

Chemistry 301: Physical Chemistry I
Department of Chemistry and Biochemistry, Loyola University Chicago
Fall 2012

Instructor: Dr. Dan Killelea
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Office Hours: M 10:30 – 11:30 am and T 2:30 – 3:30 pm, or by appointment (FH 103)
Lecture: M, 9:20-10:10am and TR 1:00 – 2:15 pm, Cuneo Hall, Room 109
Discussion: W 9:20 – 10:10 am, Cuneo Hall, Room 109
Text: Chemical Thermodynamics, Klotz & Rosenberg, Wiley, 7th Edition (or previous)

Course Prerequisites: Chemistry 222 or 224/226 (Organic) and Physics 111K and 112K (College Physics w/ Calculus) and Math 263 (Multivariate Calculus). Math 264 (Ordinary Diff. Eq.) is strongly encouraged. 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 backboard 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 Free 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. One of the greatest challenges facing us today 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 is for you, the student, to be adept at using the concepts covered in this course to critically assess 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 three 50-minute lectures (M, T, R) and one 50-minute discussion section (W) per week. As valuable as lectures may be, you will have much more to gain by doing the assigned reading and problem sets **BEFORE** the lecture. By coming to lecture 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 lectures 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.

The discussion section will be small group work. You will work in small groups (3-6 people) on problems I provide that are similar to the assigned problems, with the goal of working with your classmates to learn the material. I will not take attendance, but I strongly urge you to attend both discussion and all lectures.

The additional time after lectures on T and R will be used for returning exams, homework, or simply for further discussion of the course material.

Exams, Homework, and Grading

There will be three exams this semester, each worth 100 points. The final counts 200 points. The assignments will add up to 100 points. The lowest 100-point group will be dropped, and the grade will be assigned on a basis of 500 points. If one of the hour exams were the lowest score, it would be dropped. If the homework were the lowest score, that score would be dropped. It is also possible for the final to be your lowest score, in which case its value would be halved. (not recommended!)

Exams: There will be three 50-minute exams this semester, each replacing a regularly scheduled lecture. Each exam is worth a total of 100 points. There *may* be 'extra credit' on the exams to boost their value. During the exam you may not use any electronic device (i.e. cell phones or computers) aside from a non-programmable scientific calculator. Please check the calculator with me if in doubt. If you have any banned device, I will have it confiscated for the duration of the exam. Refusal to yield the device will give you a zero for the exam. You are permitted a single 3" x 5" notecard, with whatever you like hand-written on it on one side only. You must turn in the notecard with the exam.

Homework: Problems will be assigned roughly every week. Ideally, the homework would be assigned on Monday afternoon and due the following Tuesday at the beginning of class. **Late homework is not accepted under any circumstance.** Each problem in a set will be graded as 1 (correct answer), 0.5 (almost there), or zero credit; the grade for the set is the sum. Each homework set has equal value for determination of the homework grade.

Late Homework or missed exams: Late homework is *never* accepted for credit. *There will be no make-up exams given under virtually any circumstance.* As mentioned above, the low score for an exam is dropped, so a missed exam would simply be the one dropped.

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

Thursday, December 13th, 2012 at 1:00 pm

in Cuneo 109 (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: 100–92%	A-: 92–90%	B+: 90–88%
B: 88–82%	B-: 82–80%	C+: 80–78%
C: 78–72%	C-: 72–70%	D: 70–55% F: < 55%

Supplementary Texts

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. Unfortunately, this seems like it is out of print, but is available used. Very useful distillation of the course material for both semesters of Physical Chemistry with numerous problems.

Physical Chemistry, any edition after the 5th, by Peter Atkins. Another textbook with helpful explanations and many problems.

Other texts may be put on reserve in the library

Schedule

Note: The instructor reserves the right to make changes to the schedule, the outline below is tentative. It is unlikely that exam dates will change, but the material covered by each exam may be different than outlined in the schedule below. Any changes will be announced in class or on blackboard. Reading assignments are from Klotz and Rosenberg unless noted otherwise.

<i>Week</i>	<i>Date</i>	<i>Topics</i>	<i>Reading</i>	<i>Other</i>
1	27 Aug	Introduction; what is physical chemistry? Math	Ch. 1 +2	
2	3 Sep	First Law Enthalpy, heat capacities	Ch. 3 Ch. 4	No M class
3	10 Sep	More First Law Second Law	Ch. 5 Ch. 6	
4	17 Sep	Entropy, reversibility, temperature More Second Law		
5	24 Sep	Material equilibrium and entropy	Ch. 7	Exam I (R)
6	1 Oct	Gibbs and Helmholtz energies Thermo. relations and chemical potential		
7	8 Oct			No M or T
		Gibbs and Planck Functions	Ch. 8	
8	15 Oct	Systems of variable Composition	Ch. 9	
9	22 Oct			Exam II (R)
		Mixtures of Gases	Ch. 10	
10	29 Oct	Third Law Gibbs function and chem. transformations	Ch. 11 Ch. 12	
11	5 Nov	Phase Rule Ideal Solutions	Ch. 13 Ch. 14	
12	12 Nov	Dilute Solutions Activities, etc.	Ch. 15 Ch. 16	
14	19 Nov	Kinetic theory of gases	Hand outs	No W or R
15	26 Nov	Kinetic theory of gases Reaction Kinetics		Exam III (R)
16	3 Dec	Reaction Kinetics Mechanisms, T dep., Catalysis		

Thursday, 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/pdfs/CAS_Academic_Integrity_Statement_December_07.pdf

Anything you submit that is incorporated as part of your grade in this course (e.g., quiz, examination, homework, lab report) must represent your own work. Any students caught cheating will, at the very minimum, receive a grade of "zero" for the item that was submitted and this grade cannot be dropped. If the cheating occurred during a course exam, the incident will be reported to the Chemistry Department Chair and the Office of the CAS Dean. Depending on the seriousness of the incident, additional sanctions may be imposed.

Any instance of dishonesty as detailed on the website provided above will result in a grade of zero for that particular item, be it homework or an exam. The Dean and Chair of The Department of Chemistry will also be notified. I truly hope to never have to invoke these processes. 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 don't 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

Loyola maintains a Center for Academic Excellence & Tutoring (<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.