

CHEM 525

PHYSICAL CHEMISTRY FOR ENGINEERS

10:00-10:50 am | M-T-W-R | 427 Summerfield

People

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Textbook

Physical Chemistry: A Molecular Approach, D. McQuarrie & J. Simon

Discussions

Optional discussions for testing your knowledge and practicing problem solving

Tues., 3:30 - 4:30 pm, 2049 Malott
Wed., 12:00 - 1:00 pm, 2048 Malott

Office Hours

Thompson: Mon., 11 am - 12 pm &
Wed., 11-12 pm in 6084 Malott
Katiyar: Tues., 11 am - 12 pm &
Thurs., 11-12 pm in 6006 Malott
Mendis: Tues., 9 - 10 am &
Thurs., 9 - 10 am in 6006 Malott
If you cannot attend one of these,
please contact us for an appointment!

Course Website

A course website is available on Blackboard (<http://courseware.ku.edu>). All course materials will be posted on this website.

Final Exam

Wednesday, Dec. 13, 7:30-10:00 am
(This is not my fault!! ↑↑↑)



Photo courtesy of Brian Laird

Objective

In this course you will develop a detailed and functional understanding of how molecular-level characteristics lead to thermodynamic properties.

Methods

"We're talking about practice!" —
Allen Iverson

The only way to master physical chemistry is practice! Over the course of the semester you will be building a physical picture in your mind of molecular systems and their macroscopic properties. You will need to continually update this picture and test your understanding of it by making physical and mathematical predictions.

"The thing that doesn't fit is the thing that's the most interesting: the part that doesn't go according to what you expected." — Richard Feynman

Problem Sets

Solving problems will help you to understand the important concepts and to master the relevant mathematical tools. Problem sets will be regularly assigned and the solutions will be posted on the course Blackboard site, but the *problem sets will not be collected or graded*. It is up to you to both work the assigned problems and verify that you have done them correctly.

Reading

You should prepare for class by reading the textbook sections relevant to a given topic *prior* to the lecture on that material.

Clickers

Clickers will be used during nearly all lectures to allow you to test your mastery of the course material with rapid feedback and adjust my approach based on your understanding of the concepts. Sometimes you will be asked to work in groups as part of the clicker question. You are responsible for bringing your clicker to class

Boilerplate - read carefully!

Make-Up Exams: *There are none!* Notify me as soon as possible if you are unable to attend an exam.

Academic Misconduct: *It will not be tolerated!* At a minimum, all students involved will receive a zero for the assignment in question and be prosecuted to the fullest extent possible according to the procedures outlined in the [KU Policy Library](#). Read these guidelines carefully. While the most basic rule is anything you submit in the course must be your own work, this is only one aspect of academic misconduct. Ignorance of the rules is not a defense! Please contact me with any questions.

Course Materials: *Mine!* Course materials prepared by the instructor, together with the content of all lectures and discussion sessions presented by the instructor are the property of the instructor. Video and audio recording of lectures and discussion sessions without my consent is prohibited.

Special Needs: *Notify me privately if you need accommodations!* The KU Academic Achievement & Access Center (AAAC) coordinates accommodations and services for all eligible students. If you have a disability for which you wish to request accommodations please contact AAAC. The AAAC office is located in 22 Strong Hall; their phone number is (785) 864-4064 (V/TTY). Information about their services can be found at <http://disability.ku.edu>.

Concealed Carry: Individuals who choose to carry concealed handguns are solely responsible to do so in a safe and secure manner in strict conformity with [state and federal laws](#) and [KU weapons policy](#). Safety measures outlined in the KU weapons policy specify that a concealed handgun: i) Must be under the constant control of the carrier. ii) Must be out of view, concealed either on the body of the carrier, or backpack, purse, or bag that remains under the constant control of the carrier. iii) Must be in a holster that covers the trigger area and secures any external hammer in an un-cocked position, iv) Must have the safety on, and have no round in the chamber.

every day. You will not be graded on the correctness of your answer but only on the fraction of times you register a response (starting Monday, Aug. 28); responding to 75% or more of the questions gives you full credit, below this ($grade = response\ rate \times maximum\ points$).

Computational Exercises

Throughout the semester you will be given opportunities to implement the principles discussed in class in numerical calculations. Most, though not necessarily all, will be done in Matlab.

“So you must always be skeptical — always think for yourself.”

— Linus Pauling

Classroom Decorum

Please ask questions at any time during class! It will help clarify material for you and others while helping me provide better instruction. By enrolling in this course you accept the responsibility to come to class ready to learn/work. This means that you agree to not talk with friends, read the newspaper, complete homework, text, listen to or use electronic devices including laptop computers, or engage in any other disruptive activities. Cell phones and laptops should be put away and not kept on your desk.

Quizzes

Quizzes will give you a weekly chance to test your understanding of the material (except when there is an exam or advance notice). Each will take ~15 minutes at the beginning of class. Any topic addressed before a quiz is fair game. There will also be two “Super-Quizzes,” announced in advance, that will take ~30 minutes and allow for more in-depth questions; they are worth twice as much.

Exams

There will be two: *Thursday, Sept. 28, 5:50-7:50 pm* & *Thursday, Nov. 9, 5:50-7:50 pm*, both in 3139 Wescoe. All exams are comprehensive. You will only be permitted use an acceptable non-programmable calculator: Texas Instruments 30Xa or Casio FX260.

Grading

Clicker response	50 pts
Computational Exercises	50 pts
Quizzes*	200 pts
Exams	300 pts
Final Exam	200 pts
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Total	800 pts

*Your lowest two scores (or one SuperQuiz score) will be dropped. Final grades will be assigned on a letter-grade basis (no +/-).

List of Topics

<i>Topic</i>	<i>Chapter(s)</i>
Fundamentals of Quantum Mechanics	1, 2, & 4
Particle in a Box & Quantization	3
Molecular Vibrations & Infrared Spectroscopy	5
Molecular Rotations & Microwave Spectroscopy	5
Electronic Structure of Atoms	
Hydrogen Atom	6
Multielectron Atoms	8
Electronic Structure of Molecules	
Molecular Orbitals	9 & 10
Molecular Interactions	
Introduction to Statistical Mechanics	17
Partition Functions	
Average Values	
Fluctuations	
Statistical Thermodynamics	
The Ideal Gas Law	18
Molecular Basis for the Laws of Thermodynamics	19
Heat Capacities & Compressibilities	18
Entropies and Free Energies	20 & 22
Real Gases	16
Phase Equilibrium	23
Chemical Equilibrium	26
Equilibrium constants from statistical mechanics	
Predicting equilibrium constants from quantum mechanics	
Chemical Dynamics	
Kinetic Theory of Gases	27
Collision Theories	30
Transition State Theory	30