

**Description:** A one-semester-hour laboratory course designed to accompany organic chemistry lecture.

**Pre-requisites:** Grade of 'C-' or better in Chem 223 and Chem 225

**Co-requisite:** Chem 224

**Materials:** Making the Connections<sup>3</sup> By Anne B. Padias (ISBN: 978-0-7380-7436-8)

Permanently-Bound Composition Notebook

Full-length lab coat

Safety goggles (will be provided during safety training)

**Course Homepage:** Announcements, assessments, extra copies of the handouts, the grade book, etc. are posted on [Sakai.luc.edu](http://Sakai.luc.edu). You are responsible for this material, so you should check Sakai frequently.

**Grading:** Course grades consist of the following components:

Online Safety Training	5 pts
8 In-class Pre-lab Quizzes, 5 pts each	40 pts
9 Post-lab Notebook Submissions, 10 pts each	90 pts
Technique and Safety, 5 pts per experiment	45 pts
9 Post-lab Exercises, 10 pts each	90 pts
In-Class Exam	100 pts
Online Exam	100 pts
Formal Lab Report	50 pts
Chemistry Literature Searching Exercise	15 pts
Overall Notebook Evaluation	<u>15 pts</u>
	550 pts total

A>94%, A->90%, B+>88%, B>84%, B->80%, C+>78%, C>74%, C->70, D+>68%, D≥60%, F<60%

**Online Safety Training:** All students must watch the presentation posted on Sakai and score 5/5 on the Safety Training Quiz before being allowed to work in the laboratory. There are unlimited attempts.

**Pre-Lab Preparation:** Success in organic lab depends on advance preparation. Therefore, there are several things you must do before coming to lab. One major component of your pre-lab assignment is to thoroughly read and understand the experimental procedure and the assigned background readings listed on Sakai.

**In-Class Pre-lab Quizzes:** All but the first experiment will start with a short quiz. Pre-lab quizzes are open notebook but closed handout/book. At least one of the quiz questions will be drawn directly from the Table of Reagents. Quizzes end after 10 minutes or when everyone who was present when the quiz began is finished, whichever is shorter. Students who arrive late will not be given extra time. Students who require accommodations must complete the quiz in the SSWD office before class begins. In order to assist you in preparing for the quizzes, there are some sample questions posted for each experiment on Sakai. These are a study aid and do not count for points.

**Lab Notebooks:** The ability to keep good records is a valuable skill. Before coming to class, you must also complete the pre-lab portion of your lab notebook. After the first experiment, the TAs will be checking notebooks before each experiment. Anyone who has not completed the pre-lab portion of the notebook will not be allowed to perform the experiment. Think of your completed pre-lab as your admission ticket to each experiment. The lab notebook format is posted on Sakai and there is also a description of how to complete a lab notebook in the Padias text. The pre-lab portion includes the Title, Objective, Table of Reagents, Balanced Chemical Equation, Pre-lab Calculations (i.e.; moles of each starting material and the Theoretical Yield), and an Outline.

The remaining portions of the lab notebook for each experiment are to be completed in class. Once the experiment is over, the rest of the notebook pages must be scanned and submitted via Sakai before the next class period. Scanned notebook pages must be submitted as a PDF file. In order for credit to be awarded, the scans must be clearly legible and must be properly oriented (i.e.; no sideways or upside down pages).

Data Submission: At the end of each experiment and before you leave lab, you must report your experimental results to your Teaching Assistant. For synthesis labs, you must show your final product to your TA before placing it in the waste jar in order to receive credit for your results. The TA will initial your notebook pages. If you do not report your results before leaving lab, your Notebook submission on Sakai will only be worth half credit at most.

Technique and Safety: Your success in lab goes beyond what appears on paper. Attention to safety, housekeeping, level of preparation, ability to work with others, ability to follow directions, and ability to work independently are also important. Therefore, there will be point deductions for a variety of things that impact laboratory safety and the quality of the laboratory results generated. These items include— but are not limited to— touching door handles with gloved hands, returning unused reagents to stock bottles, having exposed skin below the waist (especially ankles and tops of the feet), placing items in your mouth in lab (e.g.; eating, drinking, chewing gum, etc.), leaving reactions unattended, removing one's eye protection, handling one's phone with gloved hands, etc. Both lab partners must also share the workload. Technique points can be deducted if one lab partner doesn't fully contribute.

Lab Drawers: You should leave the lab in a good condition at the end of the period. The TA will not initial your notebook pages until she/he has inspected your drawer. The TA or Instructor may also deduct Technique points if the drawer or other areas of the lab—such as balances, sinks, etc.—are not left in a satisfactory condition at the end of the lab period. Items that are missing or broken from the drawer should be immediately replaced at the stockroom. There is no charge for breakage. All glassware and equipment should be cleaned and returned by the end of the lab period. Unannounced drawer inspections may occur periodically throughout the semester and technique points may be deducted if items from the lab bench are missing, broken or not clean. Points may also be deducted if extra items are found in the drawer that were not on the check-in sheet. This includes items such as clamps, tubing, thermometers, vacuum adapters, etc.

Post-lab Exercises: Short questions pertaining to the experiment you have just completed will be posted on Sakai. These should be completed after lab ends and are due at the beginning of the next lab period. Students are allowed three attempts until the due date, and exercises must be submitted to count. Work that is saved but not submitted before the deadline will be ignored. Spelling, grammar, and significant figures count.

In-Class Exam: The first exam will be completed in person after the first four experiments. Be sure to bring a No. 2 pencil and your Student ID with you. You do not need to bring your goggles and lab coat. The exam will include material covered in class, the background readings, as well as co-requisite and pre-requisite material. Points will be deducted for not following instructions.

Online Exam: The second exam will be completed via Sakai and is due by 5 PM on August 11, 2017. Only one submission is allowed. The exam is not timed. Students may save their work and return to it later, but the exam must be submitted to count. Work that is saved but not submitted before the deadline will receive an automatic 20% deduction. Spelling, grammar, and significant figures count.

Formal Lab Report: A formal, type-written lab report over the Reduction experiment will be due by the beginning of class on July 19, 2017. This report should be clearly written using proper scientific grammar (do not use first person tense like "I did this" or "we saw this"). More detailed guidelines for the report will be discussed in class and posted on Sakai.

Chemistry Literature Searching Exercise: Organic chemistry is a vibrant, living science that is perpetually changing and building upon itself. New compounds and new reactions are constantly being discovered.

These advancements are normally published in journal articles and conference proceedings. This is sometimes called the primary literature. In this exercise, which is completed via Sakai, you will learn about some tools for navigating the vast amount of information in the chemistry-related primary literature. Three attempts are allowed. Students may save their work and return to it, but the exercise must be submitted to count. Work that is saved but not submitted before the deadline will receive a 20% deduction. This exercise is due by 5 PM on Friday, July 21, 2017.

Overall Notebook Evaluation: Lab notebooks will be physically collected on the last day of class. They will be checked for overall formatting items that are not reflected in the scans—things like a Table of Contents, continuously numbering the pages, using only one side of the page, not removing or altering any portion of the notebook, etc.

Re-grades: All requests to have items re-graded must be submitted in writing within one week after the graded materials are returned to the student.

Attendance: You are expected to attend every lab session. Due to safety constraints and size limitations, you will not be allowed to make up an experiment in another section. Missing a lab period will result in a zero for the Notebook and Data Submission portion of that experiment. However, you may still complete the Post-lab exercise for that experiment. The normal due dates will still apply. The missing points from the in-class quiz, technique score, and the notebook submission will be replaced by counting the exam that covers the experiment more heavily. Missing more than 2 experiments will result in automatic failure of the course.

There will be an attendance sheet that students are required to sign upon entering the lab. It is critical that the attendance sheet exactly match who is present in the lab in the event of an emergency. If you must leave the lab after signing in (e.g.; to use the restroom, get a drink of water, etc.) be sure to log your exit on the attendance sheet. For safety's sake, in order to better results and to be fair to your lab partner, limit your time out of the lab. Students who leave the lab for a period longer than 10 minutes will receive a deduction from the Data Collection points for that experiment.

Additionally, you must be signed in prior to the start of the pre-lab lecture to ensure everyone's on-time arrival to class. Tardiness or just not signing in will result in a point deduction for that experiment. Students must be present for the pre-lab lecture because important safety-related information is covered. Any student who misses a significant portion of the pre-lab lecture will not be allowed to perform the experiment and will receive a zero for that experiment. Safely working with chemicals requires your undivided attention! As such, any behavior that indicates that you are not paying attention during the pre-lab will result in the student not being allowed to perform the experiment. This includes, but is not limited to, sleeping, looking at one's phone or computer, talking, etc.

Safety Rules: Read the safety rules carefully and follow them throughout the course. Anyone who does not adhere to the safety rules will receive point deductions and may not be allowed to remain in the laboratory. You will be provided a pair of safety goggles at the beginning of the course. You must bring your eye protection and lab coat with you to every class, as well as dress in appropriate clothing and footwear.

Academic Integrity: Each student is expected to do her/his own work. Although the lab is constructed so students may work in pairs during an experiment, all work submitted for a grade must be an individual effort. The penalty for academic dishonesty is a grade of 'F' for the course.

Late Policy: Unless otherwise specified, materials that are submitted late but on the same day as they were due will receive a 10% deduction. There will be an additional 25% deduction for each day or portion of a day, including weekends, they are late after that.

Course/Instructor Evaluation – IDEA: Loyola has the IDEA program for instructor and course evaluations. At the end of the semester, you will complete an online evaluation of this course based on criteria set by IDEA

and by the instructor. For this course, the main objective is learning to apply course material. In particular, our objectives are to characterize organic compounds by measuring their physical properties, isolate organic compounds using a variety of purification techniques and, lastly, to synthesize organic compounds using chemical reactions. Keep these objectives in mind throughout the course.

Co-Requisite Chem 224 Lecture Course: The following statement came from the chemistry department office regarding dropping lecture but staying in lab, "Students who drop the co-req lecture must be receiving a grade of D or better in the lecture in order to continue in the co-req lab."

Email: You must use your Loyola email address when contacting the TAs or the instructor for this course. Emails from outside sources are often blocked automatically. In the subject line of your email, put Chem 226-section number and TAs name.

Contact: Mr. Thomas, LSB 124, (773) 508-8115, [tthoma1@luc.edu](mailto:tthoma1@luc.edu)

### Experiments

1. Sodium Borohydride Reduction of Benzophenone
2. Potassium Permanganate Oxidation of Benzyl Alcohol
3. Structural Effects on Acidity
4. Diels-Alder Reaction of Conjugated Dienes
5. Nitration of *N*-Acetyl-*p*-Toluidine
6. Reactions of Carbonyl Compounds—Derivative Formation and Aldol
7. Acylation of an Aromatic Amine
8. Fischer Esterification
9. Polymers