

**Chemistry 302: Physical Chemistry II**  
Department of Chemistry & Biochemistry, Loyola University Chicago  
Spring 2020

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Instructor: Dr. Dan Killelea  
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Phone: (773) 708-3136  
Email: dkillelea@luc.edu  
Office Hours: Mo 10:30 am – 11:30 am, **or by appointment** (FH 103)  
Lecture: Tu Th 10:00 – 11:15 am, Flanner Hall, Room 007  
Discussion: Tu 11:30 am – 12:20 pm, Flanner Hall, Room 007  
Text: Physical Chemistry, by Atkins, *et al.* 11<sup>th</sup> Ed.

Course Prerequisites: Chemistry 222 or 224/226 (Organic), Physics 112 or 112k, and **Math 263** (Multivariable Calculus). If you have not completed the course prerequisites, you may be administratively dropped from the class. Please discuss this with the instructor immediately!

Please see the Sakai site for up-to-date information and posts. Whenever contacting me about the class via email please start the subject line with CHEM 302.

### **Course Overview**

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Welcome to Physical Chemistry III! We will move beyond the macroscopic world of thermodynamics and use quantum mechanics to understand atomic and molecular structure. We will start with the historical development and fundamentals of quantum mechanics as it applies to chemistry and then apply the lessons learned to hydrogenic atoms. We will then study atomic and molecular spectroscopy, and finally return to statistical thermodynamics to link the microscopic world to the macroscopic.

### **Course Structure**

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There are two 75-minute lectures (Tu, Th) and one 50-minute discussion (Tu) section per week. Having some flexibility helps, each meeting will be a blend of discussion and lecture. As valuable as our time together may be, it is essential that you **complete** any assigned reading and problem sets **BEFORE** the lecture. By coming prepared, you will be able to fill in any remaining gaps, and can *ask questions* to better comprehend 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 as well.

As a courtesy to your classmates, please completely silence (not just vibrate mode) any audible devices you have with you before entering the classroom. The use of computers or whatnot during class is permitted, as long as it is silent, but is discouraged. Any audio or video recording (including streaming) during lectures or discussions is strictly forbidden; violations of this policy will negatively affect your grade (unless arrangements have been made otherwise). Repeated violations (at the discretion of the instructor) could result in a grade of zero on the next test.

The discussion section will be small group work. You will work in small groups (3-4 people) on problems I provide as well as the assigned problems, with the goal of working with your classmates to learn the material.

## Grading

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Your grade will be determined on a basis of **500** points.

*Tests* (200 points): We will have two tests worth 100 points each. During the test, you may not use *any* electronic device (e.g. cell phones or computers) aside from a scientific calculator. If any banned device is observed, this will be construed as cheating. *Test supplement*: If you are dissatisfied with your test performance a supplement will be provided within a week. Details regarding the supplement will be provided when the time comes.

*Final Exam* (200 points): The final exam will be cumulative and will be worth 200 points.

*Homework and Worksheets* (90 points): you will have several assignments to complement the material covered in class.

*Evaluation* (10 points): Successful completion (email the instructor) of the course evaluation is worth 10 points.

*There will be no make-up tests or exams given under virtually any circumstance.*

**Final Exam:** The university schedules the final exam. The final will be held on:

**Tuesday, April 28<sup>th</sup>, 2020 at 1:00 p.m.**

in Flanner 007 (regular room). You will have exactly 2 hours to complete the exam. Additional time will not be granted, even if you arrive late. There will be no make-up final exams given under any circumstance, and the exam will not be given early, either.

**Grading:** There is a maximum of 500 points, letter grades will be assigned as given below:

	A: > 92%	A-: 92–88%
B+: 88–84%	B: 84–80%	B-: 80–76%
C+: 76–72%	C: 72–68%	C-: 68–64%
D: 64–60%	F: < 60%	

## Supplementary Material

- Physical Chemistry: A Molecular Approach, by McQuarrie and Simon
- Physical Chemistry, 6<sup>th</sup> Ed., by Ira Levine
- MIT Open Course Ware, Physical Chemistry (2007) the 2017 version is also good (<https://ocw.mit.edu/courses/chemistry/5-61-physical-chemistry-fall-2007/>) Excellent note source with video lectures.
- **Physical Chemistry, Harcourt Brace Jovanovich College Outline Series, by. J. Edmund White.**

Please ask instructor if you want help finding supplementary materials.

## Schedule

Note: This is, at best, a framework for the semester. The instructor reserves the right to make changes to the schedule, the outline below will give you an idea of the material we will cover. Any changes will be announced in class or on Sakai. Reading assignments are from Atkins & de Paula unless noted otherwise.

<i>Week</i>	<i>Date</i>	<i>#</i>	<i>Lecture Topics</i>	<i>Reading</i>	<i>Other</i>
1	14 Jan	1	Welcome/overview/waves		
	16 Jan	2	Intro to Quantum	Ch. 7	
2	21 Jan	3			<b>Ds = SE</b>
	23 Jan	4			
3	28 Jan	5	Quantum Theory	Ch. 8	<b>Ds = SE</b>
	30 Jan	6			
4	4 Feb	7			
	6 Feb	8			
5	11 Feb	9	Atomic Structure and Spectra	Ch 9.1-5,8,10	<b>Ds = SE</b>
	13 Feb	10			
6	18 Feb	11			
	20 Feb	12	<b>TEST 1</b>		
7	25 Feb	13	Molecular Structure ( <b>UIC seminar</b> )	Ch 10.1-10.4	
	27 Feb	14			
8	3 Mar		SPRING BREAK: No Classes		
	5 Mar				
9	10 Mar	15	Symmetry	Ch 11.1-3	
	12 Mar	16			
10	17 Mar	17	Vibrational and Rotational Spectroscopy	Ch. 12	
	19 Mar	18			
11	24 Mar	19			
	26 Mar	20	Electronic Spectroscopy	Ch. 13	
12	31 Mar	21			
	2 Apr	22			
13	7 Apr	23	<b>TEST 2</b>		
	9 Apr		Easter Break: No Class		
14	14 Apr	24	Statistical Thermodynamics	Ch. 15	
	16 Apr	25	Molecular Interactions	Ch. 17	
15	21 Apr	26	Solids	Ch. 19	
	23 Apr	27	Materials + Wrap-up ( <b>Seminar on Th</b> )	Ch. 18	
Tuesday, 28 April: FINAL EXAM, 1:00pm to 3:00pm					

## Academic Integrity

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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 or in this syllabus) will ***immediately result in a grade of F for the entire course*** and will also be reported to The Chair of The Department of Chemistry & Biochemistry who will decide what the next steps may be.

## Absence Policy for Students in Co-Curricular Activities (including ROTC):

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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.

(<https://www.luc.edu/athleteadvising/attendance.shtml>)

## Accommodations for Religious Reasons

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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.

## Course Repeat Rule

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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 & 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.

## Student Accommodations

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The Student Accessibility Center (formerly known as Services for Students with Disabilities), Sullivan Center (773-508-3700), [www.luc.edu/sswd](http://www.luc.edu/sswd), has the mission “to serve students with documented disabilities by creating and fostering an accessible learning environment,” including “support[ing] faculty, staff, and administrators on matters such as ADA and Section 504 compliance, as it relates to individuals 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.

## Tutoring

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The Loyola Undergraduate ACS has open tutoring every week on We and Th evenings in Flanner 129. In addition, Loyola maintains a Center for Tutoring & Academic Excellence (<http://www.luc.edu/tutoring/>). Again, this is a service included in your tuition, so I encourage you to utilize their assistance.

## Your well-being

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If there are events occurring in your life that cause school to diminish in its priority, please discuss this with me or contact the Wellness Center (<http://www.luc.edu/wellness/index.shtml>) or the dean of students ([http://www.luc.edu/studentlife/dean\\_of\\_students\\_office.shtml](http://www.luc.edu/studentlife/dean_of_students_office.shtml)) for assistance. These are services that **your** tuition pays for and can be invaluable for your personal health and maintaining progress towards your degree.