CHEM 3321: Physical Chemistry I – *Thermodynamics and Kinetics*
Fall 2017 – SH 205

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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.; Science Hall 205

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 quantitative description. 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 apply basic principles of statistical thermodynamics

Required Textbooks and Other Course Materials:
1. *Physical Chemistry* by Engel & Reid (Prentice Hall, Pearson), 3rd edition
2. *Mathematica* from Wolfram Research. See https://www.uta.edu/oit/cs/software/wolfram/student-home-use.php; (it's free !!) 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, including the 2nd edition of Engel/Reid, 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 a different approach, a different style or 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.
We will have four exams. All exams will be written at Tuesday evening, starting at 7 pm and lasting 2.5 h. Dates are set to Sep 19th, Oct 17th, Nov 14th, and Dec 5th.

Written examination needs: Non-programmable calculator and document-proof pen (ink; ball pen). No writing in pencil!

Homework will be assigned in class via blackboard. Expect one page to two pages with exercises each week, requiring on average 5-8 hours of time to work each week. 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).

Attendance: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students'

academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I have established the following attendance policy: "My expectation is that you attend every class, and I will take attendance by signature. Attendance is defined as active participation with questions and answers, discussion and problem solving. Attendance is a part of class participation, and participation is part of your grade". However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

Class Communication: Official announcement will be made in class. E-mails sent by students to the instructor must carry the course number CHEM **3321** in their subject line. Students are responsible to use appropriate subject lines and proper netiquette. E-mails without proper subject line may get obscured in the flood of incoming e-mails, because they will not be stored in the folder for the class; they may not get answered.

Other Requirements: • Please bring with you the spirit to engage, the eagerness to learn, and the professionalism to build your career in Chemistry.
• Physical Chemistry is not a "stand-alone" class, but builds up on concepts taught in previous classes, especially in General chemistry and Quantitative Chemistry. Therefore
• be "fluent" in all concepts of physical chemistry as taught in General Chemistry courses (1441 and 1442). This includes 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 often appear to be math intensive, but this is only due to a lack of practice of math – let this not hamper your understanding of Chemistry.
• You will need to be present during the times set for the four exams on Tuesday evenings.

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.

Expectations for Out-of-Class Study: 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.

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://wweb.uta.edu/aao/fao/).

Disability Accommodations: UT 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), The Americans with Disabilities Amendments Act (ADAAA),* and *Section 504 of the Rehabilitation Act*. 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 disability. Students are responsible for providing the instructor with official notification in the form of **a letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting: **The Office for Students with Disabilities, (OSD)** www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.*

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit* www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity: Students enrolled all UT Arlington courses 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 in their courses by 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. Additional information is available at https://www.uta.edu/conduct/.

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.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are 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 via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit http://www.uta.edu/sfs.

Final Review Week: for semester-long courses**,** 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.

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 of the staircase to the right outside the classroom*. 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 individuals with disabilities.

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 http://www.uta.edu/universitycollege/resources/index.php.

Course Schedule:

Week 1-4: Thermodynamics, gases, First Law: Chapters 1-4
Exam #1
Week 4-7: Thermodynamics, Second Law, equilibrium, phases, and pure substances: Chapters 5-8
Exam #2
Week 8-10: Statistical Thermodynamics: Chapters 29-32 (excerpts)
Exam #3
Week 10-12: mixtures, ideal and real solutions: Chapters 9-11
Week 13-14: Kinetics, rates, mechanisms, transitions state theory: Chapters (33), 34-36
Exam #4
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. – Peter Kroll

Important dates:

Census date:	Sep 11
Last day to drop classes:	Nov 1
Last day of class:	Dec 6
Final exam:	Dec 11 (expected 8:00 a.m.)

Emergency Phone Numbers: In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381