CHEM 3202 for Winter 2025 (Updated Dec 17, 2024)

Advanced Organic Chemistry II

We, the people of the Faculty of Science at Carleton University, acknowledge that our campus is located on the traditional, unceded territories of the Algonquin Anishinabeg people. Miigwetch for your hospitality and stewardship of this territory and the teachings that come from it. We are grateful for this land, the air that we breathe, and the water that sustains us all as well as for the animals, plants and other living beings: these enable us to research, teach, mentor, support, study, and learn. We recognize our responsibility to our natural environment and to reconciliation with Indigenous peoples.

Course Instructor: Jeff Manthorpe

How to address me: Professor Manthorpe, Dr. Manthorpe, Jeff

Gender Pronouns: (he/him/his)

Email: jeff.manthorpe@carleton.ca

Note: If you have or question or would like to talk with me, you can send an email, visit me during student hours (see below), or approach me before or after class.

Best Ways to be in Touch: in class, via email, or during student hours

Student Hours: To be determined (will be a total of ≥3 hours/week), SC 418

Office Location: Room 418, Steacie Building

Class Location: Please check Carleton Central for the room locations.

Class Times: 10:05–11:15 Mondays and Wednesdays, 2:35–3:55 Fridays

Prerequisites: CHEM 3201

Preclusions: None

Department/Unit: Chemistry

Topics Covered and Learning Outcomes

I am committed to fostering an environment for learning that is inclusive for everyone regardless of gender identity, gender expression, sex, sexual orientation, race, ethnicity, ability, age, class, etc. All students in the class, the instructor, and any guests should be treated with respect during all interactions. It is my hope that our class will support diversity of experience, thought, and perspective.

Course Description (from Academic Calendar)

Continued mechanistic survey of additional organic reactions with emphasis on synthetic usefulness and stereochemistry. Interspersed with selected topics such as instrumental methods, photochemistry, literature of organic chemistry, natural and synthetic polymers, heterocycles, terpenes and alkaloids.

Topics to be Covered

Topic/Content	Readings/Prep for Class
Review	CHEM 2203 and 2204 materials; Chapter 5 of Clayden (basics of mechanisms); nucleophiles and electrophiles
Acidity, Basicity, pK_a	Chapter 8
Using Organometallics to make C–C Bonds	Chapter 9
Chemoselectivity: Reductions and Oxidations (redox) and Protecting Groups	Chapter 23
Nucleophilic Substitution at Saturated Carbon (S_N1 and S_N2)	Chapter 15
Formation and Reaction of Enols and Enolates	Chapter 20
Conjugate Addition	Chapter 22
Alkylation of Enolates	Chapter 26
Aldol and Claisen Reactions	Chapter 27
Conjugate Addition of Enolates	Chapter 29
Pericyclic Reactions	Chapters 35 and 36

Course learning outcomes:

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 carbonyls/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 p 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

Assessments

Grade Breakdown

COMPONENT	GRADE VALUE	DATE
PARTICIPATION IN CLASS[1]	5%	
ASSIGNMENTS (3–6)[2]	10%	Lots of notice will be given
ChemDraw ASSIGNMENT[3]	5%	?
MIDTERM I[4,5,6]	10 %	Last year: Feb 9 (between lectures 15 and 16); covered review, Chapters 8 and 9
MIDTERM II	15 %	Last year: March 8 (between lectures 24 and 25); covered up to end of Chapter 23
MIDTERM III	15 %	Last year: March 22 (between lectures 30 and 31); covered up to end of Chapter 20
FINAL EXAM	40 %	TBD. It will be 3 hours.

NOTES:

1. This is a small class and everyone is expected to interact and engage in class.
2. If you submit all of the assignments, I will automatically drop your assignment with the lowest grade. If you miss an assignment, this will be considered a zero (and thus your lowest grade). See Missed Assignments section below for more information.
4. 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. See Missed Midterm Exams section below for more information.
5. Unlike CHEM 3201, exams in this course are NOT open book.
6. Midterm exams are usually on Friday nights, outside of regular class hours. All necessary/reasonable accommodations will be provided.

Late and Missed Work/Exam Policies

Missed Midterm Exams

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. If you are able to write the exam at a mutually agreeable alternate time, that is also acceptable.

Missed Assignments

Similar to the midterm exams, your lowest assignment grade will be dropped. A first assignment missed due to illness will count as this grade to be dropped. If one or more additional assignments is missed, we will discuss the situation and find a reasonable solution.

Late Work

Late assignments will receive a 10% penalty, but for some assignments (e.g., those close to midterms where solutions must be released promptly) late assignments may not be accepted. This will be communicated clearly in advance. In cases where a deadline has been barely missed, the instructor reserves the right to use some discretion (i.e., if you miss the deadline by 2 minutes, I'm not likely to enforce a late penalty.)

Missed Work

Short-term (5 days or less): If you have an issue that requires short-term academic considerations (5 days or less), please use the academic considerations form. If such considerations are required more than once in the course, a student-instructor discussion is needed.

Long-term (> 5 days): If longer-term accommodation is necessary, please consult with the instructor and use the longer-term accommodation form.

Learning Material(s) and Other Course/Lab-Related Resources

Learning Material	Options for Purchasing *(e.g. Bookstore, Used, etc.)*	Approximate Cost
Text (**Required**)**:** Organic Chemistry (2nd ed.) by Clayden, Greeves, and Warren (Oxford University Press) ISBN: 978-0-19-927029-3	Carleton Bookstore, used options exist (2nd ed. came out in 2012, 1st in 2001). E-book is acceptable.	**Textbook alone:** $144 to $210. **Solutions manual:** $75. **Bundled together:** $149.50, CU Bookstore is selling them bundled together.
Solutions Manual (Required): Solutions Manual to Organic Chemistry (2nd edition) by Clayden, and Warren; Oxford University Press, 2013. ISBN: 978-0-19-966334-7	Carleton Bookstore, used options exist (2nd ed. came out in 2013, 1st in 2001). E-book is acceptable.	
Molecular Visions Model Kit (Highly Recommended) or another reasonable molecular model kit	Carleton Bookstore (may not be on website), www.molecularvisions.com (kit #1)	These molecular model kits are an excellent balance of affordability and accuracy.

Academic Accommodations and Regulations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/).

Statement on Chat GPT/Generative AI usage

As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

AI isn't going to write your exam for you. AI cannot do your synthetic planning for you (yet). Organic chemistry is advanced by people knowing the fundamentals of the field and generating new ideas based on those fundamentals. Therefore, if you don't understand the fundamentals, you cannot advance organic chemistry (or any science) and AI is decades away from making meaningful contributions in this way. Organic chemistry employs more chemists than any field with the possible exception of analytical chemistry. If you do not understand fundamental organic chemistry, you are missing out on the single largest employment sector for chemists.

In this course, students may use AI tools for basic word processing and formatting functions, including, (a) grammar and spell checking (e.g., Grammarly, Microsoft Word editing functions) and (b) basic formatting and design suggestions (e.g., Microsoft Word's formatting tools, PowerPoint Design editor)

Documenting AI Use: It is not necessary to document the use of AI for the permitted purposes listed above. If you have questions about a specific use of AI that isn't listed above, please consult your instructor.

Statement on Academic Integrity

Students are expected to uphold the values of academic integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy. A list of standard sanctions in the Faculty of Science can be found here.

Additional details about this process can be found on the Faculty of Science Academic Integrity website.

Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

Student Rights & Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

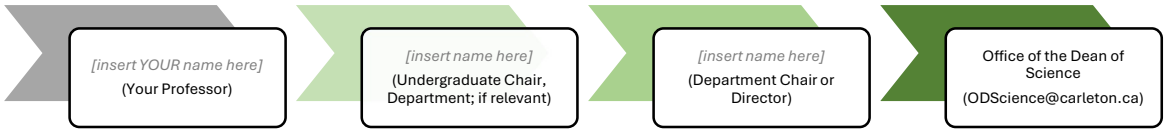
Mental Health and Wellness:

As a student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. For more information, please consult https://wellness.carleton.ca/.

Student Concerns

If a concern arises regarding this course, **your first point of contact is me**: Email or drop in during student hours and I will do my best to address your concern. If I am unable to address your concern, the next points of contact are (in this order):

Note: You can also bring your concerns to Ombuds services.



Assistance for Students

Writing and Learning Support: https://carleton.ca/csas/support/
Peer Assisted Study Sessions (PASS): https://carleton.ca/csas/pass/
Math Tutorial Centre: https://carleton.ca/math/math-tutorial-centre/
Science Student Success Centre: https://sssc.carleton.ca/