San José State University
College of Science/Department of Chemistry
Chem 161A: Physical Chemistry I, Fall, 2019

Instructors:

Bradley M. Stone, Ph.D.
Professor Emeritus of Chemistry
DH-417
bradley.stone@sjsu.edu
408-924-4938

Abraham Wolcott, Ph.D.
Assistant Professor of Chemistry
DH-005A
abraham.wolcott@sjsu.edu
408-924-5449

Office Hours:

Stone: Tuesdays and Thursdays, 1500 – 1600, or by appointment only.
Wolcott: TBD

Class Days/Time:

TR 1200 – 1315

Classroom:

SCI-164

Prerequisites:

Chem 55, Math 32 and Physics 50 (or their equivalents), with grades of C or better (C- not accepted). Reminder: *prerequisite* means that you have already completed the class, and are responsible for knowing the material presented in the class.

Canvas:

Copies of the course materials such as transparencies, power point presentations, major assignment handouts, problem set solutions etc. may be found on the Canvas page for the course. You are responsible for regularly (i.e. daily) checking the Canvas shell throughout the semester.

Course Description

Principles of classical physical chemistry. Chemical thermodynamics and kinetics.

Course Goals and Student Learning Objectives
To derive chemical thermodynamics and classical kinetics from first principles, and to develop a working proficiency in problem solving in these fields.

Course Content Learning Outcomes

Upon successful completion of this course, the student should be fluent in the language of thermodynamics, and to be able to derive the necessary equations for solving problems in thermodynamics from definitions and first principles. Additionally, the student should understand a number of concepts involved in the use of chemical kinetics, and how these techniques can be used in the laboratory to investigate chemical reactions.

1. Understand the kinetic theory of gases.
2. Understand the origin of intermolecular interactions and their role in the non-ideality of gases and the properties of liquids.
3. Understand and use the concepts of work, heat, energy, entropy and the secondary thermodynamic functions – enthalpy, Helmholtz free energy and Gibbs free energy – in a variety of chemical applications.
4. Understand the physical transformations of pure substances and mixtures and be able to interpret the related phase diagrams.
5. Understand how to calculate equilibrium constants from thermodynamic data.
6. Understand gas and liquid transport phenomena.
7. Understand how to formulate rate laws which relate chemical concentrations to time and use them to help understand the molecular mechanisms of chemical change.
8. Understand the various microscopic theories that seek to explain chemical reaction rates.
9. Develop numerical problem solving skills and the ability to apply such skills to applications of current interest in the field of physical chemistry.

Textbooks

Textbook (required):

1. "Physical Chemistry", by Peter Atkins and Julio de Paula: 11th Edition, Freeman. Chapters 1-6 and 20 will be thoroughly covered. Selected topics from Chapters 19, 21, 22 or others may be included.

Textbooks (recommended):

2. "Applied Mathematics for Physical Chemistry", James R. Barrante, Prentice Hall (excellent overview/review of the mathematics needed for this course).
3. "Physical Chemistry", Clyde Metz, Shaum's Outline Series, 2nd edition. (a wonderful source of additional practice problems, with solutions).
4. "Student's Solution Manual for Physical Chemistry, Edition 11, Peter Atkins and Julio de Paula, W.H. Freeman, 2014.

5. Any edition of Atkins "Physical Chemistry" can serve as a reference. Personally, I (Stone) feel that the 3rd edition was the best. If you're going to get a used copy, strive to get a copy of the 3rd to 6th editions. Note: assignments will be made from the 10th edition, but it should be easy for you to correlate to the older editions.
6 "Physical Chemistry", Thomas Engel & Philip Reid, 3rd edition, Pearson. (note: "Thermodynamics, Statistical Thermodynamics, & Kinetics", Thomas Engel & Philip Reid, 3rd edition is an excellent textbook that has been used previously for this course.
7. Any other physical chemistry textbook (there are a plethora of them). Particularly recommended are the classic texts by Moore, Castellan, and McQuarrie.

Note: the required text and the above recommended texts (2-4) have been ordered for you, and should be available in the bookstore.

Course Philosophy

It is virtually impossible to learn physical chemistry by simply attending lectures and reading the book (although we highly encourage you do both of these activities!). Lectures are, by nature, meant to supplement the text material and will serve to help introduce you to the concepts that are necessary for problem solving. Lecture time is both valuable and scarce, and aside from occasional examples worked in class, there is simply not enough time to work problems during lecture (let alone cover all of the material that should be covered during the semester). Therefore, this requires that you take on the responsibility of working problems, both assigned and "unassigned" (at the end of chapters, in other texts, etc.) on your own. You need to spend at least several hours weekly practicing problems (the typical student will need ~15 hours per week outside of class to work problems, to be successful in this course). If you run into difficulties, you should see us in office hours for consultation, or call us and make an appointment. Extra tutorial problem solving sessions will be scheduled, to the best of our abilities (given the limitations of my schedule). You should feel free to send questions to us via email!

Practically anyone who has already learned physical chemistry will agree that the key to understanding this material is accomplished through repeated problem solving. This may seem like the "brute force" method, but this is the way that we and all other chemists and engineers that we know have learned the material, and it is the only way that we know to accomplish this (there is no painless, learn-by-osmosis method that works, to our knowledge!).

Attendance
Lectures are for your own edification, so attending lectures is to your benefit. Attendance is, of course, not required, but highly recommended. However, you are responsible for any material discussed in lecture, as well as for any announcements that are made during lecture. If you choose to attend lecture, I ask that you show me the courtesy of arriving on time! Persons arriving late for lecture are disruptive to other students and distracting to me while we trying to present the best lecture possible. If people coming late to lecture become a problem, we may have to resort to locking the door 5 minutes after lecture commences.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html Add/drop deadlines can be found on the current academic calendar web page located at http://www.sjsu.edu/academic_programs/calendars/academic_calendar/ The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/ Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/

Assignments and Grading Policy

Quizzes, graded problems, etc.	10%
Midterm Exam I	25%
Midterm Exam II	25%
Final Exam (ACS)	40%

Exams
1. Midterms I and II will be in-class, problem solving oriented exams. They will be primarily multiple choice, with possible additional hand-graded problem(s).
2. The American Chemical Society (ACS) standardized test in Physical Chemistry covering thermodynamics and kinetics will be given as the Final Exam. Additional hand graded problem(s) may also be included on the final.
3. There are no make-up exams. If you miss an exam, you need to see us regarding your status in the course. Please plan ahead to be available on the dates of the exams. Midterm dates are posted on the schedule below, although they may change. Changes in Midterm dates will always be given *at least* one week in advance.

Problem Sets:
We will regularly assign problem sets, with problems relevant to the lectures that are particularly interesting or challenging. You will be responsible for these problems with respect to the exams. We highly recommend that you form study groups, optimally 3-6 people, to work the problems together. In some cases, solutions will be provided by me. A subset of assigned problems will be graded. In class quizzes will be given, from time to time, announced and/or unannounced. Problem sets will be due at the beginning of class, before lecture starts. Late problem sets will **NOT** be accepted – no exceptions (please do not ask). You are responsible for doing all of the WebAssign problems for each Chapter covered. This will be part of your grade.

Problem Solving Log:
Please keep a log (i.e. in a notebook, or on your computer) of the time that you spend solving problems for Chem 161A, on a daily basis.

Final Grades
The final grade will be determined based upon a straight scale, based out of 100 total possible points in the course (We reserve the right to renormalize some exam scores, but this always works in your favor!), as shown below:

98 – 100	A+
92 – 97	A
90 – 91	A-
88 – 89	B+
82 – 87	B
80 – 81	B-
78 – 79	C+
67 – 77	C
65 – 66	C-
63 – 64	D+
52 – 62	D
50 – 51	D-
0 - 49	F

In addition to assigned problems, I highly recommend doing the problems at the end of each chapter in **Atkins and de Paula**. You **will** be responsible for any problems in **Atkins and de Paula** with respect to exams. We strongly recommend that your work as many problems as possible from other texts. Some additional sources of problems can be found in the following:

- "2000 Solved Problems in Physical Chemistry" (Schaum's Outline Series)
- Any other bona fide Physical Chemistry text (such as Levine, Alberty, Atkins, Castellan, Moore, Mortimer, Noggle, Adamson, McQuarrie, etc.).

University Policies:

Per University Policy S16-9, university -wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/"

Student Technology Resources

Computer labs for student use are available in the Academic Success Center located on the 1st floor of Clark Hall and on the 2nd floor of the Student Union. Additional computer labs may be available in your department/college (Chemistry majors may use the Departmental computer lab in DH-503). Computers are also available in the Martin Luther King Library.
A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112. These items include digital and VHS camcorders, VHS and Beta video players, 16 mm, slide, overhead, DVD, CD, and audiotape players, sound systems, wireless microphones, projection screens and monitors.

Learning Assistance Resource Center

The Learning Assistance Resource Center (LARC) is located in Room 600 in the Student Services Center. It is designed to assist students in the development of their full academic potential and to motivate them to become self-directed learners. The center provides support services, such as skills assessment, individual or group tutorials, subject advising, learning assistance, summer academic preparation and basic skills development. The LARC website is located at http:/www.sjsu.edu/larc/.

SJSU Writing Center

The SJSU Writing Center is located in Room 126 in Clark Hall. It is staffed by professional instructors and upper-division or graduate-level writing specialists from each of the seven SJSU colleges. Our writing specialists have met a rigorous GPA requirement, and they are well trained to assist all students at all levels within all disciplines to become better writers. The Writing Center website is located at http://www.sjsu.edu/writingcenter/about/staff/.

Peer Mentor Center (Optional)
The Peer Mentor Center is located on the 1st floor of Clark Hall in the Academic Success Center. The Peer Mentor Center is staffed with Peer Mentors who excel in helping students manage university life, tackling problems that range from academic challenges to interpersonal struggles. On the road to graduation, Peer Mentors are navigators, offering "roadside assistance" to peers who feel a bit lost or simply need help mapping out the locations of campus resources. Peer Mentor services are free and available on a

drop –in basis, no reservation required. The Peer Mentor Center website is located at http://www.sjsu.edu/muse/peermentor/

General Expectations, Rights and Responsibilities of the Student Policy
As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU's policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arises. See University Policy S90–5 at http://www.sjsu.edu/senate/docs/S90-5.pdf More detailed information on a variety of related topics is available in the SJSU catalog, at http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not serve to address the issue, it is recommended that the student contact the Department Chair as a next step.

Chem 161A/Physical Chemistry I, Fall, 2019, Course Schedule

Please note: schedule subject to change, advance notice will be given whenever possible. As we have a great deal of essential material to cover in this course, we will attempt to tightly adhere to the following lecture schedule for the course. The lecture topics are listed below, along with the proposed (approximate) dates for the exams. We reserve the right to make changes to the schedule during the course of the semester, but we do not anticipate a large deviation from that given below, so you can plan ahead accordingly. Please note that, as we give lectures primarily from overheads or power points, it is impossible for me to go at a pace that allows everyone to copy everything from the screen during class. Therefore we will lecture at a pace that is comfortable for the presentation to the class. Presentation materials will be available on Canvas. My recommendation would be to take notes only on that material that is not given on the overheads (i.e. material that is written on the board or given verbally) during class – lectures can (and should) be copied neatly, in total, afterwards.

Table 1 Course Schedule

Week	Date	Topics, Readings, Assignments, Exam Dates
1	8-22	Atkins 1: The Properties of Gases
2	8-27 8-29	Atkins 1: The Properties of Gases Atkins 2: The First Law
3	9-3 9-5	Atkins 2: (continued) Atkins 2: (continued)
4	9-10 9-12	Atkins 2: (continued) Atkins 2: (continued)
5	9-17 9-19	Atkins 3: The Second and Third Laws Atkins 3: (continued)
6	9-24 9-26	Atkins 3: (continued) Atkins 3: (continued)
7	10-1 10-3	Midterm Exam I Atkins 4: Physical Transformation of Pure Substances
8	10-8 10-10	Atkins 4: (continued) Atkins 4: (continued)
9	10-15 10-17	Atkins 4: (continued) Atkins 4: (continued)
10	10-22 10-24	Atkins 4: (continued) Atkins 5: Simple Mixtures
11	10-29	Atkins 5: (continued)

Week	Date	Topics, Readings, Assignments, Exam Dates
	10-31	Atkins 5: (continued)
12	11-5 11-7	Atkins 6: Chemical Equilibrium Atkins 6: (continued)
13	11-12 11-14	Atkins 6: (continued) Atkins 20: Chemical Kinetics
14	11-19 11-21	Midterm II Atkins 20: (continued)
15	11-26 11-28	Atkins 20: (continued) Thanksgiving (no lecture)
16	12-3 12-5	Special topics Special topics
	12-10	Study Day (no classes – "Dead Day" here at SJSU!)
Final Exam	12-17	0945-1200 in Sci-164