

CHM 5210 Bonding and Reactivity

Syllabus for Fall 2026

Instructor: Dr. Steven Pellizzeri
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Office Hours:
Monday 1:00 pm – 2:00 pm.
Tuesday 12:00 pm – 1:00 pm.
Wednesday 1:00 pm – 2:00 pm.
Thursday 12:00 pm – 1:00 pm.
and by appointment at [Book time with Steven Pellizzeri](#)

Meeting Days, Time, and Location: MWF, 2:00 pm - 2:50 pm, PSB 4125

Course Description: A study of theoretical descriptions of molecular bonding and dynamics combined with theoretical and experimental applications of these concepts to specific chemical systems. Credits: 3

General Information: Physical chemistry provides the theoretical foundation for all of the other subdisciplines in chemistry. The topics covered in this course are topics that are integral to modern chemical sciences but are not usually covered in detail in the undergraduate curriculum. Practical applications of current interest will be emphasized. Some of the more introductory topics are covered in CHM 3910 (Chemical Thermodynamics and Kinetics) and CHM 3920 (Quantum Chemistry) but not in the depth to be covered in this course, which will focus on recent developments in physical chemistry.

Office Hours: Although these times noted above are limited, I am available most days until 4:00 pm or later or you can set up an appointment using my schedule at [Book time with Steven Pellizzeri](#). I typically have an open-door policy, i.e., if my door is open, and I am not with other students or faculty/staff members, you are welcome to drop by with questions. If I will be away during my regular office hours, I will let you know ASAP and reschedule an alternative time for that week. Office hours will be conducted in-person, however if you would prefer to meet virtually, please schedule an appointment.

Communication: Relevant class information may be distributed electronically to your EIU e-mail address or through D2L.

Email Policy: The best way to contact me in addition to office hours is via email, I routinely check the course for postings or emails, Monday (9am) – Friday (5pm), and sometimes on the weekend. You can expect a 24-to-48-hour response from me, Monday-Thursday. I will try and respond to all weekend (Friday afternoon to Sunday) emails and postings by noon on Monday or earlier. I will try to answer your email as fast as humanly possible, but don't panic if I don't get back to you right away. I do NOT reply to emails that do not adhere to the following the email protocol; your email to me should be from your eiu.edu account, and contain:

- 1) a proper subject line that includes "CHM5210".
- 2) a greeting or salutation (Hi, Hello, Dear...etc.).
- 3) my name (Dr. Pellizzeri, Prof. Pellizzeri, or Steven will do).
- 4) a concise and coherent message; and
- 5) sign off with your full name.

Pre-requisites and Co-requisites: Prior completion of CHM 3910 and CHM 3920 or equivalent.

Course Materials and Resources

- Atkins' Physical Chemistry, 9th ed. by Atkins and de Paula
- D2L will contain copies of lecture material, supplemental material, exam review materials, and answer keys for exams. Grades will also be posted on D2L.

Equipment

- Scientific or graphing calculator.
 - While a graphing calculator is allowed, they are not required, and this course can be completed using a simply scientific calculator.
- Smart phones, tablets or other communication devices are not acceptable calculators

Course Goals/Learning Objectives

- A thorough understanding of concepts in chemical bonding, kinetics, and reaction dynamics including:
 - Molecular bonding theories including Molecular Orbital Theory and Valence Bond theory and the quantum mechanical foundations of these theories
 - Applications of bonding theories as applied to specific systems such as conjugated molecules, charge transfer complexes, solids, and polymers
 - Potential energy surfaces that serve as a link between a description of bonding in individual molecules and a description of chemical reactions (i.e., the transformation of chemical bonds over time)
 - Chemical kinetics of simple and complex reactions
 - Chemical reaction dynamics, collision theory and transition state theory
 - Traditional and state-of-the-art experimental methods used to study chemical reactions, bonding, and potential energy surfaces
 - Applications of the concepts described in this course to real-world problems such as combustion, atmospheric chemistry, and the design of novel materials

Class Schedule for CHM 5210 Fall 2026

Note: This schedule is tentative and subject to change.

Module	ACTIVITY	Weeks	Readings from Atkins (Sections)
	Introduction to CHM 5210	1	
Module 1	Overview of Quantum Mechanics	1 – 3	7.3 – 7.7, 8.1 – 8.3, 8.6 – 8.8, 9.1, 9.2, 9.4, 9.5, 11.1, 11.2, 11.4, 11.5
Module 2	Molecular Orbital and Valence Bond Theories	4 – 5	10.1 – 10.5, 10.7 – 10.8
Module 3	Applications of Bonding Theories	6 – 7	10.6, 13.3, 17.1 – 17.6, 18.1 – 18.9, 19.1 – 19.12
EXAM 1	Friday October 9		
Module 4	Potential Energy Surfaces	8	22.7, 22.8, 23.3
Module 5	Basic Concepts of Chemical Kinetics	9 – 10	21.1 – 21.10
Module 6	Reaction Dynamics and Theories	10 – 11	20.1 – 20.4, 20.7 – 20.8, 22.1 – 22.8
EXAM 2	Friday November 6		
Module 7	Special Topics in Bonding and Reactivity	12	23.1 – 23.2, 23.4 – 23.7
Module 8	Experimental Methods	13 – 14	
	Student Presentations	15	
FINAL	Wednesday December 16 (2:45 pm)		

Exams: You will be allowed to use a **single-sided 8.5" x 11" handwritten** note sheet on exams, in addition to the equation sheet that I will provide. I do not want to gauge your ability to blindly memorize material and recall it in a stressful situation because it is not relevant to your lives and not what my course is about. Moreover, this note sheet is a good emulation of what you would have available through internet searches, reference books, and similar in your non-exam future as well as a helpful way to study the course material. **This note sheet will need to be turned in with your exam and will be returned with your graded exam.**

Homework: Graded homework will be assigned regularly throughout the semester. Assignments are due by the due date given on each assignment and solutions will be posted on D2L soon after the due date, hence **late papers will not be accepted**. Assignments will be based on material covered in class and from the textbook and are a required part of the course. Assignments will be challenging, while it is extremely useful to complete homework assignments yourself and I recommend relooking through homework at a later date. I recognize that many of you will utilize collaborative efforts to solve the problems. Therefore, you are allowed to work with up to two partners under the signed agreement that (i) you personally made a significant intellectual contribution to solving the problems on this homework assignment and (ii) any other signatories (up to a maximum of 3 in total) also made significant intellectual contributions, so that any shared grade is both meaningful and reflects a joint commitment to the overall intellectual endeavor. In these cases, the grade on the assignment will be the for all parties involved.

Grading Scale: Final grades will be assigned on the following average score range, these ranges are subject to change, however they will never be higher than what is listed:

88 –100% A	77 – 88% B	67 – 77% C	57 – 67% D	0- 57% F
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This average score will be based on the three exams, the final exam), class quizzes, homework and class participation. Course grades will be apportioned as shown below:

- Exams (50-minute exam) (comment 1) 32% (two exams 16 % each)
- Final Exam (2-hour exam) 22%
- Assignments (comment 2) 22%
- Research Paper (comment 3) 14%
- Oral Presentation (comment 3) 10%
- **Total 100%**
- Comment 1: A **single-sided 8.5” x 11” handwritten** note sheet may be used on exams
- Comment 2: There will be various assignments given throughout the semester, and missed assignments not due to an excused absence will receive a grade of zero and no make-up will be administered.

Comment 3: More details will be provided later in the semester.

Help: You may obtain extra help from the following sources:

- Your lecture Instructor: See section syllabus for office hours.
- Form a study group with other students who are taking CHM 5210.

Important Notes

1. Exams 1 & 2 will be given in class on the dates provided on the table on page 2. There will be no rescheduling of exams.
2. All exams should be considered comprehensive; previously covered material may be tested. The Final Exam in CHM 5210 will be cumulative over the entire semester.
3. No makeup exams will be given for any reason. Students who have conflicts with official university functions must notify their instructor and provide a list of travel dates as soon as available. Check your commitments to sports programs, ROTC or other university groups. Pay particular attention to the time of the Final Exam. Students are expected to resolve travel schedule conflicts and attend the Final Exam. If you miss the Final Exam a grade of zero will be recorded.
4. If errors occur with your exam grade, see your instructor within ten days of the exam.
5. Resolve Final Exam scheduling issues before finals week.
6. The last day to drop the course without a final grade is **Friday September 4** and the last day to withdraw from the course with a W is **Friday November 6**.

Make-up Policies

You are responsible for completing each homework assignment by the due date and time. Missed or incomplete homework assignments cannot be made up. Late assignments will only be accepted for a compelling reason. If accepted, a penalty in the form of a point deduction will likely apply. Assignments submitted more than one day after the due date will not be accepted.

For an excused absence on any major exam, the weight for that exam will be applied to the Final Exam (this is the fairest way to handle absences for everyone concerned, including the absent student). Excused absences include documented student illness and family emergencies.

Should you be unable to take the final exam due to an emergency situation, contact your instructor prior to the exam, providing documentation. A make-up will be scheduled, and the student will receive an Incomplete (I) grade in the course. The expectation is that the make-up exam will be completed within thirty days of the beginning of the spring semester.

Use of AI Programs in Research Paper Writing and Oral Presentations

With the advent of ChatGPT in November 2022, alongside other AI systems such as Google Bard, Grammarly, and DALL-E 2, the landscape of artificial intelligence tools has expanded significantly. These tools are poised to become valuable skills for future careers. However, society is still in the process of determining appropriate contexts for their use. It is important to note that work generated by AI may not be deemed original and could be classified as automated plagiarism.

Nonetheless, AI programs like ChatGPT can be utilized to foster idea generation and brainstorming. It is crucial to recognize that AI tools have inherent limitations, such as a lack of critical thinking needed to evaluate and reflect on criteria, and an absence of abductive reasoning required for making judgments with incomplete information. Consequently, content produced by these programs might be inaccurate, incomplete, or problematic.

In today's world, learning to use AI responsibly and ethically is a vital skill. Be mindful of the limitations of conversational, generative AI tools, including ChatGPT and Grammarly. Consider the following guidelines:

Prompt Quality: The output quality is directly linked to the input quality.

Prompt Engineering: Hone your prompts to achieve desirable results.

Verification: Always fact-check AI-generated content against reliable sources, as AI models may confidently present incorrect information.

Disclosure: Acknowledge the use of AI tools in your work. At the end of your assignment, include a paragraph detailing the AI tool used, its application, and the prompts employed. Neglecting this step breaches academic integrity policies.

Appropriate applications of AI in this course encompass:

Refining research questions; Creating draft outlines for papers or projects; Brainstorming and enhancing ideas; Improving grammar, rigor, and writing style; Organizing and summarizing notes.

How to Succeed in Physical Chemistry:

- 1) Come to "class" prepared: Read through the notes from the earlier class as each lecture builds off of each other. During the lecture, actively think about how all the concepts fit together, and how the material covered today relates to what was discussed in the previous class. Be ready to work problems and talk about physical chemistry with your neighbors. Ask questions!
- 2) Study actively: Rework in-class problems at home without having the solutions in front of you. Work and rework the homework problems to prepare yourself for the exams. Read through your class notes and actively thinking about how all of the concepts fit together, why they make sense, and what is confusing to you. Much of physical chemistry is about learning how to problem solve and thinking critically about abstract concepts. In my experience, the best way to build these skills is to actively practice DOING them!
- 3) Form study groups: This is challenging material – don't tackle it alone! I fully encourage everyone to study in groups as so much learning can take place when a group is collectively thinking about and talking through problems!

- 4) Stop and think about the chemistry: There is a lot of math in physical chemistry and it can be easy to get lost in all the equations and lose sight of what it all physically means. As you're working through a problem or trying to understand some equations, stop and think about what scientific concepts are involved and what all of the math tells you about the world around us. If you're unclear, ask me or a fellow student!
- 5) Come to office hours: My goal is to use office hours as an interactive recitation where we can all discuss questions about lecture as well as the upcoming problem set. As such, it will be beneficial to regularly attend office hours.
- 6) Read: After lecture, read through your lecture notes and fill-in any key information you may have missed. Supplement the lecture notes by reading pertinent sections of the required and/or recommended texts.
- 7) Budget your time: Do NOT wait until the night before a problem set is due to start working on it! Study for the exams throughout the semester, not just right before they occur!

Academic Support Center

Students who could use additional help achieving their academic goals are encouraged to contact the Academic Support Center (<https://www.eiu.edu/academicsupportcenter/>). The Academic Support Center provides individual consultations, as well as assistance with time management, test taking, note taking, avoiding procrastination, setting goals, and other skills to support academic achievement. In addition, Academic Alerts may be utilized by faculty to help students who are not making academic progress or are not attending classes regularly get connected with the Academic Support Center and other important resources. To make an appointment, call 217-581-6696, or go to McAfee Gym, Room 2230.

Student Well-Being

EIU is committed to supporting and advancing the mental health and well-being of our students. Students may experience stressors that can impact both their academic experience and their personal mental health and well-being. These may include academic pressure and challenges associated with relationships, anxiety, depression, alcohol or other drugs, identities, and finances. If you are experiencing concerns, seeking help is a courageous thing to do for yourself and those who care about you. A list of available campus resources is available on D2L.

Eastern Illinois University prohibits relationship violence, stalking, sexual assault, sexual harassment, and other forms of sexual misconduct in any of its employment situations or educational programs and activities (see <https://www.eiu.edu/mandatedinformation/assault.php>). It is the responsibility of faculty chairpersons, administrators, and supervisors to inform the appropriate offices about potential instances of sexual harassment. All other faculty and staff are expected to report these incidents as well. Employees who are not required to report include those who work in the Counseling Clinic, and Medical Clinic. Students are encouraged to contact the confidential advisor, located in the Counseling Clinic, who is able to provide support and advocacy, and explore options. A list of available campus resources is available on D2L.

Academic integrity:

Students are expected to maintain principles of academic integrity and conduct as defined in EIU's Code of Conduct <https://www.eiu.edu/deanofstudents/conductcode.php>. Violations will be reported to the Dean of Students. <https://www.eiu.edu/deanofstudents/>

When, in the opinion of a course instructor, there is evidence that a student has committed an act of academic dishonesty, that instructor will make a formal written charge of academic dishonesty to the Judicial Affairs Office.

In this class you are given multiple instances where using outside help/materials are appropriate. This includes group work for homework assignments, and the use of a note sheet on exams. However, there are still clear examples of academic integrity infractions. The use of homework/exam help websites, such as Chegg.com, are extremely prohibited. ***The posting of course material (i.e., lecture slides or homework/exam questions) on these websites is in violation of academic integrity policies as well as copyright policies and will be reported to the Dean of Students, with the suggested penalty of an F in the course.***

Students with disabilities:

If you are a student with a documented disability in need of accommodations to fully participate in this class, please contact the Office of Accessibility and Accommodations. All accommodations must be approved through Office of Accessibility and Accommodations. Please stop by McAfee Gym, Room 1336, or call 217-581-6583 to make an appointment.

Students who receive accommodations are expected to meet with their instructor to discuss necessary accommodations. This meeting should take place during the instructor's office hours as Academic Accommodation Letters are confidential and not to be discussed in a classroom setting. This meeting should be scheduled as early as possible in the semester so that accommodations can be made in a timely manner. It is the student's responsibility to schedule the meeting and ensure that accommodations are adequate. Accommodations will be made no earlier than the date that the AAL received by the instructor; the AAL is not retroactive.

Eastern Illinois University Title IX Statement

It is the policy of Eastern Illinois University that sexual harassment of one member of the campus community by another will not be tolerated. Additionally, sexual harassment is illegal, and may include conduct from one employee toward another or from one student to another. Eastern Illinois University also provides equality of opportunity in education and employment for all students and employees. Discrimination based upon race, color, sex, religion, age, national origin, ancestry, marital status, disability, Vietnam War veteran status, sexual orientation, or any other basis of discrimination precluded by federal and state statutes is strictly prohibited. This policy is located at <https://www.eiu.edu/civil/titleix.php>. For additional information concerning sexual harassment or discrimination, or to file a complaint, contact to the Civil Rights Office at (217) 581-5020.

Copyright Statement

Materials in this course should be treated as copyrighted; these materials are intended for use only by students registered and enrolled in the course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. Materials are provided in compliance with the provisions of the Teach Act.