Overview

Instructor: David Farrelly, ML153, 797-1608

Email: david.farrelly@usu.edu (please put CHEM3060 somewhere in subject header) or use Course Mail.

Time and Location: MWF 9:30am - 10:20am, Merrill-Cazier Library 405.

Office Hours: Monday 11:30 - 12:20
Wednesday 12:00 - 1:00
Drop in anytime or by appointment.
Friday 1:30 - 2:20.

Textbook: Principles of Physical Chemistry by L. M. Raff. Prentice-Hall, ISBN-13: 978-0130278050. If you are NOT taking CHEM 3070 you can probably get away with just Part A although you will need to find (e.g., in the library) a book with chapters on the kinetic theory of gases and chemical kinetics.

Material: Chapters 1 - 9, 17, 19

Grading: There will be weekly 15-minute quizzes on Fridays, graded problem sets (see later for details), two in-class midterm exams and a take-home Open World final which will consist of several longer, homework-like, problems. These will count toward the grade as follows.

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\text{Assignments} \quad 10\% \quad (\text{quizzes}) \quad + \quad 10\% \quad (\text{homeworks}) = 20\%
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\[
2 \times \text{Midterms} \quad 2 \times 20\% = 40\%
\]
\[
\text{Final} \quad 40\%.
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Final grades will be assigned based on the actual distribution of scores obtained by the class rather than being based on predetermined cutoffs.

Exams: The dates for the midterm exams will be decided in class. The final will be a take-home Open World test and its due date will be decided in class.

Mathematics: Physical chemistry requires an ability to use mathematical techniques. It is strongly suggested - but not required - that you obtain a book with a title similar to: Mathematics for the Physical Sciences. Examples include Mathematical Methods for Scientists and Engineers by McQuarrie and Applied Mathematics for Physical Chemistry by Barrante. McQuarrie’s book is excellent and much more thorough than Barrante but it is also quite a bit more expensive.

Assignments and Quizzes

Quizzes

There will be a 15 min quiz every Friday (with occasional exceptions) which will start at around 9:30 a.m. and will conclude at around 9:45 a.m.

1. Quizzes will consist of five short questions each of which will be graded 0, 1 or 2. The material will be anything covered up to that point in the semester - including homework assignments, prior quizzes and prior exams.

\footnote{In accordance with the Americans with Disabilities Act, reasonable accomodation will be provided for all persons with disabilities in order to ensure equal participation in this course.}
2. Quizzes must be worked in Examination Blue Books.

3. If you miss a quiz for any reason then make arrangements with me to make it up at my discretion.

**Homework Assignments**

Homework assignments will be assigned roughly every week and their due date will be announced in advance. However, ONLY one problem out of the problem set will be handed in for grading. The particular problem will be announced in class on the due date without previous notice. If you miss that class I will ask you to hand in a different problem (in person) within two days (you won’t know which problem until you are actually ready to hand in your homework). Untidy, illegible or hard-to-follow answers will be graded 0 with no opportunity to rework them.

You may work problem sets together and I will arrange some times when you can work problems in the room next to my office to facilitate asking questions. The problem sets are designed to be challenging.

**Important:** If you fail to hand in a problem within two days of the due date you will score 0 on that problem set. However, to have future problem sets graded you will still have to hand in any missed problems before (or at) the next due date. I will make exceptions for emergencies etc. at my discretion.

**Office Hours**

You can ask anything about lectures, homeworks, quizzes etc. If you dont understand something but dont know what to ask then that is acceptable too. You are very welcome and encouraged to come individually or with other members of the class in a small group whenever you want. Do not wait for regular office hours if you have a question. But please understand if, on occasion, I cannot deal with you on the spot. I prefer to be very informal with office visits so don’t hesitate to knock HARD on my door (which I tend to keep closed because there is heavy traffic in the hallway).

**Exams**

Both the midterms will be in-class. The Final will be open-world: that is, you can use any resource you like except for interactive communication with other people (including email etc). Missed exams will score 0 unless you can provide a documented and acceptable reason – e.g., medical emergencies, etc. A comprehensive, supervised, single make-up exam will be offered during the next-to-last week class for students who (a) have missed a midterm and (b) have made an acceptable and documented case for why they missed the exam. Dates of exams will be decided by mutual agreement in class.

**Drop Dates**

See the USU Fall 2011 Schedule of Classes (SoC) for all official dates.

**Material and **Estimated** Rate of coverage**

WEEK 1. Properties of Gases.

WEEK 2/3. The First Law of Thermodynamics.

WEEK 4. Thermochemistry.


WEEK 10. The Thermodynamics of Solids.
WEEK 11. Thermodynamics of Nonelectrolytic Solutions.

WEEK 12. Thermodynamics of Electrolytic Solutions.


WEEK 14. Kinetics

**Physical Chemistry Learning Objectives**

1. Apply the basic concepts of calculus to concepts in chemistry.
2. Manipulate the gas laws to describe real and ideal gas behavior.
3. Discuss the Three Laws of Thermodynamics and their development.
4. Use the Maxwell equations and other thermodynamic relations to compute thermodynamic quantities from thermodynamic data tables.
5. Be able to derive relationships between thermodynamic quantities.
6. Interpret phase diagrams and discuss phase equilibria in terms of chemical potential.
7. Explain the origin of $K_{eq}$ and its relation to fugacity and activity; apply these concepts to ideal and real solutions of electrolytes and non-electrolytes and to colligative properties.
8. Apply the principles of electrochemistry to conductance, voltaic, and electrolytic systems.
9. Provide a physical basis for Debye-Huckel theory.
10. List the methods for arriving at a plausible mechanism and/or rate law based on kinetic information.
11. Apply the steady-state hypothesis to obtain rate equations.
12. Explain the basic principles of photochemical and radiation-chemical reactions.

More general goals of the physical chemistry program are that the student is able to:

1. Demonstrate competency in written and oral communication including using mathematics.
2. Relate the microscopic and macroscopic properties of matter to each other.
3. Apply thermodynamic, kinetic and quantum methods and concepts to all areas of chemistry and biochemistry.
4. Explain what the main areas of research in physical chemistry are and why research is being done in these areas.
5. Make either oral or written criticisms of research articles in physical chemistry.
6. Design real or gedanken experiments or simulations to test hypotheses.

**Assessment**

In order to gauge the effectiveness of the Chemistry 3060 course, several different methods of Gain Score Analysis will be employed. A gain score is a measurement of how much a student’s capability has (hopefully) increased from the beginning of a class and the completion of the course. One measurement is the comparison of the performance on weekly quizzes and to the performance on the midterm exams. Another measurement is how the midterm exam scores compare to the comprehensive final exam grade. Throughout the semester, embedded questions will be presented. These kind of questions emphasize the above-mentioned Learning Objectives and help us assess the overall quality of the course.