

**S343: Organic Chemistry I Lab: Honors
Summer 2009**

Instructor: Dr. Ben Burlingham
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Office hours:
11:30AM-12:30PM
MTWR

Course Website: www.chem.indiana.edu/academics/ugrad/Courses/s343/default.asp

Associate Instructors:

<u>Section</u>	<u>AI</u>	<u>email</u>
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Course Structure: Lecture will meet in CH033 MTWR 10:30-11:20AM. Lab sections will meet MW or TR 12:30PM-5:00PM in CH145, CH147, or CH149.

Attendance: Attendance will not be taken during the lecture. The student is responsible to obtain any material missed during the absence. Any unexcused absences for quizzes or exams will result in a zero for that grade. There will be no make-up quizzes offered. If a valid excuse is offered for the mid-term exam, the grade for the midterm will be replaced by the percentage on the final. There will be no excuse accepted for the final.

Laboratory attendance is mandatory. There will be no make-up lab sessions. No report may be turned in for labs that were not completed during the given lab times. All such reports will result in scores of zero. With an appropriate excuse and instructor permission, one lab score of zero due to absence may be replaced by the average of all lab scores for the final grade.

Required texts: Techniques in Organic Chemistry, 2nd ed. By Mohrig, Hammond, and Schatz (ISBN 0-7167-6935-2)

Modern Projects and Experiments in Organic Chemistry, 2nd ed. By Mohrig, Hammond, Schatz, and Morrill (ISBN 0-7167-9779-8)

Additional text: Organic Chemistry by Janice G. Smith (ISBN 0-07-239746-2)

Required Supplies: approved safety goggles, lab notebook

Laboratory Goals:

- Follow experimental procedures while observing all rules regarding safety
- Understand theory of basic organic laboratory techniques, spectroscopy, and chromatography
- Employ basic laboratory techniques, spectroscopy and chromatography in experimental protocols
- Use spectroscopy in problem solving and characterization
- Learn the proper use of a lab notebook in keeping neat and accurate records of all experiments conducted

Safety:

Safety is the number one priority in the chemistry lab. In order for you to have an enjoyable experience, there are some fundamental rules of lab safety that must be followed AT ALL TIMES. These rules will be given during lab on the first meeting. All students must sign a **Safety Rules** sheet at the beginning of the semester. Failure to comply with all safety rules may result in dismissal from the course.

Grading:

The final grade will be composed of lab notebooks, formal lab reports and proposals, quizzes, and exams according to the following distribution:

Lab reports:	400 pts
Research Proposal:	100 pts
Quizzes:	100 pts
Midterm:	100 pts
<u>Final exam:</u>	<u>200 pts</u>
Total:	900 pts

Anticipated grading scale: A = above 90%, B = 80-89.9%, C = 70-79.9%, D = 60-69.9%, F=below 60%. Plus/minus grades will be awarded.

Laboratory: A fun and educational lab experience depends on the student being highly prepared. The techniques and theory behind each lab will be covered in lecture before lab. In addition, the AI will provide students with some background and advice. It is very important, though, that the student is prepared by reading and understanding the lab as outlined in the manual before coming to lab. Proper use of a lab notebook will help the student prepare for laboratory.

Lab Notebook: The lab notebook is the foundation for all written assignments for the lab. It serves as a recording of all data and observations made in lab with a few preliminary conclusions. To organize the notebook, save a few pages at the beginning of the book for a table of contents. The lab notebook will be filled out before, during, and after lab in the following format:

Prior to lab:

1. Title
2. Statement of purpose or question
3. Main reaction/table of reagents (if applicable)
4. Experimental procedure

During lab

5. Observations and results

After lab

6. Comments and discussion
7. Summary

Title: Each experiment or multipart experiment should start on a new page. At the top of the page, label the experiment with a short title that summarizes the work to be done in the experiment.

Statement of purpose or hypothesis: After reading the lab background and procedure, write a statement of purpose or an experimental question to be addressed in your own words.

Main reaction/table of reagents: In a synthetic lab, write the main reaction being performed including all reagents and products. Under the main reaction, write the quantitative data for each reagent, including molecular weight, density, gram amount, mole amount, and volume. For a non-synthetic lab, no main reaction is written, but a table of chemical data may be compiled.

Procedure: Before the start of each new experiment, each student must come to lab with the procedure written out in his or her lab notebook. **No text books, handouts, or lab manuals will be allowed into the lab—only lab notebooks may be used.** No student will be allowed to begin the lab until the procedure is written out in the lab notebook. The procedure, however, should not be simply copied from the lab manual. Rather, time should be taken to ensure that each step of the procedure is understood so that each student knows exactly what to do when he or she enters lab.

Observations and results: Thoroughly record what happened during the experiment. Include final mass yields, tables of spectral data, times between changes, color changes, physical properties (mp,bp, etc.), evolution of gases, temperature changes, and anything else of interest that you note.

Comments and discussion: Soon after the lab is complete, you will write out comments and conclusions from your data that address the purpose of the lab. At this point in your chemistry career, you still need some guidance on what is important to include in your discussion, so guiding questions will be given to you. You should treat these questions as a guide for writing, not a limitation on what you should write. This set of guiding questions is sufficient to do well on the assignment (B-level), but very well written comments and discussion sections (A-level) should go beyond a simple “answer” the questions” approach to integrating and applying data at a level of higher order thinking.

The notebook **MUST** be completed in pen. Nothing should be erased, but simply crossed out if deemed incorrect. Each page should be numbered, signed, and dated. A legible photocopy of the notebook should be turned in for grading on the appropriate days as listed in the syllabus.

Formal Laboratory Reports: Because one of the major goals of this course is to learn effective communication skills in the field of chemistry, the lab reports comprise a significant portion of the final grade. To communicate chemical results and conclusions well, one needs first to be able to know what is important to communicate and then be able to communicate in an effective style. Three formal reports will be type written and in the format of an article from *The Journal of Organic Chemistry*. Students will be responsible to initiate their own discussion from their results.

The formal reports will be due toward the end of the semester, and more detailed information will be given as needed at a later date.

The notebook reports and formal lab reports from all sections will be graded by one AI on a rotating basis using a rubric provided by the instructor, and therefore all lab sections will be graded equally.

Research Proposal: It is also important for a chemist to be able to research an original idea and write a proposal for how to accomplish the research necessary to investigate the idea. Throughout this semester, we will discuss the general details of a research proposal. Students will then use primary literature to gain a background for their own individualized project. Students will write a formal proposal for the synthesis of an unsaturated aryl sulfonate ester, incorporating primary literature into the proposal.

The proposals will be graded by the instructor.

Quizzes: Quizzes will be given six times throughout the course. Each quiz will be worth 20 points. The lowest quiz will be dropped to give a total of 100 points for quizzes throughout the course. No make-up quizzes will be given. If one quiz is missed, it will be counted as the dropped quiz score. Quizzes will be given during the last ten minutes of class, but students are permitted to stay as long as necessary to complete the quizzes.

Midterm exam: The midterm exam will be given on July 20 from 12:30PM-3:30PM in Chemistry Building room 033. The exam will be worth 100 points.

Final exam: The final will be given on August 13 from 10:30AM-1:30PM in Jordan hall room 124. The exam is worth 200 pts. It will include questions from material covered in lecture as well as questions based on the labs you did.

Academic Honesty:

The determination of academic misconduct is at the discretion of the instructor. The sanctions may range from deduction of points to a failing grade for the class. In all cases, the infraction will be immediately reported to the Dean of Students as well as the dean or director of the student's school. Please read the *Code of Student Rights, Responsibilities, and Conduct* for further detail.

Tentative Lecture Schedule: This schedule may be changed by the instructor to better meet the needs of the class.

Date	Topic	Reading guideline (Techniques)	Graded assignment
June 22	Safety, ChemDraw, structure/property relationship	2-15, 30-32	
June 23	Solubility, extraction, drying	75-84, 93-99	
June 24	Recrystallization, melting point, chromatography, TLC	100-126, 177-189	
June 25	Chemical communication, Literature searching, research proposal	AP12-AP17 Project handout	Quiz 1
June 29	IR	228-243	
June 30	IR	243-256	
July 1	IR	256-262	
July 2	Research Proposal		Quiz 2
July 6	Distillation/Project 6	133-145, 156-157	
July 7	GC analysis	190-205	
July 8	NMR-theory and equiv atoms	267-276	
July 9	NMR—chemical shift of ^{13}C and ^1H	276-283, 324-328	Quiz 3
July 13	NMR—integration and splitting	294-297	
July 14	NMR—interpreting ^1H	311-318	
July 15	NMR—interpreting ^1H		
July 16	NMR—DEPT	329-331	Quiz 4
July 20	Review		Midterm
July 21	Day Off		
July 22	NMR/Multistep synthesis exp	284-294	
July 23	NMR	294-304	
July 27	NMR		
July 28	NMR		
July 29	NMR—advanced topics	318-321	
July 30	NMR—advanced topics	331-334	Quiz 5
Aug 3	MS	341-353	Research proposal due
Aug 4	MS	353-358	
Aug 5	MS	358-361	
Aug 6	EA/Characterization		Quiz 6
Aug 10	Integrated Problems	AP18-AP26	
Aug 11	Integrated Problems		
Aug 12	Integrated Problems		
Aug 13	Final Exam		Final Exam

Lab Schedule: This schedule may be changed by the instructor to better meet the needs of the class.

Date	Lab	Assignment Due in your lab section:
June 22-23	Check-In/ChemDraw (handout)	
June 24-25	Using Extraction to Separate a Mixture (Project 2.1)	ChemDraw Worksheet (25pts)
June 29-30	Using Extraction to Separate a Mixture (Project 2.2)	Project 2.1 Notebook (25 pts)
July 1-2	Stereochemistry of Dihydroxylation (Handout)	Project 2.2 Notebook (25pts)
July 6-7	Substitution Reactions (Project 6.2)	Dihydroxylation Notebook (25pts)
July 8-9	Elimination reactions (Project 6.1,6.3)	Substitution Reactions Notebook (25pts)
July 13-14	Isomerization of Carvone (handout)	Elimination Reactions Notebook (25 pts)
July 15-16	Grignard Synthesis (Gilbert and Martin 19.4A)	Isomerization Notebook (25pts)
July 20	Midterm Exam	
July 22-23	Nitration of Bromobenzene (Gilbert and Martin 15.4)	Grignard Formal Report (50pts)
July 27-28	Multistep Synthesis of 2'-bromostyrene	Nitration Formal Report (50pts)
July 29-30	Multistep continued	
Aug 3-4	Multistep continued	
Aug 5-6	Multistep continued	
Aug 10-11	Unknown Sulfonate ester/Checkout	Multistep Formal (100pts) Unknown Structures Handout (25pts)
Aug 12-13	No meeting	