CHE 323: Physical Chemistry I

Block 1 2007-08

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Office hours: officially, M 11-12, 3-4; T 3-4; W 11-12; R 12-1; F 3-4; unofficially, just stop by anytime

Course goals

In this block we will study topics that form the foundation for much (all?) of chemistry: atomic structure, energy levels, bonding, molecular structure, and spectroscopy. These fundamental topics will be approached from the bottom up: we start with the atom. Specifically, we will study these topics through the framework of our modern understanding of the very small; i.e., quantum mechanics.

We will see that mathematics and physics play an important role in understanding chemistry at a fundamental level. This course will provide a foundation for your study of chemistry thus far and prepare you for future studies in physical chemistry. In addition, connections will be made to other branches of chemistry, including all the way back to general chemistry. More details regarding the nature of physical chemistry and specific topics are given in a separate handout.

Texts and other materials

Required: Physical Chemistry by Engel and Reid; scientific calculator; safety goggles
Recommended: a bound notebook or other good system for keeping lab notes and data
Optional: Student Solutions Manual for Physical Chemistry by Engel and Reid; The Physical Basis of Chemistry, 2e, by Warren

Meeting times, format, and expectations

Plan to meet each day from 9:00-11:00 am and from 1:00-3:00 pm. There will be a few times we won't go until 3, and we may meet at 12:30 instead of 1 on days with labs or exams. Class will be a mixture of lecture and discussion, with specific time set aside for group work and problem solving. We will have occasional labs as discussed below.

Prompt attendance at all class sessions is expected, although attendance will not specifically count in the grade. Active participation in class is expected, and you will get more from the class if you are more involved.

Reading the text more than once is strongly recommended; reading physical chemistry takes more 'work' than other types of reading. Working problems is also crucial to your success in this course.

Point distribution and explanation

ECQs, class participation, group work, and worksheets		120
Laboratory	3@30	90
Problem sets	6@15	90
Midterm exams	2@125	250
Final exam		250
Total		800

End of Class Questions (ECQs): At the end of most class sessions, I will ask you to write down one or a few questions you have regarding the material covered so far. I will then often begin the next session by addressing one or more of these questions. There are no 'stupid questions.' The ECQs, class participation, and group work parts of the point distribution are essentially effort points, and these three items will be worth around 30 points.

Worksheets: These will carry the majority of the grading weight for this subsection, likely around 90 points. You will work on these in class and in groups, but you will each turn in your own worksheets.

Labs: Expect to carry out three labs during the block. More details will be handed out separately. Lab report guidelines will also be given separately, but you should expect to include any raw data obtained during the experiments in your report.

Problem sets: Working together on problem sets is appropriate and even encouraged; science is a collaborative endeavor. However, be certain that the work you hand in is your own (see below). You must be able to solve problems to understand physical chemistry. I will check for completeness in the problem sets, and detailed answer keys will be available after you hand in each problem set. Due dates will be announced in class.

Midterm exams: There will be two covering specific portions of the course.

Final exam: In order to provide balance to all material covered, some points for the final will come specifically from material covered since the second exam. The remaining points will equally cover the entire block, including material since the second exam. My goal for exams is that all material is tested equally by the end of the block.

Grading

Cutoffs will be no higher than:

A-/B+	704
B-/C+	608
C-/D+	512
D-/F	416

Cutoffs may be lower depending on the difficulty of the exams.

Miscellaneous
Students wishing to do a 15th day drop must complete all assignments and participate in class.

Late work will not be accepted, and makeup exams will not be given. If you need to miss class, let me know ahead of time; if the reason is good the assignment in question may be excused at my discretion. Please contact me if you are having difficulty with the course or if a serious sickness/incident occurs during the block.

Cornell College is committed to providing equal educational opportunities to all students. If you have a documented learning disability and will need any accommodation in this course, you must request the accommodation(s) from me as early as possible and no later than the third day of the term. Additional information about the policies and procedures for accommodation of learning disabilities is available at http://cornellcollege.edu/academic_affairs/disabilities/.

Any student with a situation which could affect your learning (e.g., health condition, serious family trouble) must contact me by the third day of the term. Student Affairs staff members do not automatically notify faculty members concerning student health issues. You must inform me due to safety concerns in the lab.

As mentioned above, working on homework sets (as well as lab exercises) together is appropriate. However, academic and scientific misconduct will be dealt with harshly. Examples include, but are not limited to, 'collaborating' on exams, illegal material stored in your calculator, submitting another's work as your own, and falsification of lab data. **Any** question about what is (or is not) appropriate in academia or science should be directed to me. If there is any doubt at all then please ask.

Schedule

Below is a tentative schedule of topics. This schedule is somewhat flexible, but there is a certain core of material that we must cover this block. This schedule will be correlated to the more specific outline of topics (see other handout) as we go along in class. You should be aware that I might not cover material in exactly the same order as the text, and for that reason the chapter designations given here are approximate. More specifics regarding which sections in the text are most important will also be given in class. Finally, deviations from this schedule will be announced in class.

Week 1: Atomic structure

M: Introduction, quantum mechanics; Ch. 12-13
T: Quantum mechanics; Ch. 13-15
W: Quantum mechanics; Ch. 15-17
R: Quantum mechanics; Ch. 17-18
F: H atom; Ch. 20

Week 2: Atomic structure, bonding

M: **Exam 1**
T: Multielectron atoms; Ch. 21
W: Introduction to bonding, H_2^{1+}, H_2, other homonuclear diatomics; Ch. 23-24
R: Heteronuclear diatomics, variation principle, Hückel approximation; Ch. 25, 27
F: Symmetry and group theory; Ch. 28

Week 3: Molecular structure

M: Symmetry and group theory; Ch. 28
T: **Exam 2**
W: Rotational spectroscopy; Ch. 19
R: Vibrational spectroscopy; Ch. 19
F: Vibrational spectroscopy

Week 4: Molecular structure

M: Electronic spectroscopy; Ch. 26
T: **Final**
W: Course wrap up