

**Physical Chemistry - Fall 2020**  
**CHEM 410B**

On-line Synchronous (Zoom), MWF: 12:00-12:50 PM

Instructor: Dr. Karen Peterson  
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Zoom Office hours: 11-12 Tues/Thurs; I will also be available directly after class for questions.

Text: **Physical Chemistry, 10th Edition** by Peter Atkins and Julio de Paula.

Other useful books;

- “Elements of Chemical Thermodynamics”, 2<sup>nd</sup> edition, by Leonard K. Nash (Dover)  
This is a gem of a book, and not very expensive. It explains fundamental concepts in thermodynamics in more detail.
- “The Alchemy of Air: A Jewish Genius, a Doomed Tycoon, and the Scientific Discovery That Fed the World but Fueled the Rise of Hitler”, by Thomas Hager (New York: Harmony Books, 2008)  
This is a very readable book that presents the story of the invention of the Haber-Bosch process for synthesizing ammonia from nitrogen.

*The lectures will take place “live” through Zoom at 12:00 noon. Generally I will write on powerpoint slides as I talk. I encourage you to ask questions at any time. The Zoom session will be recorded and available for reviewing. For the exams and quizzes, I will send you the questions by email and you will send the answers back to me by email. Most students find it easiest to write the answers on a sheet of paper, take pictures, and then send the pictures.*

*One of the challenges of virtual classes is to provide a “social presence”, that is, interactions and collaborations with each other and with me. Although I will not require daily attendance, I will have a requirement for partial attendance where a small number of you will be my “audience” for the day. This will allow me and others to get to know you as individuals. For more information, see the section on **Attendance** below.*

Course Description

CHEM 410B. Physical Chemistry (3)

Three lectures.

Prerequisites: Chemistry 232, 232L, 251, 410A.

Theoretical principles of chemistry with emphasis on mathematical relations. Theory and practice in acquisition and statistical analysis of physical measurements on chemical systems.

The second semester of the physical chemistry course covers chemical thermodynamics, kinetics, and some statistical thermodynamics. Thermodynamics is the science that studies the relationship between heat and work, and the transfer of these quantities between a system and its

surroundings. It forms a theoretical basis for predicting product and reactant concentrations in chemical systems at equilibrium. Kinetics is the study of the rates and mechanisms of chemical reactions. It is concerned with how fast a reaction occurs as it marches toward equilibrium. Statistical thermodynamics connects the microscopic properties to bulk (macroscopic) properties of matter. While thermodynamics relates macroscopic properties, microscopic details must often be considered in order to understand the relationships between reaction rates and mechanisms.

- Ch. 1 The Properties of Gases
- Ch. 2 The First Law
- Ch. 3 The Second and Third Laws
- Ch. 4 Physical Transformations of Pure Substances
- Ch. 5 Simple mixtures
- Ch. 6 Chemical Equilibrium
- Ch. 20 Chemical Kinetics
- Ch. 21 Reaction Dynamics

### **LEARNING OUTCOMES:**

By the end of this course, you will be able to

- Understand the basic principles of thermodynamics as applied to chemical reactions and processes, particularly in terms of enthalpy and entropy.
- Calculate equilibrium constants, enthalpies, and entropies from experimental data and from information found in the literature.
- Analyze equilibrium problems and predict the direction of spontaneous change as expressed by the chemical potential
- Apply the basic principles of kinetics to chemical reactions and processes.
- Determine rate parameters from experimental data.
- Analyze chemical reaction mechanisms through the corresponding rate equation.
- Calculate physical parameters of compounds using theoretical principles
- Derive fundamental equations in thermodynamics and kinetics
- Develop simple mechanisms which correspond to experimentally-derived rate laws
- Appreciate the molecular basis of chemical thermodynamics and kinetics

### **COURSE REQUIREMENTS**

#### **Attendance**

Some attendance will be required, certainly for quizzes and exam, but also for a special 5-point assignment in which you will be required to participate during specific class periods. This is something new, which I hope will make the class more engaging. For every class period there will be 3-4 people assigned to participate during class by asking and/or answering questions, pointing out my mistakes, and reciting to me to any questions brought up in “chat”. Those students should have their webcam on. This will help make the class more active, and also give me a chance to see at least a few of my audience every day. I expect that each person will have a chance to do this 4-5 times throughout the semester.

### **Blackboard submission in the discussion board**

For each chapter, I will post a handout that will guide you in your reading by listing problems that you should be able to solve. Although everyone should do the problems, they will be formally assigned to specific students for posting on Blackboard. It is likely that each person will be responsible for 7 to 8 questions throughout the semester, each worth 8 points.

So, how does this work? The individual students who are assigned particular problems from the handouts must post a trial answer before the next class period after the assignment is given. The final deadline is the class day after the material is covered in class. Other students may help by posting replies to the initial post. If you are assigned a particular problem, and another student posts the complete correct answer, you must still post an answer to receive credit. For full credit (8 pts), your answer should be well written with the steps in any calculations explained. Points will be taken off for incorrect answers, but some of these points may be reinstated if the answer is corrected. Late submissions will almost always get some credit.

- Post an answer before the class period for which it was assigned (penalty -1 pt).
- Post a final answer two days after the class period for which it was assigned (penalty varies depending on how late the final answer is posted).
- The answer should be clearly written and steps explained.

Extra credit (up to 10 points, one point for each post) will be given for correcting, clarifying, or adding to answers posted on blackboard.

### **Short quizzes/homeworks**

Periodically, I will give a short assignment worth 3 points. These may comprise the following:

- In-class quiz. For these, the main goal is to give you practice for the exams, the answers for which you will send to me by email
- Short homework assignments. These will give you more practice on doing problems and answering conceptual questions..
- Feedback essay. These will be short paragraphs to give me feedback on some aspect of the course.

**Written homework:** A few of the longer problems may be assigned for everyone to turn in. The points for these sets will vary.

### **Midterm exams**

There will be three midterm exams. The dates are as follows:

Exam I – Friday, September 18

Exam II – Wednesday, October 14

Exam III – Monday, November 9

If you cannot make it to the exam because of some personal catastrophe, please contact me within three days of the exam. I will need documentation in order to work something out with you.

### **Final exam**

The final exam takes place on Wednesday, December 16, at 10:30 AM. The exam will have one section covering the last quarter of class, and another section that will be cumulative.

### **Grading**

Three midterm exams 300 pts (100 pts each)

Final exam 150 pts

Short quizzes/homework ~15/3 pts each = 45 pts

Homework assignments ~30 points

In-class questions/comments ~ 20 pts

Discussion board assignments ~56 pts

Total: ~601 pts

The grading scheme will be as follows:

A	89-100%	C	59-66%
A-	85-89%	C-	55-59%
B+	80-85%	D+	50-55%
B	74-81%	D	44-50%
B-	70-74%	D-	40-44%
C+	65-70%	F	< 40%

**Add/Drop Procedure:** The add/drop deadline is September, 2020. For details, see [http://arweb.sdsu.edu/es/registrar/schedule\\_adjustment.html](http://arweb.sdsu.edu/es/registrar/schedule_adjustment.html)

**Accommodations:** If you are a student with a disability and are in need of accommodations for this class, please contact the Student Ability Success Center (SASC) at (619) 594-6473 as soon as possible. Please know accommodations are not retroactive, and we cannot provide accommodations based upon disability until we have received an accommodation letter from Student Ability Success Center. Exams and quizzes for which extra time is needed as an accommodation will have to be proctored by SASC.

**Religious observances:** Notify the instructor of planned absences for religious observances by the end of the second week of classes.

**Academic Honesty:** The University adheres to a strict policy prohibiting cheating and plagiarism.

Examples of academic dishonesty include but are not limited to:

- copying, in part or in whole, from another's test or other examination;
- obtaining copies of a test, an examination, or other course material without the permission of the instructor;
- collaborating with another or others in work to be presented without the permission of the instructor;
- falsifying records, laboratory work, or other course data;
- submitting work previously presented in another course, if contrary to the rules of the course;
- altering or interfering with grading procedures;
- assisting another student in any of the above;
- using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);
- copying and pasting work from an online or offline source directly and calling it your own;
- using information you find from an online or offline source without giving the author credit;
- replacing words or phrases from another source and inserting your own words or phrases.

*The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities..*

***Resources for students:*** *A complete list of all academic support services--including the Writing Center and Math Learning Center--is available on the Student Affairs' Academic Success website. Counseling and Psychological Services (619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at [http://go.sdsu.edu/student\\_affairs/cps/therapist-consultation.aspx](http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx) between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.*

***Medical-related absences:*** *Contact the instructor in the event they need to miss class, etc. due to an illness, injury or emergency. We will try to accommodate valid reasons for absence.*

***SDSU Economic Crisis Response Team:*** *If you or a friend are experiencing food or housing insecurity, or any unforeseen financial crisis, visit [sdsu.edu/ecrt](http://sdsu.edu/ecrt), email [ecrt@sdsu.edu](mailto:ecrt@sdsu.edu).*

Last day of classes: Thursday, December 10

Final: Wednesday, December 16, 10:30 am – 12:30 pm

This schedule is tentative. The lecture times for each chapter may change during the course of the semester.

**Fall 2020**

Week of:	Mon	Wed	Fri
Aug 24	Introduction	Ch. 1	Ch. 1
Aug 31	Ch. 1	Ch. 1	Ch. 2
Sep 7	<b>Labor Day No Class</b>	Ch. 2	Ch. 2
Sep 14	Ch. 2	Ch. 2	<b>Exam I</b>
Sep 21	Ch. 3	Ch. 3	Ch. 3
Sep 28	Ch. 3	Ch. 3	Ch. 4
Oct 5	Ch. 4	Ch. 4	Ch. 4
Oct 12	Ch. 4	<b>Exam II</b>	Ch. 5
Oct 19	Ch. 5	Ch. 5	Ch. 5
Oct 26	Ch. 5	Ch. 6	Ch. 6
Nov 2	Ch. 6	Ch. 6	Ch. 6
Nov 9	<b>Exam III</b>	<b>Veteran's Day No Class</b>	Ch. 20
Nov 16	Ch. 20	Ch. 20	Ch. 20
Nov 23	Ch. 20	<b>Thanksgiving No Class</b>	<b>Thanksgiving No Class</b>
Nov 30	Ch. 20	Ch. 21	Ch. 21
Dec. 7	Ch. 21	Finish Ch. 21 and/or review <b>Last day of class</b>	Thursday, Dec 10, last day of classes
Dec 14		<b>Final Exam</b> Dec 16, 10:30-12:30	