

Sample Syllabus

CHEM 361B – Introduction to Physical Chemistry: Quantum Mechanics

COURSE DESCRIPTION

Thermodynamics and kinetics; properties of gases and solutions; molecular structure and energies and application to spectroscopic techniques; liquids, phase equilibria, thermodynamics of multicomponent systems with application to the life sciences.

COURSE OBJECTIVES

1. Develop an understanding of the nature of quantum systems and apply these principles to solve the Schrödinger Equation and determine physical observables.
2. Understand what it means for a system to be quantized and relate the quantized nature of energy from the Schrödinger Equation to predict spectroscopic phenomena including: electronic, vibrational, NMR, and rotational spectroscopy.
3. Use the solutions to the Schrödinger Equation to describe how chemical bonds are formed between atoms.

OPTIONAL TEXTS

You do not need to purchase any texts for this course, however, these are the references I used to build the course material. Most of these books should be available at the library.

1. Quantum Chemistry (Most Referenced)

Donald A. McQuarrie, 2nd Ed., University Science Books. (2008) ISBN: 978-1891389504

2. Elements of Physical Chemistry

Peter Atkins and Julio de Paula, 7th Ed., Oxford University Press. (2017) ISBN: 9780198796701

3. Physical Chemistry

Thomas Engel and Philip Reid, 3rd Ed., Pearson. (2013) ISBN: 9780321812001

4. Physical Chemistry for the Chemical and Biological Sciences

Raymond Chang, 3rd Ed., University Science Books. (2000) ISBN: 9781891389061

GRADING STANDARDS, AND CRITERIA

In this course a modified plus/minus system will be used. The grade breakdown is as follows:

94 – 100% = A+	88 – 93.99% = A	84 – 87.99% = A
80 – 83.99% = B+	74 – 79.99% = B	70 – 73.99% = B
66 – 69.99% = C+	60 – 65.99% = C	56 – 59.99% = C
52 – 55.99% = D+	46 – 51.99% = D	42 – 45.99% = D
	0 – 41.99% = F	

Chemistry majors must earn a grade of C or higher in this course to receive credit. Chemistry majors earning grades of C- or lower must repeat the course.

Retain all evaluated course material and examine it for grading irregularities. My grading philosophy is that you should be rewarded for any correct and relevant knowledge expressed in course evaluations. If you would like to discuss any evaluation, feel free to contact me within a reasonable time after it has been returned to you. If you do not, then the grade will be considered final. The only exception is errors in recording the proper value. All grades will be posted on Canvas and original, evaluated work must be shown to correct any discrepancies.

GRADING POLICY

Item	Weight	Details
Participation	10%	PeerWise, accurate evaluation of peers, participating in end of class exercises and student hours
Prep Assign.	10%	Online problems to prepare for class. Evaluated based on the degree it is successfully completed
7 Quizzes	15%	Evaluation 60% individual, 40% group-based. Worst dropped.
3 Midterms	45%	Three midterms equally weighted Final Exam 35% Cumulative for the semester
Drop Lowest	-15%	Worst Midterm or Average Quiz Score; whichever is lower
Total	100%	

• Participation

Four effective ways to internalize course material is to reflect on what you learned in every class, come to office hours to ask questions, create problems for others to solve and evaluate assessments. The participation mark is meant to reward students for actively contributing to all these activities in a structured manner.

To reflect on the course material, you will be asked at the end of each class to participate in a brief exercise that is meant to have each of you to reflect on what you learned during that session. It will only be graded for completion and is only meant to serve as a benchmark tool for yourself and the instructor to gauge your progress.

It is also important to periodically attend office hours so that you can get real-time help with course materials from the instructor. To receive full credit for this part of your participation score, you need to attend 3 separate student hour sessions in three different weeks and ask a question. Be sure to prompt me to credit the gradebook every time to ensure that it is recorded.

We will use PeerWise to create problems for each other to solve in preparation for Midterms and the Final Exam. To receive full credit in this exercise, you must submit at least one question one week before each midterm and the final. I plan on incorporating at least one question submitted to PeerWise on every midterm and the final. The evaluation will be based on the applicability of the problem to appear on the upcoming exam, that the solution is complete, posting a constructive comment on someone else's problem and your follow up on

the comments from other students.

Finally, to evaluate assessment materials, students will be randomly placed into a new group of four after every other quiz. These groups will serve two purposes: first, during class time, in-class worksheets on course material will be completed together as a group. On quiz days part of the assessment will be completed and then evaluated in these groups. This creates the possibility for discussions on the solutions as students will need to engage with their group members to assign a score. Your participation mark will be based on the fairness of your evaluations using a well-defined rubric from the instructor. All group members will receive the same score. To receive a mark, you will identify yourself (using the last five digits of your CWID) on all material that your group evaluates.

- **Class Preparation Assignments**

Prior to every class, course related information will be posted to Canvas for students to review including pre-recorded lectures and reading material. This posted material will not typically be covered directly in class. An assignment based on this material will also be available. This assignment can be attempted an **unlimited** number of times, and will be graded based on the degree to which it is successfully completed.

- **Quizzes**

7 quizzes will be administered throughout the semester. Quiz material will be based on specific lectures as indicated in the lecture schedule. 60% of the mark from the quiz will be based on your individual effort while the 40% will be based on your group's effort.

- **Midterms**

There will be three midterms during this course. Each one will be focused on the material covered already by quizzes. I plan on incorporating at least one strong question submitted to PeerWise into these exams. The lowest midterm score will be dropped if your final average quiz score is higher.

- **Final Exam**

A cumulative final exam is scheduled. I plan on incorporating at least one strong question submitted to PeerWise.

STUDENT HOURS

On the first day of class, I will conduct a survey to find several half-hour blocks of time to reserve for students to visit with me and ask questions about the class or anything else on your mind. The data from the survey will be used to create a schedule where every student can attend my student hours. In addition to visiting with me in-person I will also have a Zoom session open so that you can talk with me virtually during these times as well. Keep this in mind when filling out the survey that you do not need to be on campus to participate. You should feel free to visit me outside of student hours, however, I may have to promptly leave to fulfill other duties.

SUPPLEMENTAL INSTRUCTION (SI)

Supplemental Instruction (SI) study sessions are offered for this course. SI sessions meet two to three times a week, throughout the semester. Supplemental Instruction is an academic assistance program which provides peer-led group study sessions to assist students in traditionally difficult courses.

SI sessions are led by a SI leader who has already mastered the course material and has been trained to facilitate group sessions where students can meet to improve their understanding of course material, review and discuss important concepts, develop study strategies and prepare for exams. *SI is for everyone, and open to all students enrolled in this class; not just those students who are struggling.* Attendance at SI sessions is free and voluntary. Students, who attend SI sessions weekly, typically earn higher final course and exam grades than students who do not participate in SI. Please bring your lecture notes, books, and questions with you.

ATTENDANCE POLICY

You are expected to attend every class. Remember, participation in class is a part of your grade, so missing classes will negatively affect your academic standing.

MAKE UP EVALUATIONS

No make-up evaluations will be given. Instead, missed midterms will be given the same grade as the final exam, missed group quizzes will be given the group grade for that quiz, and missed individual quizzes will be given the average of all other individual quiz scores (including the dropped score). In order to not receive a zero for a missed evaluation you must:

1. Pre-arrange your absence with me with a valid reason for missing the assessment before the day of the exam OR
2. Providing documentation demonstrating an emergency.

It is in your best interest to arrive late for an exam, rather than skipping the exam.

LATE SUBMISSIONS

PeerWise questions that are not turned in on time will be immediately penalised 2 pts. An additional point will be deducted for every additional 12 hours the assignment is late. To promote students to prepare for lectures, class preparation assignments will not be graded after the start of class.

TECHNICAL REQUIREMENTS

Students are expected to

1. Have basic computer competency which includes:
 - a. the ability to use a personal computer to locate, create, move, copy, delete, name, rename, and save files and folders on hard drives, secondary storage devices such as USB drives, and cloud such as Google Drive and Dropbox;
 - b. the ability to use a word processing program to create, edit, format, store, retrieve, and print documents;
 - c. the ability to use their CSUF email accounts to receive, create, edit, print, save, and send an e-mail message with and without an attached file; and
 - d. the ability to use an Internet browser such as Chrome, Safari, Firefox, or Internet Explorer to search and access web sites in the World Wide Web.
2. Have ongoing reliable access to a computer with Internet connectivity for regular course assignments
3. Utilize Microsoft® Office 2013 (for P.C.) or 2011 (for Mac) including Word, PowerPoint, and Excel to learn content and communicate with colleagues and faculty; have the ability to regularly print assignments
4. Maintain and access three times weekly their CSUF student email account
5. Use Internet search and retrieval skills to complete assignment
6. Apply his/her educational technology skills to complete expected competencies
 7. Utilize other software applications as course requirements dictate
8. Utilize Canvas to access course materials and complete assignments
9. Have a web camera so that the instructor and peers can interact with everyone in a more personable

way as well for when students are giving presentations.

NETIQUETTE REQUIREMENTS

Each student is expected to conduct themselves in a professional manner during the class - taking full advantage of the learning opportunities available. This includes completing all online discussions and assignments, adhering to proper netiquette, and so on. Netiquette refers to a set of behaviors that are appropriate for online activity - especially with email and threaded discussions. The core rules of netiquette can be found at the [Netiquette website](#). Please read through these netiquette rules to ensure that you are familiar with what will be the expected online behavior for this course.

COURSE SCHEDULE

Lecture #	Lecture Topic
1	Syllabus, Calculus Review, and Complex Numbers
2	Differential Equations
3	Quantization: A Scientific Revolution
4	The First Modern Model of the Atom
	Quiz 1 on Lectures 1 - 4
5	Probability
6	The Schrodinger Equation and the Particle in the Box
	Quiz 2 on Lectures 5 and 6 (PeerWise Q1 Due)
7	Properties of Quantum Mechanical Operators
	Midterm 1 (Material from Quiz 1 and 2)
8	Finite Potential Well and Tunneling
	Quiz 3 on Lectures 7 and 8
9	Vibrations in Molecules: The Simple Harmonic Oscillator
10	Vibrational Spectroscopy
11	Rotating Molecules: Angular Momentum
	Quiz 4 on Lectures 9 - 11
12	Putting it all Together: The Hydrogen Atom
	Midterm 2 (Material from Quiz 3 and 4)
13	Electronic Spin
	Quiz 5 on Lectures 12 and 13
14	Approximation Methods
15	Forming Bonds and Molecular Orbitals
16	Visualising Molecular Orbitals
	Quiz 6 on Lectures 14 -16
17	Hybridized Orbitals
	Midterm 3 (Material from Quiz 5 and 6)
18	Nuclear Magnetic Resonance
19	Electronic Transitions and Photochemistry
	Quiz 7 on Lectures 17 - 19
20	Final Exam Review
	Final Exam