

## CHEM 3201 for Fall 2025 Term *(last updated August 27)*

Advanced Organic Chemistry I

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.

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**Course Instructor:** Prof. Jeff Manthorpe

**How to address me:** Professor/Dr Manthorpe, Jeff

**Gender Pronouns:** he/him/his

**Email:** [jeff.manthorpe@carleton.ca](mailto:jeff.manthorpe@carleton.ca)

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

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

**Student Hours:** To be determined, 418 Steacie. Feel free to email or drop by.

**Office Location:** Room 418, Steacie Bldg

**Class Location:** Please check Carleton Central for the room location.

**Lecture Times:** Tuesdays and Thursdays, 10:05–11:25

**Tutorial Times:** Fridays, 14:35–15:55

**Prerequisites:** CHEM 2204 or equiv.

**Preclusions:** Nothing at Carleton

**Department/Unit:** Chemistry (& Biochem)

**Course TAs:** Jake Edgley

Lab: 403 Steacie

Office: 410 Steacie (I have to double check the office room number)

[jakeedgley@cmail.carleton.ca](mailto:jakeedgley@cmail.carleton.ca)

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## 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.

### Course level learning outcomes

The overall objective of this course is to learn how to determine the structure of small organic molecules that contains the elements C, H, N, O, S, Si, P, F, Cl, Br, and/or I. This involves several techniques: elemental analysis, mass spectrometry, infrared spectroscopy, nuclear magnetic resonance spectroscopy, and ultraviolet spectroscopy and they will be covered in that order.

Structure determination involves three steps:

1. Determination of **molecular formula** or several possible formulae
2. Determination of functional groups present in the molecule
3. Determination of **bond connectivity** (how the different sections of the molecule are connected together)

More broadly, this course will develop your skills in

1. Logic
2. Critical thinking
3. Multidimensional problem solving
4. Puzzles

### Relevance to your degree

The ability to determine the identity of a compound is a fundamental, vital and critical skill of every chemist and biochemist. Think about it this way: If you don't know what you compound have, even if you can say fascinating and important things it does, you are missing a most basic piece of the story. Philosophically, one could argue that you until you determine the structure of a compound, it does not exist.

## Topics to be Covered

Chapter In Text	Topic (Structure Determination Step(s) Associated with that Topic)	Approx. Dates	Midterm/Final Exam Coverage			
1	Molecular Formulae/Elemental Analysis ( <b>Step 1</b> )	Sep 4, 5, 9	MT I	MT II	MT III	Final
3	Mass spectrometry: Part 1 – basic theory, instrumentation, and sampling techniques ( <b>primarily Step 1</b> )	Sep 11, 12, 16				
4	Mass spectrometry: Part 2 – fragmentation and structural analysis ( <b>primarily step 1 but also to a minor extent steps 2 and 3</b> )	Sep 18, 19, 23, 25, 26, 30				
2	IR (infrared) spectroscopy ( <b>primary technique for Step 2</b> )	Oct 2, 3, 7				
5	NMR (Nuclear Magnetic Resonance) spectroscopy: part 1 – basic concepts and $^1\text{H}$ NMR ( <b>Step 3 but can be related to steps 1 and 2 as well</b> )	Oct 9, 14, 16, 17				
6	NMR spectroscopy: part 2 – $^{13}\text{C}$ NMR ( <b>Step 3 but can be related to steps 1 and 2 as well</b> )	Oct 17, 28, 30, 31				
7	NMR spectroscopy: part 3 – Spin–spin coupling in NMR spectra ( <b>Step 3</b> )	Nov 4, 6, 7, 11, 13, 14				
8	NMR spectroscopy: part 4 – Other topics in 1D NMR – exchange processes, decoupling, nOe, conformational analysis, stereochemistry ( <b>Step 3 but can be related to Steps 1 and 2 as well</b> )	Nov 18, 20				
9	NMR spectroscopy: part 5 – advanced NMR: 2D experiments ( <b>Step 3</b> )	Nov 21, 25, 27				
10	UV spectroscopy ( <b>Steps 2 and 3</b> )	Nov 28, Dec 2				
11	Combined spectral problem solving ( <b>Steps 1, 2, and 3 because this chapter integrates all of the course material</b> )	If time allows				

## Important Dates

Thursday, September 4: First lecture

Friday, September 5: First tutorial

Week of October 13 (in the evening): Midterm I

Saturday, October 18 to Sunday, October 26: Fall break

Friday, November 7 (~6 to 8 PM): Midterm II

Friday, November 21 (~6 to 8 PM): Midterm III

Friday, November 28: Last tutorial

Thursday, December 4: Last lecture

Friday, December 5: Class follow a Monday schedule (make up for Thanksgiving on Oct 13)

Monday, December 8 to Saturday, December 20: Final Exams

*Other important academic dates and deadlines (withdrawal deadlines, etc.) can be found here: <https://carleton.ca/registrar/regISTRATION/dates/academic-dates/>, including class suspension for fall, winter breaks, and statutory holidays.*

# Assessments

## Grade Breakdown

COMPONENT	GRADE VALUE	DATE
ASSIGNMENTS (3–6)	15%	Lots of notice will be given
MIDTERM I	15%	After Chapter 2 (IR spectroscopy)
MIDTERM II	15%	After Chapter 6 ( <sup>13</sup> C NMR spectroscopy)
MIDTERM III	15%	After Chapter 8 or 9 (probably 8)
FINAL EXAM	40 %	Exam schedule will be published Oct 10

**Examination format:** *All exams in this course are OPEN BOOK! This means you must have your own hardcopy textbook—no sharing, no e-books.* Midterm exams will be held outside of class time. Practice exams and solutions will be posted on Brightspace. There will be special tutorials to go over the solutions to the practice exams, as well as your exams.

**Grade optimization:** 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.

**Important qualifier:** A grade of at least 45% on the final exam is required to pass the course.

**Missed midterm exams:** Accommodation for midterm exams missed for valid, documented reasons should be discussed with the instructor.

**Missed assignments:** You must hand in all of the assignments except one. If you hand in all of the assignments, your lowest assignment grade will be dropped.

**Early submission of assignments:** Assignments submitted at least 24 hours ahead of the deadline will receive a 5% bonus. (Note: This is 5% of your grade on the assignment. Thus, if your grade before the bonus is 60%, your bonus is  $5\% \times 0.60 = 3\%$ .)

## Late and Missed Work Policies

### Late Assignments

*Last assignments may or may not be acceptable. Assignments often occur close to midterm exams and the solutions need to be released in a timely fashion. If it is possible to submit the assignment late, the penalty is 15% per day. The maximum delay for submitting an assignment is 1 or 2 days (again, it depends on when the solutions need to be released).*

If you cannot meet the deadline, please reach out to the instructor by email or in person and if the delay is approved, please submit the [academic considerations form](#).

### Missed Assignments

If assignments cannot be completed, please contact the instructor. Trust me; he's a reasonable guy—I've known him for a long time. Remember that you may skip one assignment. If you need to miss more than one assignment, you should also contact the instructor.

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

Learning Material	Options for Purchasing (e.g., Bookstore, Used, etc.)	Approximate Cost
<b>REQUIRED:</b> Introduction to Spectroscopy (fifth edition, 2015) by Pavia, Lampman, Kriz, and Vyvyan (publisher: Cengage, ISBN: 978-1-285-46012-3) <b>NO E-BOOKS!</b>	Carleton bookstore, online booksellers, used	New: \$160 + tax Used: variable
<b>RECOMMENDED</b> (but optional): Molecular Visions Model Kit (or another molecular model kit)	Carleton bookstore, online retailers. Used is fine.	~\$30 to \$40 (new)

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## Course Logistics

**Lecture and Tutorial Formats:** Lectures and tutorials will be in person.

Lecture material will be presented (both in videos and in class) in a combination of electronic slides and writing on the slides via a tablet or traditional chalkboard delivery. Slides will be available on Brightspace the day before class or earlier, but usually will be available well in advance. Students are expected to print the slides and bring them to class or bring the slide preloaded on 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.

**Brightspace:** Brightspace will be used to distribute handouts (notes) and assignments. Brightspace email will be used to distribute notices regarding the class. Brightspace also has a discussion board that students can use to discuss problems and things related to the course. I will monitor and participate in these discussions. Please check it regularly. Any students who do not have access to Brightspace should speak to me ASAP to make alternate arrangements to receive class notices and handouts.

**Handouts:** Handouts should be printed with a MAXIMUM of 2 slides per page. Many slides contain images with critical details that cannot be seen if printed smaller than 2 slides per page. The slides do contain colour but can be printed in black and white. The colours have been chosen so that they will still appear reasonably well when printed in black and white.

**Practice Problems from Textbook:** Problems associated with each chapter will be assigned by the instructor and will be drawn from the course textbook. 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 about the problems.

**Assignments:** There will be several assignments throughout the course that will be submitted for grading. The total value of the assignments will be 15% of your final grade; hence the value of each assignment will ultimately depend on the number of assignments. Assignments will be submitted via an electronic dropbox on Brightspace. The first assignment will be after Chapter 3 and potentially after any chapter after that, but likely will not be after every chapter; we will skip some or combine two chapters into one assignment.

***All assignments must be done individually!*** Students may work together on practice problems and are encouraged to do so. There will likely be an assignment accompanying most chapters of the course. This means that every week you will have something to do – either an assignment or a midterm exam; therefore, ***IT IS IMPERATIVE THAT YOU KEEP UP WITH THE COURSE! THE NUMBER ONE REASON STUDENTS DROP THIS COURSE IS THAT THEY FELL BEHIND!***

**Midterm and Final Examinations:** The midterm and final examinations will be administered as outlined above. All exams are open book (you may use the course textbook but not your notes) and cumulative. You are permitted to write notes in your textbook and use flags on useful pages. You may not insert additional paper into your book. All students are required to write all the midterms (University policies on exemptions for illness, family emergencies, etc. and academic misconduct apply to midterm exams). Examinations and solutions and solutions from previous years will be made available through Brightspace for use as studying tools.

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## **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

All assignments and assigned textbook problems are designed to aid in your development of critical thinking skills. Use of generative AI erodes your learning in this course and prevents you from building the skills you need. Generative AI will not help you on the exams. Part of the challenge in this course is to complete the tasks in a time-efficient manner. The only way to get faster is to practice. Using AI is not practicing. Remember: this course is not merely about structure determination—it is about logical and critical thinking, which are absolutely fundamental to the scientific process.

In light of the above, **you are not permitted to use generative AI in this course**. In reality, I cannot police this perfectly on assignments. However, if you use generative AI on assignments, you will pay for it on the exams, not because I'm out for revenge, but because you won't have the necessary skills. Speaking of logic, try this on for size: You get 100% on two assignments thanks to AI. That's 5% toward your final grade (assuming six assignments for the term). Because you didn't do the practice and studying that comes from doing the assignments yourself, you get 60% on the midterm. That's 60% of 15%, or 9% toward your final grade. That means out of 20% of your final grade (5% for two assignments + 15% for midterm) you earned 14 of those 20. However, if you do the assignments yourself and get an average of 85% (most people do), that's 4.25 out of the 5%. Thanks to your hard work, you get 85% on the midterm. That's 12.75/15. Now you have earned 17/20.

I recognize that the preceding analysis does not account for the time taken. However, time on assignments (and textbook problems) = time studying for exams. Study early and often, in small amounts, and you will do better than if you cram. I did enough of both approaches to assure you it's true.

## 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 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 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.

## 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](#).

