THE OHIO STATE UNIVERSITY

CHEMISTRY 4200 – Physical Chemistry for Chemical Science I
Fall 2026

Lecture: 3 x 55 min, time and location TBD

Recitation: 55 min, time and location TBD
3 credit hours

Prerequisites:

- CHEM 2210, 2510, 2610, 2910H or equivalent
- PHYS 1201 or 1251
- MATH 1152 or 1172
- Not open to students with credit for CHEM 4300 or BIOCHEM 5721

Course overview

Instructor

Course Instructor: Dr. XXX

Instructor credentials: Professor of Chemistry and Biochemistry

Email address: xxx@osu.edu

Phone number: xxx-xxx-xxxx

Office hours: TBD

Course description

This course will cover quantum mechanics and spectroscopy, beginning with an overview of classical mechanics and the historical origins of quantum theory. Basic quantum mechanics problems including the particle in a box, rigid rotor, harmonic oscillator, and hydrogen atom will be discussed, leading to a description of chemical bonding and modern computational molecular orbital theory (Hartree-Fock theory).

Course learning outcomes

By the end of this course, students should successfully be able to demonstrate:

- a qualitative understanding for how the postulates of quantum mechanics modify classical mechanics;
- the ability to compute properties from quantum-mechanical wave functions;
- general knowledge of molecular spectroscopy (vibrational, rotational, and NMR);
- an understanding of the origins and applications of molecular orbital theory for explaining chemical bonding

Course materials and technologies

Textbook

Required

- *Physical Chemistry*, 4th edition (2018), Thomas Engel and Philip Reid (Pearson).
- The eText is available through Carmenbooks ($39.99 per semester)

Course technology

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at https://it.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** https://it.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

Carmen access

You will need to use BuckeyePass multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions.
- Download the Duo Mobile application to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

Grading and faculty response

How your grade is calculated

ASSIGNMENT CATEGORY	POINTS
Midterm exams (3)	20 each (each exam is 20% of total course grade)
Weekly problem sets (14); scores will be averaged and scaled to a total of 10 points	10 (10% of total course grade)
Recitation quizzes (10); lowest two quiz scores will be dropped. Scores will be averaged and scaled to a total of 10 points	10 (10% of total course grade)
Final Exam (1) Cumulative covering all course topics	20 (20% of total course grade)
Note: Although homework and quizzes make a relatively small contribution to the overall grade, they are important for keeping you on track in this course. *Don't neglect the problem sets, and study your notes in advance of the quizzes!*	
Total	**100**

See course schedule below for due dates.

Late assignments

Late submissions will not be accepted. Please refer to Carmen for due dates.

Grading scale

According to the University rule 3335-8-24, students should expect to spend approximately 5 hours per week outside of class, in addition to the 4 hours of in-class instructional time (including recitation) to earn the average grade of "C" in this course.

The following grade scheme is expected to apply to your work in this course. This grade scheme may be adjusted in the student's favor, depending on class performance.

P = total points earned (out of 100) according to the grade calculation described above.

A	$P \geq 95$	**C**	$70 > P \geq 65$
A–	$95 > P \geq 90$	**C–**	$65 > P \geq 60$
B+	$90 > P \geq 85$	**D+**	$60 > P \geq 55$
B	$85 > P \geq 80$	**D**	$55 > P \geq 50$
B–	$80 > P \geq 75$	**E**	$P < 50$
C+	$75 > P \geq 70$		

Instructor feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

- **Grading and feedback:** For large weekly assignments, you can generally expect feedback within **7 days**.
- **Email:** I will reply to emails within **24 hours on days when class is in session at the university**.

Absence and Closing Policies

Absences

Lecture attendance is strongly encouraged and tends to correlate with higher grades. However, attendance will not be tracked and there is no need to notify the instructor if you will be absent. Students will be encouraged to obtain lecture notes from peers in the case of an unplanned absence.

Recitation attendance is required to complete weekly quizzes and exams.

If you experience injury, illness, or other emergency situation that will impact your ability to attend recitation or an exam, please contact the course instructor directly as soon as possible (and no later than the scheduled exam start time) to make alternative arrangements for taking the exam after providing appropriate documentation.

Faith-related Absences

In accordance with Ohio State policy, you may be absent from this class for **up to three days** to observe sincerely held religious beliefs and practices, or to participate in organized activities conducted under the auspices of a religious or spiritual organization. To request a faith-related absence in this course, you must notify me in writing no later than **Monday, January 26**. Please refer to the Syllabus statement on Religious Accommodations linked below for more details.

Weather or other short-term closing

Following **Policy 6.15** (Weather or Other Short-Term Closing):

Should in-person classes be canceled, I will notify you as to which alternative methods of teaching will be offered to ensure continuity of instruction for this class. Communication will be via Carmen.

Course schedule

Please pay attention to Carmen for up-to-date information about due dates and topics that will be covered. **Changes to due dates sometimes occur, but these will always be announced both in class and on Carmen.** You are responsible for knowing about any date changes, and dates listed on Carmen are correct, in the case of any discrepancy.

Week	Dates	Topics, Readings, Assignments, Deadlines
1		**Historical origins of quantum theory** Reading: Ch. 1 Recitation: No Quiz Problem Set 1 due: Friday at the start of class
2		**Postulates and fundamentals of quantum mechanics** Reading: Chs. 2–3 Recitation: Quiz on **Historical origins of quantum theory** Problem Set 2 due: Friday at the start of class
3		**Particle in a box and elementary wave mechanics** Reading: Chs. 4–5 Recitation: Quiz on **Postulates and fundamentals of quantum mechanics** Problem Set 3 due: Friday at the start of class
4		**Rigid rotor & harmonic oscillator** Reading: Ch. 7 Recitation: Quiz on **Particle in a box and elementary wave mechanics** Problem Set 4 due: Friday at the start of class
5		**Vibrational & rotational spectroscopy** Reading: Ch. 8 Recitation: **Midterm I** *(covers weeks 1-4)* Problem Set 5 due: Friday at the start of class
6		**Angular momentum & hydrogen atom** Reading: Ch. 9 Recitation: Quiz on **Vibrational & rotational spectroscopy** Problem Set 6 due: Friday at the start of class
7		**Approximation methods** Reading: LibreTexts entry on Perturbation Theory

Week	Dates	Topics, Readings, Assignments, Deadlines
		Recitation: Quiz on **Angular momentum & hydrogen atom** Problem Set 7 due: Friday at the start of class
8		**Many-electron atoms** Reading: Ch. 10–11 Recitation: Quiz on **Approximation methods** Problem Set 8 due: Friday at the start of class
9		**Chemical bonding** Reading: Ch. 12 Recitation: **Midterm II** *(covers weeks 5-8)* Problem Set 9 due: Friday at the start of class
10		**Molecular orbital theory** Reading: Ch. 13 Recitation: Quiz on **Chemical bonding** Problem Set 10 due: Friday at the start of class
11		**Computational chemistry** Reading: Ch. 15 Recitation: Quiz on **Molecular orbital theory** Problem Set 11 due: Friday at the start of class
12		**Electronic spectroscopy** Reading: Ch. 14 Recitation: Quiz on **Computational chemistry** Problem Set 12 due: Friday at the start of class
13		**Photochemistry & x-ray crystallography** Reading: None Recitation: **Midterm III** *(covers weeks 9-12)* Problem Set 13 due: Friday at the start of class
14		**Magnetic resonance** Reading: Ch. 17 Recitation: Quiz on **Photochemistry & x-ray crystallography** Problem Set 14 due: Friday at the start of class
Finals week		**Final Exam (comprehensive):** will be scheduled according to university exam schedule

Recitation

Recitation is a small-group class designed to give you a space to review and practice what you've covered in lecture.

To earn points for your recitation assignments, you will complete weekly quizzes. Quizzes will be administered at the beginning of recitation, covering material from the prior week. (This includes the weeks following a midterm exam, because we will still have two lectures in those weeks.)

Quizzes will consist largely of short questions covering areas such as definitions, terminology and simple equations. Quizzes are primarily intended for students to keep pace with course material and to review notes prior to attending recitation where these topics will be discussed in more detail.

Quizzes will be timed (5-10 minutes, depending on the nature of each week's questions).

Quizzes are closed-book, closed note and closed internet. Only a calculator (standard non-internet enabled graphing calculator) will be allowed.

Weekly Problem Sets

Weekly problem sets will be distributed electronically on the CarmenCanvas website and should be turned in electronically through a CarmenCanvas dropbox. Please format your solutions as a single PDF document.

Problem sets will be assigned weekly on Monday morning (available at 7am on Carmen) and will be due on Friday by the start of lecture.

Problems will cover each week's assigned topic and will supplement lecture material with experience working through long form more detailed questions that will help prepare students for in-class exams.

These problems should be worked on your own without assistance from others and without the use of AI. (See AI policy at the end of this document.)

Anticipate that a weekly problem set will require 3–4 hours of effort on your part.

Exams

Midterm and Final exams will take place in person during designated class sessions as indicated on the course schedule. Exams will be delivered on paper and will consist of problems from each content area of similar length and format to those used on the weekly problem sets.

Course policies

This course adheres to the University policies related to Academic Misconduct, Artificial Intelligence, Religious Accommodations, Disability Accommodations, Intellectual Diversity, Grievances and Solving Problems, and Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct. For more information about any of these policies, please visit the Office of Undergraduate Education Standard Syllabus Statements webpage.

Counseling and Consultation Services / Mental Health Statement

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing.

If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th floor of the Younkin Success Center and 10th floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614-292-5766 and 24-hour emergency help is also available through the 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

Other course policies

Academic integrity policy

Policies for this course

- **Quizzes and exams**: You must complete the midterm and final exams yourself, without any external help or communication.
- **Weekly Problem Set assignments**: Your written assignments should be your own original work.
- **Reusing past work**: In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it.

GENERATIVE ARTIFICIAL INTELLIGENCE Tools

Policy on the Use of AI: The OSU Committee on Academic Misconduct has provided the following policy on the use of AI in academic courses:

> *All students have important obligations under the Code of Student Conduct to complete all academic and scholarly activities with fairness and honesty. Our professional students also have the responsibility to uphold the professional and ethical standards found in their respective academic honor codes. Specifically, students are not to use "unauthorized assistance in the laboratory, on field work, in scholarship or on a course assignment" unless such assistance has been authorized specifically by the course instructor. In addition, students are not to submit their work without acknowledging any word-for-word use and/or paraphrasing" of writing, ideas or other work that is not your own. These requirements apply to all students — undergraduate, graduate, and professional.*
>
> *To maintain a culture of integrity and respect, these generative AI tools should not be used in the completion of course assignments unless an instructor for a given course specifically authorizes their use. Some instructors may approve of using generative AI tools in the academic setting for specific goals. However, these tools should be used only with the explicit and clear permission of each individual instructor, and then only in the ways allowed by the instructor.*

In accordance with this policy, the use of AI is not permitted in any material that you are to turn in for credit. This primarily pertains to weekly problem sets; you should be capable of working these problems on your own, start-to-finish, with only a calculator. Similar problems are likely to be found on the exams (which are more important to your grade) so unauthorized use of AI is likely to hurt your exam scores if you cannot work the problems unassisted.

Any use of GenAI tools for work in this class may therefore be considered a violation of Ohio State's Academic Integrity(opens in new window) policy and Code of Student Conduct(opens in new window) because the work is not your own. If I suspect that you have used GenAI on an assignment for this course, I will ask you to explain your process for completing the assignment in question. The unauthorized use of GenAI tools will result in referral to the Committee on Academic Misconduct(opens in new window).