Chemistry 255: Organic Chemistry

Fall 2025

MWF 10 AM SCCT 3024

Instructor	Ian J. Rosenstein, Science Center 1074
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Office Hours	Monday 2-4 PM, Tuesday 2-4 PM, Wednesday 2:30-4:30 PM and by appointment
Required Texts	McMurry, *Organic Chemistry*, 10th Edition, OpenStax A. B. Padias, 2023, *Making the Connections: A How-To Guide for Organic Chemistry Lab Techniques*, 4rd Edition, Van-Griner Freeman Laboratory Notebook
Suggested Items	J. W. Simek, *Solutions Manual for Organic Chemistry*, Pearson Prentice Hall
Grading	Exams: 45% (three exams worth 15% each) Final Exam: 20% Homework: 10% Lab: 25% Class attendance is expected. In borderline cases I will take into account attendance/participation to determine a final letter grade.

Learning Goals

The heavy emphasis last semester was on learning the fundamental concepts that underlie organic chemistry. This semester we will learn a couple of new concepts but the focus of the course is on learning and applying new reactions. As such, the nature of the work will much more closely resemble what we did in the last few weeks of the spring semester than the first part of the course. Once again, the most important learning goals for the course center around problem solving skills. Two different kinds of problems will predominate: synthesis problems and mechanism problems. Successfully working both of these types of problems requires solid understanding of the fundamentals but it is not enough just to memorize reactions and their basic mechanisms. To do synthesis problems well, you need to approach problems systematically but, at the same time, be creative. You need to be able to focus on small details but also keep in mind the big picture. In solving mechanism problems, you need be able to determine what is possible at each step of the mechanism then determine which of the possible processes are most likely. For both types of problems, it is critically important that you are willing to take risks (i.e. do not be afraid of problems that look like they are really hard) and that you train yourself to be able to abandon an approach that does not feel right and start again from the beginning. Through

practice and in-class discussion of problem-solving approaches, I hope you will learn lessons that will help you to more effectively approach challenging problems in anything that you do.

There is a similar change to the nature of the lab this semester. In the first semester course, the bulk of the labs were designed to expose you to the basic techniques that are important to doing organic chemistry. Now that you are familiar with those techniques, the focus of most of the labs this semester is on solving an intellectual problem and the skills that are emphasized are in analyzing data and communicating your results and analysis. Once again, these are general skills that should translate to other areas of your life.

Hopefully, the relationship between the specific course goals stated above and the College's educational goals is pretty obvious. The emphasis on problem solving and the nature of the problems that you will face directly relate to ***Intellectual Curiosity and Flexibility***, ***Analytical Discernment*** and ***Creativity***. In both lecture problems and the labs, you will have opportunities to learn to think and experiment like a chemist, engaging in ***Disciplinary Practice***. Written and oral lab reports will enhance your skills in ***Communication and Expression***.

Key Concepts

In addition to the broader learning goals described above, you should be aware of how the concepts carry over from one course to another within the Chemistry curriculum. Key concepts that you learned in Organic I that are especially important in Organic II include:

1. Basics of structure: bonding, resonance, hybridization, and drawing orbitals
2. Higher order aspects of structure: conformation and stereochemistry
3. Effects of structure on properties (especially resonance) and reactivity (functional group transformation)
4. Acid/base chemistry (Brønsted-Lowry and Lewis): determining relative strengths of acids/bases and being able to predict which side of an equilibrium is favored
5. Basics of arrow pushing; at a higher level, the ability to use this logic to predict new reactions and mechanisms
6. Basics of synthesis: retrosynthesis, multistep synthesis, functional group compatibility or incompatibility with different reactions, combination of ideas to create a new reaction for a synthesis
7. Interpretation of spectral data (IR, MS, NMR)
8. Understanding of kinetics and thermodynamics in an organic context
9. Recall of key reactions (the Grignard reaction, oxidation/reduction of alcohols/carbonyls, alkene hydration, elimination reactions, epoxidation, conversion of alcohols to bromides, radical halogenation)

Key concepts that are taught in Organic II are:

1. Understanding complex organic reaction mechanisms

2. More complex syntheses and synthetic planning
3. Chemistry of carbonyl compounds (enols/enolates, nucleophilic additions, etc.) including carboxylic acid derivatives
4. Amine chemistry
5. Chemistry of conjugated systems: aromaticity and reactivity of aromatic rings (EAS, NAS); cycloadditions; conjugate additions
6. Ability to analyze multiple variables (substrate, reactants, solvent, temperature, etc.) to predict the outcome of a reaction

Key concepts that are taught in Organic II that will be especially important in future courses (Chem 263 Quantitative Environmental Chemistry, Chem 265 Inorganic Chemistry and Materials, Chem 270 Biological Chemistry) include:

1. Structure and bonding in organic molecules (270)
2. Reactivity of functional groups (i.e. identify an acid/base, nucleophile/electrophile, carbonyl derivative) (270)
3. Basics of acid-base equilibria (263, 270, 265)
4. Basics of thermodynamics (define H, S, G) (263, 270, 265)
5. Basics of how equilibrium and thermodynamics are related (263, 270, 265)
6. Periodic trends and properties (265)

Exams

Dates for the exams are: Thursday, September 25, 7:00 PM in SCCT G041
Thursday, October 23, 7:00 PM in SCCT G041
Tuesday, November 18, 7:00 PM in SCCT G041

Exams will last for approximately two and a half hours.

In the Chemistry Department, all exams at the 100- and 200-level will be proctored by a professor or student TA. Cell phones will be collected at the start of exams, and no materials, other than those allowed, will be permitted at your desk. All students must use their own calculator. Students must take exams on the scheduled day and time, with the following exceptions:

- For students with conflicts at exam times (another class obligation, athletic events, religious observances, etc.), make-up exams will be offered at a limited number of common times determined by the Department. Please inform me of conflicts as far in advance as possible and at least forty-eight hours before the scheduled exam time. For students experiencing severe illness or other emergency, alternate arrangements will be made on a case-by-case basis.

- If you have documented eligibility for testing accommodations (extra time or a low distraction space), please contact me at least 72 hours in advance of the scheduled exam time to make arrangements for each exam.
- I recognize that there may be times during the semester that you have an overwhelming amount of work. If you find yourself in this situation during a test week, you may request permission to take the exam at one of the scheduled, common make-up times. Such requests should be made no fewer than three days before the test and normally only one extension will be granted per semester.

Final Exam

The final exam is scheduled for Tuesday December 16 from 7 PM–10 PM in SCCT 3024. The final exam will be cumulative but it will emphasize the material covered in lecture after the third exam.

Homework

Homework will be assigned in four different forms: practice problems, drill problems, homework sets and problem sets.

- *Practice problems* are problems from the textbook that I think are especially relevant. Suggested problems are listed in the Full Lecture Notes that are posted on Blackboard and are also included at the end of this syllabus. These include problems from within specific sections of the textbook that are interspersed in specific sections of the notes, and End of Chapter problems from the text that are listed at the end of the notes for each unit. I strongly urge you to do these problems to help you learn the basic material but they will not be collected.
- *Drill problems* will be assigned for each lecture for which another assignment is not due. These will be short assignments with simple problems that are intended to reinforce the concepts covered in the previous lecture. These will not be handed out in class; it will be your responsibility to download the assignments from Blackboard. The drill problem assignments will be collected and full answer keys will be posted on Blackboard but they will not be graded for accuracy so it will be up to you to check the key to see if you have done the problems correctly. Drill problems will count for 20% of the homework grade.
- *Homework sets* will count for 20% of your homework grade and will be due on Fridays in weeks where there is not a problem set due or an exam. Homework set problems will be a little bit more difficult than drill problems and are designed to help you start to see the material in a broader context. The homework sets will be corrected but will be graded on a plus/minus/zero scale based on effort not accuracy.
- *Problem sets* will make up 60% of your homework grade. A problem set will be distributed approximately ten days before each exam to be turned in one week later. The difficulty of the problem sets approximates the difficulty of the exams and the problems are designed to give you practice in connecting different course concepts. The problem sets will be graded on a 15-point scale.

Homework and problem set assignments will be handed out in class and will also be available on Blackboard. Drill Problem assignments will only be posted on Blackboard. You may work

together on any of these assignments. However, the more independent you are in working problems, the better prepared you will be for the exams.

Extensions and Policy on Late Work

I understand that it may sometimes be difficult to complete work on time and I am happy to consider extensions on Drill Problems, Homeworks, or Problem Sets but these must be requested no later than the day before the assignment is due. Unless previously arranged, Drill Problems will not be accepted after the due date, late Homeworks will be accepted but given a minus, and late problem sets will be assessed a penalty of ten percent for each day late. *No late assignment will be accepted after you begin taking the exam for which the assignment is relevant.*

Lab

All students should come to lab with a Freeman Laboratory Notebook and a lab coat. You should also wear appropriate clothing, *i.e.* no shorts and no open-toed shoes. Laboratory is an essential part of the course. If you have a failing grade in the laboratory, you will fail the course. *Failure to turn in two or more lab reports will constitute an automatic failure of the course!* See the lab syllabus for more details.

Help Sessions

I will hold weekly help sessions on Tuesday evenings from 5:30–7 PM in SCCT G042. These will give you a chance to ask questions and to work extra problems in small groups. Attendance is not required but is strongly recommended. In addition, Prof. Majireck will hold a weekly help session at 6 PM on Wednesdays in SCCT G041 and there will be three sessions run by students:

Mondays at 7 PM in SCCT G042 with Juan Perez-Rodriguez
Thursdays at 7 PM in SCCT G042 with Claire Cooper and Carolyn Levin

Communication

I will communicate important information about assignments, exams, help sessions, etc. by email so you are encouraged to check your email (and to read the emails that you receive!).

Blackboard Resources

Many course resources will be posted on Blackboard. The Blackboard sites for both lecture sections have been combined so that all students have access to the materials provided by each professor. Included in the folder for the Rosenstein section is a folder that contains all of the handouts that will be distributed in class, a folder with the complete course lecture notes and a folder with partial lecture notes that contain the text from the notes but not the figures. Also within the folder for the Rosenstein section, there are folders with all of the assigned work for the semester which will include both assignments and detailed answer keys. In addition, there is a folder for practice problems that will include problems used at some of the help sessions (usually assignments from previous years) and extra sets of problems posted about a week before each of

the exams. Also available are copies of the exams and answer keys from last year that can be used as practice before each exam. Answer keys from this year's exams will also be posted once all students have completed the exam. If you would like additional practice problems beyond what is available in the folder for the Rosenstein section, you are encouraged to use assignments from the Majireck section.

The Blackboard page also has a folder for "Lab Materials". As the name implies, this folder will have all of the documents needed for the lab portion of the course including general information (the lab syllabus, lab report checklist, etc.), the weekly lab handouts and any lab data that is posted for class use. Please note that the weekly lab handouts will not be distributed in class; you will need to download them from Blackboard.

Honor Code

As with all courses at Hamilton, you are expected to abide by the Honor Code. In this course, you may work with others on practice problems, drill problems, homework sets ,and problem sets, but sharing answers (without working collaboratively) in any form (hard copy or electronic) is a violation of the Honor Code. Exams are to be done individually and no books, notes or other sources may be consulted while taking exams. In lab, when students work together, only the data is shared; all reports must be done individually. Any discussion with others must be acknowledged in the report and ideas that come from consulting pre-existing material (the textbook, journal sources, online sources, etc.) must be properly cited. As is the case for lecture assignments, sharing of work for lab (labelled spectra, mechanisms, written arguments, etc.) in either hard copy or electronic form is a violation of the Honor Code. The use of generative AI (ChatGPT or similar interface) is prohibited in this class for both lecture assignments (drill problems, homework, problem sets, and exams) and lab (prelabs, lab reports).

Disability Policy

In compliance with Hamilton College policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for students with disabilities. Requests for academic accommodations are best made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be implemented. Students should contact Allen Harrison, Assistant Dean for Accessibility Resources to verify their eligibility for appropriate accommodations (aharriso@hamilton.edu; ext. 4021).

Mental Health and Organic Chemistry

Organic chemistry is a difficult subject to master. Learning it well requires discipline and a huge amount of effort. My goal is to challenge you throughout the semester with the goal of helping you to learn as effectively as possible and I will do my best to provide you with the resources and support necessary to meet that goal. I recognize, though, that Organic Chemistry is a stressful course that can trigger or exacerbate anxiety, depression or other mental health issues. If at any time you are feeling overwhelmed, I encourage you to speak with me about ways we can schedule assignments or exams to relieve some of your stress and/or to seek out resources on campus that may be helpful. These include:

- the Counseling Center (www.hamilton.edu/offices/counselingcenter, 315-859-4340) located at 100 College Hill Road offers individual and group therapy, peer counselors, psychiatric treatment, and a 24-hour hotline. If you need immediate assistance, phoning the Counseling Center and selecting option 2 will connect you with a counselor, 24 hours a day, 7 days a week.
- the Associate Dean of Students for Student Support Services, Sarah Solomon (315-859-4600; ssolomon@hamilton.edu)
- the Associate Dean of Students for Academics, Adam Van Wynsberghe (315-859-4600; avanwyns@hamilton.edu)
- Your faculty advisor
- Your RA and Area Director in your residence hall

If at any time you feel suicidal or in danger of harming yourself or others, please reach out for support! The Hamilton community cares and is available to help. Campus Safety is available 24/7 for urgent concerns at 315-859-4000.

Tips for Succeeding in Organic Chemistry

- Yes, you do need to remember everything from last semester. Most critical will be concepts: the factors that make something a strong acid, base or nucleophile, understanding of basic mechanistic steps, etc. It is not essential that you have every single reaction from last semester memorized but we will regularly use reactions from last semester in synthesis problems so the more reactions you know, the bigger the toolkit you have at your disposal. The most important reaction for the early part of the semester is the Grignard reaction so make sure you know this one backwards and forwards.
- Working problems is critical but how you do problems is more important than how many problems you do. Take the time to think about what you are learning from each problem that you do. You will not see a problem on an exam that you have previously seen as a practice/drill/homework/problem set problem so learning the answers to the problems is not important. Learning how to approach a problem and how to think through a solution is what matters.
- Think of the different types of assignments as a pyramid, with book problems at the bottom and exams at the top. Doing problems from the book helps you to learn the basic concepts in a very directed manner, which provides a foundation for doing drill problems, which support homeworks, etc. If your foundation is weak, the top of the pyramid will be shaky.
- ***Google is not your friend!*** If you use Google to search for the answer to a problem, you may get two points for a correct answer on a problem set but you'll also likely lose fifteen points on an exam because you did not learn the skills you should have learned by thinking through the problem.
- Start assignments early. Answers to some problems may not come to you right away so having time to ponder them, to ask questions in office hours or at the QSR Center, or to discuss them with classmates is important and will minimize the likelihood that you will resort to using Google (see above).
- Do some work for the course every day. As above with assignments, it can take some time for ideas to sink in. If you can spread out your learning over a few weeks for each

unit, instead of relying on intense studying over a few days right before each exam, you will be in a much better position to gain the deeper understanding necessary to excel.

- Be engaged during class. We typically cover about four pages of notes per day. Look over what we are likely to cover before the start of class so that you have a sense of what we will be talking about. During class, make notes to yourself about things that weren't clear. I welcome questions so please ask them during class, if you feel comfortable doing so, or come ask questions later. After class, look back over the notes to identify anything else that you don't understand. Then, *don't ignore those things*. Think about them further on your own, do relevant practice problems, and use other resources, including the textbook, online sources, the QSR Center, classmates or ask me questions in office hours or at help sessions. Don't wait until two days before the exam to clear up fundamental ideas. The last few days before an exam should be used to work on your thinking skills in applying fundamental concepts, not on learning the basics.
- Find a community. It can really help to have other people to bounce ideas off of and to work problems with. Form a study group with friends in the class, even if they're in a different section. If you don't know anyone, attend help sessions, get involved with ROOTS, or go to drop in hours at the QSR Center. These may provide enough of a community or you may get to know some people through these interactions that you can study with more regularly.
- However..... use this community wisely. You may talk with others about any assignment except exams but do this to discuss ideas, not to get answers. If you're stuck on a problem, ask for a hint on how to get started, don't ask for the answer. Work together on problems but don't rely on others to do the work for you.
- If you feel that you are having trouble, get help early in the semester. Don't wait until after the second exam to try to get help; at that point, it will be very challenging to turn things around. There are lots of resources available. Come to office hours, schedule an appointment outside of formal office hours, go to the QSR Center, ask for a tutor. *Asking for help is not a sign of weakness but a sign of strength, showing that you are engaged and willing to do what is necessary to learn as much as possible.*
- Don't try to memorize everything! There is a lot that you will need to remember in organic chemistry but if you understand underlying, fundamental concepts, the amount of rote memorization that you should need to do is not overwhelming.
- Learn from the lab. While the focus of several of the labs is to teach you fundamental laboratory skills and techniques, each experiment is grounded in some way in the underlying concepts that we will be learning in lecture. For some experiments, the connection to the lecture (and exams) is obvious, for others it is less so. Carrying out the experiments and writing up the lab reports gives you an opportunity to learn organic concepts from a different perspective that should reinforce the lecture materials. Approach labs as a learning opportunity and not just something to get done as quickly as possible.
- The common theme in each of the points above is take responsibility for your own learning. What you get out of the course is proportional to what you put into it.

Approximate Lecture Schedule

Date	Topic	Chapter(s) in McMurry
8/29	Introduction	--
9/1, 3	Review of Chem 190 Concepts	1-8, 10-13
9/5, 8	XIII. Alkynes	9
9/10, 12	XIV. Ethers and Epoxides	18
9/15, 17, 19, 22	XV. Conjugated Systems	14
9/25	**EXAM 1** covering Units XIII, XIV, and XV	
9/24, 26, 29	XVI. Aromaticity	15
10/1, 3, 6, 8, 10, 10/13	XVII. Reactions of Aromatic Compounds	16
10/15, 20, 22, 24	XVIII. Aldehydes and Ketones	19
10/23	**EXAM 2** covering Units XVI, XVII, and XVIII	
10/27, 29, 31, 11/3 11/5, 7	XIX. Enolate Chemistry Part 1	22, 23
11/10, 12, 14	XX. Amines	24
11/18	**EXAM 3** covering Units XIX and XX	
11/17, 19, 21, 12/1, 3	XXI. Carboxylic Acids and Derivatives	20/21
12/5, 8, 10, 12	XXII. Enolate Chemistry Part 2	22, 23
12/16	Cumulative **FINAL EXAM** with emphasis on Units XXI and XXII	