

LOYOLA UNIVERSITY CHICAGO
DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

**CHEM 260 – Quantitative Methods in Chemistry
SYLLABUS, FALL 2024**

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COURSE DESCRIPTION

Lecture and discussion course designed to create foundational knowledge and proficiency in essential chemistry concepts and skills. Topics include quantitative description of gases, liquids, and solutions, kinetics of chemical reactions, chemical equilibria, acids and bases, the thermodynamics of chemical reactions, electrochemistry, and spectroscopy.

PREREQUISITES/COREQUISITES

CHEM 180, CHEM 181 and (MATH 131 or MATH 161), Pre-requisite for BIOI-BS majors: CHEM 180 and (MATH 131 or MATH 161).

COURSE FORMAT

Lecture (TuTh 2:30 PM – 3:45 PM, Sullivan Center – Galvin Auditorium), Discussion (section I: We 10:25 AM – 11:15 AM, Flanner Hall 105, section II: We 11:30 AM – 12:20 PM, Flanner Hall 105).

PREFERRED NAME AND GENDER PRONOUN

This course affirms people of all gender expressions and gender identities. If you prefer a different name or pronoun than what is indicated on the class roster, please let me know. Please correct me on your preferred name and gender pronouns. If you have any questions or concerns, please do not hesitate to contact me.

OFFICE HOURS

Office hours are for those with questions, who seek advice, want to share and/or provide feedback. You can “walk in” or make an appointment ahead of time. Discussion can be about this class and beyond – office hours are for EVERYONE. We can talk about college life in general, class work, class issues, your academic plans, schedules, grades, a letter of recommendation you may need, or general questions or concerns. If you are unable to attend the regular office hours, I am happy to meet at a time that works for you, just ask me (either in person or via email).

As family matters, assignments, essays, and tests in all of your courses demand your attention, there could be moments when you need assistance. If you are experiencing difficulties inside or outside the classroom that may affect your performance in this course, I WANT TO HEAR ABOUT IT. I will do my best to accommodate your specific needs to help you succeed.

COMMUNICATION OUTSIDE OF CLASS TIME AND OFFICE HOURS

Course-related communications between you and me are best conducted via email, using the Loyola email account. Avoid using personal email accounts, I may not receive those emails due to spam filters. Check your email often, AT LEAST ONCE A DAY. You can also call or text me at my cell-phone number: (858) 405 7026.

CLASS BEHAVIORAL EXPECTATIONS

We strive for a learning environment of equity, respect, and inclusiveness. Therefore, all of us are expected to follow these basic principles:

- Demonstrate respect for oneself and for others.
- Treat others with dignity and behave in a way which promotes a physically and psychologically safe, secure, and supportive climate.
- Allow all community members to engage as full and active participants where the free flow of ideas is encouraged and affirmed.

COURSE LEARNING OUTCOMES

Students will deepen their understanding of foundational concepts of chemistry and advance their skills in scientific problem solving, critical thinking, and synthesis of concepts, with specific emphasis on applying mathematical models to the properties of matter and chemical reactions. After successfully completing this course, students will be able to

- manipulate equations to solve quantitative problems symbolically using only variables to describe chemical and physical quantities,
- apply the perfect gas laws, connect the molecular properties of gases to macroscopic observables, and understand deviations of real gases from the behavior of perfect gases,
- describe reaction kinetics using instantaneous and integrated rate laws, and describe the temperature-dependency of reaction rates using the Arrhenius equation,
- describe chemical equilibria via equilibrium expressions, reaction quotients, and ICE tables,
- calculate the pH of solutions of strong and weak acids or bases and buffer solutions,
- predict buffer action to neutralize strong acids or bases,
- describe titrations of strong or weak acids or bases with strong acids or bases,
- describe the solubility of salts and the common-ion effect,
- describe the thermodynamics of chemical reactions using the concepts of free energy, entropy, and enthalpy, heats of formation, and bond dissociation energies,
- describe chemical equilibria using standard free energies of reaction,
- describe the behavior of liquids and solutions, including colligative properties, using thermodynamic models,
- predict the outcome of redox reactions under standard and nonstandard conditions using standard cell potentials,

CAMPUS RESOURCES

Loyola University is dedicated to helping students succeed in their education endeavors. There are many resources to assist you with your courses. You can find brief descriptions of the various types of support with links to the respective pages, as well as quick links to each, at <https://www.luc.edu/sas>.

REQUESTS FOR ACCOMMODATION

Loyola University Chicago provides reasonable accommodation for students with disabilities. Any student requesting accommodation 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 in order to discuss their accommodations. All information will remain confidential. Please note that in this class, software may be used to audio record class lectures in order to provide equal 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.

COURSE MATERIALS

1. **Enrollment in WileyPlus for textbook and online homework system** (instructions are posted on Sakai).
2. **Enrollment in TopHat for in-class polling** (instructions are posted on Sakai)
3. **A device with web browsing capability** (e.g. cell phone, tablet, laptop) for in-class activities.
4. **Access to your LUC email and the course website** (Sakai). Check here [often](#) for general information, announcements, discussion forums, and grades. YOU ARE RESPONSIBLE TO BE AWARE, WITHIN 24 HOURS, OF ALL EMAILS SENT TO YOUR LUC ACCOUNT, ANNOUNCEMENTS MADE ON THE COURSE WEBSITE AND FOR ALL MATERIALS PLACED THERE.

ACADEMIC CALENDAR

You are responsible for understanding all processes and timelines associated with dropping or withdrawing from this course, file for a PASS/FAIL conversion etc. The Loyola University Chicago academic calendar that lists important dates and deadlines for the semester can be found at <https://www.luc.edu/academics/schedules>.

PASS/FAIL CONVERSION DEADLINES AND AUDIT POLICY

A student may request to convert a course into or out of the "Pass/No-Pass" or "Audit" status usually only within the first two weeks of the semester (check the Academic Calendar for the actual deadline this semester). Students must submit a request for Pass/No-Pass or Audit to their Academic Advisor.

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.

ACADEMIC INTEGRITY

Before beginning, let me state EMPHATICALLY that I firmly believe that 99.9% of my students (if not 100%) are basically honest people. I also know that the pressures of school, grades, family, etc. can be overwhelming at times and can lead to choices one would not normally make. That said, I view violations of Academic Integrity as a very serious offense against your fellow students and against the integrity of the university, as well as a personal affront to me. There will be zero tolerance for infractions. If you believe there has been an infraction by someone in the class, please bring it to my attention. If caught, I will pursue disciplinary action against all parties TO THE FULLEST EXTENT POSSIBLE; this may include lowering of grades, failure, suspension or expulsion.

Academic dishonesty can take several forms, including, but not limited to cheating, plagiarism, copying another student's work, and submitting false documents. 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 here: <https://catalog.luc.edu/academic-standards-regulations/undergraduate> 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.

Any instance of dishonesty (including those detailed on the website provided above or in this syllabus) will be reported to the Chair of The Department of Chemistry & Biochemistry who will decide what the next steps may be. Dishonest behavior such as any form of cheating may cause to fail (grade = 0 or "F") an assignment, examination, or the course, depending on the severity of the case. That grade assigned because of cheating cannot be "dropped".

ACADEMIC GRIEVANCES AND ACADEMIC APPEALS POLICIES

Students have the right to protection against arbitrary and capricious academic evaluations. Arbitrary and capricious means that there is no relation between the grade given and the student's performance in the class and that a reasonable person could not find that the grade was deserved. Mere disagreement or dissatisfaction with a grade does not constitute a basis for grievance. The procedure to resolve disputes can be found at: https://www.luc.edu/academics/catalog/undergrad/reg_academicgrievance.shtml.

Students also have the opportunity to request a review of circumstances that impact their academic standing or progress at the University. For example, you can appeal for a change in academic record, a finding of academic misconduct, a decision related to transfer credit, or a dismissal for poor scholarship. The procedure to request reviews can be found at <https://www.luc.edu/academics/catalog/undergrad/academicappeals>.

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 (develop standard form on web) 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.

ACCOMMODATIONS FOR RELIGIOUS REASONS

If you have observances of religious holidays that will cause you to miss class or otherwise effect your academic work in the course you must alert the instructor no later than Friday of Week 2 in the semester to request accommodations. Advance notice must be sent to the instructor through Loyola email by this deadline.

GRADING STANDARDS AND POLICIES:

This course uses standard-based testing in conjunction with credit for participation/engagement to determine the final letter grade. The goal of the grading system is to align your course grade more accurately with your level of learning. Every grading system has pros and cons, but I believe that standard-based testing combined with the opportunity for students to reassess work without penalty is a fair and equitable way to capture your proficiency with regard to the topics of this course.

Each question in a quiz or exam will be graded according to the following rubric:

Level	Formal Meaning	Interpretation
<i>E</i>	Exceeds Expectations	Work is correct and complete, and carried out in a clear and convincing manner. Where applicable, work contains at most one incorrect or missing unit.
<i>M</i>	Meets Expectations	Work contains minor conceptual or mathematical errors, or some minor details of the solution are omitted. Where applicable, work contains at most two incorrect or missing units.
<i>R</i>	Revision Needed	Work demonstrates understanding of relevant concepts and the path to obtain the solution, but contains errors, lacks details or clarity, or contains more than two incorrect or missing units.
<i>I</i>	Insufficient	Work contains significant errors or is incomplete.

Quiz Grading: To pass a quiz, all questions must be answered at the *E* or *M* level. If a question is answered at the *R* level, a revision can be submitted according to the rules listed below and the grade of the revision will replace the original grade. If a question is answered at the *I* level, it can be retaken according to the rules listed below and the grade of the retake will replace the original grade.

Midterm Exam Grading: Questions answered at the *E* level receive 10 points. Questions answered at the *M* level receive 9 points. Questions answered at the *R* and *I* level receive 0 points. However, if a question is answered at the *R* level, a revision can be submitted according to the rules listed below and if answered at the *E* or *M* level, the revised question will receive 9 points. If a question is answered at the *I* level, it can be retaken according to the rules listed below and if answered at the *E* or *M* level, the retaken question will receive 9 points.

Final Exam Grading: Questions answered at the *E* level receive 10 points. Questions answered at the *M* level receive 9 points. Questions answered at the *R* level receive 6 points. Questions answered at the *I* level receive 0 points. The final exam is confidential, will not be returned to students, and cannot be revised or retaken.

Revision Rules	To revise a question, students must briefly describe the mistake made in the original response and submit a corrected response, which will be regraded.
Retake Rules	Retake questions will not necessarily be identical to the original question. For retakes of quiz questions, expect a close match between original and retake. For retakes of exam questions, the retake question will address the same topic as the original question but may differ significantly from the original question text and content. Time limits for quiz retakes are set by the instructor. If the retake involves multiple questions from the same quiz, all must be taken in a single session. For midterm retakes, questions can be retaken in multiple sessions.
Revision/Retake Deadlines	Quiz revisions and retakes must be submitted/taken until the Friday of the week following the return of the corresponding quiz or the last day of instructions, whatever occurs first. Midterm Exam revisions and retakes can be taken until the third Friday following the return of the exam or the last day of instructions, whatever occurs first. All retakes (quiz and midterm) can be taken without appointment during office hours and before/after discussion sections and can also be scheduled outside of those times at the instructor's discretion.

The total points achieved by each student will be calculated as follows:

1. in-class participation: percent points x 1.3, maxes out at 100 pts	100 pts	(10 %)
2. Quizzes: 25 points for each passed quiz, maxes out at 250 pts.	250 pts	(25 %)
3. Midterm Exams: percent points x 5	500 pts	(50 %)
4. Final Exam: percent points x 1.5	150 pts	(15 %)
TOTAL ACHIEVABLE POINTS	1000 pts	(100%)

The following grading standards will be used (TOTAL points achieved divided by 1000, rounded to 0.1 %):

A 92.0 % and up	B+ 84.0 % – 87.9 %	C+ 72.0 % – 75.9 %	D+ 60.0 % – 63.9 %
A– 88.0 % – 91.9 %	B 80.0 % – 83.9 %	C 68.0 % – 71.9 %	D 56.0 % – 59.9 %
	B– 76.0 % – 79.9 %	C– 64.0 % – 67.9 %	F 55.9 % and below

IN-CLASS PARTICIPATION

We will use TopHat for in-class instant polling. MOST polls have points awarded for participation (regardless of whether you gave the correct answer), and SOME polls have additional points awarded for giving the correct answer. The instructor will not necessarily announce ahead of time whether points will be awarded for correct answers or not, so give every poll your full attention. There will be ample opportunity to earn polling points, and they max out at 100 pts, so missing a few polls will not affect your score. Therefore, you will not be able to make up for missed polls even if your absence from class is excused (e.g. because of illness, sporting events etc.).

HOMEWORK

We will use the WileyPlus homework system. While homework is graded in WileyPlus to give you feedback, please note that no credit toward the course grade is given for homework. Therefore, homework is optional and whether or not you do your homework will not affect your grade in any way. However, homework questions are good practice for exams and some exam questions may even be similar to homework questions, so I highly recommend using this tool to improve your performance in the course.

QUIZZES

Approximately 11 quizzes (each lasting 15 mins) will be given at the beginning of lecture, tentatively scheduled as shown in the course schedule at the end of this syllabus. Quizzes missed for a legitimate reason can be made up for without an appointment during office hours, before/after discussion sections, or by appointment at the discretion of the instructor. The make-up quiz must be taken no later than the Friday of the week following the week in which the original quiz was given.

MIDTERM AND FINAL EXAMS

There will be three midterm exams tentatively scheduled for 9/24, 10/22, and 11/26 during class. The University sets the schedule for all final exams. The final exam will be held on Thursday, December 12th, 7 PM – 9 PM. You will have exactly 2 hours to complete the exam. Additional time will not be granted, even if you start late. There will be no make-up final exams given under any circumstance, and the exam will not be given early, either. Instructors may not reschedule final exams for a class for another day and/or time during the final exam period. There can be no divergence from the posted schedule of dates for final exams. Individual students who have four (4) final examinations scheduled for the same date may request to have one of those exams rescheduled. If a student reports having four final examinations scheduled for the same date, students should be directed to e-mail a petition to Adam Patricoski, Assistant Dean for Student Academic Affairs, CAS Dean's Office (apatricoski@luc.edu).

ATTENDANCE POLICY

Students are expected to attend lectures and discussions. However, no attendance will be taken, and unexcused absences will not affect your grade other than missing out on potential credit for in-class participation.

LATE/MISSED WORK

Assignment deadlines are firm. Assume that technology will fail sometimes. Do not assume that everything will go smoothly when it comes to computers. Plan ahead. Do not leave completion/submission of assignments to the last possible moment. If you miss an assignment, contact the instructor as soon as possible, but not later than 48 hours after the assignment's deadline and state the reason for the missed deadline. Accommodation will be provided at the discretion of the instructor on a case-by-case basis in cases of emergency circumstances (e.g. serious illness, accidents, caring for a child or other family member).

MISSED QUIZZES OR EXAMS

If you miss a quiz or midterm exam, contact the instructor as soon as possible via email, but not later than 48 hours after the missed quiz or exam and state the reason for your absence. Accommodation will be provided at the discretion of the instructor on a case-by-case basis in cases of emergency circumstances (e.g. serious illness, accidents, caring for a child or other family member). No accommodation will be provided for the final exam except unless you can prove you have a valid, acute reason for your absence (e.g. a police report or a doctor's note).

COPYRIGHT OWNERSHIP IN COURSE MATERIALS

My lectures and course materials, including presentations, tests, exams, outlines, and similar materials, are protected by copyright. I am the exclusive owner of copyright in those materials I create. I encourage you to take notes and make copies of course materials for your own educational use. However, you may not, nor may you knowingly allow others to reproduce or distribute lecture notes and course materials publicly without my expressed written consent. This includes providing materials to commercial course material suppliers such as Chegg, CourseHero and similar services.

PHOTOGRAPHS, AUDIO OR VIDEO RECORDINGS

Any photographs taken or audio or video recordings of this course or materials of this course made by you are for the students' personal academic use only and may not be distributed in any manner (to any other individual or to the public) without written consent of the instructor (me).

In this class software may be used to record live class discussions. As a student in this class, your participation in live class discussions will be recorded. These recordings will be made available only to students enrolled in the class, to assist those who cannot attend the live session or to serve as a resource for those who would like to review content that was presented. All recordings will become unavailable to students in the class when the Sakai course is unpublished (i.e. shortly after the course ends, per the Sakai administrative schedule). Students who prefer to participate via audio only will be allowed to disable their video camera so only audio will be captured. Please discuss this option with your instructor.

The use of all video recordings will be in keeping with the University Privacy Statement shown below:

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.

NOTICE OF REPORTING OBLIGATIONS FOR RESPONSIBLE CAMPUS PARTNERS

As an instructor, I am a Responsible Campus Partner ("RCP") under Loyola's Comprehensive Policy and Procedures for Addressing Discrimination, Sexual Misconduct, and Retaliation (available at www.luc.edu/equity). While my goal is for you to be able to engage fully and authentically with our course material through class discussions and written work, I also want to be transparent that as a RCP I am required to report certain disclosures of sexual misconduct (including sexual assault, sexual harassment, intimate partner and/or domestic violence, and/or stalking) to the Office for Equity & Compliance ("OEC"). As the University's Title IX office, the OEC coordinates the University's response to reports and complaints of sexual misconduct (as well as discrimination of any kind) to ensure students' rights are protected. As an instructor, I also have an obligation under Illinois law to report disclosures of or suspected instances of child abuse or neglect (<https://www.luc.edu/hr/legal-notice/mandatedreportingofchildabuseandneglect>).

STATEMENT OF INTENT

By remaining in this course, students are agreeing to accept this syllabus as a contract and to abide by the guidelines outlined in the document. Students will be consulted should there be a necessary change to the syllabus.

DISCLAIMER

THIS SYLLABUS MAY BE AMENDED AND/OR ALTERED AT ANY TIME DURING THE SEMESTER AT THE DISCRETION OF THE INSTRUCTOR.

TENTATIVE COURSE SCHEDULE

PLEASE NOTE THAT THE SCHEDULE IS APPROXIMATE WITH RESPECT TO COVERAGES; WE MAY GET BEHIND OR AHEAD AS THE SEMESTER PROGRESSES. YOU ARE RESPONSIBLE FOR EVERYTHING SAID IN LECTURE, EVEN IF YOU MISS CLASS.

WEEK	TUE	THU	DISCUSSION
1 8/26 – 9/1	INTRODUCTION manipulating equations	(1) GASES ideal gas laws	math review symbolic solutions
2 9/2 – 9/8	(1) GASES kinetic theory, real gases partial pressures	(2) KINETICS rate equations rate constants	gases
3 9/9 – 9/15	(2) KINETICS rate laws first-order reactions	(2) KINETICS Arrhenius equation	kinetics
4 9/16 – 9/22	(3) EQUILIBRIA reaction quotient, equilibrium constants	(3) EQUILIBRIA ICE tables Le Chatelier's principle	kinetics / equilibria
5 9/23 – 9/29	MIDTERM 1 (units 1-2)	(4) ACIDS/BASES autoionization of water pH calculations	equilibria
6 9/30 – 10/6	(5) AQUEOUS EQUILIBRIA relative strength of acids & bases	(5) AQUEOUS EQUILIBRIA Henderson-Hasselbalch equation	acids and bases
7 10/7 – 10/13	MIDSEMESTER BREAK no class	(5) AQUEOUS EQUILIBRIA buffer action	aqueous equilibria
8 10/14 – 10/20	(5) AQUEOUS EQUILIBRIA titrations	(6) THERMODYNAMICS work, heat, energy	aqueous equilibria
9 10/21 – 10/27	MIDTERM 2 (units 3-5)	(6) THERMODYNAMICS entropy	thermodynamics
10 10/28 – 11/3	(6) THERMODYNAMICS quantities of formation bond dissociation energies	(6) THERMODYNAMICS free energy and equilibria	thermodynamics
11 11/4 – 11/10	(7) LIQUIDS vapor pressure	(7) LIQUIDS heating curves, calorimetry	liquids
12 11/11 – 11/17	(8) SOLUTIONS concentration conversions	(8) SOLUTIONS thermodynamics of mixing	solutions
13 11/18 – 11/24	(8) SOLUTIONS colligative properties	(9) ELECTROCHEMISTRY redox reactions	colligative properties
14 11/25 – 12/1	MIDTERM 3 (units 6-8)	THANKSGIVING HOLIDAY no class	redox reactions
15 12/2 – 12/8	(9) ELECTROCHEMISTRY voltaic cells relative strength of redox agents	(9) ELECTROCHEMISTRY Nernst Equation	electrochemistry
FINAL WEEK	FINAL EXAM: THURSDAY, 12/12, 7 PM – 9 PM		