout the semester. These quizzes may or may not be announced.

## ***Laboratory Notebooks***

Scientific information in itself is valueless unless it is communicated to others in some concise, well-organized form. The first step in scientific communication is the laboratory notebook. A carbon-copy bound notebook is required. Arrange each experiment as follows:

- I. Title. If appropriate include a balanced chemical equation that shows the overall process.
- II. Purpose - 2-3 sentences that state why you are doing this lab. State **why** you are doing the experiment, not **what** you are doing. This is the purpose *as a chemist*. Do NOT state the educational objectives of the experiment - believe it or not, I know what I'm trying to teach you.
- III. Procedure & Separation/Purification Scheme - this is a procedural *outline* of what to do in lab - your summary from reading the experiment **before** class. Do not repeat verbatim what is in the lab manual. Use an outline format in short-hand notation or flow diagrams to guide yourself quickly through the procedure.
- IV. Table of reagents and solvents. This table should include all information pertinent to the experiment. This includes, but is not limited to, molecular weight, density, bpt, mpt, as well as important hazard information. Mole and gram quantities of reagents used should be included here as well as theoretical yield calculations.

ITEMS I, II, III AND IV SHOULD BE COMPLETED BEFORE YOU COME TO LAB.

- V. Observations & Data - Observations must be recorded in your notebook while you are performing an experiment. The actual quantities of all reagents must be recorded as they are used as well as the amounts of crude and purified products that you obtain. Mention which measurements and spectra are taken. Data should be recorded in tabular form where appropriate.
- VI. Results/Calculations - Calculation of percent yield and interpretation of physical and spectral data. Make sure that the final results are reported clearly and include boxes around important information.
- VII. Conclusions & Summary - Include a succinct discussion of your results. Talk like a chemist! Comment on any sources of error in measurements or reasons why the yield or product purity do not correspond to 100%. Be specific in your comments - do NOT site "human error".

ITEMS V, VI, AND VII SHOULD BE COMPLETED BEFORE YOU LEAVE THE LAB.

It is correct scientific method to keep a neat, well-organized notebook so you will not have to depend on an imperfect memory. Always use your notebook, **not scrap paper**, to record observations and data. Always use ball-point pen -- using pencil or fiber pens has resulted in many a chemist watching important data run off of the page when common solvents are spilled on the notebook. The notebook must be neat and legible so that if necessary, you can repeat the experiment by referring only to your own record. NEVER ERASE OR USE WHITEOUT IN YOUR NOTEBOOK! This piece of information that you just obliterated may not have been a mistake.

You must come to lab well prepared or it will be unlikely that you can finish on time. Sections I, II, III, and IV of the lab report should be filled out prior to class. Section V is the only section that you should fill in during the lab while sections VI and VII are written after the experiment has been completed.

Your scientific papers will be written from your laboratory notebook. *It is therefore important to keep concise, accurate, and legible laboratory notes that tell the “story” of what you did, how you did it, and how successful your work was.*

The laboratory notebooks will be graded in two ways:

#### *Notebook carbon copies*

Carbon copies will be collected at the end of every lab session. They are expected to be complete. They will be evaluated on style, content, and clarity. I will return a brief evaluation of these notebook pages along with comments for future work. These evaluations will count as 1/2 of your laboratory notebook grade.

#### *Notebook quizzes*

The other 1/2 of your laboratory notebook grade will come from several notebook quizzes given during the semester. These quizzes will be open notebook and will require you to use your own records to answer questions about procedures, data, and observations from previous laboratory experiments. Hopefully, these quizzes will teach you the value of a well prepared, carefully documented, clear notebook.

### ***Partial Scientific Papers***

At the beginning of the semester you will be given a packet that will detail all of the specifics of scientific writing. Scientific reports are carefully constructed into sections so that readers can easily find the information and ideas that are most relevant to them. You will be given examples of each section before you are required to write that section. Once you have gained experience at writing these sections of a scientific paper you will be required to write two complete scientific papers.

### ***Complete Scientific Papers***

You will spend part of the semester learning how to write each section of a scientific paper and then you will be required to write two complete scientific papers. The first paper will be returned with detailed

comments and guidelines for future work. The second paper will be due at the very end of the semester.

### ***Written exam***

Everything you learn in this course is interconnected. Every technique builds on everything else. You will be learning a series of techniques that you will have to use and apply throughout the year. Not only do you need to learn HOW to perform all the techniques, you must understand the chemistry behind them. Consequently, you will be tested on your understanding and application of these techniques in an hour long written exam.

### ***Lab Practical***

Since this is a laboratory course, it doesn't seem fair to grade you totally on written work. Consequently, close to the end of the semester you will be given a laboratory practical exam that will present a problem requiring you to use the following techniques: *extraction, recrystallization, melting point, and thin-layer chromatography*. You will be evaluated by the instructor on: planning and organizational skills, knowledge, confidence, safety skills, technique, and conclusions.

### ***Green Chemistry Readings and Responses***

I will be assigning 3 or 4 short readings on advances in green chemistry that pertain to the organic chemical industry, consumers, and society. These readings will hopefully provide you with an understanding of what "green" chemistry is and the complexity of the issues facing our society. I will ask that you write a short (1 page) response to these readings on our class conference.

### ***Instructor Evaluation***

Since this course is student-centered your attitude and performance can affect the other students. During the course of the semester the lab instructor will evaluate you in the following areas: attitude, being well prepared, being on time, following the safety rules, working efficiently, finishing on time, leaving the lab clean, working well in a group situation, working comprehension of the subject matter, and technique. The evaluation score will range from 0-100 points. Most students can expect to earn a score of 80-85. Exceptionally courteous, well-prepared, and efficient students can expect higher scores. Rude, quarrelsome, and unprepared or "perpetually lost" students can expect lower scores.

### ***Attendance***

Attendance during your assigned scheduled lab time is mandatory. There will be no make-up sessions for lab. In the event of extenuating circumstances (e.g. a serious illness) arrangements that do not involve a penalty can be made with your instructor. It is the student's responsibility to let the instructor know PRIOR to the missed lab any extenuating circumstances. If the instructor is not contacted **prior** to the missed lab the student will receive a zero for that lab. NO exceptions!

## **Late Work**

If work is turned in late, the penalty is one letter grade per day. In the event of extenuating circumstances penalties may be waived. This will be determined on a case-by-case basis.

## **Honor Code Policy**

Lab sessions are a perfect place to promote and utilize collaborative learning. You are encouraged to discuss the experiments with others before lab (group study) and while in lab. However, your laboratory notebook and scientific reports, including calculations, are to be **your work alone**. You should treat them as you would a take-home test. Collaboration on any report is a violation of the Oxford College Honor Code and will be treated as such. This rule applies to any portion of reports from previous semesters as well as papers available over the internet. Your name on your lab report is your pledge that the work is yours and that you did not give or receive unauthorized assistance. The usual penalty for students who are found to have violated the honor code is an automatic F in the course.

## **Laboratory Regulations**

### **Breakage/Missing Items :**

You are financially responsible for all equipment made available to you in laboratory. If you are working in a group and no individual accepts the responsibility for the broken or missing item, then every member of the group will equally be billed at the end of the semester. This bill must be paid by the end of the semester or grades may be withheld.

### **Cleanliness:**

No one trusts a messy chemist. Each student is expected to leave the work station clean and orderly. A dirty/cluttered work area will result in a reduction of the lab grade.

### **Safety Rules:**

- Wear eye protection at all times in the laboratory
- Wear closed toe shoes. NO open-toed shoes will be allowed!
- Tie back long hair.
- Do not wear baggy clothes, especially baggy sleeves.
- Do not wear shorts.
- Do not taste anything.
- Do not eat or drink in the laboratory.
- Do no unauthorized experiments.
- Report all injuries (no matter how minor) to the lab supervisor.
- Wash your hands before leave the laboratory.

### **Regulations :**

- Read each experiment before you come to lab.
- Leave all reagent bottles on the side table.

***Place waste in the appropriate waste container.*** Do not discard solids in the sink.  
Avoid excessive amounts of a reagent; measure the amount needed.  
Do not insert your pipettes or medicine droppers into the reagent bottles.  
Read the label twice before removing a chemical.

## **Group Work**

You will be asked to form small groups for working in and out of organic lab. You will perform most of the procedures by yourself or in pairs, but you will prepare, discuss, and evaluate the procedures in small groups of 4-6 students. The groups will have three primary activities.

- I. You will be asked to meet with your group *before* your lab day to work on assigned problems. You should be completely prepared for lab when your group meets so that you can fully contribute. The reason for this group meeting is to allow you to think about what you are going to be doing in lab and to discuss it BEFORE coming to lab. This should enhance the learning experience since you will get more out of lab if you come in with some prior understanding of the procedure.
- II. You will work with your assigned group on many activities during lab. You will discuss and evaluate the procedures and concepts during lab in these larger groups.
- III. You will work with your group to research the hazards of chemicals involved in a particular experiment (these will be assigned) and how the chemical waste generated will be handled/disposed of after the experiment. Your group will present this information to the class.

## ***Group Rules***

You will draw up a list of group rules before the second session of lab. You will have the option of excluding anyone who does not contribute at all. You will have the opportunity to “grade” the other group members performance and participation in light of the rules you agree on. I will use these grades when assigning the instructor evaluation grade.

Your list of rules should address the following:

- When and where you will meet outside of lab time.
- How you will define participation.
- How you will deal with or settle disputes.

# Tentative Organic Lab Schedule Fall 2002

<b>Week of:</b>	<b>Experiment</b>	<b>Topic</b>	<b>Quizzes</b>	<b>Scientific writing</b>
Sept. 2		Introduction/Safety/Group problems	none	
Sept. 9	<i>exercise K.1</i>	Chromatography	pre-lab quiz	procedure and results
Sept. 16	<i>exercise I.1</i>	Extraction (mini-scale)	pre-lab quiz	none
Sept. 23	Exp. 3.4 A & B	Extraction (micro-scale)	pre-lab quiz	intro, results, discussion
Sept. 30	<i>exercises C.1 &amp; C.2</i>	Melting points	pre-lab quiz	none
Oct. 7	Exp. 8.1 A & B	Rates of SN1 & SN2 Reactions	pre-lab quiz	none
Oct. 14	<i>NO LAB</i>	<i>Fall Break</i>		
Oct. 21	Exp. 3.3 A & B	Recrystallization (mini-scale)	pre-lab quiz	intro, results, discussion
Oct. 28	Exp. 3.5 B	*Isolation, purification, and identification of caffeine from instant coffee.	pre-lab quiz	<b>Scientific paper #1 due the week of Nov. 4</b>
Nov. 4	<b>Written Exam and Lab Practical</b>			
Nov. 11	Exp. 5.1 & 5.2	*Elimination E1 and E2 (GC)	pre-lab quiz	<b>Scientific Paper #2 due the week of Nov. 26</b>
Nov. 18	Exp. 14.1 A	Grignard synthesis of a tertiary alcohol	pre-lab quiz	none
Nov. 25	<i>NO LAB</i>	<i>Thanksgiving Break</i>		
Dec. 2	Exp. 14.1 A (cont)	Work-up of the Grignard synthesis	pre-lab quiz	none
Dec. 9	<i>NO LAB</i>	<i>Last week of classes</i>		

**\* Monday Labs will meet on Friday, Sept. 7 due to the labor day holiday.**

**\*\*Notebook carbon-copies are expected to be completed and turned in before you leave each lab.**





## Organic Chemistry Laboratory

### HONOR CODE STATEMENT

The Honor Code applies to Chemistry 221 L & 222 L laboratories. You should be familiar with the stipulations of the Honor Code. Some areas in which it applies in this laboratory include, but are not limited to:

1. Lab reports should be considered as tests. On a lab report you may not give or receive help from anyone but an Oxford College chemistry faculty member.
2. On a lab report (scientific writing and lab summaries), you may use your book, your notes, and the lab manual, but you may not look at or use any portion of another student's lab report. This applies to the report of any student currently in the course as well as to the report of any student who has taken the course earlier.
3. A paper submitted as a lab report (scientific writing and lab summaries) must be your work and your work alone. You may not use a portion of the paper of another current or former student, or a model paper by an instructor. This means you may not reprint a portion of another paper, photocopy a portion of another paper, retype a portion of another paper, or in any way incorporate a portion of another paper, including data, tables, and figures, into your paper. In addition, you may not have anyone else type your paper. However, you may have someone proof-read your paper for its writing (but not for its content). The Honor Code provisions regarding plagiarism apply to the lab report.

You should be aware that as the instructor, I am obligated to report any suspected Honor Code violations to the Honor Council for investigation. Should you be found guilty of violating the Honor Code by the Honor Council, you should be aware that the usual penalty is an F in the course.

I have read the Honor Code of Oxford College and the above statements as to how the Honor Code applies for this laboratory. I understand them and I agree to abide by them.

Name \_\_\_\_\_

Signed

Date \_\_\_\_\_

\_\_\_\_\_  
(print name)

