PHYSICAL CHEMISTRY II
Chemistry 310
Spring 2006

Instructor: Dr. Mark D. Ellison
Pfahler 313 D
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Office hours: Mon. 10–11 am, Tues. 2:30–4 pm, Weds. 10–11:30 am, Thurs. 2:30–4 pm, Fri. 10–11 am

Lecture: MWF 9:00–9:50 AM
Pfahler 209

Course Materials:

Textbooks: *Physical Chemistry: A Molecular Approach*, Donald A. McQuarrie and John D. Simon, University Science Books, 1997.
Scientific Calculator
Laptop

Course Description and Goals:

Chemistry 310 is the second course of a two-part sequence in physical chemistry. The first course covered thermodynamics and kinetics, which are macroscopic descriptions of the chemical behavior of atoms and molecules. This course will investigate in detail, the structure of atoms, how that structure governs the formation of molecules, and the properties of individual atoms and molecules. The tool that we will use is *Quantum Mechanics*. It relies heavily on mathematical manipulations, and there is no way to get around that. However, Quantum Mechanics is a strange and paradoxical model of the nature of matter, and some discussion will be devoted to the philosophical aspects of the subject matter. Finally, we will show that the properties of individual atoms and molecules as determined by Quantum Mechanics, when averaged over a large number (moles), provide results consistent with Classical Thermodynamics.

Specific course goals for the students of this course are to:
(1) Develop an understanding of the structure of atoms and molecules, how that structure relates to properties, and how the nature of atoms and molecules may be investigated
(2) Be able to critically analyze and solve complex problems
(3) To gain experience in physical measurement methods
(4) Be able to analyze experimental results in detail
(5) Become proficient at using computers to help solve chemical problems

Course Work

1. Class participation. I will not take attendance, but I expect you to attend all class sections. This will help you determine which material is most important. Please read the relevant sections of the book before coming to lecture. I welcome any questions, and I will ask questions of you.

2. Quizzes. I will give you nine or ten quizzes during the course of the semester. The quizzes give me an idea of your understanding of the material, and they give you an idea of your understanding of the material **before** the tests. Quizzes can **NOT** be made up. I will only count your best eight scores on quizzes. That gives you some leeway in case you miss a quiz or do poorly on one.

3. Homework. Your success in this course will be largely determined by the amount of effort you put in outside of class periods. Homework does not mean just working problems. It also means reading the material before coming to lecture. If you have any questions while reading the material, you are then able to ask me for clarification during class. After class you should re-read the material and work some problems to help solidify your understanding. Spending time on a daily basis is the most effective method of learning chemistry. Waiting until a day or two before the exam to study is a recipe for disaster.
   Problem assignments will be given at the start of each chapter. A due date will be given, and the problem sets will be collected on that date and graded. I encourage you to work with other students in

solving the problems. However, each student must turn in his or her own solutions. I will not accept one solution set with several names on it. Problem assignments are considered late if not turned in by 5:00 PM on the due date. Late assignments will be penalized 5% per day. No assignments will be accepted after 10:00 AM on the first day of Finals Week.

4. Exams. Three one-hour exams will be given during the normal class period, plus a final covering the entire course material. Tentative dates for the exams are listed on the calendar in this syllabus. Mark these dates on your calendar. If you absolutely cannot take the exam on the scheduled day, you must let me know before the exam. Call me, send me an e-mail, or call the chemistry office (2315) if you have a legitimate reason to miss an exam. The day and time of the final exam are set by the college and cannot be changed.

5. Email accounts. I check my e-mail many times a day. It is a good way for you to ask me questions. I expect you to check your e-mail at least every other day. Because I will send out e-mail about schedule changes and other things, you are responsible for any information sent out via e-mail.

6. Absences. If you are unable to attend class on the day of a scheduled exam, *and* you have a legitimate excuse, it is your responsibility to inform me as early as possible. Exams must be made up as early as possible before the next class period. Missed quizzes count as 0 points, but the lowest two scores will be dropped. Inform me of any conflicts as soon as possible.

7. Honesty and Ethics. Science depends upon the honesty of its researchers. Scientists work under an honor system that requires them to report the results of their experiments in a truthful manner and credit the source of original ideas and information. I expect you to follow the same honor system. Assignments should reference all sources of information (books, articles, people, etc.) that contribute to its completion. Also, falsifying data is not acceptable. You must honestly report the results of your experiment. Part of the learning process is explaining why an expected result was not obtained.

8. Grading. I do not grade on a curve for this course. Points will be distributed as follows:

Graded Item	**Points Each**	**Total Points**
Exams (3)	100	300
Final	300	300
Quizzes (8)	10	80
Homework (10)	25	250
TOTAL		930

Your final course grade will be based on the percent of the total points that you earn:

A+ 97.0 – 100%	A 93.0 – 97.0%	A- 90.0 – 93.0%
B+ 87.0 – 90.0%	B 83.0 – 87.0%	B- 80.0 – 83.0%
C+ 77.0 – 80.0%	C 73.0 – 77.0%	C- 60.0 – 63.0%
D+ 67.0 – 70.0%	D 63.0 – 67.0%	D- 60.0 – 63.0%
F below 60.0%		

Week	Day	Date	Chapt.	Sec.	Classroom Topic
1	M	1/15	Intro, 1	1,2,3,4	Dawn of the
	W	1/17		4,5, 6, 7	Quantum Theory
	F	1/19	1, Math A	8,9	
2	M	1/22	2, Math B	1,2,3,4,5	The Classical Wave Equation
	W	1/24	3	1,2,3	The Schrödinger
	F	1/26		4,5,6	Equation and a
3	M	1/29		7,8	Particle in a Box
	W	1/31		9	
	F	2/2	3, Math C		
4	M	2/5			***Exam 1***
	W	2/7	4	1,2,3	Postulates and
	F	2/9		3,4	Principles of QM
5	M	2/12		4,5	
	W	2/14		5,6	
	F	2/16	Math D, 5	1,2	Harmonic
6	M	2/19		3,4	Oscillator and
	W	2/21		4,5	Rigid Rotator
	F	2/23		6,7	
7	M	2/26		8,9	
	W	2/28			***Exam 2***
	F	3/2	6, Math E		The Hydrogen
8	M	3/5		1,2	Atom
	W	3/7		3,4	
	F	3/9		5,6	
9	M	3/12	*Spring*	*Break*	
	W	3/14			
	F	3/16			☺
10	M	3/19		6,7	
	W	3/21	7	1,2,3	Approximation
	F	3/23		3,4	Methods
11	M	3/26	8	1,2	Multielectron
	W	3/28		3,4	Atoms
	F	3/30		5,6,7	
12	M	4/2		8,9	
	W	4/4		10,11	
	F	4/6	9		***Exam 3***
13	M	4/9		1,2	The Chemical
	W	4/11		3,4	Bond: Diatomics
	F	4/13		5	
14	M	4/16		6-10	
	W	4/18	***COSA***	11-16	*No Class*
	F	4/20	10	1,2,3,4,5	Polyatomic Molecules
15	M	4/23	17	1,2	
	W	4/25		3,4	
	F	4/27	18	1,2,3,4	Statistical
16	M	4/30	***Make-up for COSA***	5,6,7,8	Thermodynamics
	W	**5/4**	***FINAL EXAM***	**1–4 PM**	**Pfahler 209**