

Description: CHEM 242 is the third course in the chemistry laboratory sequence and is designed to teach Chemistry and Biochemistry majors how to plan and perform chemical synthesis reactions and to evaluate and report the results.

Course Objectives:

- To establish best practices for working safely in lab—including maintaining good chemical hygiene, wearing personal protective equipment, knowing the locations of and proper use of safety showers, eye washes, fire extinguishers, etc., maintaining good ventilation, and proper waste disposal.
- To develop and apply laboratory techniques necessary to synthesize, purify, and characterize chemical compounds including:
 - Methods to control reaction temperature.
 - Glassware setups for containing reactions.
 - Methods for monitoring the progress of reactions.
 - Methods for determining the identity of reaction products.
 - Controlling reaction pH.
 - Separating reactive monomers to control polymerization.
- To utilize computational chemistry to help predict the products of a reaction.
- To develop analytical reasoning skills by determining the identity of an unknown compound by characterizing the product of a reaction of the unknown.
- To search the chemistry literature for existing synthesis laboratory procedures
- To render a published procedure into an executable laboratory experiment
- To present the results with a written report and an oral presentation
- To perform laboratory work in a research environment

Academic Calendar: It is the student's responsibility to know the course schedule, posted on Sakai, and the official University Academic Calendar.

Meeting Times and Locations: CHEM 242 meets in Flanner Hall 308.

Section	Day/Time	Instructor	Teaching Assistants
001	Mondays & Fridays 11:30 AM – 2:15 PM	Mr. Thomas	Jordan MacQueen

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

Pre-requisites: Grade of 'C-' or better in CHEM 180 and CHEM 181.

Required Materials:

- Bound composition notebook (not spiral bound and with no tear-out perforations).
- Access to Microsoft 365. This is provided by Loyola to students.
- Safety goggles (We provide a pair to you on the first day). If you wish to get your own, they must be Type G, H, or K goggles and must meet the requirements of ANSI Z87.1.
- Long-sleeved, full-length laboratory coat.
- Appropriate clothing and footwear as described in the laboratory safety rules.
- A 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 the Information Commons, or contact ITS (Information Technology Services) for information on their loan equipment program within the first few days of the start of the course and arrange for them.

Course Homepage: Announcements, assessments, extra copies of the handouts, the grade book, etc. are posted on Sakai.luc.edu. Students should check Sakai frequently as it is central to how the course operates. **Please note that all course materials should be accessed using the Lessons tab**, where details are broken down by topic/experiment. Some assignments may not open properly if accessed through other tabs.

Safety Rules: Students must read and agree to follow the lab safety rules before they can work in the lab. Students must sign a Lab Safety Contract that acknowledges that the student received the safety rules, and that the student agrees to follow them. A lab safety contract must be signed by a student before they can 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

Grading: The course grade consists of the following components:

1. Lab Results/Notebook Entries	20%
2. Post-Lab Exercises	20%
3. Lab Safety Points	10%
4. Lab Reports	10%
5. Synthesis Proposal	10%
6. Synthesis Project Performance and Records	15%
7. Synthesis Report and Presentation	15%
	100% total

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

Attendance: Students are expected to attend every lab session. **Any student without their safety goggles and lab coat, not dressed appropriately, or who has not completed the pre-lab preparation on time will be marked absent.** Missing a lab period for any reason will result in an automatic zero for any work that is not completed. Students who miss an experiment may be allowed to perform a makeup experiment on a scheduled makeup day. There is at most one makeup per student for each half of the course. Absent students are responsible for requesting the makeup via an email to the instructor within 48 hours of the absence. Any additional missed work beyond one experiment per half of the semester cannot be made up and will result in scores of zero.

There will be an attendance sheet students must sign upon entering the lab. The attendance sheet must match who is present in the lab in an emergency. If anyone 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 to log out on the attendance sheet. For safety's sake, to obtain 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 safety 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 do the experiment; any student arriving more than 15 minutes late will be marked absent.**

Pre-Lab Preparation: Success in 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 examine the materials posted about the experiment on Sakai. Before coming to class, students must complete all the materials included in the “Pre-lab Preparation” section of Sakai for that experiment. All handouts must be opened and read. Videos must be viewed to 100% completion. Any Labster simulations must be completed to 100% progress. Students must also complete the pre-lab portion of their laboratory notebooks, which will be checked at the door.

Students who do not complete the pre-lab preparation before class will not be allowed to perform the experiment.

Notebook/Lab Results: The ability to keep good records is a valuable skill. Proper documentation of experiments will make experimental results easier to interpret and, very importantly, will facilitate replication of the experiment. (Reproducibility is central to the scientific method!) One of the most important facets of experimental work is that everything should be recorded as completely and accurately as possible. Sometimes, important discoveries are made when things do not go exactly as expected. Therefore, it is critical that students report their actual data and not what it is thought that the correct answer should be. **THE NOTEBOOK MUST ACCURATELY REFLECT WHAT HAPPENED DURING THE EXPERIMENT.** Procedures should be written entirely in past tense to document the experiment as it was performed. Lab notebook entries are not meant to be written as instructions for others, but as a written record of what happened while performing the experiment.

For this course, notebook entries then will be completed in a bound composition book or a similar bound notebook. A portion of the notebook is completed before class (see handout on Sakai). This includes the Title, Objective, a Balanced Chemical Equation, and a Theoretical Yield calculation. Pre-lab notebook preparation will be checked at the door. During class, a **detailed procedure section will be written while the experiment is being performed**, along with a summary of the experimental results (usually as a table). The material normally covered in the discussion or conclusion section of the notebook will be included in the post-labs. Therefore, the discussion/conclusion section does not have to be included in the lab notebook for this class. After an experiment is completed, the notebook pages will be uploaded on Gradescope before leaving lab. To receive credit, the pages must be legible and oriented properly.

Post-lab Exercises: While performing an experiment, students are often 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 to allow more time to think through the experiments, students will also complete post-lab exercises outside of class. Post-lab questions will be posted on Sakai. Students are allowed unlimited attempts until the due date, and assessments must be submitted to count. Spelling, grammar, and significant figures count.

Lab Reports: Students will compose two type-written lab reports that convey the results and importance of the experiment. A lab report formalizes one’s experiment with written documentation that is accurate and understandable to others. The two experiments for which there will be lab reports are “Synthesis of Aspirin” and “Fischer Esterification.”

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 three, lesser safety violations in one lab period will result in a student being asked to leave the lab, even if the infractions would not warrant expulsion individually. Any student removed from lab for safety violations twice will automatically receive one lower letter grade. If a student is removed from lab for safety violations a third time, they will automatically fail the course. Each experiment will have three safety points at stake.

Final Lab Notebook Evaluation: Notebooks will be collected at the end of the semester and compared against the scanned notebook pages submitted on Sakai. Points up to and including full credit may be deducted if the actual notebook does not match the submitted files, does not match the characteristics described in the handout posted on Sakai, such as permanently bound, written in pen, etc. Notebook point deductions may also be made for not writing in third person or passive voice, using the wrong tense, grammatical errors, spelling errors, etc.

Re-grades: All requests to have any submitted assignment re-graded must be submitted in writing before the hard deadline. Students should email the instructor, not the TA.

Late Policy: Unless otherwise specified above, assignments may be submitted late. Assignments submitted late but within a week of the due date will automatically receive a 25% deduction. Assignments submitted beyond one week late will automatically receive a 50% deduction. Work submitted after the hard deadline will not be graded.

Synthesis Proposal: A major component of this course will be for students to explore the chemical literature for published synthetic procedures, choose a two-step synthetic procedure, revise it as needed, and perform the experimental steps and analysis for the synthesis in the laboratory. Students will have to evaluate their various resources (time, equipment, cost, etc.) and gain laboratory work experience in a research environment.

Synthesis Project Report and Presentation: At the end of the semester, students are expected to write a formal lab report summarizing the results of their independent projects. The lab report formalizes 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. Reports must be submitted as a single PDF file using the assignment link posted on Sakai. Students will also give a BRIEF presentation to explain their projects and results to the class.

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 within the same week as they were due will receive an automatic 25% deduction. Late submissions will be accepted until the course hard deadline but will receive a 50% deduction.

Hard Deadline: All materials of any kind must be submitted by 5 PM on Friday, April 26, 2024. 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 the 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 at 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.”

Regarding the use of Artificial Intelligence: our Provost has expressed to “Let us all make sure we are learning and sharing best practices and not allowing AI (Artificial Intelligence) to do the learning for us.” In this course, any work you submit for credit must represent your own ideas and understanding of the assigned material. If you are unsure about any case where your use of AI may conflict with university or course standards, please see your instructor to discuss your concerns.

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: Loyola University Chicago provides reasonable accommodations for students with disabilities. Any student requesting accommodations related to a disability or other condition is required to register with the Student Accessibility Center (SAC). Professors will receive an accommodation notification from SAC, preferably within the first two weeks of class. Students are encouraged to meet with their professor individually to discuss their accommodations. All information will remain confidential. Please Note that in this class, software may be used to audio record class lectures to provide equitable access to students with disabilities. Students approved for this accommodation use recordings for their personal study only and recordings may not be shared with other people or used in any way against the faculty member, other lecturers, or students whose classroom comments are recorded as part of the class activity. Recordings are deleted at the end of the semester. For more information about registering with SAC or questions about accommodations, please contact SAC at 773-508-3700 or SAC@luc.edu.

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 how they can be remedied. Students must provide their instructors with proper documentation i.e., [“Athletic Competition & Travel Letter”](#) 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 to the professor in the first week of a semester. It is the student's responsibility to make up any assignments. If the student misses an examination, the instructor must allow them to take it at another time. (<https://www.luc.edu/athletheadvising/attendance.shtml>)

Students who will miss class for an academic competition or conference must provide proper documentation to their instructor as early in the semester as possible.

Accommodations for Religious Reasons: If you have observances of religious holidays that will cause you to miss class or otherwise effect 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 initiated by the instructor may be retained by them only for individual use. Additionally, all materials from this course cannot be shared outside the course without the instructor's written permission.

Instructor Contacts: Mr. Thomas, LSB-124, (773) 508-8115, tthoma1@luc.edu

Experiments

1. Laboratory Safety
2. Importance of Reaction Temperature (Chemical Kinetics)
3. Hydrolysis of Methyl Salicylate
4. Synthesis of Aspirin
5. Synthesis of Isopentyl Acetate

6. Reaction Monitoring (Sodium Borohydride Reduction)
7. ^1H NMR Spectroscopy
8. Characterizing Reaction Products by NMR: Combinatorial Fischer Esterification
9. Predicting Reaction Product with Computational Chemistry: Diels-Alder
10. Buffering Reaction Conditions: Acylation of an Aromatic Amine
11. Generating Reactive Intermediates *in situ*: Aldol Condensation
12. Interfacial Polymerization
13. Independent Synthesis Proposals