

Chemistry 221: Organic Chemistry I

Professor: Cooper Battle
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Contact policy: I generally check my e-mail between 8 AM and 6 PM on weekdays and once or twice a day on weekends, and will get back to you within 24 hours. Please feel free to stop by my office. If my door is open, I will make time to talk if I am able. If my door is closed, it means I'm in the middle of something and would appreciate not being interrupted.

Course Mentors:

Minu Bidzimou (bidzimou@grinnell.edu) & Michelle Lee (leegahyu@grinnell.edu)

Office Hours:

I will be starting the semester with limited office hours, as I have found it works much better to poll the class after schedules have settled and find office hours that work best with your schedules rather than setting them all at the beginning of the semester. Starting hours for the semester will be: **11:00 AM – 12: 00 PM on Thursdays.**

I will be in my office and available to meet with individuals or groups during these scheduled office hours for questions or discussion about either the lecture or the lab. If you cannot make these times, feel free to call or e-mail me to schedule another time that works better for you. With less than 24 hours of notice, I may not be able to accommodate you but I will try to work something out.

Class Schedule:

Lecture: 8-8:50 AM Monday/Wednesday/Friday, Noyce 2022

Texts:

The main text for the course will be **Organic Chemistry (2nd Ed)**, by Jonathan Clayden from Oxford University Press. The solutions manual to this text is on reserve in the Kistle Library. You will also need a molecular model kit, available in the bookstore or online.

Additional reading materials will be made available in class or through Pioneer Web.

You are encouraged to reference your general chemistry textbook and from time to time as we review material from previous courses. For those of you who no longer have it, I may suggest readings from an open source General Chemistry textbook.

There are a number of excellent texts on reserve in the Science Library that can help provide additional background or details throughout the semester. I also recommend <http://organicchem.sites.grinnell.edu> as a reference throughout the semester- it links to good reference material, and is organized by topic.

Pre-requisites:

A solid background in general chemistry (CHM 129) is required for this course.

Special Needs:

The success of every student in this class is important to me, and I assume that all of us come from different backgrounds and have different needs and learning styles. I am always open to suggestions of how you feel I can make the class more accessible to you, and am happy to work with you to develop strategies that will help you succeed in this course.

I encourage you to visit the Coordinator for Student Disability Resources, John Hirschman, located on the 3rd floor of the Rosenfield Center (x3089). to help you find out how your learning could be improved. If you need official

accommodations, you have a right to have them met, and the Coordinator for Disability Resources can provide you with documentation that will help me determine how to best provide them for you.

Academic Honesty:

Unless specifically stated in an assignment, all work turned in for credit must be done individually. All work turned in must be your own, and all citations and attributions of ideas and wording must be clear and correct. If you are unsure at any time, please see me. An excellent guide to avoiding accidental plagiarism can be found through Harvard's Writing School: <http://usingsources.fas.harvard.edu/icb/icb.do?keyword=k70847&pageid=icb.page342054>

Absence and Makeup Policy:

If you know of any days you will be unable to attend class, I encourage you to let me know as soon as possible so we can come to a mutual understanding of how best to allow you to meet the requirements of the course while attending to other important issues in your life. If an emergency situation prevents you from making a class session, or causes you to miss an exam/assignment without prior notice, makeup work can be arranged on an individual basis depending on the assignment.

Course Outline & Goals:

The overall goal of this semester of organic chemistry is to familiarize you with carbon-based chemical structures, techniques for structure determination, and basic reactivity. It is intended to prepare you for both second semester organic chemistry (which focuses on chemical synthesis) and biochemistry (which involves much of the reactive chemistry we will cover this semester). The ability to predict chemical structures and apply those structures to predictions of chemical reactivity and properties is very important, and something we will come back to throughout the semester. The material you will cover over the semester during lecture will blend with what you are learning in lab. You will not always cover material in the lecture first- sometimes material from the lab will inform what we cover in lecture.

Course Expectations & Grading:

I expect that proper preparation and studying for this course will take you at least 2 hours out of class for every hour of credit. While recall of information is important, learning how interpret new concepts and information based on an understanding of the underlying principles is the driving motivation for this class. I expect to you to come to class having completed the suggested readings for the day.

In Class Discussion & Participation, Homework (5%):

I expect you to come to attend all classes, be prepared, and be actively involved in classroom activities and discussions. Homework will be given out in groups of weekly problems, some of which will be on material that has already been covered, and some of which will be on material that has not yet been discussed in class, but which you may know from your readings and previous classes. Homework will be graded based on completeness and a legitimate effort, with a focus on feedback and learning rather than correctness. I also strongly suggest you make use of other sources of homework problems, including online homework problems from your textbook, and those found in other organic textbooks on reserve in the library.

Problem Sets (10%):

As preparation for each midterm exam, there will be a problem set encompassing the types of questions you can expect on the exam material, as well as a final problem set that spans the whole semester as preparation for the final. Each problem set will be worth 2.5 % of your final grade. They will be due the week before the exam, to give time for any questions to be answered in office hours or class before the test.

Quizzes (10 total, 10%):

While we will quickly move beyond chemical structure and into reactivity, the ability to correctly interpret and predict chemical structures (and how they play into reactivity) is a crucial skill in organic chemistry. Moreover, research shows

that small, regular quizzes are highly beneficial to helping you learn the material. Accordingly, we will have 11 short quizzes (1% each) throughout the semester that will recall structural prediction and ask you to predict reactivity. If you take all 11 quizzes, your lowest will be dropped.

Final Project

A final paper/project based on the synthetic literature will be available in the last week of the semester that can replace a low or missed problem set score. Details of this project will be available after Spring Break.

Exams (3 midterms, 1 comprehensive final, 50% total):

There will be three exams spaced throughout the semester (10% each), with a final exam worth 20%. The final exam will also include material on elimination reactions from the last week of class, and will focus on combining material from earlier in the semester to solve more complex problems. As organic chemistry is a constantly building set of material, all exams will to some degree be comprehensive and integrate previous material. Accordingly, I strongly recommend studying in such a way that you build long-term rather than short-term recall of the material (in other words, don't cram the night before the test!).

Laboratory (25%):

As Organic Chemistry is an experimental science, learning how to work with chemicals safely and effectively in the lab is just as important as learning the theory in the lecture. Successful completion of the lab (passing grade) is required to pass the course.

Course Grade:

Grades in the course will be assessed according to the following scheme:

| | |
|-----------------------------------|-------|
| Attendance, Discussion & Homework | 5 % |
| Problem Sets | 10 % |
| Quizzes | 10 % |
| Exam 1 | 10 % |
| Exam 2 | 10 % |
| Exam 3 | 10 % |
| Final Exam | 20 % |
| Lab | 25 % |
| Total | 100 % |

At any point in the course I will be more than happy to discuss your performance with you and indicate where you currently fall with respect to your performance. Individual improvement and growth is very important to me, and final grades will be assigned to reflect individual performance in the course as a whole, with the following expectations:

- To receive an A in the course, you must demonstrate outstanding mastery and command of the course material.
- To receive a B in the course, you must demonstrate excellent command of the course material.
- To receive a C in the course, you must demonstrate satisfactory command of the course material.
- Grades of D and F in the course indicate unsatisfactory command of the course material.

Additionally, you must earn passing grades (at least 60%) in both the lab and lecture portions of the course to pass the class.

Course Schedule:

The course schedule provided below is tentative, as I want to ensure we adequately cover material before moving on to the next section, but should give a good guide to the order in which we will cover material, and roughly how long we will spend on each topic.

| Week | Lecture Dates | Lecture Topics/Chapter | Assignments |
|------|----------------------------|---|---------------------|
| 0 | Friday, August 25 | Introduction/Overview (Ch. 1 & 2) | |
| 1 | Monday, August 28 | Organic Structure Determination (Ch. 3) | |
| | Wednesday, August 30 | Organic Structure Determination (Ch. 3) | Quiz 1 |
| | Friday, September 1 | Organic Structure Determination (Ch. 3) | |
| 2 | Monday, September 4 | Structure of Molecules (Ch. 4) | |
| | Wednesday, September 6 | Structure of Molecules (Ch. 4) | Quiz 2 |
| | Friday, September 8 | Understanding Organic Reactions (Ch. 5) | |
| 3 | Monday, September 11 | Understanding Organic Reactions (Ch. 5) | |
| | Wednesday, September 13 | Nucleophilic Addition to Carbonyls (Ch. 6) | PS 1 Due, Quiz 3 |
| | Friday, September 15 | Nucleophilic Addition to Carbonyls (Ch. 6) | |
| 4 | Monday, September 18 | Delocalization & Conjugation (Ch. 7) | |
| | Wednesday, September 20 | Test 1: Chapters 1-6 | Test 1 |
| | Friday, September 22 | Delocalization & Conjugation (Ch. 7) | |
| 5 | Monday, September 25 | Acidity, Basicity & pKa (Ch. 8) | |
| | Wednesday, September 27 | Acidity, Basicity & pKa (Ch. 8) | Quiz 4 |
| | Friday, September 29 | Acidity, Basicity & pKa (Ch. 8) | |
| 6 | Monday, October 2 | Organometallic Reagents in C-C Bond Formation (Ch. 9) | |
| | Wednesday, October 4 | Organometallic Reagents in C-C Bond Formation (Ch. 9) | Quiz 5 |
| | Friday, October 6 | Nucleophilic Substitution Reactions at Carbonyls (Ch. 10) | |
| 7 | Monday, October 9 | Nucleophilic Substitution Reactions at Carbonyls (Ch. 10) | |
| | Wednesday, October 11 | Nucleophilic Substitution Reactions at Carbonyls (Ch. 11) | Quiz 6 |
| | Friday, October 13 | Nucleophilic Substitution Reactions at Carbonyls (Ch. 11) | PS 1 Due |
| | Oct. 16th-Oct. 20th | Fall Break | Fall Break |
| 8 | Monday, October 23 | Chemical Equilibrium, Rates & Mechanisms (Ch. 12) | |
| | Wednesday, October 25 | Proton NMR (Ch. 13) | |
| | Friday, October 27 | Test 2: Chapters 7-12 | Test 2 |
| 9 | Monday, October 30 | Proton NMR (Ch. 13) | |
| | Wednesday, November 1 | Proton NMR (Ch. 13) | Quiz 7 |
| | Friday, November 3 | Stereochemistry (Ch. 14) | |
| 10 | Monday, November 6 | Stereochemistry (Ch. 14) | |
| | Wednesday, November 8 | Stereochemistry (Ch. 14) | Quiz 8 |
| | Friday, November 10 | Stereochemistry (Ch. 14) | |
| 11 | Monday, November 13 | Substitution Reactions (Ch. 15) | |
| | Wednesday, November 15 | Substitution Reactions (Ch. 15) | Quiz 9 |
| | Friday, November 17 | Substitution Reactions (Ch. 15) | |
| 12 | Monday, November 20 | Substitution Reactions (Ch. 15) | |
| | Wednesday, November 22 | Conformational Analysis (Ch. 16) | PS 3 Due, Quiz 10 |
| | Friday, November 24 | Thanksgiving Break | Thanksgiving |
| 13 | Monday, November 27 | Conformational Analysis (Ch. 16) | |
| | Wednesday, November 29 | Elimination Reactions (Ch. 17) | |
| | Friday, December 1 | Test 3: Chapters 13-16 | Test 3 |
| 14 | Monday, December 4 | Elimination Reactions (Ch. 17) | |
| | Wednesday, December 6 | Integrating Reactions | PS 4 Due, Quiz 11 |
| | Friday, December 8 | Final Class | |