

Advanced Organic Chemistry II
CHEM 3202
Winter 2024
Prospectus

(Last updated: January 2, 2024)

*****PRELIMINARY VERSION*****

Who (Instructor): Prof. Dr. Jeff Manthorpe, Office: 418 Steacie; Research Lab: 403 Steacie
Email: jeff.manthorpe@carleton.ca

Who (TA): To be determined (possibly nobody)
Email:

When and Where: Classes: Tuesdays and Thursdays, 13:05 to 14:25 PM, Tory 202
Tutorials: Tuesdays, 8:35 to 9:55, Richcraft 1200
Office Hours (Jeff: In-person and Zoom): *To be determined*, or send an email to make an appointment. Zoom: [Click Here](#)
Office Hours (TA): By appointment. Office hours will be scheduled when midterm/final exams are coming up; times will be distributed by email.

Brightspace: Brightspace will be used to distribute notices regarding the class. Please check it regularly. Any students who do not have access to Brightspace should speak to me ASAP.

Zoom: Will be used for (a) hybrid office hours, (b) online classes/tutorials if the prof is sick or (c) we are told by the university that we have to do so.

What:

*This course builds on and expands on many concepts and topics that were introduced in Organic Chemistry I and II therefore you **NEED** to review ALL of your notes from Organic Chemistry I and II NOW and review specific topics as we start to study them this term. There are also several new, but related concepts and topics introduced.*

Resources if you need to review old material:

1. Second-year notes
2. Search for the topic at www.masterorganicchemistry.com
3. Check the textbook for this course
4. Try common textbooks used for second-year organic chemistry (I'll post a list on Brightspace)

Course Learning Objectives:

To develop or further develop student understanding and appreciation of:

1. Reaction mechanisms, including electrophilic and nucleophilic sites in organic molecules
2. Reaction coordinate diagrams
3. Hard-Soft Acid-Base (HSAB) principle
4. Principle of stability vs. reactivity
5. Acids and bases in organic chemistry
6. Oxidation states in organic chemistry
7. Molecular orbital theory in organic chemistry
8. Addition reactions versus Substitution reactions
 - a) Nucleophilic addition to C=O bonds (aldehydes and ketones)
 - b) Nucleophilic substitution at carbonyl systems (see 9c-9h)

- c) Nucleophilic addition to the alkene of α,β -unsaturated carbonyl systems/Conjugate addition
 - d) Electrophilic addition to alkenes
 - e) Electrophilic aromatic substitution
 - f) Nucleophilic aromatic substitution (S_NAr)
 - g) Unimolecular nucleophilic substitution (S_N1)
 - h) Bimolecular nucleophilic substitution (S_N2)
9. The chemistry of carbonyl systems and pseudocarbonyl systems (e.g., i, j, k):
 - a. Aldehydes
 - b. Ketones
 - c. Esters
 - d. Thioesters
 - e. Amides
 - f. Carboxylic acids
 - g. Carboxylic acid anhydrides
 - h. Carboxylic acid chlorides
 - i. Nitroalkanes
 - j. Cyanides/Nitriles
 - k. Imines
 10. The chemistry of alkenes
 11. The chemistry of aromatic rings, including heterocycles
 12. The chemistry of conjugated π systems:
 - a) α,β -unsaturated carbonyl systems
 - b) conjugated dienes
 13. The chemistry of radicals
 14. The relationship between organic chemistry and biochemical processes
 15. Stereochemistry
 16. The organic chemistry literature

Topics Scheduled to be Covered (in an approximate order):

Review	2203 and 2204, the basics of mechanisms
Chapter 8	Acidity, basicity, and pK_a
Chapter 23	Chemoselectivity: selective reactions (Oxidation and Reduction) and protection
Chapter 9	Using organometallics to make C-C bonds
Chapter 15	Nucleophilic substitution at saturated carbon (S_N1 and S_N2)
Chapter 21	Formation and reaction of enols and enolates
Chapter 22	Conjugate addition
Chapter 26	Alkylation of enolates
Chapter 27	The aldol reaction
Chapter 29	Conjugate addition of enolates
Chapt. 35, 36	Pericyclic reactions
Chapter 37	Radical reactions (* we rarely get this far)
Chapt. 29,30	Aromatic and heterocyclic chemistry (* we rarely get this far)

Evaluation:

Midterm Examination I	10%
Midterm Examination II	15%
Midterm Examination III	15%
Assignments	10%
Participation in class	5%
ChemDraw Rx Assignment	5%
<u>Final Examination</u>	<u>40%</u>
Final Grade	100%

You are allowed to drop your grade from ONE of the midterm exams if it will result in a higher final grade. The weight of the dropped midterm examination will be added to the value of your final examination. Similarly, if you are unable to attend a midterm examination for any reason (documented illness, etc.), the weight of that midterm exam will be added to your final exam.

Important Dates (Dates may be changed, if required):

January 9: First tutorial (SciFinder + Intro/Review)	March 22: Midterm Exam III
January 13: First lecture	April 9: Final tutorial
February 2 or 9: Midterm Exam I	April 9: Final lecture
February 17 to 24: Winter Break	April 15–27: Final exams
March 1 or 8: Midterm II	

DATE and TIME of the FINAL EXAM will be determined at a later date by the University. The examination will be three hours in duration and will cover all of the course material (i.e., the exam will be cumulative).

Midterm Examinations: Midterm examinations will be scheduled in the evening, outside of class time (approximately 6:30 PM). All exams will be cumulative. All students are recommended to write all the midterm exams; however, you may opt not to write or drop one of them (i.e., you must write at least two). If you miss a midterm exam you do not need to provide an explanation unless you did not write the first two and had a legitimate reason for missing the third.

Assignments: There will be at least 3 assignments spread throughout the term, often in preparation for an exam. You will be able to miss 1 assignment without penalty. This is in case of illness, etc. If you submit all of the assignments, your worst grade will be dropped.

ChemDraw Reaction Assignment: ChemDraw is the preeminent chemical drawing software tool. Carleton has a licence and you can install the app on your own computer (PC or Mac) for free. This assignment will require you to write out the mechanism of the one or more reaction(s) and we will put them in a class database on Brightspace so that they can be shared among the class. More details will be shared at a later date.

Lecture and Tutorial Formats: We will start the term with some review and discussion of fundamental principles of organic chemistry. Once we get into a pattern for the term, two classes will generally be used to present lecture material for the week and the third will be a tutorial. Note that this may not always follow the pattern of the Friday classes being the tutorial.

Lecture material will be presented in a combination of electronic slides and writing on the slides via a tablet. Slides will be available on Brightspace the day before class or earlier. Students are expected to print the slides and bring them to class or bring a tablet computer. An effort will be made to leave appropriately sized gaps in the slides so that additional material may be written in the appropriate place. Students are also expected to have some extra paper handy.

Textbook:

1a) **Organic Chemistry** (2nd edition) by Clayden, Greeves, and Warren; Oxford University Press, 2012. ISBN: 978-0-19-927029-3 and...

1b) **Solutions Manual to Organic Chemistry** (2nd edition) by Clayden, and Warren; Oxford University Press, 2013. ISBN: 978-0-19-966334-7 (**Required**) from the Carleton University Bookstore.

NOTE!!!: These two items are sold together as a bundle for \$149.50 plus tax. The textbook alone regularly sells for \$144 to \$210 and the solutions manual is at least \$75 so by bundling them together you basically get the solutions manual for FREE! You're welcome. 😊

2) **Molecular Visions Model Kit (Highly Recommended)** These molecular model kits are an excellent balance of affordability and accuracy. They are available online at <http://www.molecularvisions.com/> (kit

#1) or possibly from the Carleton University Bookstore. **(UPDATE: If they still have the kits at the bookstore, I can't find them on the website.)** They are also useful for organometallic and inorganic chemistry – money well spent!

Prerequisites: CHEM 3201 (uOttawa equivalent: CHM 3122).

Problems from the Textbook: Problems associated with each chapter will be assigned by the instructor and will be drawn from the course textbook and other sources. Solutions (i.e., *SOLUTIONS*, not simply answers) to the problems from the course textbook (which are actually on the web, not in the book – it was another cost-saving measure to keep the book shorter) can be found in the Solutions Manual listed above. It is the responsibility of the student to do these problems. They will not be handed in for grading. However, students are free (and encouraged) to ask questions of the instructor and TA about the problems.

*****CHEMTUBE3D: SUPER USEFUL!** <http://www.chemtube3d.com/> This website contains useful 3D animations of many of the reaction mechanisms discussed in this course. The interface is a little dated but it certainly serves the purpose. 🐸

Online Resource Centre for the Textbook: <https://learninglink.oup.com/access/clayden2e-student-resources#all-chapters> This is where you can find the textbook problems and many other resources. You will need to create an account to access this information.

Paul Menton Centre Registrants: Students registered with the Paul Menton Centre for Students with Disabilities be adequately accommodated. However, PMC students are hereby notified that in order to receive accommodation, they must present the appropriate paperwork to the instructor **NO LATER THAN ONE WEEK IN ADVANCE**.

Academic Integrity: The consequences of copying, plagiarism, and other forms of cheating are substantial. Students are referred to Section 10 of the Course Calendar for information on this topic. The Carleton University Academic Integrity Policy can be found online at <https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/academic-integrity-and-offenses-of-conduct/#academic-integrity-policy>. It is **YOUR RESPONSIBILITY** to know the contents of these policies so it is highly recommended that you read them.

WHMIS Training: While not specifically required for this course, you are **REQUIRED** to have done WHMIS training **WITHIN THE LAST YEAR** if you are taking any labs or working in a research lab. See any of your lab coordinators to obtain the instructions for the online training course, which takes about 2 hours.

EXPECTATIONS AND RESPONSIBILITIES

It is my responsibility, as the instructor, to:

- show up for class on time and ready to teach well and be prepared to answer questions
- teach in a stimulating and engaging way
- make myself available to students outside of class hours to a *reasonable* extent to answer questions
- evaluate students in as fair a manner as possible by providing frequent feedback about performance and testing on knowledge of material actually included in the course content
- treat students with respect and foster a healthy intellectual environment in and out of the classroom
- respond to emails by the end of the next school day (*i.e.* emails received on Friday, Saturday, or Sunday will be responded to by the end of the day on the following Monday)

- make a sincere effort to have grading completed and the grades posted on Brightspace within one week

It is your responsibility, as a student, to:

- show up for class on time, ready to learn and be prepared to participate in class
- bring your lecture notes for the day's class
- not disrupt the class ☺
- devote an appropriate amount of time outside of class to studying, doing the assigned reading and problems from the textbook
- attending all examinations unless health or personal reasons intervene

As a student, you are requested to:

- provide (anonymous) feedback to the instructor about their performance throughout the term, not just at the end. You can anonymously print out or write comments and/or constructive criticism and put them in my departmental mailbox in 203 Steacie.

Tips for Success in this Course:

- Take 10 minutes before class and look over the notes for the day
- Spend 10 minutes after class to review the day's notes
- Set aside 2 hours a week to read the chapters from the textbook
- Set aside 2 hours a week to do the problems from the textbook
- ASK QUESTIONS

Course Outline (Syllabus) Information on Academic Accommodations

Requests for Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Religious obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline