

CHEMISTRY 3060¹
Physical Chemistry
FALL 2005

Instructor: David Farrelly, ML153, (435)-797-1608, email: david.farrelly@gmail.com
(please put CHEM3060 somewhere in the subject header.)

Time and Location: MWF 9:30 a.m. - 10:20 a.m. in BUS 313

Office Hours: M 11:30 a.m., W 12:00, Th 1:30

Textbook & Material to be covered to : *Physical Chemistry* (4th edn.)
by K. J. Laidler, J. H. Meiser, and B. C. Sanctuary; Chapters 1 - 10 We will
aim to cover about 1.5 chapters per week and reading assignments will be given
weekly

Grading: There will be weekly quizzes (most weeks), graded problem sets, a
midterm exam and a final. See below for details of how these will operate. They
will count toward the grade as follows.

<i>Assignments</i>	15%(quizzes) + 40%(homeworks) = 55%
<i>Midterm</i>	15%
<i>Final(comprehensive)</i>	30%.

Final grades will be assigned based on the actual distribution of scores obtained by the class rather than being based on predetermined cutoffs. However, A and F grades will only be assigned to students who meet a basic qualification criterion; i.e., a score greater than 75% or less than 45% respectively. **Note particularly that a score greater than 75% does not in itself guarantee an A, nor does scoring less than 45% guarantee an F. That is, 75% and 45% are necessary, but not sufficient, conditions to receive either an A or an F.**

Exams: The midterm exam will be available around Halloween and the final on a date to be decided. Both are open world take-home exams.

Mathematics: Physical chemistry requires an ability to use mathematical techniques; in CHEM3060 this includes multivariate calculus, differential equations and linear algebra. It is strongly suggested 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 (~\$86) and *Applied Mathematics for Physical Chemistry* by Barrante (~\$28). McQuarrie's book is excellent and much more thorough than Barrante but it is also more expensive. If you plan to continue your career in physical chemistry then it is recommended, otherwise Barrante's book should suffice. In the interests of fairness mathematical weakness cannot be taken into account when grading nor can I spend extensive amounts of lecture time going over mathematical methods.

¹In accordance with the Americans with Disabilities Act, reasonable accommodation will be provided for all persons with disabilities in order to ensure equal participation in this course.

1 Assignments and Quizzes

1.1 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.. The first few minutes of class will be for questions, if any. Here are the rules:

1. Quizzes will consist of five short questions each of which will be graded 0 or 1. The material will *usually* be based on the previous 3 or 4 lectures but any material covered to that point in the semester - including homework assignments and prior quizzes - may be tested.
2. Quizzes must be worked in Examination Blue Books. Quizzes handed in on loose leaf paper will not routinely be accepted.
3. If you miss a quiz for any reason then, in order to make up the missed quiz, and avoid a score of zero, you need to do both of the following;
 - (a) Hand in a completed solution to the missed quiz along with the regular quiz on the following Friday. The missed quiz should be entered at the **back** of your Blue Book and labelled "Missed Quiz for _date_". You will receive no score for the missed quiz itself but you need to do it to qualify to take make-up quizzes later.
 - (b) On the last day of classes four different comprehensive make-up quizzes will be offered during the class period. You can make-up your missed quiz or quizzes by taking one or more of these quizzes up to a maximum of four.
4. If you are late for a quiz, at my discretion, I *may* allow you to take the quiz sometime later that day or another day but please don't abuse this possibility.

1.2 Homework Assignments

Homework assignments will be given on Wednesdays. These will be due on the Friday of the following week. Here are the rules:

1. A single-subject, spiral-bound, narrow-ruled, notebook **must** be used for homework assignments. Your name should be printed clearly on the outside and inside front cover of the notebook.
2. What you hand in should reflect your final best attempt at a solution. It should not show all of the steps that you actually took (e.g., wrong turns) to reach that solution. However, key steps in the solution should be clearly shown together with short explanations of what you did, e.g., "*next integrate over r to ...*". That is, the solution you hand in should be

similar to what you would expect to see in a solutions manual. You will lose points for showing too many unnecessary steps or too few necessary ones!

3. You will lose points if your answers don't contain brief statements explaining what you are doing. An unbroken stream of correct mathematics is not enough!
4. It is suggested that you first work the problems out on scrap paper and then transcribe your final, edited, attempt into your notebook.
5. Each problem will be worth 5 points unless otherwise stated and each assignment will be worth 50 points.
6. Each assignment should be started on a new page and be clearly labelled and dated as, e.g., "Assignment 1, September 1, 2005."
7. Only one side of the paper should be used.
8. Assignments should be done in black or blue ink. Mistakes should be neatly crossed out or whited out. Assignments done in **pencil** will **NOT** be accepted.
9. Problems should be clearly numbered and different problems should be separated by two or three blank lines.
10. Illegible or untidy work will not be graded. Too small writing and/or homeworks done on loose-leaf paper will never be graded. In these events;
 - (a) a grade of NG for "not-graded" will be assigned.
 - (b) if you hand in an acceptably neat version by the end of the following day (or so) I will grade the homework.
 - (c) you should not remove the original NG homework and the re-written version should simply be a neat transcription of your original efforts. This is not a mechanism for improving your score or gaining extra time!
 - (d) a maximum of 3 NG grades will be allowed. Any NGs after that will start to count as zeroes
11. You may ask me for help in approaching any problem or assignment and some collaboration with others in the class is acceptable and desirable. However, the midterm and final will test your *own* ability to solve problems - not mine, those of your collaborator or of the solutions manual! While I am happy to provide clues and suggestions, if I feel that this is becoming excessive and I am being asked to solve the problem for you then I may resort to "selling you clues." That is, I will tell you that additional clues will cost you 1 or more of the available points for that problem. This cost will be noted in your notebook! This is acceptable in some cases but try not to overdo it.

12. ALWAYS bring your notebook to office hours when you have questions about assignments.
13. Incomplete or incorrect solutions may still receive full credit if the approach was sensible.
14. If you cannot complete a problem, just state that and leave a blank to finish the problem later. "Solutions" that start out acceptably, degenerate to gibberish, and then arrive at the correct answer anyway, will receive the **negative** of the full number of points that the problem was worth. Good faith efforts that peter out will be treated more favorably.
15. Assignments will be due by end of class on the relevant Friday. You should view this as a hard deadline. However, I will normally accept assignments through 9 a.m. on Sunday with these provisos;
 - (a) You hand the notebook to me personally if possible.
 - (b) You drop the notebook by 9 a.m. on Sunday - AND AT YOUR OWN RISK - in a box that I will leave outside my door.
 - (c) You leave your notebook with the secretary on Friday and leave me a note that you have done this.
 - (d) You check with me when and if I intend to be available on Saturday/Sunday - the building is locked on weekends. I cannot be responsible for failed attempts to get assignments to me over weekends no matter what the reason might be. However, if you are reasonable then I will be also. If you are *occasionally* late, for whatever reason, then I will make an exception so there is no need to panic or to go to extreme lengths.
 - (e) You make other arrangements, in advance if possible, if you cannot meet a deadline.
 - (f) If something does come up then, if possible, contact me by email or leave voicemail.

I will make exceptions to any of the rules regarding quizzes and assignments in exceptional cases, but please try to follow the rules as closely as possible.

2 Office Hours

There are no rules beyond number 11 regarding assignments. You can ask anything about lectures, homeworks, quizzes etc. If you don't understand something but don't know what to ask then that is acceptable too. Make a habit of coming to office hours (or making appointments or dropping in) at least once a week. You are welcome to come individually or with other members of the class in a small group. I always try to answer questions even if it is outside official office hours. In fact, I would strongly encourage you not to wait for regular

office hours if you have a question or comment. But please understand if, on occasion, I can't deal with you then and there. Sometimes I have deadlines etc. and I will have to ask you to come back at another time or during regular office hours.

3 Exams

Both the midterm and 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).

1. The midterm and final will be open-world take-home exams given on dates that are mutually agreeable to everyone. These will be close to, or on, the scheduled dates in the syllabus. The following dates can be changed if everyone agrees - we can take into account conflicts with other exams/finals etc. But the exam dates need to be agreed upon no later than the end of the second week of classes.
2. The midterm exam will become available for collection at 4 p.m. on the day we decide and will be due at 9 a.m. the following day. The exam cannot be done over a weekend although "Friday night hand in Saturday" is possible.
3. The final exam will become available at 9 a.m. on a day to be decided and will be due one day later.
4. Your examinations should be done in your homework assignment notebooks while adhering to exactly the same rules of presentation and format as for assignments.
5. NG grades may be temporarily assigned to illegible or untidy examinations but these will not count against the 3 NG maximum limit for homeworks. I will photocopy the NG exam and you will then have 1 day to produce an acceptably neat examination. This DOES NOT apply to the final which must be neat the first time round

4 Drop Dates

See the USU Fall 05 Schedule of Classes (SoC) for official dates. The class will adhere rigorously to the SoC deadlines.

5 Physical Chemistry 3060 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 be 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.