CALIFORNIA STATE UNIVERSITY
FULLERTON

College of Natural Science and Mathematics

Department of Chemistry and Biochemistry

CHEM 361B – Introduction to Physical Chemistry

Synchronous Lecture Information: Tu/Th 10:00 am – 11:15am
MH-513

Instructor: Dr. Michael Groves

Office: MH-582G (Student hours will be held in MH534)

E-mail: mgroves@fullerton.edu

Phone: (657)278-7018

Student hours in MH534 and on Zoom (873 6125 9170):

Mo 1:30pm – 2:30pm; We 11am-12pm; Fr 2:30pm-3pm (Zoom only)

Technical support: (657)278-8888

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
Preparation Assignments	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 Score	-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 (September 6th, September 15th, September 29th, October 13th, October 27th, November 10th, and December 6th). 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 (September 22th, October 20th, and November 17th). 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 for Tuesday, December 13th from 9:00am to 10:50am in MH513. I plan on incorporating at least one strong question submitted to PeerWise.

COURSE COMMUNICATION

All course announcements are sent through Canvas, which only uses CSUF email accounts. Therefore, you MUST check your CSUF email on a regular for the duration of the course. If you would like help regarding course content, post a relevant question to the discussion board on Canvas. This is so that all relevant discussions can benefit the entire class. I will make every effort to respond to your communications within 24 hours of being received. However, in order to promote pro-active preparation, I reserve the right to not answer last-minute communications. Students should also feel free to post constructive responses to their peers.

For other matters, email is the most effective way to reach me. When composing an email, please write CHEM 361B, followed by a brief description of the email. Also, before sending the email, please proofread it for grammar and tone. Our conversations should be respectful and professional. I will not respond to poorly worded emails. If I think that your query should be posted to the discussion board, I will direct you to pose the question there.

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.

SI sessions for this class will meet at the following days/times: Tu/Th at 8:30am-9:45am
SI location: MH-049
SI leader for this class: Christopher Bodolian

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.

POLICY ON RETENTION OF STUDENT WORK

Work is submitted through the Canvas course site and Gradescope. It shall be retained there for a reasonable time after the semester is completed.

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 (Titan Aps) 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.

Software for Students

Did you know you can get FREE and low-cost software for being an active CSUF student? Software downloads and request forms can be found on the CSUF Student Software website.

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.

UNIVERSITY INFORMATION

Canvas

As a registered student you are enrolled in the Learning Management System (LMS) Canvas. You may access Canvas for all your classes by clicking on your student portal, found on the CSUF website. There are student resource guides for Canvas . Problems? Contact the student help desk at (657) 278-8888 or email StudentITHelpDesk@fullerton.edu.

Students with Special Needs

Please inform the instructor during the first week of classes about any disability or special needs that you may have that may require specific arrangements related to attending class sessions, carrying out class assignments, or writing papers or examinations. According to California State University policy, students with disabilities must document their disabilities at the Disability Support Services (DSS) Office in order to be accommodated in their courses. Additional information can be found at the DSS website , by calling 657-278-3112 or email dsservices@fullerton.edu.

Academic Dishonesty Policy

Academic dishonesty includes such things cheating, inventing false information or citations, plagiarism, and helping someone else commit an act of academic dishonesty. It usually involves an attempt by a student to show a possession of a level of knowledge or skill, which he/she in fact does not possess. Cheating is defined as the act of obtaining or attempting to obtain credit for work by the use of any dishonest, deceptive, fraudulent, or unauthorized means. Plagiarism is defined as the act of taking the work of another and offering it as one's own without giving credit to that source. An instructor who believes that an act of academic dishonesty has occurred (1) is obligated to discuss the matter with the student(s) involved; (2) should possess reasonable evidence such as documents or personal observation; and (3) may take whatever action (subject to student appeal) he/she deems appropriate, ranging from an oral reprimand to an F in the course. Additional information on this policy is available from University Policy Statement 300.021.

Emergency Preparedness

To be able to respond effectively in an emergency, be sure to note (a) fire alarm pull station locations, (b) evacuation map including the class's outside meeting area, (c) emergency procedures for fire, medical emergency, hazardous materials release, earthquake and dangerous situations, and (d) location of nearest emergency phone. Any person with special needs is encouraged to speak with the instructor privately. All campus personnel are required to participate in all campus-wide drills. More emergency preparedness information can be found at the Classroom Preparedness website. The emergency procedures (c above) that you need to follow in our class are detailed in the classroom guide at the end of this syllabus.

If an emergency disrupts normal campus operations or causes the University to close for a prolonged period of time (more than three days), students are expected to complete the course assignments listed on the syllabus as soon as it is reasonably possible to do so.

Library Support

The Pollak Library has many services to offer students. Assistance available for online students includes online instruction guidelines available on the library website.

University Learning Center

The goal of the University Learning Center is to provide all CSUF students with academic support in an inviting and contemporary environment. The staff of the University Learning Center will assist students with their academic assignments, general study skills, and computer user needs. The ULC staff work with all students from diverse backgrounds in most undergraduate general education courses including those in

science and math; humanities and social sciences; as well as other subjects. They offer one-to-one peer tutoring, online writing review, and many more services. More information can be found on the University Learning Center website.

Writing Center

The Writing Center offers 30-minute, one-on-one peer tutoring sessions and workshops, aimed at providing assistance for all written assignments and student writing concerns. Writing Center services are available to students from all disciplines. Registration and appointment schedules are available at the Writing Center Appointment Scheduling System. Walk-in appointments are also available on a first come, first served basis, to students who have registered online. More information can be found at the Writing Center webpage. The Writing Center is located on the first floor of the Pollak Library their phone number is (657) 278-3650.

COURSE SCHEDULE

Lecture #	Lecture Day	Lecture Topic
1	Tu, Aug 23	Syllabus, Calculus Review, and Complex Numbers
2	Thur, Aug 25	Differential Equations
3	Tu, Aug 30	Quantization: A Scientific Revolution
4	Thur, Sept 1	The First Modern Model of the Atom
	Tu, Sept 6	**Quiz 1 on Lectures 1 - 4**
5	Thur, Sept 8	Probability
6	Tu, Sept 13	The Schrodinger Equation and the Particle in the Box
	Thur, Sept 15	**Quiz 2 on Lectures 5 and 6 (PeerWise Q1 Due)**
7	Tu, Sept 20	Properties of Quantum Mechanical Operators
	Thur, Sept 22	**Midterm 1 (Material from Quiz 1 and 2)**
8	Tu, Sept 27	Finite Potential Well and Tunneling
	Thur, Sept 29	**Quiz 3 on Lectures 7 and 8**
9	Tu, Oct 4	Vibrations in Molecules: The Simple Harmonic Oscillator
10	Thur, Oct 6	Vibrational Spectroscopy
11	Tu, Oct 11	Rotating Molecules: Angular Momentum
	Thur, Oct 13	**Quiz 4 on Lectures 9 - 11 (PeerWise Q2 Due)**
12	Tu, Oct 18	Putting it all Together: The Hydrogen Atom
	Thur, Oct 20	**Midterm 2 (Material from Quiz 3 and 4)**
13	Tu, Oct 25	Electronic Spin
	Thur, Oct 27	**Quiz 5 on Lectures 12 and 13**
14	Tu, Nov 1	Approximation Methods
15	Thur, Nov 3	Forming Bonds and Molecular Orbitals
16	Tu, Nov 8	Visualising Molecular Orbitals
	Thur, Nov 10	**Quiz 6 on Lectures 14 -16 (PeerWise Q3 Due)**
17	Tu, Nov 15	Hybridized Orbitals
	Thur, Nov 17	**Midterm 3 (Material from Quiz 5 and 6)**
	Tu, Nov 22	Fall Recess – No Class
	Thur, Nov 24	Fall Recess – No Class
18	Tu, Nov 29	Nuclear Magnetic Resonance
19	Thur, Dec 1	Electronic Transitions and Photochemistry
	Tu, Dec 6	**Quiz 7 on Lectures 17 - 19**
20	Thur, Dec 8	Final Exam Review (PeerWise Q4 Due)
	Tu, Dec 13	**Final Exam from 9:00am – 10:50am in MH513**

Classroom Emergency Preparedness Guide

Information provided by the University Police Emergency Management Coordinator

EMERGENCY PREPAREDNESS FOR: CHEM 361B INTRODUCTION TO PHYSICAL CHEMISTRY

ON THE FIRST DAY OF EVERY SEMESTER:

- Know the emergency exits and evacuation areas for every classroom.
- Devise "buddy systems" so that everyone is accounted for in an evacuation.
- Evaluate the challenges that you might face during an evacuation and speak with your instructor.
- Add the CSUF Emergency Information number – **877-278-1712** – to your cell phone to hear recorded information regarding campus conditions or closure.
- Personal Preparation website

EMERGENCY COMMUNICATION

Campus emergency communication is done via a voice message, text and/or an email. Go to your Portal to review your contact information. A guide to update your personal information

EVACUATIONS – DRILLS OR REAL

- You may not know if this is a drill or not, so take every call to evacuate seriously.
- Take your personal belongings and immediately leave the building.
- Know where the evacuation area is for every building. A map of all campus evacuation areas
- Re-enter buildings only when directed by Building Marshals or other campus authority.
- Leave the campus only if instructed.

For this class, the closest 2 exits are: The two doors on the south end of the class and then down the west or central staircase outside.

We will meet at: Nutwood Avenue

Earthquake

As soon as you feel shaking, **DROP, COVER and HOLD ON**: Immediately seek shelter (under a desk or table) cover your head and hold on. Evacuate if directed, or you feel it is safe to do so.

Fire

- When you see smoke or fire, immediately evacuate the building.
- If not already activated, pull the fire alarm switch to alert others of the situation.
- Use a fire extinguisher only if you know how to use it and the fire is small.

Shelter in Place or Dangerous Situation

- If directed, or you feel it is best to do so, seek shelter in a room with a lock.
- Turn off the lights and silence all cell phones.
- Hide as best as possible until the all clear signal has been given by authorities.
- If possible, move away from the dangerous situation as fast as you can.
- If you cannot safely hide or escape, be prepared to take action to protect yourself.
- See some helpful videos on sheltering in place

WHEN YOU NEED HELP IMMEDIATELY OR TO REPORT A DANGEROUS SITUATION, CALL 911.

University Police non-emergency line: (657) 278-2515

FOR MORE INFORMATION

Ask your instructor, or go to Campus Preparedness website