

Chemistry 301: Physical Chemistry I
Department of Chemistry & Biochemistry, Loyola University Chicago
Fall 2016

Instructor: Dr. Dan Killelea
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Office Hours: M 10:20 – 11am, **or by appointment** (FH 103)
Lecture: TR 10:00 – 11:15 am, Flanner Hall, Room 007
Discussion: MW 9:20 – 10:10 am, Flanner Hall, Room 105
Text: Physical Chemistry, Atkins & De Paula, W.H. Freeman, 10th Edition

Course Prerequisites: Chemistry 222 or 224/226 (Organic), Physics 112K (College Physics w/ **Calculus**), and Math 263 (Multivariate 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.

Course Overview

Welcome to Physical Chemistry! The objective of this course is for you to gain a firm understanding of the fundamentals behind the properties and behavior of macroscopic systems. Thermodynamics is the study of how systems behave at or near equilibrium, and is widely used in chemistry to quantify the energetics of chemical systems. We will start in the very physics world of The Three Laws Of Thermodynamics; we will then see how these concepts are manifest in chemistry and guide chemical reactions through concepts such as the Chemical Potential and Gibb's Energy. From there, we will focus on how the thermodynamic fundamentals give rise to the properties of solids, liquids, and gases and their mixtures and solutions. Towards the end of the semester, we will look at the microscopic properties of gases and briefly cover some basic chemical kinetics. Throughout the semester, we will explore how the concepts we are studying are relevant to the critical problems facing humanity as a whole. Of the great challenges facing our society, one of the most significant is one that chemists are well suited to solve, and that is the development of new energy sources. Thermodynamics is key to understanding the obstacles in the quest for plentiful, clean fuels. The overarching goal of this course is for you, the student, to be adept at using the concepts covered in this course to critically gauge the accuracy and potential efficacy of political and scientific (!) solutions to problems that, in your lifetime, will only grow in significance.

Course Structure

There are two 75-minute lectures (T, R) and two 50-minute discussion sections (M, W) per week. There will be variance; some T,R will be more discussion-like and some M,W will be more lecture-like. 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** 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 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. Repeated violations (at the discretion of the instructor) will 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 that are similar to the assigned problems, with the goal of working with your classmates to learn the material.

Grading

Your grade will be determined on a basis of **600** points.

Tests (300 points): We will have three tests worth 100 points each. There *may* be 'extra credit' on the tests. The tests *may* be a mixture of in-class and take home components. You may use any resource, except interactions with other humans, for the take-home part. During the in-class portion, 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.

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

Quizzes and Discovery Problems (90 points): you will have a few (3-4) short quizzes on the material covered in class, usually given during discussion. In addition, problems (from the text or elsewhere) will be assigned to help you learn the material. A subset of these will be collected and evaluated.

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

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

Final Exam: The College of Arts & Sciences schedules the final exam. The final will be held on:

Tuesday, December 13, 2016 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 600 points, letter grades will be assigned as given below:

	A: > 93%	A-: 93–90%
B+: 90–87%	B: 87–82%	B-: 82–80%
C+: 80–78%	C: 78–72%	C-: 72–70%
D: 70–55%	F: < 55%	

Supplementary Material

- Companion site for Atkins Physical Chemistry: <http://bcs.whfreeman.com/pchem10e>
- Physical Chemistry, 6th 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.
- Chemical Thermodynamics by Klotz & Rosenberg.
- Thermodynamics by Crooksy

Please ask instructor if you want help finding supplementary materials.

Schedule

Note: 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.

Week	Date	Lecture Topics	Reading	Other
1	30 Aug	Fundamentals; what is physical chemistry?	Fundamentals	
	1 Sep			
2	6 Sep	Gases	Ch. 1	No M disc
	8 Sep			
3	13 Sep	1 st Law	Ch. 2	
	15 Sep	State functions, thermodynamic processes		
4	20 Sep			
	22 Sep	Need for a 2 nd Law	Ch. 3	
5	27 Sep			
	29 Sep	2 nd Law and 3 rd Law		
6	4 Oct	Criteria for spontaneity		
	6 Oct	Test 2		
7		<i>no class – mid-semester break</i>		No M disc
	13 Oct	Phases	Ch. 4	
8	18 Oct			
	20 Oct	Phase Changes, ice and helium		
9	25 Oct	Mixtures	Ch. 5	
	27 Oct			
10	1 Nov	Chemical Equilibria	Ch. 6	
	3 Nov			
11	8 Nov			
	10 Nov	Microscopic treatment of gases	Ch. 19	
12	15 Nov	A bit of kinetics	Ch. 20	
	17 Nov			
14	22 Nov	Introduction to Statistical Thermodynamics	Ch. 15	
		<i>no class – Thanksgiving Holiday</i>		No W disc
15	29 Nov	Properties of Solids	Ch. 18	
	1 Dec	Test 3		
16	6 Dec	Surfaces and Catalysis		
	8 Dec	Course Overview		
Tuesday, 13 Dec: FINAL EXAM, 1:00pm to 3:00pm				

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, that 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.

I have no tolerance whatsoever for cheating or plagiarism. *Any instance of dishonesty (including those detailed on the website provided above or in this syllabus) during a quiz, test, or exam will result in a failing grade (F) for the course.* The Dean of Arts & Sciences and The Chair of The Department of Chemistry & Biochemistry will also be notified. Please be honest with your work.

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.

Students with Disabilities

If you have any special needs, please let me know in the first week of classes. The university provides services for students with disabilities. Any student who would like to use any of these university services should contact the Services for Students with Disabilities (SSWD), Sullivan Center, (773) 508-3700. Further information is available at <http://www.luc.edu/sswd/>.

Tutoring

The Loyola Undergraduate ACS has open tutoring every week on W and R 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

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) for assistance. These are services that **your** tuition pays for and can be invaluable for your personal health and maintaining progress towards your degree.