ORGANIC CHEMISTRY LABORATORY 221 L
Fall 2001

Instructor Ms. Brenda Harmon
220A Pierce Hall
4-8341

Office Hours Mon. 10:30-12:30
and by appointment.
****Drop-in Mon., Tue., & Wed. 2-5 during labs*

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 form taking the organic laboratory course. Some of the student objectives are to:

- Develop new laboratory skills.
- Build organizational, problem solving, and critical thinking skills by compiling and analyzing data.
- 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.
- Appreciate the art of experimental design.

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
  - Sublimation
- *Identification*
  - Melting points
  - Boiling points

- Chromatography
- Infrared Spectroscopy (FTIR)

Grading Methods and Course Requirements

15%	Quizzes (pre-lab and group theory)
20%	Laboratory Notebook (notebook quizzes and carbon copies)
5%	Partial scientific papers
15%	Complete scientific papers
5%	Written lab mid-term
15%	Written lab final
20%	Lab Practical
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.

Group Theory Quizzes

A 15-20 minute quiz will be given at the end of selected laboratory sessions. These quizzes will be completed in groups of four and will cover the concepts behind the experiment or technique just completed. These quizzes will require you to consolidate information that you have previously learned and apply it to new situations. These quizzes are hoped to stimulate group discussion and to help put the laboratory experience into context.

The pre-lab quizzes and group theory quizzes will be averaged to determine your quiz grade. The quizzes will count as 20% of your laboratory course grade.

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 experimentation steps.

IV. Table of reagents and solvents. This table should include all pertinent information such as 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. (MSDS on-line: http://siri.uvm.edu/msds/)

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.

The laboratory notebook carbon copies will be a significant part of your grade for the course. In addition, 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 1/3 of your laboratory notebook grade.

Notebook quizzes

The other 2/3 of your laboratory notebook grade will come from two notebook quizzes: the first given along with the written mid-term, the second given along with the written lab final. 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 each of the sections of a scientific paper you will be required to write a complete scientific paper. Your grades for each of the scientific paper sections will be averaged and together they will count as 5% of your course grade since this is primarily a learning experience.

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. The first paper will count as 1/3, and the second paper will count as 2/3 of your complete scientific paper grade (15% of your laboratory course grade).

Written mid-term and final theory-practice exams

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 two, hour long, written exams. The mid-term will count as 5% and the final (which will include all of the information before and after the mid-term) will count as 15% of your total course grade.

Lab Practical

Since this is a laboratory course, it doesn't seem fair to grade you totally on written work. Consequently, at 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. This lab practical is worth 20% of your total course grade.

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. This evaluation will count as 5% of your overall course grade.

Attendance

Attendance during your assigned scheduled lab time is mandatory. <u>There will be no make-up sessions for lab.</u> 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. <u>If the instructor is not contacted **prior** to the missed lab the student will receive a zero for that lab.</u> NO exceptions!

Late Work

If a daily lab report 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. Students who are found to have violated the honor code will receive an automatic F in the course and may be suspended or expelled.

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.
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.
Do not work alone.
Report all injuries to the lab supervisor.
Wash your hands when you are ready to 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.

Scientific Notebooks:

Tentative Organic Lab Schedule

Fall 2001

Week of:	Experiment	Topic	Quizzes	Scientific writing
Sept. 3		Introduction/Safety/Group problems	none	
Sept. 10	*excercise* K.1	Chromatography	pre-lab quiz & group-theory quiz	none
Sept. 17	*exercise* I.1	Extraction (mini-scale)	pre-lab quiz & group-theory quiz	none
Sept. 24	Exp. 3.4 A & B	Extraction (micro-scale)	pre-lab quiz & group-theory quiz	results & discussion
Oct. 1	*exercises* C.1 & C.2	Melting Points	pre-lab quiz & group-theory quiz	none
Oct. 8	Exp. 3.3 A & B	Recrystallization (mini-scale)	pre-lab quiz & group-theory quiz	intro & procedure
Oct. 15	*NO LAB*	*Fall Break*		
Oct. 22	Exp. 3.5 B	Isolation, purification, and identification of caffeine from instant coffee.		***Scientific paper #1*** **due the week of Nov. 5**
Oct. 29	**Lab Practical** ***Written mid-tem exam and notebook quiz #1***			
Nov. 5	*Exp. 8.1 A & B*	Rates of SN1 & SN2 Reactions	pre-lab quiz & group-theory quiz	none
Nov. 12	Exp. 5.1 & 5.2	Elimination E1 and E2 (GC)	pre-lab quiz & group-theory quiz	**Scientific Paper #2 due the week of Dec. 3**
Nov. 19		FTIR	group work on FTIR	none
Nov. 26	*Exp. 4.1*	ROH -> RX an SN2 reaction (GC)	pre-lab quiz & group-theory quiz	none
Dec. 3		***Written Final Exam and notebook quiz #2***		
Dec. 10	*NO LAB*	*Last week of classes*		

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