

**Chemistry 302: Physical Chemistry II**  
Department of Chemistry & Biochemistry, Loyola University Chicago  
Spring 2021

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Instructor: Dr. Dan Killelea, pronouns: he/him  
Office: ~~Flanner Hall 103~~ (use class Zoom room)  
Phone: ~~(773) 708-3136~~  
Email: [dkillelea@luc.edu](mailto:dkillelea@luc.edu)  
Office Hours: TBD, **or by appointment** (FH 103)  
Lecture: Tu Th 9:45 am – 11:00 am (Chicago Time)  
Discussion: Tu 11:15 am – 12:15 pm (Chicago Time)  
Text: Physical Chemistry, by Atkins, *et al.* 11<sup>th</sup> Ed.  
Zoom Link: <https://luc.zoom.us/j/89648437171>

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.

**E-mail:** please use “Chem 302:” to start your subject line. **ONLY** use your Loyola email for correspondence with me. I will do my best to respond with 24 hours for emails Mo-Fr, 9a-4p. Emails outside those hours and on weekends may be delayed.

### **Course Overview**

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Welcome to Physical Chemistry II! 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, paying particular attention to rotational, vibrational, and electronic transitions. From there we will look at the connections between the microscopic and macroscopic regimes using statistical mechanics, and then look at solid structure and properties, and the dynamics of chemical reactions.

### **Expectations for Online Instruction**

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My goal is to provide the best course instruction I can. This will require all of us to work together. We are dealing with challenging situations and it is essential that we communicate clearly. I am accessible outside our class meeting times via Zoom (please make appointment) and email. I will do my best to reply promptly.

**Synchronous class meetings:** As a courtesy to your classmates, please mute your microphone unless wishing to speak to the class. During “lecture”, I expect you to be an active participant. Please ask questions, either via Zoom chat or by speaking. You do not need to have your camera active, but you are welcome to if you wish. During “Discussion” you will be working in small groups. It is essential that you communicate and work together. If this poses issues, please let me know ASAP.

**Participation:** Please ask questions during lecture and be actively involved with the small group work. The more the merrier! In your small group work, you may choose to rotate roles. For example, each group may have a speaker, scribe, researcher, and checker. The speaker leads the discussion and communicates your results. The scribe writes down and submits your work. The researcher finds references and communicates with other groups. The checker reviews the problems for accuracy and proper format (e.g. units and sig figs). The scribe signs the sacred parchment.

**Assessment:** Please refer to the Academic Integrity statement on p. 5 of this syllabus. While I do not believe that students are looking for ways to cheat, it has become all too easy with predatory websites (e.g. Chegg) providing real-time answers to questions. IF I find Chem 301 material appearing on any such service, I will change how assessment is done to account for the availability of such coaching. **ANY USE OF ONLINE ANSWER SERVICE IS FORBIDDEN AND WILL BE TREATED AS CHEATING.** The consequence is a grade of F for the course and a report to the Department Chair. Each assessment (test, homework, etc.) will have guidelines to what sources are allowable. Please do not deviate from these.

## Course Structure

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There are two 75-minute online synchronous lectures (Tu, Th) on Zoom. These will be recorded and available for you to review. We also have a 50-minute discussion section on Tuesday after lecture, also on Zoom. It is likely that I will mix lecture, small group work, and interviews among these times. Having some flexibility helps! As valuable as lectures and discussion may be, you will gain much more by **completing** assigned reading and problem sets **BEFORE** our meetings. 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.

I will record the 'lectures' on zoom and make them available to you by sharing the link on Sakai. The discussions will not be recorded. No other recordings of our class meeting are allowed. You may not share or disseminate the video or audio recording of our meetings, as they are exclusively for your review of class material.

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 either **600 or 700** points.

*Tests* (300 points): We will have three tests worth 100 points each. These will be the equivalent of a take-home hour exam. These are to be done **outside** class meeting times. You will have either 12 or 24 hours to complete. 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.

*Conversation* (100 Points): I will hold 1:1 meetings with each of you during the semester to discuss various topics covered in class, these will be spread throughout the middle portion of the semester. I will provide guidance as to what we will cover in your meeting beforehand.

*Final Exam* (100 or 200 points): The final exam will be cumulative and will be worth either 200 or 100 points. This will consist primarily of a written test administered during the final exam period. The weight of this final (200 or 100 points) will be the one most beneficial to your final grade.

*Homework* (90 points): you will have several homework assignments to complement the material covered in class. These will not be graded for accuracy.

*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:

**Monday, 3 May 2021, 1 – 3 pm (CDT)**

You will have exactly 2 hours to complete the synchronous portion of the final 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. The exam will be released on Sakai and must be emailed back to me.

**Grading:** There is a maximum of 600 or 700 points, letter grades will be assigned as given below:

	A: > 93%	A-: 93–90%
B+: 90–86%	B: 86–83%	B-: 83–80%
C+: 80–76%	C: 76–73%	C-: 73–70%
D: 70–60%	F: < 60%	

## Text and Supplementary Material

The 11<sup>th</sup> edition of Atkin's Physical Chemistry is the current one. Be sure to get the full book, not a partial. If you find a previous edition (9<sup>th</sup> or later) that will be fine. I suggest getting the solutions manual was well. Please contact me ASAP if you have any concerns about the textbook; the book is pricey new and there are options to save you some money.

### 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, Thermodynamics and Kinetics. (<http://ocw.mit.edu/courses/chemistry/5-60-thermodynamics-kinetics-spring-2008/>) Excellent note source with video lectures.
- Physical Chemistry, Harcourt Brace Jovanovich College Outline Series, by J. Edmund White.

Please ask 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 11<sup>th</sup> Ed. unless noted otherwise.

Week	Date	#	Lecture Topics	Reading	Other
1	19 Jan	1	Welcome/overview/waves	<i>handouts</i>	
	21 Jan	2	Quantum Theory	Ch. 7	
2	26 Jan	3			
	28 Jan	4			
3	2 Feb	5			
	4 Feb	6	Atomic Structure and Spectra	Ch. 8	
4	9 Feb	7			
	11 Feb		<i>MINI BREAK!!!</i>		
5	16 Feb	8			
	18 Feb	9	Molecular Structure	Ch. 9	
6	23 Feb	10			
	25 Feb	11			
7	2 Mar	12	Symmetry	Ch. 10 A+B	
	4 Mar	13			
8	9 Mar		<i>MINI BREAK!!!</i>		
	11 Mar	14	Molecular Spectroscopy	Ch. 11	
9	16 Mar	15			
	18 Mar	16			
10	23 Mar	17			
	25 Mar	18	Statistical Thermodynamics	Ch. 13	
11	30 Mar	19			
	1 Apr		<i>Holy Thursday</i>		
12	31 Mar	20			
	2 Apr	21			
13	6 Apr	22	Solids	Ch. 15	
	8 Apr	23			
14	13 Apr	24			
	15 Apr	25	Reaction Dynamics	Ch. 18 A–D	
15	20 Apr	26			
	22 Apr	27			

Monday, 3 May 2021, 1 – 3 pm (CDT), FINAL EXAM

## **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.

## **Online Class Specifics**

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Any and all material shall not be shared; all intellectual property remains with me and/or the university.

*Recording of Lectures:* I will record our lectures (not discussions) on Zoom and share with the class. These will not, and may not, be shared outside the class.

You may not have another person or entity 'take your place' for any course-related activity.

### **Recording of Zoom class meetings**

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In this class software will 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 course has concluded. *Students will be required to turn on their cameras at the start of class. Students who have a need to participate via audio only must reach out to me to request audio participation only without the video camera enabled.* The use of all video recordings will be in keeping with the University Privacy Statement shown below.

### **Privacy Statement**

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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.

### **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.

### **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. I am always willing to discuss how I can adapt the class and its materials so that you are successful.