

Chemistry 302: Physical Chemistry II (Spring 2023)
Department of Chemistry and Biochemistry, Loyola University Chicago

Instructor: Dr. Pengfei Li
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Lectures: 001: Tuesday and Thursday 10:00 AM-11:15 AM, Flanner Hall-105
Discussions: 002: Tuesday 1:00-1:50 PM, Flanner Hall-105
003: Tuesday 2:30-3:20 PM, Flanner Hall-105
Office Hours: Thursday 2:30 PM-3:30 PM, **or by appointment**

Please see the Sakai site for up-to-date information and posts.

Course Prerequisites: CHEM 222 or 224, PHYS 112 or 122, and MATH 162, 263A, or the equivalent. If you have not completed these course prerequisites, you may be administratively dropped from the class. Please discuss this with the instructor immediately!

Required Textbook: “Atkins' Physical Chemistry Volume 2: Quantum Chemistry, Spectroscopy, and Statistical Thermodynamics”, 11th edition, by Peter Atkins, Julio de Paula, and James Keeler, Oxford University Press, 2018, ISBN: 978-0-19-881790-1.

Require Materials: A calculator capable of scientific notation.

Course Overview: Physical chemistry is a chemistry discipline that uses physical principles to understand chemical phenomena. This class aims to enable the students to understand the fundamental principles of physical chemistry and apply them to interpret chemical phenomena as well as solve chemical problems. We will cover fundamental knowledge about physical chemistry, mainly quantum mechanics and molecular spectroscopy, along with their applications in chemical systems. Specifically, a tentative schedule of lectures is shown in the end of this syllabus. Your attendance at lectures and discussions is expected. The correct answers of the exam problems may require knowledge of all the information presented in the lectures, discussions, and textbook, along with the prerequisite knowledge in general chemistry, physics, and mathematics.

Class Preparation: In order to understand the material presented during lectures and discussions, it is important to come to the class with good background knowledge. This can be achieved by reading (and thinking about) material in the textbook, reviewing appropriate material from calculus, physics, and general chemistry classes, and solving end-of-chapter problems. Work together with your classmates; if you don't understand something, someone else may. You will also find that explaining a solution to your classmate will improve your understanding and long-term retention of the material. I cannot overstate how much more useful the classes will be if you come into the room well prepared, and even better, with questions for me and your fellow classmates. The three keys to success in physical chemistry are reading the text, solving as many problems as possible, and asking questions! Ask me questions about the material in class and office hours and ask your classmates questions. It is recommended that students devote to the preparation for this class a minimum of one hour every day.

Course Structure and Online Class Specifics: There are two 75-minute lectures (Tuesday and Thursday) and a single 50-minute discussion section (Tuesday) per week. The discussion section will be small group work. You will work in small groups on problems, with the goal of working with your classmates to learn the material. Again, it is highly recommended that you read (and think about) appropriate contents in the textbook before the lecture covering such content, and ask relevant questions during the lectures, discussions, and office hours. Materials from the course, including the exam problems, cannot be shared outside the course without the instructor's written permission.

Spring 2023 Masking Requirement: Currently there is no requirement about the masking-wearing during the class. However, masking-wearing may be required during the class as the semester goes, depending on the real-time pandemic situation.

Grade Components: There will be several homework assignments, three tests, and the final exam. Each test is worth the same number of points, **with the lowest score will be dropped.** *There will be no make-up tests or exams.* In the end, the class score is calculated based on the following components:

Homework assignments:	20%
Tests:	40%
Final exam:	40%

Finally, the class score will be rounded to the nearest integer, and then the course grade will be determined based on the class score through the following scale:

Fixed scale	Grade
score \geq 85	A
$80 \leq$ score $<$ 85	A-
$75 \leq$ score $<$ 80	B+
$70 \leq$ score $<$ 75	B
$65 \leq$ score $<$ 70	B-
$60 \leq$ score $<$ 65	C+
$55 \leq$ score $<$ 60	C
$50 \leq$ score $<$ 55	C-
$45 \leq$ score $<$ 50	D
score $<$ 45	F

Midterm Grade: Your midterm grades will be obtained based on test(s) (80%) and the homework (20%) according to the method described above.

Homework: You will have several homework assignments to complement the materials covered in the class. The homework assignments will be graded for completeness. You will have 5 days to finish each homework assignment. Due date may be postponed for excused absences that last three or more days. Late homework turned in within 72 hours of the due time will receive 50% of the credits, while late homework turned in after 72 hours of the due time will receive zero points.

Tests: We will have three tests. You will have 24 hours to complete each test. They will be open note and book, but no other resources will be allowed. These will typically be opened on a Thursday, and due the next day. If a student disagrees with her/his score for the test, she/he must request re-grading **within one week** from the day she/he received the graded test.

Final Exam: The University sets the schedule for all final exams. The final exam will be held on: **Tuesday, May 2, 2023 at 1:00 PM (CST)**. 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). If a student disagrees with her/his score for the final exam, she/he must request re-grading **within four days** from the day he/she received the graded final exam.

Ethical Considerations:

a. 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 and 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 or in this syllabus) will be reported to The Chair of The Department of Chemistry and Biochemistry who will decide what the next steps may be.

b. **Tests and Exams:** Students will not collaborate on any tests or exams. Only those materials and devices permitted by the instructor may be used to assist in tests or exams. Students will not represent the work of others as their own. Any student caught cheating during a test or exam will be reported to the Dean's office and will receive zero points for the given test or exam. The Chair of the Department of Chemistry and Biochemistry will also be notified and will decide what the next steps may be. Please be honest with your work.

c. **Teamwork:** I strongly encourage you (the class) to work together to solve assigned and unassigned problems. In order to learn and excel in Physical Chemistry, you should work through problems. The assigned problems are a minimum. Work together with your classmates, if you do not understand something, someone else may. You will also find that explaining a solution to your classmate will cement the information in your mind, and make you a better student. When working as a group, if each member contributes to the discussion, and you each hand in very similar work, that is perfectly acceptable given the nature of the assignments. On the other hand, if someone simply copies an assignment from someone else, that is plagiarism, and will be treated as such. Any students caught plagiarizing for an assignment will receive zero points on the given assignment. The Chair of the Department of Chemistry and Biochemistry will be notified and will decide what the next steps may be.

Health, Safety, and Well-Being On-Campus:

Please be familiar with and adhere to all policies and protocols posted on the Campus Info & Resources site: <https://www.luc.edu/healthsafetyandwellbeing/campusinforesources/>

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 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 responsibility of the student to make up any assignments. If the student misses an examination, the instructor is required to allow the student to take the examination at another time. (<https://www.luc.edu/athleteadvising/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.

Student Accommodations: Loyola University provides reasonable accommodations for students with disabilities. Any student requesting accommodations related to a disability or other condition is required to register with Student Accessibility Center (SAC), located in Sullivan Center, Suite 117. Professors receive the accommodation notification from SAC via Accommodate. 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 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.

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.

Universal Absence Accommodation Policy: The purpose of a universal absence accommodation policy is to account for emergency circumstances (e.g., serious illness, caring for a family member, car accident) that require you to be absent from class, while maintaining fairness in grading for students who attend and complete all in-class graded assignments/exams. We believe that class attendance and participation are essential for your success in this class, and that your health is important to us and our shared community. Please use good judgement and stay home if necessary/prudent for your circumstances. You should inform the instructor and provide documentation for such an absence. The instructor will handle the accommodations on a case-by-case basis.

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 only within the first two weeks of the semester. For the Spring 2023 semester, students are able to convert a class to “Pass/No-Pass” or “Audit” through Monday, January 30th. 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). 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 and Biochemistry website: <http://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.

The Loyola Official Academic Calendar: www.luc.edu/academics/schedules

The CURA website: <https://www.luc.edu/cura/>

COVID-19 Info & Resources: <https://www.luc.edu/healthsafetyandwellbeing/covid-19inforesources/>

Student Services at Loyola Online: <https://www.luc.edu/online/resources/index.html>

Tentative Schedule*

Week	Dates	Lecture Topics	Reading
1	Tuesday Jan 17	Syllabus, the Boltzmann distribution	Syllabus, Topic 13A
	Thursday Jan 19	Origins of quantum mechanics	Topic 7A
2	Tuesday Jan 24	Wavefunctions	Topic 7B
	Thursday Jan 26	Operators and observables	Topic 7C
3	Tuesday Jan 31	Translational motion	Topic 7D
	Thursday Feb 2	Vibrational motion	Topic 7E
4	Tuesday Feb 7	Rotational motion	Topic 7F
	Thursday Feb 9	Hydrogenic atoms	Topic 8A
5	Tuesday Feb 14	Many-electron atoms	Topic 8B
	Thursday Feb 16	Atomic spectra	Topic 8C
6	Tuesday Feb 21	Valence-bond theory	Topic 9A
	Thursday Feb 23	Molecular orbital theory	Topic 9B
7	Tuesday Feb 28	Molecular orbital theory: diatomic molecules	Topics 9C & 9D
	Thursday Mar 2	Molecular orbital theory: polyatomic molecules	Topic 9E
8	Tuesday Mar 7	<i>No Classes; Spring Break</i>	
	Thursday Mar 9		
9	Tuesday Mar 14	Shape and symmetry	Topic 10A
	Thursday Mar 16	Group theory	Topic 10B
10	Tuesday Mar 21	Applications of symmetry	Topic 10C
	Thursday Mar 23	General features of molecular spectroscopy	Topic 11A
11	Tuesday Mar 28	Rotational spectroscopy	Topic 11B
	Thursday Mar 30	Vibrational spectra of diatomic molecules	Topic 11C
12	Tuesday Apr 4	Vibrational spectra of polyatomic molecules	Topic 11D
	Thursday Apr 6	Symmetry analysis of vibrational spectra	Topic 11E
13	Tuesday Apr 11	Electronic spectra	Topic 11F
	Thursday Apr 13	Decay of excited states	Topic 11G
14	Tuesday Apr 18	General principles of magnetic resonance	Topic 12A
	Thursday Apr 20	Features of NMR spectra	Topic 12B
15	Tuesday Apr 25	Pulse techniques in NMR	Topic 12C
	Thursday Apr 27	Electron paramagnetic resonance	Topic 12D
Final exam: Tuesday May 2, 1:00-3:00 PM (CST)			

*The instructor reserves the right to make changes to the schedule, except the date and time of the final exam. Any changes to other exam dates will be announced in class and on Sakai. Reading assignments are from the textbook unless noted otherwise.