

ORGANIC CHEMISTRY LABORATORY 221 L

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

Office Hours Mon. 10:30-12:30
and by appointment.
***Drop-in Mon., Tue., & Thur.. 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 from taking the organic laboratory course. Some of the student objectives are to:

- Develop new laboratory skills. Utilize and reinforce previously learned laboratory skills.
- Develop and reinforce scientific record keeping skills.
- Write clear and concise reports summarizing the purpose, procedures, data, and conclusions from laboratory investigations and protocols.
- Develop the ability to observe closely and use scientific insight.
- Build organizational, problem solving, and critical thinking skills by compiling and analyzing data.
- 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*
 - Simple Distillation
 - Fractional Distillation
 - Preparative thin-layer chromatography
- *Identification*
 - Chromatography
 - Infrared Spectroscopy (FTIR)
 - Nuclear Magnetic Resonance (NMR)



Grading Methods and Course Requirements

25%	Quizzes (pre-lab and post-lab)
10%	Pre-lab questions, flow schemes, and group member evaluation
30%	Laboratory Notebook (notebook quizzes and carbon copies)
30%	Experiment (or technique) summaries
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 5-10 minute quiz will be given at the end of selected laboratory sessions. These quizzes will test your comprehension of the concepts behind the experiment or technique just completed. These quizzes will be completed individually.

The pre-lab quizzes and post-lab quizzes will be averaged to determine your quiz grade. The quizzes will count as 25% of your laboratory course grade.

Group Work

Pre-lab questions

The answers to pre-lab questions may be with a group or on an individual basis. The answers to these questions will be due from each student at the beginning of each lab period. If you work in a group setting, please indicate your group members at the top of the page. For some experiments you will be asked to design a flow-scheme before lab. These also can be prepared with a group or on an individual basis. Each student will be required to have a flow scheme in his or her laboratory notebook at the beginning of that particular laboratory session.

Group member evaluations

At the end of the semester you will have the opportunity to evaluate your lab partner and group members. This evaluation will cover topics ranging from knowledge and preparation to technical skills and carrying a fair share of the work load. Remember, your partner and other group members will have the opportunity to evaluate you. This evaluation will be considered when calculating this part of your grade.

Experimental (or technique) summaries

You will be required to write a clear, concise summary of each experiment or technique we perform in the lab. These summaries should be no longer than 3 pages (double spaced, 12 pt font) and cover the following information:

- The purpose of the experiment (or technique). No educational objectives!
- A brief summary of the procedures used and a reference to the lab manual or handout.
- A summary of the data collected from the experiment.
- A succinct conclusion that relates back to the purpose.
- A thoughtful explanation of experimental sources of error or loss if necessary.

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

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.

Laboratory Regulations

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.

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.

Tentative Organic Lab Schedule				
	Spring 2002			
Week of:	Experiment	Assigned Reading	Pre-lab group work	
Jan. 21	MLK Holiday	No Lab		
Jan. 28	Qualitative Organic Analysis I	pgs. 271-274	pg. 274: 6	
Feb. 4	Distillation - simple and fractional Exercises G.2 & H.1	pgs. 55-60, 62-64 pgs. 67--68, 74-75	pg. 68: 2,4,5,9 pg. 75: 1,4	
Feb. 11	Synthesis of Alkenes Exp. 5.2	pgs. 219-221	pg. 220: 2,3,4	
Feb. 18	Synthesis of Alkenes Exp. 5.1	pgs. 222-224	pg. 222: 2,3	
Feb. 25	Grignard I Exp. 14.1 the reaction	pgs. 347-351	pg. 350: 1,3	
Mar.4	Grignard II Exp. 14.1 the work-up & purification	pgs. 347-351	Design a flow scheme for work-up	
Mar. 11	SPRING BREAK	NO LAB!!!!		
Mar. 18	Synthesis of Aspirin Exp. 20.1	pgs. 409-412	pg. 410: 1,2,3	
Mar. 25	Student designed synthesis of fruity esters Exp. 20.2	pgs. 413-416	pg. 414/415: 1,2,3,4	
Apr. 1	Synthesis of Soap Exp. 26.1 (you choose Part A or B) Partial hydrogenation of olive oil Exp. 6.1 Part C	pgs. 489-492 pgs. 225-226	pg. 492: 1,3,4,5 N/A	
Apr. 8	Isolation of curcumin	Handout	Design a flow scheme for the separation and purification	
Apr. 15	Polymer Synthesis	Handout	N/A	
Apr. 22	**Qual II Exp. 28.2	pgs. 511-521	pg. 504: 1,2	
Apr. 29	**Qual II (cont.) Exp. 28.2	pgs. 521-529	N/A	
**The correct identification of your unknown is the lab final.				