

Advanced Main Group Chemistry Syllabus

Department of Chemistry

Chem4101/5101 Winter 2026

Dalhousie University operates in the unceded territories of the Mi'kmaw, Wolastoqey, and Peskotomuhkati Peoples. These sovereign nations hold inherent rights as the original peoples of these lands, and we each carry collective obligations under the Peace and Friendship Treaties. Section 35 of the Constitution Act, 1982, recognizes and affirms Aboriginal and Treaty rights in Canada.

We recognize that African Nova Scotians are a distinct people whose histories, legacies, and contributions have enriched the part of Mi'kma'ki known as Nova Scotia for over 400 years.

Course Instructor

Name	Email	Office Hours
Alex Veinot	alex.veinot@dal.ca	Wednesdays, 2-3 pm, Chem218, or by appointment

Course Description

Course Description: Following a brief overview of the fundamental aspects of preparation, structure and bonding for familiar systems, selected topics are examined in some detail. An emphasis is placed on novel structure and bonding arrangements in comparison with carbon chemistry.

Course Prerequisites

CHEM 3103.03 (grade of C- or better)

Student Resources

University Policies and Programs

Important Dates in the Academic Year (including add/drop dates):

http://www.dal.ca/academics/important_dates.html

Classroom Recording Protocol: <https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/class-recording-protocol.pdf>

Dalhousie Grading Practices Policies:

<https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/grading-practices-policy.pdf>

Grade Appeal Process: https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy: <https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/sexualized-violence-policy.pdf>

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Learning and Support Resources

General Academic Support – Advising (Halifax): https://www.dal.ca/campus_life/academic-support/advising.html

General Academic Support – Advising (Truro): https://www.dal.ca/campus_life/ssc.html

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond): https://www.dal.ca/campus_life/academic-support/On-track.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Mi'kmaq and Indigenous Relations: <https://www.dal.ca/about/mission-vision-values/mikmaq-indigenous-relations.html>

Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at elders@dal.ca or 902-494-6803: <https://www.dal.ca/about/mission-vision-values/mikmaq-indigenous-relations/elders-in-residence-and-traditional-knowledge-keepers.html>

Black Student Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre.html

LGBTQ2SIA+ Collaborative: <https://www.dal.ca/about/mission-vision-values/equity-diversity-inclusion-and-accessibility/about-office-equity-inclusion/community-specific-groups/lgbtq2sia-collaborative.html>

Dalhousie Libraries: <http://libraries.dal.ca/>

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Dalhousie Student Advocacy Services: <https://www.dsu.ca/dsas?rq=student%20advocacy>

Dalhousie Ombudsperson: https://www.dal.ca/campus_life/safety-respect/ombudsperson.html

Human Rights and Equity Services: <https://www.dal.ca/about/mission-vision-values/equity-diversity-inclusion-and-accessibility/about-office-equity-inclusion/human-rights-and-equity-services.html>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Study Skills/Tutoring: http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Faculty of Science Advising Support: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Safety

Biosafety: <http://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <http://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Laser Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html>

Course Structure

Course Delivery

Class material will be delivered in-person whenever possible, but may be delivered online due to illness/inclement weather at the discretion of the instructor. The midterm and final exams, and presentations will require in-person attendance. Students connecting to online resources from outside Canada are responsible for ensuring awareness and compliance with any applicable laws in the country from which they are connecting.

Lectures

MWF, 8:35 – 9:25, MCCAIN ARTS&SS 2132

Tutorials

At the discretion of the instructor, times will be determined on an *ad hoc* basis.

Course Materials

Course Materials: Electronic notes will be provided. Due to copyright issues, these must not be publicly shared. Resources pertinent to the presentation component of the assessment (see below) are available upon request.

Assessment

Component	Weight	Date
Midterm	30 %	Feb 13, 2026
Presentation	20 %	last two weeks of class
Final Exam	50 %	To be scheduled during exam period

Tests

- One midterm exam is scheduled to be held during regular scheduled class time.
- **Missed term test:** If you miss a term test for any reason, no make-up will be offered. Once the Student Declaration of Absence (SDA) form is submitted, points from the missed term test will be transferred to the final exam.

Presentations

- Student presentations will be scheduled during regular class time, with presentation details to follow in a separate document.
- **Missed presentations:** If you miss your presentation for any reason, no make-up will be offered. Once the SDA form is submitted, points from the missed presentation will be transferred to the final exam.

Final exam

- One final exam is scheduled to be held during the regular scheduled exam period.
- **Missed final exam:** If you miss the final exam for reason, as per Dalhousie policy, the SDA form does not apply. You must contact Dr. Veinot by email (alex.veinot@dal.ca) within 24 h of the missed exam for further instructions. Appropriate documentation (e.g. medical certificate indicating dates and duration of illness and a description of the impact it had on your ability to fulfill academic requirements) must be submitted within 3 calendar days of the missed exam if you wish to write a make-up. If no appropriate notification and documentation is provided within the timeframe described above, no make-up will be allowed, and you will earn a mark of '0' for the exam. Please note that if you are 30 minutes or more late to write a test or exam, it will be considered a missed test/exam.

Conversion of numerical grades to final letter grades follows the

[Dalhousie Grade Scale](#)

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

Short-term absence policy: As of January 1, 2018, the university has adopted a new policy regarding short-term absences, as detailed here:

<https://www.dal.ca/dept/universitysecretariat/policies/academic/missedor-late-academic-requirements-due-to-student-absence.html>.

In accordance with the new policy, students will no longer submit a sick note or medical certificate in case of a missed academic requirement due to short-term absence (defined as “absence of 3 consecutive days or fewer due to minor physical or mental health conditions, or other extenuating circumstances such as caregiving duties; immediate family illness, injury or death; involvement in an accident; legal proceedings or being a victim of a crime, domestic or intimate partner violence”).

Instead, they will:

1. notify the instructor by email within 24 h of the missed academic deadline or test
2. submit a Student Declaration of Absence (SDA) form on-line within 3 calendar days following the last day of absence.

The SDA can be used a maximum of two times. Note that the submission of the SDA form does not provide an automatic exemption from any academic requirements that were missed or late during an absence. Once the form is submitted, course policies will apply regarding procedures for making up the missed academic requirement.

Course Policies related to Academic Integrity

The use of generative AI to assist with the generation of notes, presentation materials and other materials is encouraged provided (i) proper notice is given, including the extent to which AI was used to generate the content and (ii) copyright and privacy considerations are made (i.e. ensuring that information shared with any LLMs are widely available and not considered confidential or private). Additional University-wide policies are given below.

Learning Objectives

- Derive molecular orbital (MO) diagrams for main group compounds and understand the relationship between MO manifold, molecular structure, and reactivity
- Understand and apply quantitative energy decomposition schemes to understand structure and bonding in s and p-block compounds
- Rationalize the structure and reactivity of multiply-bonded main group compounds

- Understand Lewis acid/base interactions quantitatively and the concept of Frustrated Lewis Pairs
- Understand the reactivity of molecular s-block compounds
- Understand the reactivity of amine-borane and phosphine-borane adducts as hydrogen sources and precursors to polymers

Course Content

Topics covered:

1. Electronic Structure

- a) Atomic Orbitals and Hybridization trends
- b) MO Diagrams
- c) Relativistic and Dispersion effects
- d) Formalisms

2. Bonding

- a) Components of bonding: Energy Decomposition Analysis
- b) Bonding in diatomics
- c) Bonding in E2 and E4
- d) Heavy alkynes
- e) Heavy alkenes
- f) Molecular s-block hydrides
- g) TM chemistry of s-block elements
- h) Lewis Acid/Base interactions and Frustrated Lewis Pairs

3. Reactivity

- a) Reactivity of heavy alkynes
- b) Reactivity of s-block compounds
- c) Reactivity of Frustrated Lewis Pairs
- d) Reactivity of NB/PB Adducts (hydrogenation)
- e) Reactivity of NB/PB Adducts (dehydrocoupling)

4. Independent Study Presentations: Topics assigned in class.

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding Mi'kmaq and Indigenous Relations (including the Elders in Residence program, Land Acknowledgements, Understanding Our Roots, and much more) can be found at: <https://www.dal.ca/about/mission-vision-values/mikmaq-indigenous-relations.html>

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about/mission-vision-values/global-relations.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (https://www.dal.ca/campus_life/ssc.html).

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <https://www.dal.ca/about/mission-vision-values/equity-diversity-inclusion-and-accessibility/about-office-equity-inclusion.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at:

<https://www.dal.ca/content/dam/www/about/leadership-and-governance/governing-bodies/code-student-conduct.pdf>

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: <https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/fair-dealing-policy.pdf>

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.