Chemistry 301: Physical Chemistry I
Department of Chemistry & Biochemistry, Loyola University Chicago
Fall 2017

Instructor:	Dr. Dan Killelea
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Office Hours:	M 9:30am, **or by appointment** (FH 103)
Lecture:	T Th 10:00 – 11:15 am, Flanner Hall, Room 105
Discussion:	T Th 8:55 – 9:45 am, Flanner Hall, Room 105
Text:	Physical Chemistry, 10th Ed., by Atkins & de Paula

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.

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 with a treatment of the gas laws. From there, we will discuss energy levels, and use that framework for statistical treatments of large numbers of particles. With the microscopic-macroscopic link in place, we will then cover 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. 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) preceded by two 50-minute discussion sections per week. 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 as well as 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 four tests worth 100 points each. **The low test score will be dropped**. 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.

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

Homework (90 points): you will have weekly homework 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 College of Arts & Sciences schedules the final exam. The final will be held on:

Tuesday, December 12, 2017 at 1:00 p.m.

in Flanner 105 (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

- Physical Chemistry: A Molecular Approach, by McQuarrie and Simon
- 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*
1	29 Aug	Introduction: What is Physical Chemistry? Ideal Gas	Foundations
	31 Aug	Ideal Gases, Real Gases	Ch. 1
2	5 Sep		
	7 Sep	Intermolecular interactions	Ch. 16
3	12 Sep		
	14 Sep	**Test 1**	
4	19 Sep	Schrödinger Equation, Particle in a Box, Quantization	Ch. 7
	21 Sep		
5	26 Sep	Boltzmann Factors, Populations, and Partition Functions; Molecules and Ideal Gases	Ch. 15
	28 Sep		
6	3 Oct		
	5 Oct	**Test 2**	
7	10 Oct	*no class – mid-semester break*	
	12 Oct	First Law; heat and work	Ch. 2
8	17 Oct		
	19 Oct		
9	24 Oct	Second Law and Entropy	Ch. 3
	26 Oct		
10	31 Oct	Entropy and the 3rd Law	Ch. 3
	2 Nov	Helmholtz and Gibbs Energies	
11	7 Nov	**Test 3**	
	9 Nov	Phase Equilibria and Chemical Potential	Ch. 4
12	14 Nov	Mixtures	Ch. 5
	16 Nov		
14	21 Nov	Chemical Equilibrium	Ch. 6
	23 Nov	*no class – Thanksgiving Holiday*	
15	28 Nov	Kinetic Theory of Gases	Ch. 19
	30 Nov	Kinetics	Ch. 20
16	5 Dec	**Test 4**	
	7 Dec		
Tuesday, 12 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.

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 & Biochemistry website: http://www.luc.edu/chemistry/forms/ and obtain a signature from 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.