CHEM 3503/3507 (Fall) 2025

Inorganic Chemistry I

The Faculty of Science at Carleton University acknowledges that our campus is located on the traditional, unceded territories of the Algonquin Anishinabeg people. Thank you 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: Seán Barry

How to address me: Seán

Gender Pronouns: (he/him)

Email: sean_barry@carleton.ca

Note: If you have or question or would like to talk with me, you can send an email, visit me whenever you feel like it, or get me after lecture.

Best Ways to be in Touch: in class, via email

Student Hours: any time the door is open, SC 203b

Office Location: Room 203b, Steacie

Class Location: Please Check Carleton Central for classs location.

Class Times: Monday and Wednesday, 8:35 am

Prerequisites: CHEM 2501

Preclusions: cross-listed preclusion

Department/Unit: Chemistry

All information will be updated at: https://carleton.ca/barrylab/chem-3503/

Topics Covered and Learning Outcomes

In this class, I aim to create an inclusive and welcoming environment where every student feels valued and supported. I celebrate diverse perspectives, recognizing that each student brings unique strengths and experiences to our learning community.
I encourage questions and foster curiosity, emphasizing that mistakes are a natural part of learning. Together, we will build both knowledge and confidence. My goal is for everyone to feel empowered to succeed and inspired to see chemistry in their everyday lives.

Course Description

Symmetry, identification of Raman and infrared active vibrations, symmetry-adapted molecular orbital theory of polyatomic molecules, electron-deficient bonding, bonding in coordination complexes, solid-state bonding, and ionic lattices. The laboratory will introduce the student to a range of synthetic techniques and physical methods of characterization.

Topics to be Covered
Detailed list of topics to be covered.

Topic/Content	**Subtopics**
Inorganic Chemistry	• Coordination, nomenclature, and isomerisation • Electron counting and the 18 and 16 electron rules • Thermodynamics of complex formation: formation constants, enthalpy, and entropy • Steric effects and ligand basicity (pKa) • Hard-Soft Acid-Base Theory • The chelate effect
Coordination Chemistry	• Crystal field theory and crystal field stabilization energy • Strong field and weak field ligands; low spin and high spin electron configurations • Term symbols • Microstate analysis and the d-orbitals • Ligand field spectroscopy • Russell-Saunders coupling terms, ligand field terms, correlation diagrams • Assignment of d-d transitions using Tanabe-Sugano diagrams • Determination of d-orbital splitting energies • Repulsion terms and the nephelauxetic effect
Symmetry and Group Theory	• Symmetry elements • Symmetry point groups of molecules • Character tables, symmetry labels
Molecular Orbitals	• Fragment molecular orbital theory • Molecular Orbital (MO) theory and non-directed symmetry adapted LCAOs • application to organic and main group compounds • Symmetry labelled molecular orbital schemes • Molecular orbital theory of transition metal complexes, symmetry labelled MO schemes, the effect of a ligand's pi-acceptor or pi-donor properties on d-orbital splitting • Paramagnetism and magnetic moment, and the determination of the number of unpaired electrons
Motion	• Chemical applications: chirality, IR and Raman spectroscopy

Important dates and deadlines 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: *N.B. For CHEM 3503, these numbers represent 70% of your final grade, with 30% coming from the laboratory. For CHEM 3507, these comprise 100% of your mark.*

COMPONENT	GRADE VALUE	DATE
ASSIGNMENTS (~10)	20 %	ongoing
MIDTERM[1]	30 %	TBD
FINAL EXAM	50 %	TBD

Recall that no work can be assigned during Fall/Winter break, and no summative tests or final examinations may be held during the last two weeks of fall or winter terms, or during the last week of each half of the summer term. Please note that practical exams, where the material cannot be tested during formal examination period, are exempt from this rule provided (i) students are made aware of the practical exam requirement at the start of the term via the course outline, and (ii) the examination contributes to no more than 15% of the final grade. If provision (i) above is met but the examination comprises more than 15% of the final grade, Dean approval is required prior to informing students via the course outline.

*If you plan on using e-Proctoring, **you must** include this statement:*
Please note that tests and examinations in this course will use a remote proctoring service provided by Scheduling and Examination Services. You can find more information at https://carleton.ca/ses/e-proctoring/.

Late and Missed Work Policies

Late Work

Late work happens: please try to have it submitted on time.

If that can't happen, let me know in advance. In this case, where an agreement is reached, there is no penalty. If you inform me after the due date, discuss it with me and we will try to reach an accommodation.

If you want a related policy use the academic considerations form.

Missed Work

Short-term (5 days or less): The above policy applies to work that is late for 5 days or less.

Long-term (> 5 days): For missed work that is late beyond 5 days, we will use the course-related policy for longer-term accommodation .

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

Ancillary fees associated with this course, e.g., textbooks, course packs, lab manuals, field work, online resources or links required for the course along with their associated cost (if applicable). Estimated costs can be acquired based on current bookstore offerings, Amazon, etc.

Learning Material	Options for Purchasing *(e.g. Bookstore, Used, etc.)*	Approximate Cost
Inorganic Chemistry | 5th Edition *Gary L. Miessler, Paul J. Fischer, Donald A. Tarr* ISBN-13: 978-9361593284	On Amazon	$54 CAD

Students are not required to purchase textbooks or other learning materials for this course. Check with me if you have a different Inorganic Chemistry text.

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

In general, you can use AI to assist with writing, but not in the synthesis or creation of new ideas. 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.

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.

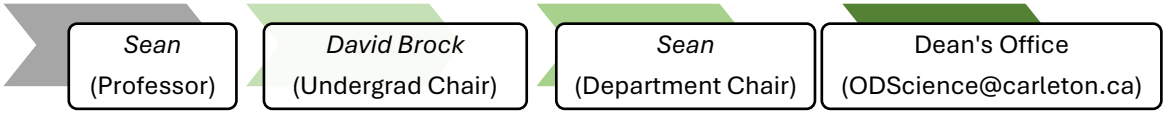
Student Rights & Responsibilities

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.

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/