CHEM 1333: Chemical Reactivity

Spring 2026, 4 credits

Lecture sessions

Lectures are held on Tuesdays and Thursdays in One Discovery Square, Room 360. You must attend your scheduled section.

Section 001	8:00 AM – 9:15 AM
Section 002	9:30 AM – 10:45 AM
Section 003	11:00 AM – 12:15 PM
Section 004	12:45 PM – 2:00 PM
Section 005	4:00 PM – 5:15 PM

Laboratory

The lab is a required component of this course and accounts for 20% of the total course grade. Refer to the lab syllabus and the lab Canvas page for details.

Instructor Team

Lecture team

Prof. Madison Ames	(they/them)	ames0129@r.umn.edu
Dr. Shannon Anderson	(she/her)	andesy@r.umn.edu
Dr. Deepali Butani	(she/her)	dbutani@r.umn.edu
Dr. Xavier Prat-Resina	(he/him)	pratr001@r.umn.edu

Lab team

Prof. Madison Ames	(they/them)	ames0129@r.umn.edu
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Dr. Deepali Butani	(she/her)	dbutani@r.umn.edu
Dr. Dihua (Victoria) Xue	(she/her)	dihuaxue@r.umn.edu

Emailing your instructor

For questions about content, assignments, or other common issues, please use the **Instructor Team Email Address**:chem1333_s26@r.umn.edu above rather than emailing just one instructor, unless it is a personal/private message**.** This ensures questions are answered more quickly!

For lab questions, please email your individual lab instructor.

JustAsk Hours

Students are encouraged to attend JustAsk hours on a regular basis to receive help with course content or just to chat. You are welcome to visit any of the CHEM 1333 instructors for help. See the schedule at the link below. JustAsk hours are subject to change so please make sure you are checking the schedule. Meetings outside the lecture, lab, and JustAsk hours can be scheduled upon request.

https://r.umn.edu/academics-research/academic-resources/just-ask

UAA Team

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Course Description

This course focuses on the structure and reactivity of molecules. The topics being covered are conformational analysis of organic molecules and its effect on reactivity, chirality, thermodynamics, energy diagrams, acid and bases in aqueous solutions and acid and bases in organic solvents, nucleophilic substitution and elimination reactions are taught. Kinetic and thermodynamic principles will be explored when applicable. Spectroscopic techniques such as NMR and IR are revisited and developed further as tools for evidence and analysis of molecular structure and products of a reaction. Polarimetry will be introduced.

This course is the second semester of the sequence of Chemistry courses at UMR. The first two semesters combined – CHEM 1331 and CHEM 1333 - are comparable to what is known elsewhere as "General Chemistry 1" and "Organic Chemistry 1", but not in that order and not with the exact same content. These two semesters are designed to provide the necessary foundations on chemical structure and reactivity for our graduates. Our chemistry courses at UMR only serve a BS in Health Science. This is why we can remove the somewhat artificial barrier between the organic and general chemistry courses and introduce organic structures and spectroscopy from the very beginning. More information about UMR Chemistry Curriculum can be found here: https://z.umn.edu/umrchem

This course is scheduled as an in-person course. All instructors intend to hold all class sessions in-person except if situational factors arise, such as personal illness of the instructor or weather-related issues, when the class may be held synchronously via Zoom or recorded for later viewing.

Course Prerequisites

A grade of "C-" in CHEM 1331: Chemical structure and properties.

Disability Resources

UMR provides access to resources for students with a documented disability. Students must register with Disability Resources each semester and can do so following the instructions located at https://r.umn.edu/student-life/student-services/disability-resources. Students should reach out to Disability Resources at the start of the semester to register their disability. Instructors will be automatically notified of your registered accommodation from the Disability Resources office within a few days of you registering with the Disability Resources office. For the most part, accommodations should be registered within the first two weeks of the semester, however if you seek an accommodation in the middle of the semester or there is a change to your accommodation, please email chem1333_s26@r.umn.edu to alert the instructor team that you will start using or have a change to your accommodation in the class so we can

discuss how we can start supporting you in new ways. Time extensions on quizzes and exams will automatically be honored once instructors are notified of the accommodation.

Course Materials
Required

- *Organic Chemistry Principles and Mechanisms*, 3rd edition Joel Karty, loose-leaf edition or just the ebook version and Smartworks

Organic Chemistry, 3e Courseware	978-0-393-87764-9
Organic Chemistry, 3e Print Upgrade (Optional)	978-1-324-02795-9

- Chemistry model kit available at the bookstore or purchase a MolyMod kit on your own. Your kit from CHEM 1331 is just fine. You can purchase a used kit or borrow from a UMR student who has previously taken Chemistry. We do recommend every student in CHEM 1333 has their own kit to use for this course rather than sharing with a student currently enrolled in the course.

You will be doing a large amount of chemical structure drawing in this course. You may find it beneficial to have a drawing tablet that will allow you to draw during class and/or JustAsk hours more easily.

- XP-Pen Star G640
- Wacom CTL4100 - Small

These are just two options, feel free to explore other possibilities as well

Learning Objectives

As we go through the course, each module will have specific learning objectives listed. These are available on Canvas as we progress through the course.

Student Learning Outcomes(link)
Out of the four UMR's institutional learning outcomes this course addresses three of them.

- **Knowledge in the Health Sciences**: UMR students will acquire knowledge to provide a substantive foundation for advanced learning in the health sciences and related disciplines, including humanities, biological science, historical perspective, literature, mathematical thinking, physical science, and the social sciences.
- **Intellectual and Practical Skills**: UMR students will demonstrate progressively advanced competence in the intellectual and practical skills related to oral and written communication, independence, interdependence, and reasoning, including but not limited to scientific inquiry, quantitative literacy, information literacy, and problem-solving.
- **Self-Regulation**: UMR students will develop and implement practices associated with self-monitoring, goal orientation, academic discipline, determination, accountability, and responsibility. In addition, students will develop the ability to evaluate and modify reactions and behaviors in order to work under conditions of uncertainty and facilitate introspection and resilience.

Besides the institutional outcomes listed above, our chemistry courses use the scientific practices listed by the Next Generation of Science Standards (https://www.nextgenscience.org) as part of our student learning outcomes:

- **Asking Questions**: generate a scientific question about a real-world event, observation, phenomenon, data, scenario, or model

- **Developing and Using Models**: construct a mathematical, graphical, computational, symbolic, or pictorial representation and use it to explain or predict an event, observation, or phenomenon.
- **Planning Investigations**: design an experimental method or identify a set of observations that can be used to answer a scientific question or test a claim or hypothesis
- **Analyzing and Interpreting Data**: given a question, claim, or hypothesis and data collected from an experiment or observation and is asked to analyze the resulting data and interpret their meaning
- **Using Mathematics and Computational Thinking:** use mathematical reasoning or a calculation and interpret the results within the context of the given event, observation, or phenomenon
- **Constructing Explanations and Engaging in Argument from Evidence**: provide reasoning based on evidence to support a claim
- **Evaluating and communicating Information**: make sense of information or ideas presented to them

Course Policies & Information

Course Style

Here at UMR, we believe learning works best when it occurs in many different formats and represents many different voices. The lecture for this course is taught by teams of instructors, who will both be present on lecture days to guide and facilitate student learning. Students are welcome to attend JustAsk hours for any of the course instructors during the week to hear content explained in a different way. Undergraduate Academic Assistants or UAAs will also be present during lecture days to support students.

The flow of this class follows a **Prepare, Practice, and Polish model**.

Prepare: That means that most of the new information will be presented via pre-lecture videos, designed to be viewed outside of class time, accompanied by a pre-class assignment involving the new information. You are expected to watch the videos and complete short pre-class assignments.

Practice: This allows us to use our time together on lecture days for higher-level learning tasks such as completing activities and working through challenging problems in groups to provide more practice and draw out questions. Students are expected to actively participate in the activities. All work done during class time will be completed as group work. Local employers have informed us that working together with others is one of the top 10 essential workplace skills, and education research has shown that group work may lead to higher content mastery and an enhanced learning community.

Polish: This means we expect that you will continue to study and do practice problems outside of class. We will assign short homework assignments after each class to practice drawing, explanations, and solving problems.

This is a 4-credit course. As such, the average student expecting to earn a grade of C, should plan to spend *at least 12 hours a week* studying the material and practicing applications (practice problems). If you have any questions regarding this syllabus, make sure you ask someone on the Instructor Team during the first week of the semester.

Course Grade Breakdown

Assignment Category	%	Drop Policy
Lab	20%	
Pre-Class assignments	10%	4 lowest scores.
Attendance	10%	6 absences.
Formative Homework	5%	4 lowest scores.
Smartworks Homework	5%	2 lowest scores.
Quizzes	10%	6 quizzes throughout the semester. Drop 1 lowest.
Mid-Term Exams (3)	30%	3 mid-term exams worth 10% each.
Final Exam	10%	The comprehensive exam will include everything covered
Total	100%	

Grading Scale

		A	100 – 93.51	**A-**	93.50 – 89.51
B+	89.50 – 86.51	**B**	86.50 – 83.51	**B-**	83.50 – 79.51
C+	79.50 – 76.51	**C**	76.50 – 73.51	**C-**	73.50 – 69.51
D+	69.50 – 66.51	**D**	66.50 – 63.51	**D-**	63.50 – 59.51
		F	59.50 and below		

Lab – 20%

Lab is a required part of the CHEM 1333 course. If a student misses **more than 2 labs**, they will automatically fail CHEM 1333. One final course grade will be given that includes both the lecture and lab components. There is a separate Canvas course containing the lab materials. All questions about lab should be directed to your lab instructor. See the lab syllabus for more information.

Pre-Class Assignments – 10%

Watching the required lecture videos before coming to class is **essential** in our flipped-classroom model. The content in the videos is needed to complete the in-class activities, and it will not be repeated during class. Students who do not make the time to watch the video content before coming to class will not be prepared to engage meaningfully in class, which requires some familiarity with the content and terminology. You are expected to take notes on these videos and write down any questions you might have about the material. Please bring these notes to class with you. There will be Pre-Class assignments **due at 7 am before every class** that will help you gauge whether you understand the material before coming to class. You should plan to spend ~30 minutes preparing for each class.

Pre-Class assignments will be assigned using Formative. Pre-Class assignments will cover concepts directly covered in the Pre-Class videos. These are the foundational concepts needed to engage in the lecture activities. They will be graded on accuracy. You may work with your peers to complete Pre-Class assignments but the work you submit must be your own. Please see the section below for more details about expectations regarding academic integrity.

- **No late Pre-Class assignments will be accepted regardless of the reason.**
- **We will automatically drop your lowest 4 Pre-Class scores.**

In-Class Attendance & Participation – 10%

Attendance and participation in class are essential for your success in this course. We will take attendance daily. Active participation with the in-class activities, as well as participation in group discussions, is key to getting the most out of the flipped-classroom model. We expect students to be on task while in class. We ask that students remove earbuds/headphones, put phones away, and avoid working on assignments from other classes while in CHEM 1333 lecture. We expect students to download the PowerPoint slides from Canvas and annotate their notes on those slides or use some other method of taking notes electronically or using paper/pencil. The instructor team will be circulating around the room during class and will often ask to see your work. We will speak with you if you do not meet our expectations for engagement. **If engagement does not improve, the instructor team reserves the right to assign a zero for the day if a student is consistently not engaging in the classroom activities.**

- **If a student is more than 10 minutes late, they will be marked absent for that day.** A student who repeatedly comes to class late, even if it is less than 10 minutes will lose their participation credit as well. A student who foresees to be repeatedly late should contact the instructors ahead of time.
- **We will automatically drop your lowest 6 Attendance scores.**

Important rules of engagement
The UMR pedagogical model is built around an in-person, classroom-centered learning environment in which students and instructors interact in real time. Physical presence, active participation, and sustained engagement with peers and faculty are foundational to achieving the course's learning outcomes. As a result, a student who does not meaningfully engage in this shared learning environment or who fails to meet the minimum participation expectations cannot successfully complete the course. Keeping that in mind, **a student will not pass the course if they meet any of the following criteria:**

- **If a student misses 10 or more attendance/participation sessions**
- **If a student misses 10 or more preclass assignments**
- **If a student misses more than 2 labs (see the lab syllabus for details)**

Homework
Homework assignments will be assigned after each class period. There are two platforms where homework will be assigned: Formative and SmartWorks through the Karty e-textbook. You may work with your peers to complete Homework assignments but the work you submit must be your own. Please see the section below for more details about expectations regarding academic integrity.

Formative Homework assignments – 5%
Formative Homework assignments will be assigned after class and are due at the start of the next class. The assignments will be a combination of drawing, multiple-choice, and short-answer questions. Formative Homework assignments will be graded on accuracy. Answer keys for written explanations and mechanisms will not be posted for these homework assignments. We will spend the first 10 minutes of each class going over the homework to discuss the correct answers to explanations, and mechanisms. Students are expected to open up their own homework assignment and assess their own work to determine if they understand the material.

- **Late Formative Homework assignments will not be accepted.**
- **We will automatically drop your lowest 4 Formative Homework scores.**

SmartWorks Homework assignments – 5%
SmartWorks is an online textbook companion. The SmartWorks system provides instant feedback on student work. SmartWorks Homework Assignments will be graded on accuracy, but students have an unlimited number of attempts to get their best score. The SmartWorks links MUST be accessed through Canvas. SmartWorks assignments will be assigned once a week on Thursdays at 8 am and be due the following Thursday at 11:59 pm. There will be one assignment per week.

- **Late SmartWorks Homework assignments will not be accepted.**
- **We will automatically drop your lowest 2 SmartWorks Homework scores.**

Quizzes
There will be 6 quizzes throughout the semester. We will drop your lowest quiz grade. These quizzes will take place during the **last 15 mins of class** on the following dates:

Quiz 1 – Tuesday, February 3
Quiz 2 – Tuesday, February 10
Quiz 3 – Tuesday, March 3
Quiz 4 – Tuesday, March 17
Quiz 5 – Tuesday, April 7
Quiz 6 – Tuesday, April 14

- **The lowest quiz score will be dropped.**
- **No make-up quizzes will be given.**
- **One missed quiz may be excused in the case of a justified absence as it is listed under the University Excused Absence policy document.**

Exams
There will be three mid-term exams and one final exam on the dates/times listed below. **The first exam will be held outside of class time in the evening.** Students agreed to this time when they enrolled in the course. **There will be no make-up exams**. If an exam is missed due to a legitimate reason listed under the University Excused Absence policy (https://policy.umn.edu/education/makeupwork), the grade for that missed exam will be the average of the points earned on the other two mid-term exams. **No more than one exam can be missed.** Students who are going to miss (or did miss) an exam must communicate the absence to the instructor via email. If a student cannot give notice until after the exam, they have 24 hours from the exam start time to inform your instructors. For unexcused absences from exams or excused exams missed beyond the one allowance, students will be assigned a score of zero.

Midterm Exam 1 – Friday, February 20, from 4:00 PM – 6:00 PM. This is the only evening exam.
Midterm Exam 2 – Tuesday, March 24, during lecture.
Midterm Exam 3 – Thursday, April 23 during lecture.

Final Exam – Thursday, May 7 from 3:00 - 5:00 PM

Regrade Policy
Regrade opportunities are provided for students to alert instructors to errors or oversights that can sometimes occur during the grading process. Every regrade request should include a specific reason that relates to some form of error during grading (mismarked deduction, rubric indicates the wrong answer, etc.).

Academic Dishonesty
In any case of academic dishonesty, students may receive a partial deduction or a zero on the graded material, or a failing grade for the course as determined by the extent of the violation. Students may have the case referred to the student conduct team. Additionally, any items that are scored as a zero for academic dishonesty are not eligible for being dropped from the gradebook.

Using ChatGPT & Artificial Intelligence
Artificial intelligence (AI) language models, such as ChatGPT, *may* be used for Pre-Class and Homework assignments **with appropriate citation**, but not for exams or quizzes. Using ChatGPT or any AI to generate answers without citing the generation source is considered Academic Dishonesty. If you are in doubt as to whether you are using AI language models appropriately in this course, I encourage you to discuss your situation with the instructor team by attending JustAsk. Examples of citing AI language models are available at: libguides.umn.edu/chatgpt. We will discuss our expectations of citing AI in class. You are responsible for fact checking statements composed by AI language models. If the answer you turn in is incorrect, you will be held responsible for that and your response may be deemed as not representing your "best faith effort", and therefore receive a zero. To be clear, we do not recommend that you use AI or ChatGPT to generate responses in this class because evidence tells us that constructing explanations on your own is vital to supporting your learning. You will be responsible for writing explanations on quizzes and exams without the assistance of any AI. We assign explanation problems as a way for you to practice constructing explanations. It is also important to learn how to construct explanations to communicate your thinking to others. Pre-Class and Homework is your time to practice these skills because it will be assessed on your exams. However, if you do use ChatGPT or AI for Pre-Class and Homework, you cite its use appropriately, and the answer you turn in is correct, you will not be penalized. You will, however, be missing out on valuable opportunities to practice constructing your own explanations.

Syllabus Disclaimer
While the provisions of this syllabus are as accurate and complete as possible, the instructors reserve the right to change any provisions herein with a notice if circumstances so warrant. Every effort will be made to keep students advised of such changes in advance. It is the responsibility of each student to know what changes, if any, have been made to the provisions of this syllabus and to successfully complete the requirements of this course. Questions regarding information on the syllabus and course requirements need to be addressed by the students when the syllabus is received.

Additional Policies
Instructor's responsibility: https://policy.umn.edu/education/instructorresp
Student conduct code:
https://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf
Student Mental Health Website: http://www.mentalhealth.umn.edu
Universal syllabus of UMN (Rochester):
https://docs.google.com/document/d/1tNSc3bIIP87fsUOF9KZpfFx5emQWWlVOUsUjBQzYgFc/edit
Other aspects of this syllabus are in the University of Minnesota website:
https://policy.umn.edu/education/syllabusrequirements

Tentative Course Schedule

WK	Lecture #	Date	Content
WK 1	Lecture 1	Tues, Jan 20	M1.D1. Introduction to Course and Review
	Lecture 2	Thurs, Jan 22	M1.D2. Conformations with Newman Projections and strain in linear molecules
WK 2	Lecture 3	Tues, Jan 27	M1.D3. Angle strain in cyclic molecules
	Lecture 4	Thurs, Jan 29	M1.D4. Interpreting Chairs and Considering Stability
WK 3	Lecture 5	Tues, Feb 3	M1.D5. Practice identifying strain and stability in conformations ***Quiz 1 in class***
	Lecture 6	Thurs, Feb 5	M1.D6. Introduction to Enantiomers, Diastereomers, and Chirality
WK 4	Lecture 7	Tues, Feb 10	M1.D7. Determining isomeric relationships with alkenes ***Quiz 2 in class***
	Lecture 8	Thurs, Feb 12	M1.D8. Assigning R&S nomenclature
WK 5	Lecture 9	Tues, Feb 17	M2.D1. Introduction to acid and bases and into the energy diagram
	Lecture 10	Thurs, Feb 19	M2.D2. Acids and bases based on pka difference
Exam 1 - Friday, February 20, in the evening, 4:00-6:00 pm.			
WK 6	Lecture 11	Tues, Feb 24	M2.D3. Key Factors that Stabilize Bases- charge, atom. Electronegativity, inductive effect, orbital hybridization
	Lecture 12	Thurs, Feb 26	M2.D4. Key Factors that Stabilize Bases- Resonance
WK 7	Lecture 13	Tues, March 3	M2.D5. Practice identifying stronger acids and bases ***Quiz 3 in class***
	Lecture 14	Thurs, March 5	M2.D6. Introduction to Nucleophiles and Electrophiles
Spring Break: March 9-13			
WK 8	Lecture 15	Tues, March 17	M2.D7. Review of acids and bases ***Quiz 4 in class***
	Lecture 16	Thurs, March 19	M3.D1. SN2. Mechanism, Substrate, Nucleophile strength, stereochemistry, kinetics, graphing
WK 9	Lecture 17	Tues, March 24	**Exam 2 in class**
	Lecture 18	Thurs, March 26	M3.D2. SN1. Mechanism, Substrate, Nucleophile strength, stereochemistry, kinetics, graphing
WK 10	Lecture 19	Tues, March 31	M3.D3. Competition between SN2/SN1 and carbocation rearrangement

	Lecture 20	Thurs, April 2	M3.D4. E1. Mechanism, Substrate, Nucl strength, stereochem, kinetics, graphing
WK 11	Lecture 21	Tues, April 7	M3.D5. Competition between SN1/E1, heat, more practice with carbocation rearrangement ***Quiz 5 in class***
	Lecture 22	Thurs, April 9	M3.D6. E2. Mechanism, Substrate, Nucl strength, stereochem, kinetics, graphing
WK 12	Lecture 23	Tues, April 14	M3.D7. Practice E2 with rings ***Quiz 6 in class***
	Lecture 24	Thurs, April 16	M3.D8. Solvent, Intramolecular vs. Intermolecular
WK 13	Lecture 25	Tues, April 21	M3.D9. Competition between SN1/SN2/E1/E2
	Lecture 26	Thurs, April 23	**Exam 3 in class**
WK 14	Lecture 27	Tues, April 28	M3.D10. More competition between SN1/SN2/E1/E2
	Lecture 28	Thurs, April 30	Review Day
Final Exam: Thursday, May 7 3-5pm.			