

# Physical Chemistry II

## Chemistry 3760

### Spring 2020

#### General Information

Time: MWF 8:15-9:10 a.m.

Place: 265 D. M. Brown Hall

#### Course Summary

A second semester in physical chemistry, concentrating on gases, thermodynamics and equilibrium.

#### D2L Site

A Desire2Learn (D2L) site (<http://elearn.etsu.edu>) for this course is available. All assignments, handouts, etc. will be posted to the site.

#### Contact Information

Instructor: Dr. Scott Kirkby

Phone: 423-439-8638

Office Hours: M, 10:00 a.m. - noon

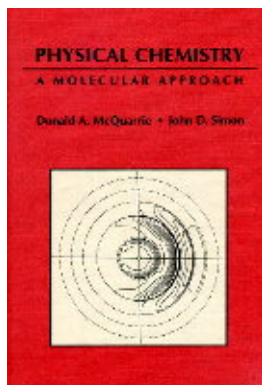
Office: 464 D. M. Brown Hall

Email: [kirkby@etsu.edu](mailto:kirkby@etsu.edu)

Individual assistance may also be obtained by appointment or by emailing questions to the instructor.

#### Text

McQuarrie, D. A. and Simon, J. D. Physical Chemistry, A Molecular Approach, University Science Books, Sausalito, California 1997. A solution manual for the text is also available: Cox, H. Problems and Solutions to Accompany McQuarrie and Simon Physical Chemistry, A Molecular Approach; University Science Books, Sausalito, California 1997.



## Grading

Assignment	Percent of Final Grade
Problem Sets & Assignments	10%
Best Two of Three Midterm Tests 17.5% each (1 hour, in class) After lectures 10, 20, and 30.	35%
Poster Presentation 10% peer evaluation 5% instructor evaluation	15%
Final Exam (2 hours) Wed. 1 May, 3:50 - 5:50 p.m.	40%
Total	100%

The midterm tests will not be explicitly cumulative, but material from previous tests may be required to complete the current work. There will be no make-up tests except for extenuating circumstances. Written documentation (*e.g.* a doctor's note) must be provided. An early ride home, being late for class, *etc.* are not such circumstances. If you must miss an exam, arrangements should be made with the lecturer before the exam. If you miss more than one midterm, the remaining midterm and the final exam will still compose 75% of your grade.

**Calculators:** Non programmable scientific calculators are permitted for use on the midterm tests and the final exam. Programmable calculators may not be used. Calculators that are part of a communications device, including IR transmitting calculators, are not permitted.

**Electronic Devices:** With the exception of a non-programable scientific calculator, no electronic device shall be in use by, and/or in the possession of, the student while taking a test or exam. For the purposes of this course, possession in a functional state will be considered usage.

## Academic Integrity

This course will comply with the Department of Chemistry's Academic Integrity Policy (available in the course's content section on D2L). Any violation of the policy is unacceptable and will not be tolerated. At the minimum, a grade of zero for the assignment will be given.

## Poster Presentation

Working in pairs, students will prepare a poster, in the style of a scientific poster, on any topic in physical chemistry. These posters will be presented at the end of term. As intermediate steps in the preparation of the poster, an abstract of the topic must be submitted by 17 February, and a "story board" or equivalent outline must be submitted by 25 March. Grading of the posters will be by the other students and the instructor.

## Conversion to Letter Grades

Grade	Percent	Grade	Percent
A	$\geq 90.00\%$	C	63.00 - 66.99%
A-	85.00-89.99%	C-	60.00 - 62.99%
B+	80.00 - 84.99%	D+	55.00 - 59.99%
B	75.00 - 79.99%	D	50.00 - 54.99%
B-	70.00 - 74.99%	F	$< 50.00\%$
C+	67.00 - 69.99%		

This course is an introduction to physical chemistry. The material is often very abstract and highly mathematical. It cannot be learned the night before a test. It can only be mastered by working problems. Please make every attempt to keep up and do not hesitate to ask questions both in and out of class.

## Lecture Titles

1. Introduction
2. Review of Quantum Mechanics
3. Gas Equations of State
4. The Effects of Intermolecular Forces on Equations of State
5. The Boltzmann Factor
6. Partition Functions
7. The Partition Function of a Diatomic Molecules
8. Selected Problems: Gases and Partition Functions
9. The First Law of Thermodynamics
10. Molecular Interpretation of Work and Heat
11. Heat Capacities of Solids
12. Entropy and the Second Law of Thermodynamics
13.  $S = k_B \ln W$
14. Entropy and the Third Law of Thermodynamics
15. Absolute and Spectroscopic Entropies
16. Helmholtz and Gibbs Energies
17. Phase Equilibria
18. Selected Problems: Laws of Thermodynamics
19. Liquid-Liquid Solutions
20. Solid-Liquid Solutions
21. Chemical Equilibrium
22. Which Way to Equilibrium?
23. Equilibrium Constants and Partition Functions
24. Thermodynamics of Electrochemical Cells
25. Solubility
26. Non Equilibrium Thermodynamics
27. Non Equilibrium Thermodynamics Continued
28. Selected Problems: Equilibrium

29. The Thermodynamics of Magnetism
30. The Maxwell-Boltzmann Distribution
31. Bose-Einstein Gases
32. Fermi-Dirac Gases

**Note:** You will also be responsible for all of the mathematics covered in Math Chapters A-F.

## **Course Notes**

Course notes will be available for download from the course D2L site. These notes are not meant to be a complete set, merely an additional aid to the student. No assurances are given for their correctness. The textbook should be assumed to be correct in all conflicts between it and these notes.

## **Suggested Problems**

Students are encouraged to attempt as many problems as required to become proficient with the course material.

## **Sample Midterms and Final**

Three sample midterm tests and a final exam have been posted to the D2L site.

## **Lab Safety Training**

If you are enrolled in laboratory courses (*e.g.* CHEM 3611) you are required to complete the online safety training module. This is available on D2L at the ADMN-0005-573 - Chemistry Safety Quiz site. You must complete and pass the on-line quiz once a year before being allowed in lab. If you do not complete the safety training prior by 4:30 p.m. on 24 January 2020, you will not be allowed to remain in these classes.

## **Disability Services**

It is the policy of ETSU to accommodate students with disabilities, pursuant to federal law, state law and the University's commitment to equal educational access. Any student with a disability who needs accommodations, for example arrangement for examinations or seating placement, should inform the instructor at the beginning of the course. Faculty accommodation forms are provided to students through Disability Services in the D.P. Culp Center, telephone 439-8346.

## **Mental Health**

Students often have questions about mental health resources, whether for themselves or a friend or family member. There are many resources available on the ETSU Campus, including: ETSU Counseling Center (423) 439-4841; ETSU Behavioral Health

& Wellness Clinic (423) 439-7777; ETSU Community Counseling Clinic: (423) 439-4187.

- **If you or a friend are in immediate crisis, call 911.**
- Available 24 hours per day is the National Suicide Prevention Lifeline: 1-800-273-TALK (8255).