

CHM4411 — Physical Chemistry, Thermodynamics and Kinetics – Spring 2015

Instructor	Dr. Alexander Angerhofer
Phone	352-392-9489 (office, CLB318A)
E-mail	alex@chem.ufl.edu
Class Times	T,R 4 – 5 periods (10:40am – 12:35pm) in Flint Hall 50
Office Hours	M–5 (11:45am – 12:35pm), W–7 (1:55pm – 2:45pm), and F–4 (10:40am – 11:30am) in CLB318A, and by appointment.

TA	Larry Tesler	Qian Xiao
Phone	386-793-2939	352-214-6562
E-mail	ltesler@ufl.edu	pbxiaoq@ufl.edu
Office Hours	M-7, W-3, F-5 periods in FLI258	M-4, W-6, R-7 periods in FLI258

Holidays	01/19 (MLK Day), 03/02 – 06 (Spring Break)	
Class Text [†]	“Physical Chemistry,” by P. Atkins & J. dePaula, 9 th Edition, W. H. Freeman, New York, NY, 2010, ISBN #1-4292-1812-6.	
Homework	Homework will be assigned weekly, usually on T and be due at 10:40am (beginning of class) the next T, starting on 01/20. No HW during exam weeks.	
Points Earnable	3 progress exams @ 200 pts. each for 600 pts. total. 1 cumulative optional final exam @ 400 pts. For 400 pts total. 3 online quizzes @ 30 pts. each for 90 pts. total. 10 homeworks @ 20 pts. each for 200 pts. total. 1 participation grade @ 110 pts. for 110 pts. total. Total earnable points: 1,400 with final exam and 1,000 without final exam.	
Grading Scheme [‡]	<p>With final exam:</p> <p>A: ≥ 1190 pts. (85.0%) 1190 pts > A– ≥ 1155 pts (82.5%) 1155 pts > B+ ≥ 1120 pts (80.0%) 1120 pts > B ≥ 1050 pts (75.0%) 1050 pts > B– ≥ 1015 pts (72.5%) 1015 pts > C+ ≥ 980 pts (70.0%) 980 pts > C ≥ 910 pts (65.0%) 910 pts > C–[¶] ≥ 875 pts (62.5%) 875 pts > D+ ≥ 840 pts (60.0%) 840 pts > D ≥ 770 pts (55.0%) 770 pts > D– ≥ 735 pts (52.5%) 735 pts > E.</p>	<p>Without final exam:</p> <p>A: ≥ 850 pts (85.0%) 850 pts > A– ≥ 825 pts (82.5%) 825 pts > B+ ≥ 800 pts (80.0%) 800 pts > B ≥ 750 pts (75.0%) 750 pts > B– ≥ 725 pts (72.5%) 725 pts > C+ ≥ 700 pts (70.0%) 700 pts > C ≥ 650 pts (65.0%) 650 pts > C– ≥ 625 pts (62.5%) 625 pts > D+ ≥ 600 pts (60.0%) 600 pts > D ≥ 550 pts (55.0%) 550 pts > D– ≥ 525 pts (52.5%) 525 pts > E.</p>

[†] Atkins/dePaula is the textbook that had been advertised on the course registrar's web site as the course text. However, you should feel free to use other comparable modern texts on Physical Chemistry, *e.g.*, A. Cooksy, 'Physical Chemistry – Thermodynamics, Statistical Mechanics, and Kinetics,' Pearson Education, Inc., 2014.

[‡] See <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx> for more info on UF grade policies.

[¶] Please note that a 'C-' is not considered a passing grade for majors requiring CHM4411.

Course Topics (not necessarily in this order):

1. Mathematical Tools, Basic Definitions.
2. Ideal Gas, Kinetic Gas Theory, absolute T , Molecules in Motion, Collisions, Diffusion, Effusion
3. Real Gases, Equations of State, Joule-Thomson Effect
4. Boltzmann Distribution, Internal Energy, Degrees of Freedom, Partition Functions
5. 1st Law of Thermodynamics, Work, Heat, Heat Capacity, Gas Expansions, Calorimetry
6. 2nd Law of Thermodynamics, the Carnot Engine
7. 3rd Law of Thermodynamics, Gibbs Free Energy.
8. Formal Thermodynamics, Maxwell Relations, Legendre Transformation
9. Phase Equilibria, Colligative Properties, Phase Diagrams
10. Thermodynamics of Mixing, Partial Molar Quantities
11. Activities, Electrolytes, Debye-Hückel Limiting Law
12. Chemical Equilibrium, Le Chatelier's Principles
13. Electrochemical Equilibria
14. Statistical Thermodynamics and its Applications
15. Chemical Kinetics, Rates, Rate Laws
16. T -Dependence of Chemical Rxns, Arrhenius Law
17. Mechanisms of Chemical Rxns, Complex Rxns, Radical Rxns, Photochemistry
18. Chemical Catalysis, Enzyme Catalysis
19. Macromolecules, Polymers, Organized Molecular Assemblies

Relevant Textbook Chapters: 1 – 6, 15 – 18, 20 – 23

Your best course of action is to read ahead in the textbook. There will be an 'outlook' at the end of each lecture on what topic will be covered next. Make sure to read ahead in your book to come prepared for the next lecture. You will find that it will be much more easy to comprehend and digest if you come prepared.

Further Important Information:

1. **Overview and Goals:** CHM 4411 covers gas laws, kinetic gas theory, classical and statistical thermodynamics and applications to solutions, phase equilibria, chemical equilibria, and electrochemistry. The goal of this course is to familiarize students who major in chemistry, chemical engineering or other related majors with the techniques and tools of classical and statistical thermodynamics as well as kinetics.
2. **Prerequisites:** One year of General Chemistry (CHM2045/46, CHM2045/51, or CHM2047) and one year of college physics or equivalent (ideally PHY2048/49), background in analytical (CHM3120) and organic chemistry (CHM2210/11, CHM2212/13, or CHM3217/18) is recommended.
3. **Corequisites:** MAC2313 (implies MAC2311/12 as prerequisites).
4. **Exam Dates:** All during-term exams are evening exams taking place during periods W-E2+E3 (8:30pm – 10:10pm). The dates for the three DTE exams are: February 11; March 25; April 22. The final exam date is May 1st and will take place in FLI 050 from 12:30pm – 2:30pm (exam group 1C).

5. **Exam Policies:** Three mid-term exams will be given (see schedule above). These exams will be evening exams. Exam duration will be approximately 2 hours. Making up a missed exam is a serious and exceptionally burdensome problem. Consequently, a makeup exam will require that you have a legitimate excuse, and that you have brought this to the attention of the instructor before the missed exam. Legitimate excuses include sickness or a conflict with another exam for a higher numbered class. If you are not sure whether your excuse is valid, talk to the instructor before missing an exam. If you have an emergency that prevents you from letting the instructor know ahead of time that you are missing an exam, an excused absence and rescheduled make-up exam will be granted after official documentation about your emergency (doctor's notes, *etc.*) deemed appropriate by your instructor has been presented.
The final exam is optional. If a student is happy with his/her grade at the end of the semester (see grading scale without final exam above) he/she may skip the final exam. Since the final exam is cumulative, the instructor reserves the right to consider assigning a letter grade above that which the student would receive based strictly on total points earned (as listed above). This will only take effect if the final exam is taken and the performance on the final exam is significantly above the student's overall performance for the semester, and if the student shows clear improvement in his/her exam grades over the course of the semester. This qualification cannot lower your grade and will depend on the instructor's evaluation of the student's performance on the final exam.
A student contending that an exam or quiz has been mis-graded or mis-scored must report this to the TA responsible for grading within one week of receiving the original grade or score. Failure to follow this policy results in no reconsideration of the contended grade or score. For all questions on grades or grading, please consult with the TA first in person. If this does not resolve the issue you may talk to the instructor about it. Except for problems with on-line quizzes (see below), emailed questions on grades or grading will not be answered.
6. **On-line Quizzes:** There will be three on-line quizzes on elearning (1 quiz = 30 points max.). The on-line quizzes will be administered through the elearning interface to the class. Quiz durations will be between 30 and 60 minutes depending on the level of difficulty and the number of questions. For your convenience the web format will allow for an extended period of time (typically a 4-day period) during which you can take the quiz. Once a quiz has been started the clock starts running and you have to finish it in the allotted time. On-line quizzes will typically open up the Friday before a mid-term exam and close the following Tuesday night.
7. **E-learning:** This course uses the canvas e-learning site. Please log on at <https://lss.at.ufl.edu/> to get access to your course page.
8. **Study Habits:** This course demands on average 8 – 10 hours/week of work outside of class. Regular lecture attendance is essential. The class will not be taught “by the book.” It is expected that you read the assigned pages from the textbook in advance to coming to class. The instructor will build on this material and you are expected to be able to follow in-class discussion. The course demands a regular sustained effort throughout the term. Most importantly, do not allow yourself to fall behind! The material builds up and you need to stay ahead of the game. If you find that you are not grasping essential material by reading the textbook and following in-class discussion, seek help! Visit your instructor's and/or TA's office hours (see above), talk to other students in your class, compare notes, form a study group, *etc.*
9. **Homework:** Homework will be assigned weekly on canvas. Homework problems come from many different sources, including the instructor's own personal list of problems. Homework assignments will typically be available on canvas on Tuesday night and will be due the next Tuesday at the beginning of lecture (10:40am). Policies for late submission: Each work day that homework is late, 20% of the achievable points are subtracted. Homework is considered a day late if it is turned in after 10:40am the day it is due.
10. **Calculators:** You must have your own scientific calculator. Calculators may be used on quizzes and exams but may not be shared. You may **not** use graphing calculators or any calculators that are capable of information storage or communication on any exam. Simple inexpensive scientific

calculators such as the TI-30 series or the Casio fx-260 are acceptable and sufficient for any problem encountered on exams.

11. **Participation Grade:** The participation points (up to 110) will be earned through active participation in class. This is primarily done by using the learning catalytics app on your digital device (smartphone, tablet, notebook PC, *etc.*) to respond to questions asked by the instructor throughout the lectures (see further explanation below under #10).
12. **LearningCatalytics (LC):** In this course, we will use LC for your digital device for you to respond to the instructor's questions and earn valuable points toward your grade. An access code will be distributed to you through your canvas account. You will need to create a student account on <https://learningcatalytics.com/> using that access code. Follow instructions on the web site to activate your account and link it to our course, CHM4411. You are required to bring at least one wifi-enabled digital device to class to use for this activity. If you don't have access to a digital device, please contact the instructor.
13. **Class Attendance:** Lecture attendance is essential for your success in this class. However, we will not take roll-calls. Repeated absence in class will make it very difficult to earn full participation points.
14. **Students with Disabilities:** Students requiring special accommodations should register with the Dean of Students Office and present documentation from that office to the instructor.
15. **Counseling Services:** The University of Florida provides counseling services for students, staff, and faculty. See <http://www.counsel.ufl.edu/> or call (352) 392-1575 during regular service hours (8am – 5pm). For other hours or on weekends call the Alachua County Crisis Center (264-6789). Students may also call the clinician on-call at Student Mental Health for phone callback and consultation at (352) 392-1171.
16. **Cell Phones:** Please put all cell phones and other digital devices on “silent mode” during all class periods. Thank you.
17. **Honors Code:** This class will operate under the policies of the student honor code which can be found at: <http://www.registrar.ufl.edu/catalog/policies/students.html> The students, instructor, and TA's are honor-bound to comply with the Honors Pledge: **We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.**

If you have further questions, please contact me. Have a great spring term!

Sincerely, Alexander Angerhofer