

Chemistry 301: Physical Chemistry I
Department of Chemistry, Loyola University Chicago
Fall 2011

Instructor: Dr. Dan Killelea

Office: Flanner Hall 103

Phone: (773) 708-3136

Email: dkillelea@luc.edu

Office Hours: MW 10:10 – 11:30, or by appointment (FH 103)

Lecture: TR 1:00 – 2:15 pm, Galvin Auditorium, Sullivan Center

Discussion: MW 9:20 – 10:10 am, Cudahy 202

Text: Physical Chemistry, Ira Levine, McGraw-Hill, 6th Edition (or 5th Ed.)

Course Prerequisites: Chemistry 222 or 224/226 (Organic) and Physics 112 or 114 (College Physics) and Math 162 (Calculus 2) or 264 (Ordinary Diff. Eq.). If you have not completed the course prerequisites, you may be administratively dropped from the class.

Please see the backboard site for this class for up-to-date information and posts.

(www.luc.edu/blackboard; Chem 301 001 1151 Fall 2011)

Course Overview

Welcome to Physical Chemistry! The objective of this course is for you to gain a firm understanding of how to describe the behavior of macroscopic chemical systems. Thermodynamics is the study of how systems behave near or at equilibrium, and is widely used in chemistry to quantify the energetics of a chemical system. 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 with concepts such as the Chemical Potential and Gibb's Free Energy. Finally, we will study basic chemical kinetics, in which we begin paying attention to time, which is largely absent from most of the discussion of thermodynamics. Once more thing, through the semester, we will look at how the concepts we are studying are relevant to some of the problems facing humanity as a whole. Of central interest to many chemistry today is the development of new energy sources. Thermodynamics is key to understanding the obstacles the quest for plentiful, clean fuels. At the end of the class you will be adept and using the concept of a system to properly account for the sources and sinks of energy; and you will be even better equipped to gauge the accuracy, and efficacy, of political, and scientific (!), strategies presented to the citizenry at large.

Lectures and Discussions

There are two 75-minute lectures and two 50-minute discussion sections per week. As valuable as lectures may be, they will have a much greater yield if the reading and problem sets are completed **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. As a courtesy to your classmates, please silence (not just vibrate mode) any 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 not encouraged.

The discussion sections will be small group work. The same material will be covered in each section (M and W), so you may choose which one you prefer to attend. Please feel free to attend either (or both) section. 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.

Exams, Homework, and Grading

There will be three exams this semester, each worth 100 points. The final counts as two exams, or 200 points. The total value of the assigned work is also 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 it's value would be halved.

Exams: There will be three 75-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 (both sides ok). You must turn in the notecard with the exam.

Homework: Problems will be assigned from the text, or otherwise provided, roughly every 1.5 weeks. Late homework is not accepted under any circumstance. I will not return you graded homework, but rather I will supply you with an answer key on blackboard after the due date. You will receive full credit for an honest effort at each problem. Incomplete assignments will receive half credit. Late, or less than 1/3 completed assignments will receive no credit.

Late Homework or missed exams: Late homework is never accepted for credit. If an exam is missed, there will be no make-ups under any circumstances. As mentioned above, the low score for an exam is dropped, so a missed exam would simply be the one dropped. If there are events in your life that cause school to lose its priority, please 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). These are services your tuition pays for and can be invaluable for maintaining your personal health and progress towards your degree.

Final Exam: The College of Arts & Sciences schedules the final exam. The final will be held on **Thursday, December 15th, 2011 at 1:00 pm** in Galvin Auditorium. There will be no make-up exams given, and the exam may 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%	D: 72–70%	D: 70–55%	F: < 55%

Supplementary Texts

Student Solutions Manual to accompany 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.

Schedule

Note: The instructor reserves the right to make changes to the schedule, and to move assignments or hour exams to later dates. It is unlikely that exam dates will change, but the material covered by each exam may be different that outlined in the schedule below. Any changes will be announced in class or on blackboard.

<i>Date</i>	<i>Class</i>	<i>Topics</i>	<i>Readings</i>	<i>other</i>
30 Aug	1	Introduction; what is physical chemistry?	n/a	
1 Sep	2	Ideal gas, eqn's of state	Ch 1	
6 Sep	3	First Law	2.1 – 2.4	No M Disc.
8 Sep	4	Enthalpy, heat capacities	2.4 – 2.6	
13 Sep	5	More First Law	2.8, 2.9	
15 Sep	6	Second Law	3.1 – 3.3	
20 Sep	7	Entropy, reversibility, temperature	3.4 – 3.6	
22 Sep	8	More Second Law		
27 Sep	9	Material equilibrium and entropy	4.1 – 4.2	
29 Sep	10			Exam I
4 Oct	11	Gibbs and Helmholtz energies	4.3 – 4.4	
6 Oct	12	Thermo. relations and chemical potential	4.4 – 4.6	
11 Oct	No class, Mid-semester break, no M Disc			
13 Oct	13	Phase and rxn equil., thermochemistry	4.7, 4.8, 5.1 - 5.4	
18 Oct	14	T effects, Third Law, ΔG_{rxn}	5.5, 5.7, 5.8	
20 Oct	15	Rxn equilibria in Ideal Gases I	6.1 – 6.3	
25 Oct	16	Rxn equilibria in Ideal Gases II	6.4, 6.6	
27 Oct	17	Phases and phase transitions	7.1 – 7.3	
1 Nov	18			Exam II
3 Nov	19	Other phase transitions, surfaces	7.4 – 7.8	
8 Nov	20	Solutions I	9.1 – 9.6	
10 Nov	21	Solutions II	9.7, 9.8	
15 Nov	22	Colligative properties	12.1 – 12.4	
17 Nov	23	Two-component systems, phase diagrams	12.5 – 12.9	
22 Nov	24	Kinetic theory of gases	14.1 – 14.6	No W Disc.
24 Nov	No class, Thanksgiving break			
29 Nov	25	Kinetic theory of gases	14.6 – 14.10	
1 Dec	26			Exam III
6 Dec	27	Reaction Kinetics	16.1 – 16.5	
8 Dec	28	Mechanisms, T dep., Catalysis	16.6, 16.8, 16.16	
15 Dec	FINAL EXAM, 1:00pm to 3:00pm			

Students with Disabilities

If a student has special needs, please let the instructor 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.

Teamwork: I also encourage you (the class) to work together to solve assigned and unassigned problems. As Professor Levine explains towards the end of Chapter 1 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.

Academic Integrity: Without an open and free exchange of ideas, the university system would fail. All members of the university community must hold themselves, and others, to the highest standards of honesty in their scholarly work. The university has strict policies regarding academic dishonesty. Please see the Academic Standards and Regulations page for the full details (<http://www.luc.edu/academics/catalog/undergrad/reg.shtml>), and in particular the policy on Academic Integrity (http://www.luc.edu/academics/catalog/undergrad/reg_academicintegrity.shtml) for more information. Some important points from the website above are:

Plagiarism is a serious form of violation of this standard. Plagiarism is the appropriation for gain of ideas, language, or work of another without sufficient public acknowledgement and appropriate citation that the material is not one's own. It is true that every thought probably has been influenced to some degree by the thoughts and actions of others. Such influences can be thought of as affecting the ways we see things and express all thoughts. **Plagiarism, however, involves the deliberate taking and use of specific words and ideas of others without proper acknowledgement of the sources.**

The faculty and administration of Loyola University Chicago wish to make it clear that the following acts are regarded as serious violations of personal honesty and the academic ideal that binds the university into a learning community:

Submitting as one's own:

1. Material copied from a published source: print, internet, CD-ROM, audio, video, etc.
2. Another person's unpublished work or examination material.
3. Allowing another or paying another to write or research a paper for one's own benefit.
4. Purchasing, acquiring, and using for course credit a pre-written paper.

The critical issue is to give proper recognition to other sources. To do so is both an act of personal, professional courtesy and of intellectual honesty.

Plagiarism on the part of a student in academic work or dishonest examination behavior will result minimally in the instructor assigning the grade of "F" for the assignment or examination. In addition, all instances of academic dishonesty must be reported to the chairperson of the department involved. The chairperson may constitute a hearing board to consider the imposition of sanctions in addition to those imposed by the instructor, including a recommendation of expulsion, depending upon the seriousness of the misconduct.

Academic cheating is another serious act that violates academic integrity. Obtaining, distributing, or communicating examination materials prior to the scheduled examination without the consent of the teacher; providing information to or obtaining information from another student during the examination; attempting to change answers after the examination has been submitted; and falsifying medical or other documents to petition for excused absences all are violations of the integrity and honesty standards of the examination process.

Any instance of dishonesty as detailed on the websites 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.

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.