

**Physical Chemistry II
Chemistry 342, Section 1
Spring 2021**

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Lecture Schedule: MWF 9:00-9:50, RSS 252

Due to the unpredictable nature of this semester resulting from the COVID-19 pandemic, the syllabus is subject to change by the instructor.

Textbook & Recommended Materials

*A textbook is not required for this course. However, if you would like to purchase a textbook (I would recommend a used copy or older edition) there are several good: (1) *Physical Chemistry: Thermodynamics, Structure, and Change*, 10th Ed., (Atkins and DePaula), (2) *Thermodynamics, Statistical Thermodynamics, & Kinetics*, 2nd Ed. (Engel and Reid), (3) *Quantum Chemistry*, D.A. McQuarrie. Dr. Boucher highly recommends you get a copy of a mathematical handbook of formulas and integral tables, e.g., *Schaum's Outlines: Mathematical Handbook of Formulas and Tables*, M.R. Spiegel and John Liu, or a similar reference*

Course Description

Second semester of a one-year physical chemistry sequence, the basic principles of chemistry are treated primarily from a theoretical viewpoint. Emphasis on introductory quantum mechanics, atomic structure, molecular bonding and structure and spectroscopy. Statistical thermodynamics of gaseous systems may be introduced. Uses multivariable calculus, differential equations and some linear algebra. Lectures three hours per week. *Prerequisites:* CHEM 221 and MATH 220; MATH 221 is strongly recommended. *Co-requisite:* CHEM 342L

Office Hours

Dr. Boucher will be available for office hours MWF (10-11 am) and T and TR (11-12). During online instruction these office hours will be held via Zoom. If you would like a one-on-one Zoom help session, please e-mail Dr. Boucher to reserve a block of time during the office hours. If you have a problem attending one of the regular office hour period Additional appointments can be made outside regular

Course Webpages

All important information regarding this course, e.g., exam dates, assignment due dates, etc., will be available on the OAKS webpage. This information includes all announcements and postings, lecture schedule and suggested reading assignments, lecture notes, exam answer keys, handouts. We will also make extensive use of the *discussion board* and *dropbox* features on OAKS to, respectively, openly discuss course content and submit written assignments, e.g., exams, quizzes, and problem sets.

Messages

Technical issues: If you experience technical issues (unable to access material, quiz not opening, etc.) notify Dr. Boucher by using the “Technical Issues” *discussion board within the course OAKS page*. If you have insight into resolving a technical issue that another student posted in this board, you are encouraged to respond to the post on the discussion board and help out your classmate!

Course content: If you have questions about course content or a particular assignment (further clarification on assignment directions) you should post your question in the *OAKS discussion board* related to that content module, which are listed on the last page of this syllabus.

Other: All other comments or concerns regarding the course or personal needs should be directed to Dr. Boucher through email (boucherds@cofc.edu) or by making an appointment to virtually meet using Zoom.

Dr. Boucher will respond within 24 hours to e-mails and discussion board posts sent Monday-Friday, and within 48 hours to discussion board posts and e-mails sent on Saturday or Sunday.

Assignment Submission Policy

All assignments, e.g., problem sets, quizzes, exams, etc., should be submitted as a pdf using the Dropbox on the course OAKS page. All assignments are to be completed and turned in on time. Late assignments will result in a reduced grade of 10% for each day late. Notify Dr. Boucher immediately via e-mail if you are having technical difficulties.

Please note, computer failure or unavailability does not constitute an excuse for not completing assignments by the due date. It is your responsibility to ensure you have internet access required to successfully complete this course. This may require you to be creative in cases where your original plan for network access falls through (ie. go to a library, coffee shop, etc. if your internet goes out at home).

Due dates are subject to change; students will be notified via e-mail and the OAKS announcement board.

Students are encouraged to subscribe in OAKS to receive notifications about updates. To subscribe, select the down arrow next to the “news” header on the course home page. Then select the types and methods of notifications you wish to receive. This notification system will greatly improve your ability to stay informed of course-related happenings.

Logistics and Continuity of Learning

Due to social distancing requirements, this class will include a variety of online and technology enhanced components to reinforce continuity of learning for all enrolled students. Before the drop/add deadline, students should decide whether the course plan on the syllabus matches their own circumstances.

A majority of the lectures will be presented in Powerpoint format. The lecture notes and Powerpoint presentation will be posted on OAKS. This practice is intended to free your hands and minds to concentrate on the material during the lectures. This practice is also intended to encourage questions as you will not have to worry about writing down everything written on the board. Course handouts, lecture notes, homework sets, and homework solutions will be available on the OAKS course website.

All class sessions will be recorded via both voice and video recording. By attending and remaining in this class, the student consents to being recorded. Recorded class sessions are for instructional use only and may not be shared with anyone who is not enrolled in the class

Because of the reliance of online course content there are a few critical elements required to effectively participate in the course.

Hardware requirements:

- Computer with high speed internet access, sound card, microphone and external speakers or headphones.
- Webcam for class participation.

Software requirements:

- Consistent and reliable access to high speed internet.
- Adobe Acrobat Reader to view assigned readings.

Student Resources:

- The College of Charleston has put together an online resource guide for students enrolled in a distance education course. I recommend you take a look at the following link to view some helpful strategies and resources for successfully navigating this online course:

<https://academicaffairs.cofc.edu/distance-education/index.php>

Some Comments

Physical chemistry sometimes has an intimidating reputation. This is partly because it requires you to think about chemistry in new ways. In organic chemistry you were able to use powerful symbolic ways of thinking about how molecules behave to qualitatively understand molecular behavior in synthetic chemistry. In physical chemistry we use the language of mathematics to quantitatively calibrate the intuition you have developed thus far in your career as a chemist. During this semester we will learn to use the powerful tools of quantum chemistry, group theory, and spectroscopy. As when learning any new language or skill, the key to success in physical chemistry is practice. You can study rules of grammar for years on end, but you will not be able to carry on a conversation unless you actually practice talking to people. In physical chemistry you can gain general familiarity with physical concepts like energy, entropy, and chemical potential, but *unless you practice working problems you will not be able to use your familiarity with these concepts to your advantage*. The goal of this class is neither to develop vague familiarity with trendy concepts like entropy nor to mindlessly plug numbers into formulas until you get a number that agrees with the answer key. Rather, the goal of this course is to gain a solid knowledge of the physical basis of chemical phenomena and to turn that knowledge into a tool for doing chemistry. In short, you need to attend the lectures, read a book to improve and clarify your understanding of the material in the lecture (and the lab), AND do the assigned problems.

This course is demanding; we will cover a large amount of material this semester. You must spend enough time to keep up with the lectures. If you fall behind it will be very hard to catch up because topics are interconnected. You will not be able to study for this class the night before an exam and expect to do well.

Physical Chemistry and the Curriculum

This course should help you meet several of the College's curricular goals. The primary goal is to introduce you to modern chemical theory. By the time you are finished you should have a better idea of how physical chemistry, particularly quantum chemistry, is different from other areas of chemistry. Physical chemistry operates at the interfaces between chemistry, physics and mathematics. We will use many ideas from physics and mathematics to explore chemical systems so you can see how chemistry is related to other

scientific fields. Physical chemistry's role in the chemistry curriculum is to provide you with a strong physical basis for understanding ideas that chemists use every day. In addition, learning to use advanced quantum mechanical theories is extremely good practice at solving difficult and unfamiliar problems as well as thinking analytically, critically and creatively.

Learning Outcomes

Physical chemistry provides you with an opportunity to do lots and lots of quantitative reasoning, and at the end of Chemistry 342 you should be able to use the tools of mathematics and physics to solve problems in chemistry and biochemistry. If someone poses a question about the physical basis of some chemical phenomenon, you should be able to apply your knowledge of physical chemistry to suggest the appropriate theory or model to apply, be able to do the calculations necessary to apply the model and explain what you have done clearly and coherently so the person who asked the question has confidence that you know what it is you are doing. It would also be nice if, along the way, you gain some appreciation for the underlying beauty of the physical world. However, progress on this goal is hard for me to assess, so I'll leave it up to you to decide how you are coming along.

Listed below are the broad learning outcomes for Chemistry 342:

1. Define the postulates of quantum mechanics
2. Apply the principles of quantum mechanics to atomic and molecular structure and spectroscopy.
3. Set up and solve fundamental quantum mechanical problems, e.g. particle in a box, rigid rotor.
4. Apply the basics of group theory to molecular symmetry, structure and spectroscopy.

Attendance Policy and Online Conduct ("Netiquette")

Although the instructor will not be keeping a record of attendance, students are expected to attend all classes. If in-person classes are suspended, faculty will announce to their students a detailed plan for a change in modality to ensure the continuity of learning. All students must have access to a computer equipped with a web camera, microphone, and Internet access. Resources are available to provide students with these essential tools

In order to foster a cordial and secure learning environment, please be respectful of your instructor and your classmates. Do not obstruct or disrupt the teaching and learning processes by carrying on conversations on your cell phone or with other students in the class using the chat feature on Zoom. Please keep your microphone muted unless you would like to engage in the lecture or ask a questions. Additionally, due to the online environment of this course, we should all strive to meet the some of the basic standards of "netiquette", which is network etiquette, i.e., the do's and don'ts of online communication.

Netiquette: What to Do

- **Be professional:** Use positive, polite language in your comments about a topic and other people's comments, both in lecture and on the discussion board.
- **Be polite:** Avoid taking the conversation away from the course content.
- **Be a referrer:** When making a comment, be sure to refer to the lecture text (e.g., "On slide #15..."), the professor's video lecture (e.g., "At the 4:10 mark of video lecture #10..."), or other course materials.

- **Be clear:** Remember that you are not in the room with your classmates. Any information you want to express needs to be self-evident, particularly on the discussion board.
- **Be a reader first, then a responder:** Before you respond, read the other comments on a discussion board first. If someone else made the point you wanted to make, you can agree with them and elaborate further, expand the idea, take in a different direction, or come up with a different approach altogether.

Netiquette: What Not to Do

- **Avoid sarcasm:** It's difficult to detect online. Remember that you are relying on your words to show the tone you intend. If in doubt. Leave it out.
- **Avoid yelling:** ALL CAPS LOOKS LIKE YELLING. As does a lot of punctuation!!!!????? Just as you wouldn't shout during a classroom discussion, avoid shouting in an online discussion.
- **Avoid unprofessional language:** This includes avoiding texting shorthand, e.g UR, NP, AF. Also, check your spelling and grammar, and be patient with other's spelling and grammar.
- **Avoid posting when angry:** If a post or feedback upsets you, take a breath before responding. Re-read your responses carefully before finally posting them. If you aren't sure, wait a few minutes and then re-read. Once you've posted a comment or sent an e-mail their impact cannot be undone (even if the post itself is deleted).
- **Avoid overly long posts:** As the number of posts on a discussion board increases as the week goes on, it's easier for everyone to participate if posts are clear and to the point so that everyone's posts can be read in a timely manner.

To avoid the dreaded "timed out" issue that makes posts go "poof", consider creating your responses using word processing or text editing software first, and then copying and pasting your comment into the discussion.

Exams/ Problem Sets

There will be no in-class examinations in this course. Instead, there will be approximately seven problem sets assigned throughout the semester, one every two weeks or so, and most of your course grade (70%) will be based on these problem sets. Absences or an inability to complete the problem set on time should be arranged in advance when possible and students should contact the instructor as soon as possible regarding scheduling conflicts. If you miss a problem set due to illness, you and your instructor will meet to discuss if there is a reasonable accommodation for making up the assignment. ***Problem sets must be submitted as a single pdf in the dropbox on the course OAKS page. Late assignments will not be accepted.***

Final Exam: A mandatory, comprehensive final exam worth 30% of your total grade will be administered **8–10 am on Friday, April 23rd.**

Grading and Assessment

Your final grade will be based on the following distribution,

70% Problem Sets
30% Comprehensive Final Exam

Graded exams and problem sets will be returned using the "Feedback" feature in the OAKS dropbox.

Letter grades will be assigned based on straight grading scale shown in the table below.

Score/%	Grade
≥75	A
71-74	A-
61-70	B+
63-66	B
59-62	B-
55-58	C+
51-54	C
47-50	C-
43-46	D+
39-42	D
35-38	D-
< 35	F

The instructor reserves the right to increase a student's grade if the instructor feels that it is warranted. Periodically you will be made aware of your class standing so that you can assess your progress and to help you avoid any surprises at the end of the semester.

Important Dates

DATE	DESCRIPTION
Monday, January 11	<i>Classes begin</i>
Monday, January 18	<i>MLK Day (No Classes)</i>
Tuesday, January 19	<i>Last day to drop or submit a request for pass/not Pass option</i>
Tues & Wed, March 2-3	<i>Review/Study Days (No Classes)</i>
Monday, March 8	<i>Midterm grades available</i>
Monday, March 22	<i>Last day to withdraw with a grade of "W"</i>
Monday, April 19	<i>Last day of classes</i>
Friday, April 23	<i>FINAL EXAM: 8-10 AM via OAKS</i>
Tuesday, May 4	<i>Final Grades Available Online</i>

Disabilities/Access

The College will make reasonable accommodations for persons with documented disabilities. Students should apply for services at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104. Any student eligible for and needing accommodations because of a disability is requested to speak with the professor during the first two weeks of class or as soon as the student has been approved for services so that reasonable accommodations can be arranged.

Student Code of Conduct

The Honor Code of the College of Charleston forbids lying, cheating, stealing, plagiarism, and failing to report an Honor Code violation. The Student Code of Conduct can be found in the Student Handbook.

The problem sets are to be treated as exams, and you are expected to work on the problem sets on your own.

Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when identified, are investigated. Each incident will be examined to determine the degree of deception involved. Incidents where the instructor determines the student's actions are related more to a misunderstanding will be handled by the instructor. A written intervention designed to help prevent the student from repeating the error will be given to the student. The intervention, submitted by form and signed both by the instructor and the student, will be forwarded to the Dean of Students and placed in the student's file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XF in the course, indicating failure of the course due to academic dishonesty. This grade will appear on the student's transcript for two years after which the student may petition for the X to be expunged. The student may also be placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board.

Students should be aware that unauthorized collaboration--working together without permission-- is a form of cheating. Unless the instructor specifies that students can work together on an assignment, quiz and/or test, no collaboration during the completion of the assignment is permitted. Other forms of cheating include possessing or using an unauthorized study aid (which could include accessing information via a cell phone or computer), copying from others' exams, fabricating data, and giving unauthorized assistance.

Research conducted and/or papers written for other classes cannot be used in whole or in part for any assignment in this class without obtaining prior permission from the instructor.

Students can find the complete Honor Code and all related processes in the Student Handbook at <http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php>

Statement on Religious Accommodation for Students

([Faculty/Administration Manual VIII.A.10](#))

The College of Charleston community is enriched by students of many faiths that have various religious observances, practices, and beliefs. We value student rights and freedoms, including the right of each student to adhere to individual systems of religion. The College prohibits discrimination against any student because of such student's religious belief or any absence thereof.

The College acknowledges that religious practices differ from tradition to tradition and that the demands of religious observances in some traditions may cause conflicts with student schedules. In affirming this diversity, like many other colleges and universities, the College supports the concept of "reasonable accommodation for religious observance" in regard to class attendance, and the scheduling of examinations and other academic work requirements, unless the accommodation would create an undue hardship on the College. Faculty are required, as part of their responsibility to students and the College, to ascribe to this policy and to ensure its fair and full implementation.

The accommodation request imposes responsibilities and obligations on both the individual requesting the accommodation and the College. Faculty members are expected to reasonably accommodate individual religious practices. Examples of reasonable accommodations for student absences might include: rescheduling of an exam or giving a make-up exam for the student in question; altering the time of a student's presentation; allowing extra-credit assignments to substitute for missed class work or arranging for an increased flexibility in assignment dates. Regardless of any accommodation that may be granted, students are responsible for satisfying all academic objectives, requirements and prerequisites as defined by the instructor and by the College.

2020 – 2021 Religious Holidays¹

Date	Holiday	Religion
September 18 2020	Rosh Hashanah ²	Jewish
September 28, 2020	Yom Kippur ²	Jewish
October 2 – October 9, 2020	Sukkot ²	Jewish
October 9, 2020	Shemini Atzeret ²	Jewish
October 19 - October 26, 2020	Navaratri	Hindu
October 19, 2020	Birth of Baha'u'llah	Baha'i
January 7, 2021	Christmas ³	Orthodox Christian
February 17, 2021	Ash Wednesday (Beginning of Lent)	Christian
February 25-26, 2021	Purim ²	Jewish
March 15, 2021	Great Lent Begins	Christian
March 20, 2021	Naw-Ruz	Baha'i
April 2, 2021	Good Friday	Christian
March 26 - April 3, 2021	Passover ²	Jewish
April 12-May 11, 2021	Ramadan	Muslim
April 30, 2021	Good Friday (Orthodox) ³	Orthodox Christian
April 20 and 28, 2021	Ridvan	Baha'i

¹ The previously included Islamic holidays of Eid al-Adha and Eid al-Fitr fall outside the regular academic year and are therefore not listed here.

² All Jewish holidays begin at sunset on the evening before the date given.

³ Orthodox Christian holidays begin at sunset on the evening before the date given.