

Description: CHEM 226 is the second course in the organic chemistry laboratory sequence. In this course, students combine lab techniques learned in previous lab courses as well as new ones to run successful organic chemical reactions. Students will isolate and characterize the newly synthesized organic compounds while documenting their findings.

Meeting Times and Locations: All sections of CHEM 226 meet in LSB 115.

Section	Day/Time	Instructor	Teaching Assistants
001	Tuesdays/Thursdays 8:30 AM – 11:15 AM	Eisenberg	Emily Radz, Katie Siver
002	Tuesdays/Thursdays 11:30 AM – 2:15 PM	Eisenberg	Gaby Martinez-Ramirez, Aryana Sayeed

Academic Calendar: It is the student's responsibility to know both the schedule for this course (posted above) as well as the University's official [Summer Session Academic Calendar](#). Students are responsible for attending class for the duration of the term.

Office Hours: Office hours for the instructor and TAs are posted on Sakai.

Pre-requisites: Grade of 'C-' or better in CHEM 223 and CHEM 225.

Required Materials:

- Full-length lab coat
- Safety goggles (will be provided during the first day of class)
- Appropriate clothing and footwear (more information below)
- Bound composition book
- Non-erasable, waterproof pen
- Access to Sakai

This course utilizes materials that require a device with high-speed internet access. Wired (ethernet cable) internet is preferred, but WI-FI is acceptable if the connection is reliable. Students are responsible for having access to a suitable device and the internet access necessary for submitting all online assignments by the posted due dates. If you do not have a desktop/laptop computer or Internet service, go to Cudahy Library (the Information Commons is closed for summer refurbishments) or contact ITS for information on their loan equipment program within the first few days of the start of the course and arrange for them.

Course Homepage: All course materials are posted on Sakai.luc.edu. Students should check the Sakai site for this course frequently as it is central to how the lab operates. **Please note that all course materials should be accessed under the Lessons tab** where details are broken down by topic/experiment. Certain assignments may not open properly if attempts are made to access them through other tabs.

Grading: The course grade consists of the following components:

1. Preparation for Synthesis Assignment: Establishes some key steps involved in properly preparing and documenting a synthesis experiment 5%
 2. Pre-lab Exercises: Assigned to ensure students are aware of the experimental parameters for each lab; must be completed 30 minutes before lab begins 25%
 3. Lab Results/Notebook Entries: Written entirely during lab to accurately document the experiment as it is being performed; scanned and submitted at the end of lab 25%
 4. Post-lab Exercises: Completed after lab to allow more time to think about and digest the aim(s) of the experiment and the results 25%
 5. Lab Safety: Earned for properly following the lab safety rules during experiments 5%
 6. Lab Report: Ensures students can convey the parts of an experiment using formal scientific writing; grade will be based on a first draft, completing peer reviews, as well as a score on the final submission 15%
- 100%

A>93%, A->90%, B+>87%, B>83%, B->80%, C+>77%, C>73%, C->70, D+>67%, D≥60%, F<60%

Lab Safety Rules: Working safely in the laboratory is something that everyone must always consider. Before working in lab, all students will be expected to have watched the safety videos and read the lab safety rules, both of which are posted on Sakai. Students MUST follow these rules throughout the course. On lab safety day, students must sign a Lab Safety Contract that acknowledges that the student received the safety rules and agrees to follow them. A lab safety contract must be signed by a student before they are allowed to work in the lab. Anyone who does not adhere to the safety rules will receive point deductions and may not be allowed to remain in the laboratory, depending on the severity of the violation. Students must bring eye protection and a full-length lab coat to every experiment. Students must also dress in appropriate clothing and footwear such that there is no exposed skin at any point below the shoulders. For the sake of hygiene and other reasons, students may not borrow goggles and/or a lab coat. Any student who comes to lab without these items will automatically not be allowed to perform the experiment. More information on the course attendance policy and safety points can be found below.

***** WHENEVER CHEMICALS ARE PRESENT, NO ONE MAY ENTER LSB-115 UNLESS THEY ARE WEARING THE FOLLOWING: *****

1. **EYE PROTECTION (These must be type G, H or K goggles and must meet or exceed ANSI Z87.1)**
2. **FULL-LENGTH LAB COAT**
3. **CLOSED-TOE, CLOSED-HEEL SHOES**
4. **APPROPRIATE ATTIRE THAT FULLY COVERS ALL SKIN BELOW THE WAIST**

Attendance: Students are expected to attend every lab session. **Any student who does not have their safety goggles or lab coat, is not dressed appropriately, or has not completed the pre-lab preparation on time will be marked absent.** Due to safety constraints, time, and size limitations, students are not allowed to make up an experiment in another section. Missing a lab period for any reason will result in an automatic zero for any in-class work that is not completed. The Pre-lab and Post-lab exercises can still be completed via Sakai, but the normal due dates will still apply. **Students will be allowed to complete an alternate assignment for the Lab Results/Notebook and Safety scores for ONE absence from lab during the course.** Students are responsible for requesting it via email from the instructor within 48 hours of the absence. Any additional missed work beyond one experiment cannot be made up and will result in 0s.

Students are required to check in with their TA and sign an attendance sheet before entering the lab. It is critical that the attendance sheet exactly matches who is present in the lab in the event of an emergency. If someone must leave the lab after signing in (e.g., to use the restroom, get a drink of water, etc.) that person must be sure to talk to their TA and/or log out on the attendance sheet. For safety's sake, to better results and to be fair to both lab partners, students should limit time out of the lab. Students who leave the lab for a period longer than 10 minutes will receive a deduction from the Lab Results/Notebook points for that experiment.

Additionally, to ensure fairness to everyone, students who arrive late may be asked to perform an experiment solo. **Students must arrive within 15 minutes of the start time for lab to complete the experiment; any student arriving more than 15 minutes late will be marked absent.**

Preparation for Synthesis Assignment: This assignment will be done at the start of the course to establish the important steps and calculations that are involved in performing and documenting a synthesis experiment successfully. Students will review where to find physical property values, how to perform stoichiometry calculations, how to document an experimental procedure, as well as review infrared (IR) and nuclear magnetic resonance (NMR) spectroscopies while analyzing the starting material and product of an organic synthesis. The assignment consists of two parts, both of which are submitted via Sakai. Only one late submission for each part will be permitted.

Pre-Lab Preparation: Success in organic lab depends on advance preparation. Students who come to class prepared get better results, get done faster, and, most importantly, tend to have fewer accidents. Therefore, there are several things that students must do BEFORE coming to the lab. One major component of the pre-lab assignment is to thoroughly read and understand the experimental procedure that is posted on Sakai. Students must also watch any videos posted on Sakai about the experiment. Before coming to class, students must complete the pre-lab exercises posted on Sakai. Pre-lab exercises have unlimited attempts until the due

date. A student must attempt every question and score a minimum of 80% of the available points on the pre-lab exercises for an experiment to be eligible to complete that experiment in lab. To allow time for the pre-lab assignments to be checked before class and to minimize last-minute, rushed preparation, the due date for pre-lab exercises will be 30 minutes before class begins. **No late pre-labs will be accepted, and students who don't complete the pre-lab as instructed will not be allowed to perform the experiment.**

Lab Results/Notebook Entries: The ability to keep good records is a valuable skill. A properly maintained notebook will make documenting an experiment easier, and it keeps the experimental results all in one place. You must show your TA that you have your lab notebook as you enter the lab. However, for this class, you do NOT need to have anything written in your notebook for the experiment before lab starts. The pre-lab information will be posted on Sakai, and THIS MATERIAL DOES NOT HAVE TO BE RECOPIED INTO THE LAB NOTEBOOK. **Notebook entries will be written DURING LAB and should include a title, a balanced chemical equation, a detailed procedure section written while the experiment is being performed, and a summary of the experimental results.** The material normally covered in the discussion/conclusion section of the notebook will be included in the post-lab exercises, so this does not have to be included in the scanned lab notebook entries for this class. Unlike forgetting a lab coat or goggles, students will be allowed to perform the experiment if the lab notebook is forgotten, but any entries written on loose-leaf paper will receive safety point deduction(s) for a lack of proper scientific records.

It is worth stressing that one of the most important facets of experimental work is that data should be recorded as completely and accurately as possible. Sometimes, important discoveries are made when things don't act exactly as expected. Therefore, it is critical that students report their actual procedure and data, NOT what it is thought that the correct answer should be. Procedures should be written entirely in past tense to document the experiment as it was actually performed. THE NOTEBOOK MUST ACCURATELY REFLECT WHAT HAPPENED DURING THE EXPERIMENT. Lab notebook entries are not meant to be written as instructions for others, but as a written record of what happened performing the experiment. After a lab is completed, the pages will then be scanned and uploaded to Sakai to maintain a digital record of the work as well as for grading purposes. **Notebook entries are due at the end of every lab period.** If an experiment runs long enough to prevent notebook pages from being scanned by the end of class, the due date may be extended on a case-by-case basis. Late notebook submissions will only be accepted for 48 hours after the due date and will be penalized 10-20%. To receive credit, the upload must be submitted as a single file in the PDF format, and the contents must be legible and oriented correctly. Emailed notebook submissions will not be accepted.

Post-lab Exercises: While performing an experiment, students are often very focused on the tasks being completed and do not always pause to consider why certain things are done in specific ways. To reinforce the concepts and techniques that were performed in lab and allow more time to think through the results, students will also complete post-lab exercises outside of class after each experiment. The format and late submission policies for the post-labs will vary depending on the type of post-lab exercise assigned, so always refer to the individual experimental Lessons folders on Sakai for details.

Lab Safety Points: Laboratory safety is an extremely serious and important topic. All violations of the safety rules will result in point deductions. Some safety violations may also result in the student being expelled from the lab. As employees, the instructors and Teaching Assistants are expected to enforce the safety rules and disciplinary actions may be taken against them by Loyola if the safety rules are not enforced. Therefore, please do not ask the instructors or Teaching Assistants to ignore any safety rules or to not apply any penalties for safety infractions. They are not optional. Some examples of safety violations that result in immediate point deductions include things like removing safety goggles in the lab, touching your phone with your gloved hands, eating or drinking in lab, etc. These are just some examples—the list is not all-inclusive because it is impossible to foresee every potential safety violation. Some examples of safety violations that will result in immediate expulsion from the laboratory include things like wearing inappropriate attire, dumping chemical waste down the sink, etc. Again, these are just some examples. There are other safety violations that could come up that may result in a student being asked to leave the lab. In addition, incurring multiple lesser safety violations may also result in a student being asked to leave the lab, even if the infractions wouldn't warrant expulsion individually. Each experiment will have three safety points at stake.

Lab Report: There will be one lab report written for one of the lab experiments in this course. The purpose of the lab report is to formalize one's experiment with written documentation that is accurate and understandable to others. Students will combine and elaborate on the experimental information from the pre-lab materials and their lab notebook entries to compose a type-written report that conveys the results and importance of the experiment. A first draft of the lab report will undergo peer review. Each student is expected to submit an initial draft on Sakai (using the appropriate Assignments link) and will then be randomly and anonymously assigned 3 of their peers' reports to review using a provided rubric. After receiving feedback from their peers, students will then have the chance to edit and resubmit their reports for the final evaluation. The total lab report grade will be broken down based on the average of the peer reviewed scores for the first draft, for properly completing 3 peer reviews, as well as for the score earned on the submission of the final report. **Students must submit their first draft of the report ON TIME using the proper link posted on Sakai to be eligible for peer review.** Failure to do so will result in an automatic ineligibility to participate in the peer review process and point losses. First draft submissions must be done as a single PDF file without any identifiers to ensure anonymous review (no name header in the document, file name, etc). All students must also submit a final draft of their reports using the proper link on Sakai for final evaluation, even if they choose to make no changes to their original draft. The final submission can have identification but must also be submitted as a single PDF file. Late submissions for the final draft are permitted following the general late policy for the course.

Re-grades: All requests to have any submitted assignment re-graded must be submitted in writing within one week after the graded materials are returned to the student. Students should email the instructor to question the specific portion(s) of their assignment that they feel was scored incorrectly for a re-grade, not the TA.

Late Policy: Unless otherwise specified above, assignments may be submitted late. Assignments submitted late but on the same date as they were due will receive a 10% deduction. There will be an additional 10% deduction for each day or portion of a day, including weekends, they are late after that. Late submissions will be accepted for up to 1 week past the posted due date or the hard deadline, whichever is sooner.

Hard Deadline: All materials of any kind must be submitted by 5 PM on Friday, August 11, 2023. No materials will be accepted after this time. Final grades will be calculated based only on materials submitted by this deadline. If there are substantial materials that are missing and that cannot be submitted before this deadline, the student should consider withdrawing from the course or requesting an Incomplete by completing [this form](#) prior to the end of the term.

Email: Faculty email addresses are posted on the open Internet for every software bot and spammer in the world to see. Therefore, faculty Outlook accounts are configured differently, and an outside contractor also scans faculty email. Emails from outside sources are often blocked automatically. Because of this and a Federal law relating to student privacy (FERPA), students must use a Loyola email address when contacting the TAs or the instructor about this course. In the subject line of an email, please put Chem 226-section number and TA's name.

Interactions with TAs: To increase the amount of individual assistance students receive in lab, Teaching Assistants will participate in delivering this course. If at any time during the semester you have any questions or concerns about the behavior of your Teaching Assistant, please contact the instructor.

Academic Integrity: All students in this course are expected to have read and to abide by the demanding standard of personal honesty, drafted by the College of Arts & Sciences, which can be viewed at: <http://www.luc.edu/cas/advising/academicintegritystatement/>

"A basic mission of a university is to search for and to communicate the truth as it is honestly perceived. A genuine learning community cannot exist unless this demanding standard is a fundamental tenet of the intellectual life of the community. Students of Loyola University Chicago are expected to know, to respect, and to practice this standard of personal honesty.

Academic dishonesty can take several forms, including, but not limited to cheating, plagiarism, copying another student's work, and submitting false documents."

Any instance of dishonesty (including those detailed on the website provided above) will be reported to The Chair of The Department of Chemistry & Biochemistry, who will decide what the next steps may be. The penalty may include a grade of zero for that assignment and/or failure of the course.

Health, Safety, and Well-Being On-Campus: Please be familiar with and adhere to all current policies and protocols posted on the Campus Info & Resources site:

<https://www.luc.edu/healthsafetyandwellbeing/campusinforesources/>

Course/Instructor Evaluation – SmartEval: The following information came from the University regarding course evaluations, “Towards the end of the course, the students will receive an email from the Office of Institutional Effectiveness reminding them to provide feedback on the course. They will receive consistent reminders throughout the period when the evaluation is open, and the reminders will stop once they have completed the evaluation.

- The evaluation is completely anonymous. When the results are released, instructors and departments will not be able to tell which student provided the individual feedback.
- Because it is anonymous and the results are not released to faculty or departments until after grades have been submitted, the feedback will not impact a student’s grade.
- The feedback is important so that the instructor can gain insight into how to improve their teaching and the department can learn how best to shape the curriculum.”

Course Repeat Rule: Effective with the Fall 2017 semester, students are allowed only THREE attempts to pass Chemistry courses with a C- or better grade. The three attempts include withdrawals (W). The Department advises that it is preferable to complete a course with a grade of C or C-, and to demonstrate growth in future coursework, rather than to withdraw from a course.

After the second attempt, the student must secure approval for a third attempt. Students must come to the Chemistry Department, fill out a permission to register form or print it from the Department of Chemistry & Biochemistry website: <https://www.luc.edu/chemistry/forms/> and personally meet and obtain a signature from either the Undergraduate Program Director, Assistant Chairperson, or Chairperson in Chemistry. A copy of this form is then taken to your Academic Advisor in Sullivan to secure final permission for the attempt.

Student Accommodations: The Student Accessibility Center (SAC), Sullivan Center (773-508-3700), <http://www.luc.edu/sac>, has the mission “to support, service, and empower Loyola University Chicago students with disabilities” and to “Partner with faculty and staff to provide opportunities for collaboration, professional development, personal growth, and staff interaction, as they relate to students with disabilities.” Please direct all questions concerning accommodations of disabilities to the Student Accessibility Center. Academic accommodations afforded to students require documentation and review. The Student Accessibility Center will issue accommodation letters for registered students to present to their instructors; accommodations are not active until students present these letters to their instructors. If students’ accommodations involve attendance or deadlines, instructors and students will jointly complete and execute an Agreement Form articulating their terms. See <https://www.luc.edu/sac/faculty/facilitatingaccommodations/> for guidance about implementing various kinds of accommodations in a way that is appropriate to your class. The Student Accessibility Center stands ready to work with you.

Loyola University Absence Policy for Students in Co-Curricular Activities (including ROTC): Students missing classes while representing Loyola University Chicago in an official capacity (e.g. intercollegiate athletics, debate team, model government organization) shall be allowed by the faculty member of record to make up any assignments and to receive notes or other written information distributed in the missed classes. Students should discuss with faculty the potential consequences of missing lectures and the ways in which they can be remedied. Students must provide their instructors with proper documentation describing the reason for and date of the absence. This documentation must be signed by an appropriate faculty or staff member, and it must be provided as far in advance of the absence as possible. It is the responsibility of the student to make up any assignments. If the student misses an examination, the instructor is required to give the student the opportunity to take the examination at another time. (<https://www.luc.edu/athletheadvising/attendance.shtml>).

Accommodations for Religious Reasons: If you have observances of religious holidays that will cause you to miss class or otherwise affect your performance in the class you must alert the instructor within 10 calendar days of the first class meeting of the semester to request special accommodations, which will be handled on a case-by-case basis.

Privacy Statement: Assuring privacy among faculty and students engaged in online and face-to-face instructional activities helps promote open and robust conversations and mitigates concerns that comments made within the context of the class will be shared beyond the classroom. As such, recordings of instructional activities occurring in online or face-to-face classes may be used solely for internal class purposes by the faculty member and students registered for the course, and only during the period in which the course is offered. Students will be informed of such recordings by a statement in the syllabus for the course in which they will be recorded. Instructors who wish to make subsequent use of recordings that include student activity may do so only with informed written consent of the students involved or if all student activity is removed from the recording. Recordings including student activity that have been initiated by the instructor may be retained by the instructor only for individual use. Additionally, all materials from this course cannot be shared outside the course without the instructor's written permission.

Instructor Contact: Dr. Eisenberg, LSB-124, (773) 508-8714, jeisenberg2@luc.edu

Topics and Experiments:

1. Lab Safety; Control of Reaction Temperature
2. Preparing for and Running a Synthesis Reaction: Oxidation of Benzyl Alcohol
3. Compound Separation Using Column Chromatography
4. Monitoring a Reaction with TLC (Sodium Borohydride Reduction)
5. Combinatorial Chemistry to Form Esters
6. Manipulating Chemical Equilibria (Fischer Esterification)
7. Multi-Step Synthesis of Aspirin: Ester Hydrolysis and Acylation
8. Multi-Step Synthesis: Acylation of an Amine and Electrophilic Aromatic Substitution (Nitration)
9. Synthetic Polymers and Biopolymers
10. Predicting Products with Computational Chemistry: Diels-Alder (Carbon-Carbon Bond Formation)
11. Conjugation and Color: Aldol (Carbon-Carbon Bond Formation)