ORGANIC CHEMISTRY LABORATORY 222 L
Spring 2013

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

Office Hours Mon and Wed 10:30-11:30
and by appointment.
****Drop-in Mon., Tue., 2-4:30 during labs*

"In theory, there is no difference between theory and practice.
In practice, however, there is."
- Jan van de Snepscheut

Laboratory Text

- Pre-lab reading materials and questions will be made available via Blackboard.
- Carbon-copy notebook and approved safety glasses required.

A liberal-arts intensive laboratory course for organic chemistry

Many organic laboratory courses focus on developing techniques and applying them (given detailed, rote instructions) randomly to many different synthetic reactions discussed throughout lecture. Sort of a "show and tell" approach. This laboratory course, in line with the Oxford College mission statement, takes a liberal-arts intensive approach.

The focus in this course is developing a rich understanding of the chemistry behind the techniques and connecting the macroscale (what you see and do in lab) to the microscale (the theories and concepts from lecture). Instead of following detailed procedures, students are guided to develop their own procedures and to develop the disciplined habits of mind of a scientific researcher.

Course Goals

Cognitive Domain

Students will demonstrate their ability to:

- *Think like a chemist* by applying content knowledge from the general chemistry organic lecture courses to problem-solving in real laboratory situations.
- Employ trouble-shooting skills (backward diagnosis) while problem-solving in real laboratory situations.
- Interpret, manipulate, and analyze matter and chemical phenomena on both a macroscopic and a microscopic scale.
- Employ disciplined habits of mind that characterize scientific thinking.
- Practice scientific record keeping skills in a laboratory notebook.
- Observe closely and use scientific insight.
- Apply oral communication skills working with a team of peers.
- Organize and present qualitative and quantitative evidence.
- Calculate theoretical and % yield for a synthetic reaction.
- Interpret simple NMR and IR spectra to identify organic compounds and determine purity.
- Construct valid arguments using logic and reasoning skills.

Affective Domain

Students will demonstrate their ability to:

- Know the laboratory safety rules and practice them.
- Prioritize time and multi-task to meet the needs of the laboratory time constraints.
- Cooperate in group activities (displays teamwork).
- Use failure as a tool for producing more effective learning. (Mistakes are an important part of the scientific method, often more can be learned by making mistakes than by being right the first time.)
- Show self-reliance when working independently.
- Question new concepts, models, etc. in order to fully understand them.
- Revise judgments and change behavior in light of new evidence.

Content Goals

Synthesis: Students will demonstrate their ability to perform and evaluate simple organic synthesis reactions (the BIG 3: % yield, identity, and purity) using complex tools of organic chemistry. Work-up: Students will demonstrate their ability to apply the concepts of **molecular structure, polarity, and intermolecular forces** in order to **predict physical and chemical properties** and to **use these properties to separate mixtures and identify pure substances**.

- *Synthesis of small range of organic compounds*
- *Separation and Purification*
  - Liquids: Simple and Fractional Distillation
  - Solids: Recrystallization
- *Identification*
  - Infrared Spectroscopy (FTIR)
  - Nuclear Magnetic Resonance (proton NMR)
- *12 Principals of Green Chemistry*
- *Microwave synthetic procedures*
- *To begin to search, read, and understand a small subset of chemical literature.*

Grading Methods and Course Requirements

Intro to Synthesis/Distillation/Recrystallization	**15%**
Notebook	
Results/Conclusion	
Quizzes	
IR/NMR	**15%**
Lab activities (handouts)	
Quizzes	
Engagement	
Grignard Synthesis Module	**25%**
Notebook	
Data grade	

Analysis grade	
Quizzes	
Research Module	**10%**
Lab Activities (handouts)	
Laboratory Work	
Quizzes	
Engagement	
*Proposal (Intro and procedure)	**10%**
Mid-Term Exam	**15%**
Final Exam	**10%**

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 20-30 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 each laboratory session. These quizzes will test your comprehension of the concepts behind the experiment or technique just completed and connections to material previously covered in the course

Lab Activities (Handouts)

You will be asked to complete several worksheets for each module. Some will be completed during lab and others will be completed outside of lab time, in order to prepare for quizzes.

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 four 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. The groups will work on an independent research project. This project will be presented to the class.

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 just **what** you are doing. This is the purpose *as a chemist*. Do NOT state the educational objectives of the experiment. **Draw the chemical reaction representing the synthesis. This is how organic chemists talk to each other.**

IV. Table of reagents and solvents. This table should include all information **pertinent** to the experiment. This might include: 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**.

V.

VI. 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.

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. Conclusion – 1-3 sentences relating back to the purpose of the experiment. 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".

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.

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 F in the course.

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.

Please Note:

Student work submitted as part of this course may be reviewed by Oxford and Emory faculty/staff for the purposes of improving instruction and enhancing Emory education.

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)

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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.

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