

CHEM 3201 for Fall 2026

Structure Elucidation

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: David Sabatino

How to address me: Professor Sabatino

Email: david.sabatino@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: Tuesday and Fridays 1:00 p.m. – 2:30 p.m. and by appointment

Office Location: SC 207 F

Class Location: TB 240.

Tutorial Location: NI 3020

Class Times: Tuesday & Thursdays, 2:35 p.m. – 3:55 p.m. and Fridays 4:35 p.m. – 5:55 p.m.

Prerequisites: CHEM 2204 or CHEM 2208

Preclusions: N/A

Department/Unit: Chemistry

Course TAs:

Teaching Assistant: Josh O'Grady -
JoshOGrady@cmail.carleton.ca

I. Course Materials:

The Introduction to Spectroscopy, 5th ed. textbook is a comprehensive learning text that includes theoretical content, adaptive practice and problem-solving questions that serve as suitable preparation for assignments and exams. This textbook is required for this course, everything else is optional. The cost to purchase this textbook from the Carleton University Campus Store for this term is \$236.00. An ebook version is also available at the Campus Store for \$80.00. Students have the option to purchase the textbook in text or ebook format, directly through the Campus Store or the publisher, Cengage, and other online sources in used or new formats.

The textbook options (required and optional) for this course are also available in the library course reserves <https://library.carleton.ca/find/reserves>

➤ Textbooks

Required:

1. [Donald L. Pavia, Gary M. Lampman, George S. Kriz and James A. Vyvyan, Introduction to Spectroscopy, 5th ed. Cengage 2015, ISBN: 978-1-285-46012-3](#)

Optional, Not Required:

2. [David Klein and Laurie Starkey, Organic Chemistry 5th ed. Wiley, ISBN: 978-1-394-35080-3](#)
3. [John McMurry, Organic Chemistry 9th ed. Cengage Learning, Inc. ISBN: 978-1-305-08048-5](#)

➤ Molecular Modelling Kit, Optional, Not Required:

1. [Walter Products Molecular Orbital Theory & Structural Molecular Model Kit](#)

II. Class Schedule and Topics (*tentative*)

Date	Lecture
Sept 10	Welcome and Syllabus Review Lecture Topic: Introduction to Structure Elucidation
Sept 15, 17	Lecture Topic: Elemental Analysis and Molecular Formula Pavia Chapter 1: <i>Molecular Formulas and What Can Be Learned From Them</i>
Sept 22, 24	Guest Lecture Topics (Marczenko/Wang): Crystal, Molecular and Supramolecular Structures Integrated Instrumental Analyses: <i>X-ray diffraction, Energy Dispersive X-ray Spectroscopy and Electron Microscopy</i>
Sept 29, Oct 1	Lecture Topic: Mass Spectrometry (Part 1) Pavia Chapter 3: <i>Basic Theory, Instrumentation and Sampling Techniques</i>
Oct 6, 8	Lecture Topic: Mass Spectrometry (Part 2) Pavia Chapter 4: <i>Fragmentation and Structural Analysis</i>
Oct 13, 15	Guest Lecture Topics (Smith/Hu): Analytical Separation and Sample Characterization Integrated Instrumental Analyses: <i>Liquid Chromatography Mass Spectrometry</i>
Oct 20, 22	Lecture Topic: IR Spectroscopy Pavia Chapter 2: <i>Infrared Spectroscopy</i>
Oct 26-30	Fall Break, No Classes
Nov 3, 5	Lecture Topic: UV Vis Absorption Spectroscopy Pavia Chapter 10: <i>Ultraviolet Spectroscopy</i>
Nov 5	Mid-Term Exam: Elemental Analysis, Mass Spectrometry, IR and UV Vis Spectroscopy (Pavia Ch. 1-4, 10)

Nov 10, 12	Lecture Topic: Nuclear Magnetic Spectroscopy (Part 1) Pavia Chapter 5: <i>¹H NMR Spectroscopy: Basic Concepts</i>
Nov 17, 19	Lecture Topic: Nuclear Magnetic Spectroscopy (Part 2) Pavia Chapter 7: <i>¹H NMR Spectroscopy: Spin-Spin Coupling</i>
Nov 24, 26	Lecture Topic: Nuclear Magnetic Spectroscopy (Part 3) Pavia Chapter 6: <i>¹³C NMR Spectroscopy and Heteronuclear Coupling</i>
Dec 1, 3	Guest Lecture Topic (Pallister): Advanced NMR Spectroscopy Pavia Chapter 9: <i>2D NMR Correlation Spectroscopy</i>
Dec 8, 10	Guest Lecture Topic (McMullin): Integrated Structure Elucidation of Complex Molecules Pavia Chapter 11: <i>Combined Structure Problems</i>
Dec 12-23	Final Exam: Cumulative Final Exam (Pavia Chapters: 1-7, 9-11)

III. Grading

Final grade distribution as follows:

1. Assignments (40%)

Description and Scheduling: There will be 4 total assignments, 2 prior to the mid-term and 2 before the final exam. Each will be worth (10%) and will contain problem solving questions similar to those on exams. Students will work in teams of 4-5 students and have 1 week to complete and submit the group assignments.

Assignment 1 (10%): Elemental Analysis, Molecular Formula and Mass Spectrometry

Posted: Friday October 2, 2026

Due: Friday October 9, 2026

Assignment 2 (10%): IR Spectroscopy

Posted: Friday October 16, 2026

Due: Friday October 23, 2026

Assignment 3 (10%): NMR Spectroscopy

Posted: Friday November 20, 2026

Due: Friday November 27, 2026

Assignment 4 (10%): Integrated Problems

Posted: Friday December 4, 2026

Due: Thursday December 10, 2026

Note: In preparation for assignments and exams, the tutorials will be problem solving sessions.

2. Mid-term exam (30%)

Description: The mid-term exam will cover in-class lecture material on Elemental Analysis, Mass Spectrometry, IR and UV Vis Spectroscopy (Pavia Ch. 1-4, 10). The mid-term is a take-home exam that students will have to complete independently but may use textbooks and lecture notes as resources to complete the exam.

Posted: Monday November 2, 2026

Due Date: Thursday November 5, 2026

3. Final exam (30%)

Description: The final exam is cumulative and will cover all in-class lecture material related to Elemental Analysis, Mass Spectrometry, IR, UV Vis Spectroscopy and NMR Spectroscopy (Pavia Ch. 1-7, 9-11). The final exam is a take-home exam that students will have to complete independently during the final exam period but may use textbooks and lecture notes as resources to complete the exam.

Posted and Due Dates: Final exam period: December 12-23, 2026

IV. Course Learning Objectives and Outcomes

In this course, students will learn to:

1. Determine molecular formulas of small molecules that contain the elements C, H, N, O, S, Si, P, F, Cl, Br, and/or I.
2. Determine bond connectivity and functional groups present in molecules
3. Elucidate and interpret (supra)molecular structure from spectroscopic and microscopic data
4. Integrate analytical separation and characterization techniques
4. Understand the organic chemistry and reaction mechanisms linked to structure elucidation
5. Make the link between chemical structure characterization and related scientific fields

V. Approach to study

Course expectations and study approach:

1. Attend lectures and tutorials, take notes and ask questions.
2. Review lecture notes before and after class. Avoid falling behind.
3. Complete on time and review practice and assignment problems in preparation for exams.
4. Ask questions and feedback from the course instructor and TA during and after class hours.

VI. Course Policies

Attendance:

All lectures will begin promptly at the scheduled time. Do not be late or you may not be admitted to that period.

1. Absences:

Students are responsible for getting the lecture material from their classmates and review the lecture material in the event of an absence.

2. Makeups and Lateness:

Are only permissible with the approval from the instructor. If approved, the student will have one additional week to complete the task. A grade of 0 will be administered if the student does not complete the make-up task within the allotted time period.

Please use the [Academic Considerations Form](#) for any circumstances where you require and are permitted to hand in late or missed work.

3. Distance Exams:

Students who are studying remotely or are varsity athletes with in-person tests or exams can apply to write their exam off-campus if they will be at least 160 km away from campus on the exam day and meet the course requirements for distance exams. There is a fee for this service, and all exams must be proctored. Apply for a distance exam at [Distance Exams - Scheduling and Examination Services](#). The application deadline for this term is September 24, 2026.

Instructor Responsibilities:

The instructor will be responsible for managing the in-class lecture presentations. The instructor will also be responsible for addressing student questions during and after the lectures, including tutorials and office hours. The instructor will also be responsible for preparation of the course requirements (e.g., assignments, exams). Teaching assistants (TA) will aid in the administration, proctoring and evaluation of assignments and exams. If anything is unclear or mis-understood, ask your instructor and/or TA, they are here to help! Instructor questions may be addressed during lectures, tutorials, by email, office hours and appointment.

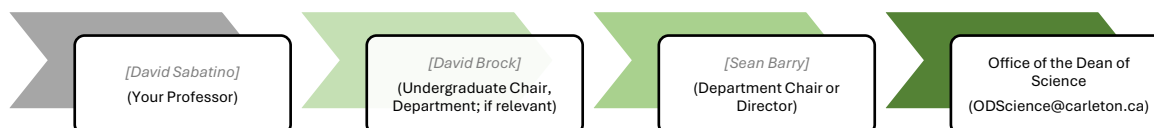
Student Responsibilities:

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.

Students will be responsible to attend the lectures, participate in class, take notes and ask questions. Students also have the responsibility of obtaining lecture notes from classmates, for any missed lectures, which should be reviewed before the next class. Keep pace with the lecture material and review the lecture notes on a weekly basis. If additional explanation is required, ask questions in class, attend office hours and tutorials, email questions or schedule appointments if scheduling conflicts persist.

Student Concerns:

If a concern arises regarding this course, **your first point of contact is me**: Email or drop in during office 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.

For additional help, contact science student services:

Science Student Success Centre

3431 Herzberg Laboratories
1125 Colonel By Drive,
Ottawa, ON K1S 5B6

<https://sssc.carleton.ca/>

Phone: (613) 520-2600 Ext. 3111

VII. Academic Accommodations:

It is the policy and practice of Carleton University to promote equity, diversity and inclusion (EDI) in its learning environments. 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/>).

If you have a documented disability, you may be eligible for reasonable accommodations in compliance with University policy. Please note, students are not permitted to negotiate accommodations directly with professors. To request accommodations or assistance, please self-identify with the Paul Menton Centre (PMC) for Students with Disabilities at the beginning of the semester. For more details, visit the Equity Services website. <https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

For more information or to register for services, contact PMC at:

Paul Menton Centre
501 University Centre
1125 Colonel By Drive,
Ottawa, ON K1S 5B6
Email: pmc@carleton.ca
Phone: 613-520-6608

VIII. Information Technology Service Desk:

The first point of contact for any technology related question or problem is Carleton University's Information Technology Service (ITS) Desk. Contact ITS by phone by calling 613-520-3700, via e-mail at its.service.desk@carleton.ca or chat at carleton.ca/its/chat

ITS is staffed by professionals Monday-Friday from 8 a.m.-4:30 p.m. ITS provides phone support for most University applications, including Carleton Central, Brightspace Learning Management System, Carleton 360, Microsoft Windows, and the Microsoft Office suite.

Course Outline Resources

Statement on Chat GPT/Generative AI usage (See the *Sample Syllabus Statements for AI use in Courses* [document](#) for examples)

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.

Minimal AI use in this course – Basic Assistance Only: Students may use AI tools for basic gathering of information and word processing functions, including grammar and spell checking (e.g. Grammarly, Microsoft Word Editor, Copilot). 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.

IX. Academic Honesty:

Lying, cheating and stealing are not tolerated in civilized society and in scientific work. While you will be encouraged to collaborate, you must follow directions in preparing work independently.

1. Relevant examples of lying include but are not limited to signing in someone else's name on assignments and exams, falsifying documentation or statements to receive an excused absence and claiming to have completed an assignment that you did not complete.
2. Relevant examples of cheating include but are not limited to copying another student's assignment and purporting it as your own or collaborating with another student on an assignment or exam for which collaboration is prohibited.
3. Relevant examples of stealing include plagiarism (purporting another's work no matter the source as your own), removing any items from the classroom or from another student's work area without permission.
4. 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.

X. Academic and Professional Integrity Policy:

Students are expected to follow the Academic and Professional Integrity Policy outlined in the Student Guide: [Carleton University's Academic Integrity Policy](#). Additional details about this process can be found on [the Faculty of Science Academic Integrity website](#). A list of standard sanctions in the Faculty of Science can be found [here](#).

The specific Academic and Professional Integrity Policy of Carleton University includes:

1. Dependability: candidates are reliable, timely, and consistent in their presence and preparation for courses at the university as well as their field settings.

2. Respect & Empathy: candidates are respectful in their address, writing, language, and physical space toward faculty, university staff, school personnel, peers, students in field.
3. Open-mindedness: candidates respect the context and experience of others; developing skills to use that information in classroom conversation, writing, and lesson planning.
4. Integrity: candidates submit original work, fully cite all sources associated with the development of their work (including information from the internet) and recognize that the university fully supports the use of anti-plagiarism software in support of academic integrity. (Original student work is expected. Any work containing plagiarized material will result in an automatic “0” for the assignment.)

Passion for the profession: the right for all students to have access to positive and productive learning environments, and a recognition that the teacher’s dedication is to provide a thriving learning environment for all students.