

CHEM 3321: Physical Chemistry I – *Thermodynamics and Kinetics* Fall 2013

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Section Information: CHEM 3321-001

Time and Place of Class Meetings: Monday, Wednesday, Friday 10:00 a.m. – 10:50 a.m.

Chemistry Research Building 114 (CRB 114)

Description of Course Content: Thermodynamics, gases, First and Second Law, pure substances, mixtures and solutions, equilibrium; Statistical Thermodynamics; Kinetics, rates, mechanisms, transitions state theory.

In this class you will learn to understand the basic principles of Chemistry as the Science of Transformation and Change. We emphasize conceptual understanding and will become skilled in a quantitative description of the phenomena we study. The goal is that at the end of the course every student can outline the basic principles of Thermodynamics, has a sound understanding of ideal and approximate systems, and can apply the tools to engage in self-driven investigations.

Student Learning Outcomes: By the end of the semester you should be able to:

- apply First and Second Law to understand heat engines, chemical reactors, and biological metabolisms.
- derive and use approximate descriptions for non-ideal systems in chemistry (real gases, solutions)
- develop mechanisms of simple reactions, calculate rate laws, and solve them numerically (reactor design)
- understand and use the basic principles of statistical thermodynamics

Required Textbooks and Other Course Materials:

1. *Physical Chemistry* by Engel & Reid (Prentice Hall, Pearson), 3rd edition

2. Mastering Chemistry Access (available with the Engel&Reid textbook and from <http://masteringchemistry.com>)

The course ID at MasteringChemistry is MCPCHEMFALL2013KROLL9876.

3. *Mathematica* from Wolfram Research: You may consider purchasing Mathematica (currently \$30 for UTA students, see <http://www.uta.edu/oit/cs/software/wolfram/mathematica-8-win/index.php>).

Mathematica is also installed on many campus computer labs, as well as on some computers in the modeling lab (CRB 317).

You are advised to read the text before you come to class!

The Engel/Reid book (3rd edition) defines the standard level of difficulty for assigned homework problems and exams. Other textbooks are quite good as well, and might – for your personal taste – even be better. You can try and take a look into Atkins, Levine, McQuarrie. Many of them are available at bargain prices. So take them all for studying. Having a different text provides the same material from a different view using some other style and language. It often helps the process of understanding the content – especially if you share the information with others.

Descriptions of major assignments and examinations: Besides homework, there will be four written exams during the semester and a final examination.

Written examination needs: Non-programmable calculator and No. 2 pencil with eraser.

Attendance: You are supposed to attend every class. This includes active participation with questions and answers, discussion and problem solving. Quick “stand-up” problems may be used to check the learning

progress. I expect that you are able to reproduce what I did in a previous lecture (drawings, explanations) in any of the following lectures. Class participation includes quizzes and, if started, participation in the class blog.

Homework:

We follow a two-fold path in Homework:

1. MasteringChemistry: the homework system that comes along with the textbook contains a variety of tutorials, short answer questions, and will provide some foundation for succeeding in exams. However, the computerized system lacks the complexity necessary and required for many problems dealing with concept understanding and derivations, and is short in some content.

Expect: 2-3 times a week about 1 hour (by MSChem indicated time) homework via Mastering Chemistry.

2. Additional homework will be assigned in class. Expect one page with exercises each week, requiring on average 2-3 hours of time to work. Due days are indicated and the homework will be collected in class and graded. I expect readable and tidy hand-writing and drawings on clean paper. No computer-printed homework will be accepted until explicitly noted otherwise! You are encouraged to form study groups, so I don't mind if solutions look comparable. However, indicate with whom you worked together and, above all, don't cheat on yourself! Simply copying other students work will have its end in the written exams.

Note: some homework problems will include the use of Mathematica (see Course Material).

PCChem Blog: We start a PCChem Blog first week of September. The blog will include discussion of topics of the lecture. We also start a wiki. Contributions to the wiki may be made from homework assignments or through extra-credit work.

Extra Credit:

You have the chance to receive extra credit (up to 5 grading points during the semester) for work that you contribute to the Wiki or for the general benefit of the class. I will usually award one grading point for well carried out extra work, for most outstanding work up to two grading points. You can strive for this extra credit reward only once between exams, giving you 5 opportunities during the semester. Your work must reflect the current content of the lecture, and shall not address a topic of a previous exam. I will not accept a back-log on extra-credit work.

Other Requirements: • Please bring with you the spirit to engage, the eagerness to learn, and the professionalism to build your career in Chemistry.

• I expect you to be “fluent” in all concepts of physical chemistry as taught in General Chemistry courses (1441 and 1442). This includes basic principles of thermochemistry, equilibrium, and kinetics.

• Likewise, you master problems of Quantitative Chemistry at any level.

• You are “at ease” with differentiation and integration at the level of Calculus III. Lecture and homework only appear to be math intensive, due to a lack of practice of math – let this not hamper your understanding of Chemistry.

• We start a PCChem Blog first week of September. The blog will include discussion of topics of the lecture. We also start a wiki. Contributions to the wiki may be made from homework assignments or through extra-credit work.

• the four exams during the semester will happen

Grading: [Grading is based on class participation (10%), homework (25%), four exams (40%), and a final exam (25%).

Letter Grade assignments: 100-90: A ; 89-76: B ; 75-60: C ; 59-50: D ; below 49: F

Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

Course Schedule:

Week 1-3: Thermodynamics, gases, First Law: Chapters 1-4

Week 4-6: Thermodynamics, Second Law, equilibrium and phases: Chapters 5-8

Week 7-9: pure substances, ideal and real solutions: Chapters 9-11

Week 10-12: Statistical Thermodynamics: Chapters 29-32 (excerpts)

Week 13-14: Kinetics, rates, mechanisms, transitions state theory: Chapters (33), 34-36

As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course.

We will have four exams. All exams will be written at Tuesday evening, starting at 6 pm and lasting 2.5 h. Dates are set to Tuesday, Sep 17th, Oct 15th, Nov 12th, and Dec 3rd. All exams are comprehensive, though the emphasis will be on the most recent material covered in lecture. You will have to be present for the exams – you must contact me during the first two weeks of the semester if you have a time conflict. I will accept only conflicts due to other UTA class, and the only alternative time I can offer is on the following Wednesday morning! No make-up will be given for a written exam.

Exams are to a significant portion composed of homework problems (in variation, of course), end-of-chapter problems found in the book, and additional transfer problems as well.

The final will be written during Final week. Expect it to be 3 hours long. Target day is Monday, Dec 9th at 8:00 am. I reserve the possibility to substitute parts of the written exams with oral examinations (10 to 15 minutes instructor-student colloquium).

Expectations for Out-of-Class Study: A general rule of thumb is this: for every credit hour earned, a student should spend 3 hours per week working outside of class. Hence, a 3-credit course has a minimum expectation of 9 hours of reading, study, etc..

Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 3-4 hours per week working outside of class for every credit hour earned. This is of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc.

You will experience weeks during which you find that the Physical Chemistry class requires even more time. However, this depends not at least on your experience with quantitative problems in general.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/aao/fao/>).

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Americans with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic

accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Academic Integrity: Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, [which is located at the bottom floor of the building](#). When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.