

ORGANIC CHEMISTRY LABORATORY 221 L

Fall 2003

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| Instructor | Ms. Brenda Harmon 220A Pierce Hall 4-8341 | Office Hours Tues., Wed., Thurs 10:30-12:00 and by appointment. ***Drop-in Mon., Tue., Wed & Thur. during labs |
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*"In theory, there is no difference between theory and practice.
In practice, however, there is."*

- Jan van de Snepscheut

Laboratory Text

- Microscale and Miniscale Organic Chemistry Laboratory Experiments
Schoffstall, Gaddis, & Druelinger
- *Instructor provided notebook and approved safety glasses required.

Course Objectives

Students can benefit in many ways from taking the organic laboratory course:

- Learn to *think like a chemist* by applying material covered in the General Chemistry courses and the Organic Lecture course to real laboratory situations. This application (with real understanding) is what chemistry is all about.
- To think about, understand, and evaluate matter on both a macroscopic and a microscopic scale. To describe chemical phenomena on both a microscopic and macroscopic scale.
- Build organizational, analytical, and problem solving skills using chemistry specific approaches.
- Develop scientific writing and record keeping skills. To strengthen your skills in communicating analytical results in a clear and concise manner.
- Develop the ability to observe closely and use scientific insight.
- Develop oral and written communication skills working with a team of peers.
- Develop new laboratory skills.
- Understand the need for safe laboratory practices involving chemicals and their conditions for use.

Content Objectives

Students will be expected to master the following techniques of experimental organic chemistry and to understand the chemistry that makes each physical separation or analysis work:

Separation and Purification

Recrystallization
Extraction

Identification

Melting points
Chromatography

Grading Methods and Course Requirements

| | |
|-----|--|
| 20% | Laboratory notebook |
| 10% | Pre-lab quizzes |
| 15% | Post-lab quizzes |
| 20% | Lab summaries/revisions |
| 10% | Complete scientific paper/revisions |
| 15% | Written exam |
| 10% | Lab practical, instructor observations, group member evaluations |

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 question quiz will be given at the beginning of each lab period to determine your level of preparation. You will be allowed to use the procedure and table of reagents sections of your laboratory notebook to answer three questions specific to the procedure. Two further questions will investigate your understanding of the material. The quiz 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 most 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. An instructor provided, 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.
- III. Procedure - 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 – You will write this portion after lab. See details in the following section.

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 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 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. You will be quizzed on these sections. 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 summaries and 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.

Laboratory notebooks will be collected at mid-term and again at the end of the semester. They will be evaluated on style, content, and clarity. *The in-lab sections of the notebook are expected to be complete at the end of each lab. I will randomly examine notebooks while you are taking the post-lab quizzes. Leaving lab with an incomplete notebook may result in grade penalties.*

Lab Summaries

In this course, it is not sufficient to come to lab, blindly follow the procedures, and turn in data. The most important aspect of this course is for you to understand the chemistry behind what you are doing. After each lab you will write a (double spaced, 2-page minimum, 3-page maximum) summary explaining the purpose of what you did in lab (as a chemist – no educational objectives!!!) and then thoroughly explain the chemistry behind what you did. I will post information to help you in writing each summary on learnlink. These summaries will be due 48 hrs after your lab is over.

Complete Scientific Paper

You will be required to write one complete scientific paper during this semester. Guidelines will be handed out at the time of the assignment.

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.

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, lab summaries, 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.

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.

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.

Tentative Organic Lab Schedule Fall 2003

| Week of: | Experiment | Topic | Quizzes | Writing Assignment |
|----------|---------------------------------------|---|---|---|
| Sept. 1 | | Introduction/Safety/Group problems | none | |
| Sept. 8 | exercise K.1 | Chromatography | pre- and post- | Summary |
| Sept. 15 | exercise I.1 | Extraction (mini-scale) | pre- and post- | Summary |
| Sept. 22 | Exp. 3.4 A & B | Extraction (micro-scale) | pre- and post- | Summary |
| Sept. 29 | exercises C.1 & C.2 | Melting points | pre- and post- | Summary |
| Oct. 6 | Handout | Team Problem | pre- and post- | Summary |
| Oct. 13 | NO LAB | Fall Break | | |
| Oct. 20 | Exp. 3.3 A & B | Recrystallization (mini-scale) | pre- and post- | Summary |
| Oct. 27 | Exp. 3.5 B | *Isolation, purification, and identification of caffeine from instant coffee. | pre-lab quiz | Scientific paper due the week of Nov. 10 |
| Nov. 3 | Written Exam and Lab Practical | | | |
| Nov. 10 | Handout | Synthesis of Ethanol | Individual meetings to discuss caffeine paper | |
| Nov. 17 | Handout | Distillation of Ethanol | pre- and post- | Summary |
| Nov. 24 | NO LAB | Thanksgiving Break | | |
| Dec. 1 | Tech. M | FTIR | pre- and post- | Scientific paper Revisions due |
| Dec. 8 | NO LAB | Last week of classes | | |

*** Monday Labs will meet on Friday, Sept. 5 due to the labor day holiday.**

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 summaries and scientific papers should be considered as tests. On a lab summary or scientific paper you may not give or receive help in writing content from anyone but an Oxford College chemistry faculty member.
2. In writing a lab summary or scientific paper, 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 summary. 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 summary or scientific paper 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. You may not use papers available via the internet. 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. All sources must be referenced.

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)

