

ORGANIC CHEMISTRY LABORATORY 222 L

Spring 2009

Instructor	Ms. Brenda Harmon 220A Pierce Hall 4-8341	Office Hours Mon and Tue 11:00-12:00 and by appointment. ***Drop-in Mon., Tue., 2-4:30 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

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

A liberal-arts intensive TPSL 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 TPSL approach.

The focus in this course is in 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.

Experiments and synthetic procedures have been selected that highlight the importance of organic chemistry to societal and personal decision making- consumer products, environmental sustainability, and biological and health science topics.

TPSL (Theory-practice/service-learning) is a teaching method that enriches learning by engaging students in meaningful service to their schools and communities. Students apply academic skills to solving real-world issues, linking established learning objectives with genuine needs. The TPSL approach used in this laboratory based course will focus on strengthening the students' understanding of organic chemistry, sustainability, and their capacity for responsible citizenship.

Course Goals

Students can benefit in many ways from taking the organic laboratory course. Some of the learning goals of the course are to:

- Learn to *think like a chemist* by applying material covered in the General Chemistry courses and the Organic Lecture courses 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 thinking skills. To develop the habits of mind necessary for disciplined inquiry and evidence based decision making...the foundation of a liberal education.
- Develop the ability to observe closely and use scientific insight.
- Develop scientific writing and record keeping skills. To strengthen your skills in communicating analytical results in a clear and concise manner.
- Develop oral and written communication skills working with a team of peers.
- Learn new laboratory skills.
- Strengthen your capacity for sustainable living and civic responsibility through a service learning project.
- Connect scientific understanding and aspects of organic chemistry to societal and personal decision making.
- Understand the need for “green chemistry” approaches in organic chemistry.
- Understand the need for safe laboratory practices involving chemicals and their conditions for use.

Content Objectives

Students will have an opportunity to learn the following content:

- *Synthesis of small range of organic compounds*
- *Separation and Purification*
 - Simple and Fractional Distillation
 - Gas Chromatography
- *Identification*
 - Gas Chromatography
 - Infrared Spectroscopy (FTIR)
 - Nuclear Magnetic Resonance (proton NMR)
 - Qualitative Analysis
- *12 Principles of Green Chemistry*
- *Biofuels and Environmental Sustainability*

TPSL community service project:

Biodiesel is a renewable fuel synthesized from vegetable oil or animal fat that can be used as a substitute for petroleum derived diesel in most diesel engines. Students in this laboratory course will use cafeteria waste oil to produce 40 gallons of fuel grade biodiesel that will be donated to local biodiesel users (Emory's 53 bus shuttles are fueled with 20% biodiesel). Students will also provide 5 hours of community service (outside of the laboratory) in planning and hosting a Earth Day Celebration held at Oxford College in celebration of Earth Day 2009. Students will educate children, citizens, and lawmakers of Newton County about renewable biofuels, the importance of lowering CO₂ emissions, and developing more sustainable energy alternatives.

Grading Methods and Course Requirements

Each laboratory session is worth 100 points:

60 points notebook

20 points quizzes

20 points post lab writing assignment

* you can drop your lowest lab grade

Total lab grades	1000 points (55%)
TPSL Project and Reflection Paper	250 points (10%)
Written lab final	250 points (15%)
Independent group project	250 points (15%)
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Total points for the course	1700 points

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

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. Each group will be responsible for a portion of the Sustainability Carnival (preparation, hosting, demos, etc.).
- IV. The groups will work on an independent project comparing a green chemical synthesis to a traditional approach. This project will be presented to the class as a power point presentation.

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 workload. 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.

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. 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”.

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.

The incomplete carbon-copies will be collected at the end of each lab session. I will periodically return these with feedback on your notebook keeping skills. The 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.

Post-lab Writing Assignments

The most important aspect of this course is for you to understand the chemistry behind what you are doing. Post-lab writing assignments will include: summaries of what you did, how you did it

and your results; similar summaries written in third-person, past -tense, passive-voice; and complete scientific papers. Guidelines will be handed out at the time of the assignment.

Independent Group Project

Each group will have the opportunity to design and complete a project to compare a traditional synthetic method to a “green” approach. The group will present their work as a power point presentation on the final day of lab. Guidelines for the project and a grading rubric will be handed out at the time of the assignment.

Written final 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, comprehensive written exam.

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.

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:

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.

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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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. This also includes papers available on the internet.
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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