

Chemistry 161B.01, Physical Chemistry, Spring 2021

San José State University Department of Chemistry

Course and Contact Information

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| Instructor: | Abraham Wolcott, Ph.D., Assistant Professor of Chemistry |
| Office Location: | Duncan Hall 5A |
| Telephone: | (408)-924-5449 |
| Email: | abraham.wolcott@sjsu.edu |
| Office Hours: | Tuesday and Thursday, 3 – 4pm or by appointment with Prof. Wolcott |
| Class Days/Time: | Tuesdays and Thursdays, 12 – 1:15pm |
| Classroom: | Online due to COVID restrictions |
| Prerequisites: | Chem 55, Phys 50, Math 32, Chem 161A (with grades of “C” or better, “C-“ not accepted) |
| Credit: | 3 units |

Textbooks

Required: “Physical Chemistry, Thermodynamics, Structure and Change”, 10th Edition, Peter Atkins and Julio De Paula, W.H. Freeman and Company (2011). ISBN-10: 1-4292-9019-6.

This is a low-cost class and book purchases/rentals are ~\$30. By keeping this text the cost of the course was reduced from \$200 to \$30. This is in compliance with California bill SB-1359; Low-cost course material bill (The Donahoe Higher Education Act). You are required to have the text and Prof. Wolcott will verify that the text is in your possession. Please provide a receipt.

Not required: “Solutions manual to accompany Physical Chemistry”, 2nd Edition, Charles Trapp and Marshall Cady, W.H. Freeman and Company (2011)

Virtual Reality Headsets and Tablets (SJSU Property)

Virtual reality (VR) headsets that allow VR content to be displayed will be provided free of charge. They will be signed out and you are responsible for their care and safe return. A replacement cost is \$30 for a VR headset. They are provided with a remote control and case. The replacement fee for the remote is \$12 and the case is \$22. The complete set of VR equipment will be returned at the end of the semester. **NOTE: VR content should be viewed while sitting down comfortably in your residence. VR content should be viewed in 10 minute increments.**

Tablets may also be distributed for video production work and will be distributed prior to the assignment being posted on CANVAS. The tablets will also be returned at the end of the semester and a replacement fee is \$85.

Course Web Page (CANVAS)

Copies of the course materials such as this syllabus, assignments, handouts, extra materials and **Kahn Academy style lecturers**, etc. may be found on the course website hosted by Canvas. **We will also be using virtual reality in the class and Canvas will be used to link to instructions and VR assignments.** You are responsible for the material on the course website, so you should either check it daily or set up your profile to notify you when there are changes. **Camtasia will be used to communicate complex topics and complete mathematical derivations for topics in Thermodynamics, Kinetics, Quantum Mechanics and Spectroscopy. The Kahn-academy style videos are posted to Youtube and as video files on Canvas.**

Catalog Course Description

Introduction to the fundamental principles of physical chemistry which includes topics in Quantum mechanics and spectroscopy.

Course Learning Outcomes

The main learning outcomes for CHEM 161B students are as follows:

1. Students will explain and apply the concepts of quantum mechanics and spectroscopy to chemical, physical, and biochemical systems.
2. Students will be able to derive essential mathematical relationships in quantum mechanics, and spectroscopy.
3. Students will apply essential mathematical relationships to chemical, physical, and biochemical problems especially focusing on the electronic structure of atoms, molecules and solids.
4. Wide ranging topics will allow students to apply and extrapolate deep information through the use of the rigid rotor approximation, harmonic oscillator and particle-in-a-box models.

Program Learning Objectives

This course addresses the following [BS/BA Chemistry Program Learning Objectives](#)

1. Demonstrate understanding of core concepts, methods and limits of scientific investigation to effectively solve problems in quantum mechanics.
2. Demonstrate understanding of core concepts, methods and limits of scientific investigation to effectively solve problems in spectroscopy.

Attendance

Attendance will not be taken in lecture, but you are responsible for all announcements and material presented during class. Lecture material will not necessarily reiterate text material. It is a serious mistake either to depend on a classmate's notes or exclusively on the textbook. To succeed in this course it is essential to attend class, perform the readings prior to class and complete the assigned homework. The instructor is not responsible for covering material you missed due to unexcused absences. **There will be no make-up exams and exams are ~80% of your grade!**

Reading

The course schedule indicates the lecture topics and the chapters in Atkins and De Paula that are relevant to these topics for each week. You are expected to read these chapters *before* each lecture. **It is very important to read the material in the text! It may require multiple readings of the text to absorb the concepts and mathematical descriptions.** Not everything in the text will be covered in the lecture. Likewise, some material covered in lecture may not be found in the text. The text is intended to be a primary reference for the material covered in the course.

Homework

Homework problems will be posted to Canvas with problems relevant to the lectures that are important, interesting and challenging. Homework problems will reflect similar questions on the exams. You are encouraged to work with others on homework assignments, but be sure that you are able to solve the problems on your own for exams! Homework keys will be posted on the CHEM 161B Canvas page in a pdf format. Homework problems include both text book problems and the supplemental problems assigned for oral presentations. You will be responsible for any problems in Atkins and De Paula with respect to exams.

It is difficult to learn physical chemistry by simply attending lectures and reading the book (although I highly encourage you do both of these activities!). Lectures are, by their nature a supplement to the text and will help introduce you to the concepts that are necessary for **problem solving**, which is **the key** to learning physical chemistry. Therefore, this requires that you take on the responsibility of working through problems,

both assigned and “unassigned” (at the end of chapters, in other texts, etc.) on your own. You need to spend at least 4-5 hours weekly practicing problems.

Lecture Exams and Final

Some topics have been covered in General Chemistry courses. Review that course materials and exams! Two midterm exams (100 points each), will be given approximately every fourth week. Dates for the exams are on the course schedule (On this greensheet/syllabus below and on Canvas). There will be no make-ups for lecture exams. Should you miss an exam because of illness or equally compelling reasons, you should inform me of the fact as soon as possible, and hopefully before the exam is given. You can do so via e-mail. You will need to provide me with written evidence (doctor’s note, police report, etc.) for your absence. If I accept your excuse, I will use the score on the final as your missing exam score. An unexplained or unsatisfactory excuse for missing an exam will result in a grade of zero.

Grading

Your performance in the course will be evaluated as follows:

| | | |
|--------------------------------|----------------|---------------|
| Homework Problem sets | 75 pts. | |
| On-line quizzes and VR content | 50 pts. | |
| 2 Midterm Exams | 200 pts. | 100 pts. Each |
| Final Exam | 150 pts. | |
| Extra credit assignments | 25 pts. | |
| Total | 500pts. | |

NOTE: Grading points are subject to change and the instructor will explain any changes that are implemented.

Failure to take the final will result in a failing grade (F) for the course. The following scale indicates the letter grade has a function of the percentage of points received per student. I reserve the right to adjust the scale downward if conditions warrant, but will not raise the minimum required for any particular grade. **Grade percentages are rounded to nearest whole number based on standard rounding practices.**

A: >93% **A-:** 88-92% **B+:** 84-87% **B:** 79-83% **B-:** 75-78%
C+: 69-74% **C:** 65-68% **C-:** 60-64% **D:** 51-59% **F:** <50%

For example, Fela received 85.4% of points and rounded to 85% is a B+. Nina received 92.7% of points that rounded to 93% and received an A.

Emergencies and Building Evacuations

If you hear a continuously sounding alarm, or are told to evacuate the building by an Emergency Coordinator, walk quickly to the nearest exit. Take your personal belongings as you may not be allowed to return. Follow the instructions of the Emergency Coordinators. Be quiet so you can hear instructions. Once outside, move away from the building. Do not return to the building unless the Police or the Emergency Coordinator announces that this is permissible.

Library Liaison

Yen Tran, yen.tran@sjsu.edu

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](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars webpage](http://www.sjsu.edu/provost/services/academic_calendars/) at http://www.sjsu.edu/provost/services/academic_calendars/. The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/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](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

University Policies

Academic integrity

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The University Academic Integrity Policy S15-7 (<http://www.sjsu.edu/studentconduct/policies/>) requires you to be honest in all your academic course work. Executive order 1098 also outlines student conduct and honesty policies and can be found on the student conduct website. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://www.sjsu.edu/studentconduct/) is available at <http://www.sjsu.edu/studentconduct/>.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. Any text, diagram, chart or data that is not the product of the student author must cite a reference for the source as appropriate. This includes (but is not limited to) material taken from reference books, tables, primary research literature, laboratory manuals and computer programs. Failure to adhere to the principles that protect the academic integrity of this course will be dealt with according to the policies and

procedures of the Department of Chemistry, the College of Science and San Jose State University.

Workload

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in [University Policy S12-3](http://www.sjsu.edu/senate/docs/S12-3.pdf) at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

Class Attendance

NOTE that [University policy F69-24](http://www.sjsu.edu/senate/docs/F69-24.pdf) at <http://www.sjsu.edu/senate/docs/F69-24.pdf> states that “Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading.”

Consent for Recording of Class and Public Sharing of Instructor Material

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor’s permission to record the course and the following items to be included in the syllabus:

- “Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor’s permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.”
 - It is suggested that the greensheet include the instructor’s process for granting permission, whether in writing or orally and whether for the whole semester or on a class by class basis.
 - In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- “Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent.”

General Expectations, Rights and Responsibilities of the Student

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](http://www.sjsu.edu/senate/docs/S90-5.pdf) 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.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. [Presidential Directive 97-03](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the [Accessible Education Center](http://www.sjsu.edu/aec) (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.

Note from Dr. Wolcott: This ensures protection of privacy as well as allows for adequate accommodations to be provided in cases where they are necessary. Assignments missed due to disabilities or other special concerns will not be accepted except as requested by the AEC.

SJSU Peer Connections

Peer Connections, a campus-wide resource for mentoring and tutoring, strives to inspire students to develop their potential as independent learners while they learn to successfully navigate through their university experience. You are encouraged to take advantage of their services which include course-content based tutoring, enhanced study and time management skills, enhanced critical thinking strategies, decision making and problem-solving abilities, and campus resource referrals.

In addition to offering small group, individual, and drop-in tutoring for a number of undergraduate courses, consultation with mentors is available on a drop-in or by appointment basis. Workshops are offered on a wide variety of topics including preparing for the Writing Skills Test (WST), improving your learning and memory, alleviating procrastination, surviving your first semester at SJSU, and other related topics. A computer lab and study space are also available for student use in Room 600 of Student Services Center (SSC).

Peer Connections is located in three locations: SSC, Room 600 (10th Street Garage on the corner of 10th and San Fernando Street), at the 1st floor entrance of Clark Hall, and in the Living Learning Center (LLC) in Campus Village Housing Building B. Visit [Peer Connections website](http://peerconnections.sjsu.edu) at <http://peerconnections.sjsu.edu> for more information.

Course Schedule

The following schedule of lecture topics is tentative and subject to change at the instructor's discretion. **(Exam dates are not tentative and should be noted in your calendar immediately.)** Readings should be completed **before** the lecture.

| Week | Date | Readings from Atkins and De Paula, Topics for Lectures, Exams |
|------|-----------|-----------------------------------------------------------------------------------------------------------------|
| 1 | Thu. 1/28 | Classical Mechanics and Introduction to Quantum |
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| 2 | Tue. 2/2 | Chapter 7A/7B. Introduction to quantum theory |
| | Thu. 2/4 | |
| | | |
| 3 | Tue. 2/9 | Chapter 7C. The principles of quantum theory Chapter 8A. Translation (Particle-In-A-Box) |
| | Thu. 2/11 | |
| | | |
| 4 | Tue. 2/16 | Chapter 8A. Translation (Particle-In-A-Box) Chapter 8B. Vibrational Motion (Harmonic Oscillator) |
| | Thu. 2/18 | |
| | | |
| 5 | Tue. 2/23 | Chapter 8C. Rotational Motion (Rigid Rotor) |
| | Thu. 2/25 | Chapter 9A. Hydrogenic Atoms |
| | | |
| 6 | Tue. 3/2 | Chapter 9A. Hydrogenic Atoms Chapter 9B. Many-electron atoms |
| | Thu. 3/4 | |
| | | |
| 7 | Tue. 3/9 | Chapter 9C. Atomic Spectra Midterm Exam #1 |
| | Thu. 3/11 | |
| | | |
| 8 | Tue. 3/16 | Chapter 10A. Valence Bond Theory (VB Theory) Chapter 10B. Principles of molecular orbital Theory (MO Theory) |
| | Thu. 3/18 | |
| | | |
| 9 | Tue. 3/23 | Chapter 10C. Homonuclear diatomic molecules |
| | Thu. 3/25 | Chapter 10D. Heteronuclear diatomic molecules |
| | | |
| 10 | Tue. 3/30 | Spring Break Spring Break |

| Week | Date | Readings from Atkins and De Paula, Topics for Lectures, Exams |
|------|------------------|----------------------------------------------------------------------------------------------------------|
| | Thu. 4/1 | Spring Break Spring Break |
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| 11 | Tue. 4/6 | Chapter 10E. Polyatomic molecules |
| | Thu. 4/8 | Chapter 11A. Symmetry elements |
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| 12 | Tue. 4/13 | Chapter 11B. Group theory Chapter 11C. Applications of symmetry |
| | Thu. 4/15 | |
| | | |
| 13 | Tue. 4/20 | Midterm #2 Chapter 12A/B. General features of molecular spectroscopy and Molecular Rotation |
| | Thu. 4/22 | |
| | | |
| 14 | Tue. 4/27 | Chapter 12C. Rotational Spectroscopy |
| | Thu. 4/29 | Chapter 12D. Vibrational spectroscopy of diatomic molecules |
| | | |
| 15 | Tue. 5/4 | Chapter 12E. Vibrational spectroscopy of polyatomic molecules Chapter 13A. Electronic Transitions |
| | Thu. 5/6 | |
| | | |
| 16 | Tue. 5/11 | Chapter 13B. Electronic Transitions |
| | Thu. 5/13 | Chapter 13C. Lasers |
| | Mon. 5/17 | Last Day of Class for Spring 2020 |
| 17 | Tue. 5/18 | Final Exam Review |
| | Fri. 5/21 | Final Exam: 9:45am – 12pm |

Important Dates

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|---------------------------|--------------------------------|
| February 8 th | Last day to drop without a "W" |
| February 15 th | Last day to add classes |
| May 17 th | Last day of instruction |
| May 18 th | Study day |
| May 21 st | Final Examination |

Disclaimer

This document is subject to change with fair notice.