CHEM309 Fall 2007
Physical Chemistry I

Instructor: Dr. Codrina Popescu
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Class Schedule: MWF 9:00 -9:50 am in Pfahler 106.
Optional problem solving sessions -upon agreement with the class- are to be held before scheduled exams, or by demand.

Office Hours: Monday: 1:30-4:00 pm; Thursday 11:00-12:00; Friday 1:30-3:30 or by appointment (made personally or by e-mail).
Prerequisites: Chemistry 206; Math 112; Physics 111Q.

Textbooks: Required are two books, available in the bookstore:

Engel, Thomas and Reid, Phillip, **Physical Chemistry** (This is the textbook for the course.); ISBN 0-8053-3842-X, Ed. 2006, Pearson, Benjamin Cummings.

Barrante, James R., **Applied Mathematics for Physical Chemistry** *(2004, Pearson, Prentice Hall, ISBN 0-13-1000845-5)* – a necessary mathematics complement.

Other useful books: (on reserve in Myrin library)
David M. Eisenberg and Donald S. Crothers, **Physical Chemistry with Applications for the Life Sciences** (*1979*);
Ira N. Levine, **Physical Chemistry**, Fifth Ed. (2002);
P.W. Atkins and De Paula, **Physical Chemistry** (2002).

Grading

Exams (3 x 100 points each)	*300 points*
Final Exam	*200 points*
Quizzes (6x25p)	*150 points (pop quizzes may be added to these)*
Problems sets (best 6 of 9 x 25p)	*150 points*
Formulae List +Journal+ Attendance	*not graded*
Total	*800 points*

Approximate Grading Scale (The following averages do not account for the instructor's decisions based on the class averages**.)**

85–100	A
74-85 %	B
63-73%	C
50-62%	D
0-49%	F

Objectives and brief description: This course is part of the two-semester sequence, which gives an exposure to Physical Chemistry to Chemistry majors. This semester covers chemical thermodynamics, equilibrium and kinetics, as well as phase diagrams, ideal solutions, real gas, and other topics.

This course may be different from all other courses you have taken in your career. Physical Chemistry is conceptual and relies heavily on mathematics. While we can alleviate the abstractness of concepts by studying examples, we cannot circumvent the mathematical manipulations. The effort to learn the mathematics and use it is worthwhile. Not only you will learn a great deal about problem solving, but you will discover that mathematics provides general solutions and explanations to questions about real-life phenomena, such as heat engines, (like that in your car) boiling liquids, liquefying gases and others.

What distinguishes this class from BCMB 307? While the fundamental theory is the same, all the applications in *P-Chem for the Life Sciences* are selected directly from biochemistry, while in CHEM 309, we use mostly chemical examples. However, chemistry is a life science, and as the frontiers between chemistry and biology continue to disappear in modern science, we use an assortment of examples, from pure and applied chemistry and biochemistry.

Goals: - To build the *vocabulary of terms and concepts* in Physical Chemistry.

- To *connect fundamental theories of chemistry and physics with chemical processes* and emphasize the global nature of the former. Understanding the chemical and physical mechanisms at the root of biological processes is the key to modern research and development in the life sciences.

- To develop *logical reasoning and deduction skills,* specific to the physical sciences. This thinking style is based on understanding concepts behind natural physical laws (e.g. the laws of Thermodynamics).

- To build *problem solving skills and independent thinking*. Solving problems in this course may be different from other courses; it is not algorithmic (that is, one cannot provide a general set of steps that could be employed for all problems). Each problem may necessitate a different approach, that must be deduced based on concepts learned.

- To develop *integrative abilities*. What you learn in one chapter forms the basis for the next chapter. Thus, you are expected to study every week and to not forget from one chapter to the next.

Description of Assignments and Policies:

1. *Problem sets are obligatory*. Success in this class is largely determined by your commitment to doing the homework on time. Problem sets are of utmost importance in your preparation for exams. That is why you are expected to turn in ALL the problems posted on Blackboard or given in class.

Problem sets will be posted on Blackboard and **will be expected in my office by 5:00 pm on the "due date"**. Two to four *representative* problems from each problem set will be graded. Due dates will be written on assignments, posted and announced in class. Late homework will not be accepted, unless exceptional circumstances have been announced (sickness, justified absence, etc.).

2. *Practice problems are* strongly recommended. These additional problems will show up on Blackboard and will not be collected, nor graded.

Homework policy: You are encouraged to work together on homework assignments. However, the work you submit cannot be copied directly from another student's work and cannot be submitted through e-mail, faxed etc, unless specific emergency procedures have been approved prior to submission. Each assignment must indicate the names of all group members. If identical work is submitted by people who did not belong to the same group, both students will receive no credit for the assignment. All group members must participate in good faith in preparing solutions to the problem sets. It is a serious breach of ethics to include the name of someone who did not contribute.

4. *Quizzes* (5 quizzes). Quizzes are generally 10-15 minutes at the end of class. The dates are not formally marked in the syllabus, but the dates will be announced one class in advance. Do not expect the exact same problems from class or homework to show up in the quizzes. ☺

5. *Exams* (3 hourly + 3-hour Final). ***Exam dates are 9/21, 10/22, and 11/19*** and will not change. Should an exam fall on an inclement weather day and I am on campus, then only commuting students will be excused, and only they will be allowed to take the exam on a different date.

Attendance at all examinations and quizzes is required. There are no make-up exams. The exams will be taken at the scheduled time and place, with no exceptions. Always **be on time**. If you arrive late, after the first student has finished, you will not be allowed to take the exam and will have a zero in that exam.

In case of legitimate reasons for absence in the exam, you will notify me in advance and we will schedule you to take the exam EARLIER than the scheduled time. In case of a sudden illness or event that precludes you from taking the exam at the scheduled time, you must notify me as soon as the situation permits. Naturally, I will work with you to reschedule the exam. The student who is legitimately ill must present a physician's note, stating not only that the student was seen by the physician but also that the student's illness made it impossible for her or him to sit in the examination. If death in the immediate family occurs, documentation must be provided. Illness before an exam is generally not considered to be a legitimate excuse as you are expected to keep up-to-date with the material and not to allow the bulk of your studying to be done immediately before the exam.

Anyone who is absent from an examination will receive a grade of zero for that exam, except in the case of excused absence, indicated above. In case of excused absence, the final exam will be weighted more heavily. For example, if you miss and exam, your final will be scaled up to 300 points.

Regrades for all exams will be handled by Dr. Popescu. Regrades will only be considered during the five days after the exam has been distributed to the class.

Individual exams will not be curved. You will be assigned two approximate grades based on your cumulative total during the semester. After EXAM II, your grade will be based on 200 points (exams I and II), and before the final exam you will be given an approximate grade based on 400 points. This will give you a better idea of your performance in the course throughout the semester. Please feel free to discuss you grade with me during the semester.

Exams have the largest ponder in your grade in this class. However, you will need to work on problem sets every week much more than you work before an exam.

Note on formulae sheets: Create your own list of formulae, within one half of an 8"/11" sheet. Show me the list before exam. Only approved formulae are allowed.

5. *Problem Sessions:* I found it useful to gather the whole class in review sessions before exams. For this to work, I need at least half the class to agree to come at a designated time.

6. *Feedback about the class:* I urge you to express your opinions about the course, as the class progresses. Do not hesitate to come to me and indicate what works or does not work for you. I am always open to your suggestions regarding the style, the pace and even (when appropriate) the contents of the class.

7. **Attendance Policy:** According to the college policy stated in the 2006-2007 Ursinus College Catalog "[…] the college expects students to attend class. Specific attendance policies are set by individual instructors and indicated on the course syllabus at the beginning of each term. Academic warnings will be issued by instructors for all students failig to meet the stated course attendance policies. […] Students may be dropped from a course with a grade of F for failing to meet the stated policy." I hereby establish the attendance policy. If you miss six class sessions (with no justification communicated to me) you run the risk of failing the class; you will get warning slips starting with the fourth unjustified absence. Beyond six absences you will need a note from your advisor and the dean in order to continue attending this class.

8. *Class notes* and assignments are of prime importance for preparation and success in this course.

9. *Class participation:* I intentionally refrain from delivering long monologues. I encourage your participation by asking questions and pertinent comments. However, class participation is not graded.

10. *A final note:* Physical Chemistry has a reputation of being difficult. Some people found this reputation to be hollow, others accurate. The key is to get used with the concept-based style, and with a schedule

of sustained work on problems, which requires some work. This has not stopped the majority of the students who took this class from enjoying it and being successful. Is there a way to make this easy? Perhaps not easy, because all the successful students testify that they worked hard. But work was enjoyable and success gave great satisfaction. What is the trick? Some will say, it's calculus. In part, yes, that is why we start this semester with a primer of calculus. I would argue that knowing calculus before you start the class is not essential. But if you know that you don't know it, you must work hard from the beginning and not give up when it gets difficult.

I make a pledge that I will give you the tools, (calculus, elements of physics) the theory, (laws, theorems, formulae derivations, logic of experiments) and sometimes examples to guide you through the rough spots. Your job is to take notes, ask questions, and put 100% effort outside of class in working with the notes and the book, until you feel that you can attack problems. Independent work is the key to problem solving. In my experience, students who do not work at least nine hours a week are not successful in this class. Most importantly, whenever you feel like talking, even if you don't quite know how or what to ask, drop by my office or drop me an e-mail.

♦Rules and Expectations

Main rule #1: My responsibility is to teach, your responsibility is to learn. Be proactive by coming early with your questions and concerns.

Main rule #2: If you hand in your work on time, it is my first priority to bring it back graded within two weeks. If you hand in work late, it will be at the bottom of my grading pile and I do not guarantee a date of return.

My goal is to make you comfortable in the encounter with problems and questions that require independent thinking. You are expected to **be active in class and work on your own out of class**. I require your commitment to invest time and effort.

My minimal expectations from you:

1) In class: Take notes and ask questions; be active; I often use short-hand notation, so you must pay attention. Your notes will not always look clean, complete and legible. See item 2.
2) When the class is over, read and correct any mistakes you find in your notes. When you study, take the textbook and your notes and make a clean, complete copy of your notes in a notebook or on new sheets of paper. This way, you will know what you don't understand from class and will be immediately able to ask questions in office hours or the next class. Keep your notes and homework sets organized.
3) Read the notes from the past class when you come to class. It is your responsibility to keep the continuity of the material in your head and to make connections.
4) *Have a current list of all formulae given in class and used in homeworks.* If I indicate that a derivation is important, make sure you know it.
5) *Solve all the problems assigned in problem sets and posted on Blackboard*, attempt all problems in the book. Come to ask questions if you don't know how to solve a problem. Keep a current record of your problems, which you will reuse when reviewing for exams.
6) *Check Blackboard often. There you will find not only answers to problems, but also old exams, recommended problems, small videos, advice, latest announcements, and more.*
7) Work at the pace of the class, do not fall behind. Start on a problem set as soon as you get it. The pace of the lectures will vary, but it is usually alert.
8) Get help promptly if you fall behind. Ask all the questions you have! There is no such thing as a stupid question.

College policies that apply to this class:

Inclement weather: Commuting students will identify themselves to me and give me a phone number at which they can be reached in case of class cancellation. The college has a special number (610-409-3700) where students can call to get a message from the dean about "inclement weather days". If classes are canceled for inclement weather, commuter students will be excused in case of absence.

Academic Honesty: Plagiarism and cheating: All writing assignments must be prepared individually. Do not copy solutions from the solution manual. Should you include any written material from the World Wide Web, original articles or books in your assignments, exercise particular care in using proper citation and precise references.

The college imposes severe penalties on students who cheat. Please read the *Student Handbook* on academic honesty, plagiarism, and procedures for suspected academic honesty violations for further details. The students will read and sign the attached "Statement of Academic Honesty", they will keep one copy and return the other to me in the first week of class.

Tentative Schedule of Topics

Week	Day	Date	Chapter/Sections	Topics/ Textbook Sections
1	M	8/27	1.2-1.5	INTRODUCTION. Some basic definitions.
	W	8/29	Appendix A Part 2/p.973+ Barrante	Review of Elements of Calculus
	F		3.1	Partial derivatives in P, V, T and some properties of gases
2	M	9/3	Ch. 2/1, 2, 3, 4, 5	The First Law
	W	9/5	2.6, 2.7	of
	F	9/7	2.8, 2.9,	Thermodynamics
3	M	9/10	2.10	
	W	9/12	Ch. 3/ 3.1-3.3	Mathematical Properties of State Functions
	F	9/14	3.4-3.6	Applications of partial derivatives for U and H
4	M	9/17	Ch. 4	Thermochemistry
	W	9/19		Thermochemistry
	F	9/21		Exam 1
5	M	9/24	Ch. 5/5.2	Entropy and the Second Law
	W	9/26	5.3	of
	F	9/28	5.4	Thermodynamics
6	M	10/1	5.5-5.7	
	W	10/3	5.8	The Third Law
	F	10/5	5.10	Entropy Changes in Chemical Reactions
7	M	10/8	CH. 6/6.1	Chemical Equilibrium
	W	10/10	6.2, 6.3	Gibbs and Maxwell Relations: UHAGS
	F	10/12	6.15	Using Gibbs and Maxwell
8	M	10/15	FALL HOLIDAY	Oct. 13-16
	W	10/17	6.4, 6.5	Chemical Potential
	F	10/19	6.6, 6.7	
9	M	10/22		EXAM 2
	W	10/24	6.8, 6.9	The Equilibrium constant
	F	10/26	6.10	Temperature dependence of K
10	M	10/29	6.11	Equilibria in ideal gases
	W	10/31		
	F	11/2	Ch. 8/	Phase Diagrams
11	M	11/5		Clapeyron Equation
	W	11/7	Ch.9/9.1, 2	Ideal Solutions
	F	11/9	9.10, 11	
12	M	11/12	9.12	
	W	11/14	Ch. 36	Elementary Reaction Kinetics
	F	11/16	36.3	
13	M	11/19		Exam 3
	W	11/21		THANKSGIVING
	F	11/23		RECESS
14	M	11/26	36.4, 5	Rate Laws
	W	11/28	36.5	
	F	11/30		Problems
15	M	12/3	36.7	Sequential reactions
	W	12/5		The steady-state approximation
	F	12/7		

FINAL EXAM: 12/11/07, 9-12PM, PFAHLER 106.