

Faculty of Science Course Syllabus
Department of Chemistry
CHEM 2101 01
Introductory Inorganic Chemistry
Winter 2019

Lecturer & Laboratory Instructor:	Professor Marc Whalen Office: CHEM 110 Email: marc.whalen@dal.ca		
	Office Hours:	Tues	2:00-3:00
		Thurs	2:30-3:30
Lectures:	Mon, Wed & Fri	10:35-11:25 am	(LSC 232)
Laboratory:	approximately every other week See Laboratory Schedule below for exact dates		
	Section B02:	Thurs	1:05 – 4:55 pm (CHEM 118P)
	Section B01:	Fri	1:35 – 5:25 pm (CHEM 118P)

Course Description

The fundamental models introduced in first year chemistry are developed to explain the trends in structure and reactivity of Main Group compounds. Group theory is introduced to quantify molecular symmetry and provide insight into NMR (nuclear magnetic resonance), vibrational spectroscopy (IR and Raman) and molecular orbital theory. Fundamental aspects of the solid state are also introduced and discussed within the context of periodic trends for Main Group elements. The chemistry of the Main Group Elements will be surveyed within the context of the models stated above. The laboratory portion of the course will introduce practical aspects of Main Group synthesis and characterization.

Course Prerequisites

CHEM 1011.03/1012.03 or equivalent (grade of C- or better)

Course Objectives/Learning Outcomes

- Obtain a more comprehensive understanding of basic models (Lewis structures, VSEPR theory, molecular orbital theory, Lewis theory of acids and bases, etc.)
- Understand trends in Main Group chemistry within the context of the basic models
- Generalize the discussion of acidity and basicity to better understand the chemical possibilities within specific solvent systems, including superacids, superbases and weakly coordinating solvents
- Introduce theories of the solid state (survey of basic structure types, lattice energies, Born-Haber cycles, band theory, semiconductors, conductors, insulators)

- Obtain an introductory knowledge of molecular symmetry (symmetry elements and operations, point groups, character tables)
- Apply principles of molecular symmetry to better understand molecular spectroscopy (nuclear magnetic resonance, infrared and Raman)
- Gain familiarity with synthetic and characterization techniques in Main Group chemistry through hands on laboratory experiments

Course Materials

- Textbook: Inorganic Chemistry, 5th Ed. Miessler, Fischer and Tarr. Pearson, 2014 (Dalhousie Bookstore)
- Chemistry 2101 Laboratory Manual, Winter 2019 (Dalhousie Bookstore)
- Course website (Brightspace) and resources therein

Course Assessment

Component	Details	Value (%)
Laboratory ¹	Laboratory report sheets ²	20.0
	Notebook evaluation (weekly)	2.5
	Samples evaluation (each lab)	5.0
	Lab skills (each lab)	2.5
	Lab Quizzes (beginning of each new lab)	5.0
Take-home assignments	4 -5 throughout term, due dates to be announced	10
Midterm 1	In lecture (Mon Feb 11)	10
Midterm 2	In lecture (Mon Mar 25)	10
Final Exam	Scheduled by registrar (3 hours)	35

¹See CHEM 2101 Laboratory Manual pp. 27-29 for more details.

²Laboratory Report Sheet due dates **depend on your group** and are stated in the **Laboratory Schedule** (see below)

Requirements to Pass the Course

- Grade of at least 27.5/55 in the tested component (midterms + final exam).
- Grade of at least 17.5/35 in the laboratory component.

Conversion of numerical grades to Final Letter Grades (Dalhousie Common Grade Scale)

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

To manage your expectations, please see the following link for a description of performance levels associated with letter grades. https://www.dal.ca/campus_life/academic-support/grades-and-student-records/grade-scale-and-definitions.html.

Other Course Requirements

Chemistry Safety Module and Quiz: Chemicals and laboratory equipment can pose serious hazards if they are not treated with an appropriate amount of caution. As a chemistry student, part of your training involves understanding the hazards that are present within a chemistry laboratory and learning the measures that must be taken in order to maximize the safety of you and your peers.

You are **REQUIRED** to read the Chemistry Safety Module in your 2101 Lab Manual and complete the on-line safety quizzes, with perfect marks, by **January 13, 2019 at 11:30 pm**. Students who do not successfully complete this requirement will not be allowed to perform experiments in any Dalhousie undergraduate chemistry laboratory until the module is completed. If a lab session is missed due to an incomplete safety module, the instructor is not obligated to provide a make-up session.

Course Policies

Testable Material: All material presented in lecture is testable in the midterms and final exam. The annotated Power Point slides presented during each lecture will be posted on the course website after each lecture. However, additional information stated by the lecturer or written on the chalk board may not be captured in the slides. If you wish to be informed on all material, it is advised that you attend all of the lectures.

Short-term Absence Policy (missed academic requirements): In the past, students were required to present sick notes to report short-term absences resulting in missed or late academic requirements, which include the following:

- Missed midterm or final exam.
- Missed laboratory session (lab quiz and performing the experiment).
- Late submittal of a graded assignment.
- Late submittal of a laboratory report sheet.

The university has adopted a **new policy** for reporting missed academic requirements. For a full statement of the policy, follow the link below or in the course website.

https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

To summarize the new policy, students will no longer submit a sick note. Instead, they will submit a **Student Declaration of Absence (SDA)** form **online** through the course website within 24 hours of a missed or late academic requirement. **** Paper copies are not accepted.**** Students can use the SDA form **twice** in this course. Once submitted, course policies will apply regarding procedures for making up the missed academic requirement (see below).

- **Missed midterm:** If you miss a midterm for any reason, **no make-up will be offered**. You are required to submit a SDA form within 24 hours of the missed midterm. The instructor will then transfer the points from the missed midterm to the final exam.
- **Missed final exam:** No SDA form is required. The student is required to contact the instructor by email to make alternate arrangements for writing the final exam after the end of the exam period posted by the Registrar.
- **Missed laboratory session:** You are expected to attend the laboratory sessions scheduled for the Group to which you are assigned (see **Laboratory Schedule** below). Students cannot attend a different laboratory session unless prior arrangements have been made with the instructor. After submittal of the SDA form for an absence, it is at the discretion of the instructor as to whether or not the lab can be performed at another time. The **Laboratory Schedule** has space for the makeup of only one laboratory experiment (on April 4, 5).

- **Late submittal of a graded assignment or laboratory report sheet:** For each week day late after the posted due date, 10% will be deducted. A submitted SDA form will excuse one week day late (unless alternate arrangements are made with the instructor).

Laboratory Performance and Expectations:

- **Personal Protective Equipment in the Laboratory:** No student will be allowed to work in the lab without approved safety glasses, closed toe shoes, and a properly fitting cotton lab coat (sleeves cannot be rolled up). Lab coats and glasses can be purchased in the Dalhousie Bookstore.
- **Lab Preparation:** For safety reasons, students are expected to come to the lab having completed adequate preparation in advance according to the guidelines stated in the laboratory manual. For this reason students will write a quiz at the beginning of each lab session. The instructor reserves the right to ask any student to leave the laboratory if they are deemed unprepared to conduct the lab in a safe manner. No make-up session will be provided in these cases.
- **Timely Completion of Laboratory Sessions:** All lab sessions are 4 hours in length, which is ample time for a prepared student to complete the work and perform all clean up and organizational tasks. Students will complete their work (including clean up) by the end of the lab period in all cases. Budget your time accordingly.

Laboratory Exemptions: If you have taken this course before and earned a passing grade in the lab, you may **apply** for a laboratory exemption. To do so, contact the instructor by email before the beginning of the laboratory (Jan 10, 2019). The instructor will then seek documentation within the department to obtain your previous lab grade. Once the exemption is granted, the grade you previously earned in the lab will be transferred over to this course.

Collaboration vs. Copying on Assignments and Lab Report Sheets (Academic Integrity): Students are encouraged to work together, discuss, debate, etc. when doing the take-home assignments, etc. However, **copying** the work of another student (or providing work for someone else to copy) is a violation of the Dalhousie Academic Integrity Policy (see **University Policies and Statements** below) and is subject to academic penalty and a record on your transcript. It is far better to pass in the work late or incomplete than to copy the work of someone else.

Tentative Schedule of Lectures (subject to change)

The course will cover the stated chapters of your textbook and supplemental readings posted on Brightspace.

Week	Day	Date	Lecture	Topic(s) / Textbook Chapter Sections and Supplemental Readings
1	M	Jan 7	1	Syllabus and Intro / 1.1-1.4; Periodic Table /2.2.1; Schrodinger Equation/2.2
	W	9	2	Periodic Properties of Atoms /2.3; Simple Bonding Theory 3.1
	F	11	3	VSEPR / 3.2, 3.2.1, 3.2.2, 3.2.3 (and <i>Inorg. Chem.</i> 1982 , 21, 275-281) ¹ ; 3.2.4
2	M	14	4	Symmetry Elements and Operations /4.1
	W	16	5	Point Groups/4.2
	F	18	6	Properties and Representations, Character Tables and Orbital Symmetries/4.3
3	M	21	7	Molecular Orbitals / 5.1, 5.1.1-5.1.4, 5.2, 5.2.1-5.2.4
	W	23	8	Molecular Orbitals / 5.3, 5.3.1-5.3.2, 5.4, 5.4.1-5.4.2, 5.4.3-5.4.4 (including Walsh Diagrams: "Applications of Qualitative Molecular Orbital Theory", In <i>Accounts of Chemical Research</i> Vol. 7, 1974, pp. 384-392. Benjamin M. Gimarc.) ¹ , 5.4.6, 5.4.7
	F	25	9	Molecular Orbitals continued
4	M	28	10	Bronsted Acid-Base Chemistry / 6.1, 6.1.1, 6.2, 6.3, 6.3.1-6.3.7
	W	30	11	Bronsted Acid-Base Chemistry continued
	F	Feb 1		Monroe Day (University Holiday)
5	M	4	12	Lewis Acid-Base and Frontier Orbitals / 6.4, 6.4.1-6.4.8, 6.5.1, 6.5.2
	W	6	13	Lewis Acid-Base and Frontier Orbitals continued
	F	8	14	The Crystalline Solid State: Structures / 7.1, 7.1.1-7.1.4, 7.6
6	M	11		Midterm 1
	W	13	15	Thermodynamics of Ionic Crystal Formation and Solubility / 7.2, 7.2.1, 7.2.2
	F	15	16	Thermodynamics continued
7		18-22		Study week
8	M	25	17	Solution Phase Multinuclear NMR Spectroscopy (R.S. Drago, <i>Physical Methods for Chemists</i> , 2 nd Ed. Saunders College Publishing, Toronto, 1992) ¹
	W	27	18	Molecular Vibrations/ 4.4.2
	F	Mar 1	19	Hydrogen / 8.2, 8.2.1
9	M	4	20	Alkali Metals/ 8.3, 8.3.1-8.3.2
	W	6	21	Alkaline Earths / 8.4.1-8.4.2
	F	8	22	Group 13/ 8.5.1, 8.5.2
10	M	11	23	Boranes and Heteroboranes/ 15.4.1, 15.4.2
	W	13	24	Group 14/ 8.6.1, 8.6.2
	F	15	25	Guest Lecture by Professor Mark Obrovac
11	M	18	26	Guest Lecture by Professor Saurabh Chitnis
	W	20	27	Group 14 continued and Group 15 / 8.7, 8.7.1, 8.7.2
	F	22	28	Group 15 continued and Group 16 / 8.8, 8.8.1
12	M	25		Midterm 2
	W	27	29	Group 16 continued and Zintl Ions /15.4.4 and <i>Angew. Chem. Int. Ed.</i> 2000, 39, 670. ¹
	F	29		Group 17 / 8.9, 8.9.1
13	M	Apr 1	30	Group 17 continued
	W	3	31	Group 18 / 8.10, 8.10.1, 8.10.2
	F	5	32	Group 18 continued
14 ²	M	8	33	Review (Q&A style)

¹Posted on Brightspace in "Posted Readings for Lecture" folder.

²Monday April 8 is designated as a Friday in the University calendar.

Laboratory Schedule

Groups A and C are in lab section 2101 B02 (Thursday labs)

Groups B and D are in lab section 2101 B01 (Friday labs)

 The instructor will post the groups on Brightspace by **5pm, Tues Jan 8.**

Week	Group	Thurs	Group	Fri	Lab Activity	Report Sheets Due
1	A1, A2	Jan 10	B1, B2	Jan 11	Check-in and Exp. 1	-
2	C1, C2	Jan 17	D1, D2	Jan 18	Check-in and Exp. 1	-
	A1		B1		Exp. 4 Computer Lab (Thurs 1-2:30; Fri 1:30-3)	-
3	A1, A2	Jan 24	B1, B2	Jan 25	Exp. 2	Exp. 1
	C1		D1		Exp. 4 Computer Lab (Thurs 1-2:30; Fri 1:30-3)	-
4	no labs	Jan 31	no labs	Feb 1	Week of Munroe Day	
5	C1, C2	Feb 7	D1, D2	Feb 8	Exp. 2	Exp. 1
	A2		B2		Exp. 4 Computer Lab (Thurs 1-2:30; Fri 1:30-3)	-
6	A1	Feb 14	B1	Feb 15	Exp. 3	Exp. 2
	A2		B2		Exp. 4	
	C2		D2		Exp. 4 Computer Lab (Thurs 1-2:30; Fri 1:30-3)	-
7	no labs	Feb 21	no labs	Feb 22	Study Week	
8	C1	Feb 28	D1	Mar 1	Exp. 3	Exp. 2
	C2		D2		Exp. 4	
9	A1	Mar 7	B1	Mar 8	Exp. 4	Exp. 3
	A2		B2		Exp. 3	-
10	C1	Mar 14	D1	Mar 15	Exp. 4	Exp. 3
	C2		D2		Exp. 3	-
11	A1	Mar 21	B1	Mar 22	Exp. 4 / breakout groups and Check-out	-
	A2		B2			Exp. 3
12	C1	Mar 28	D1	Mar 29	Exp. 4 / break out groups and Check-out	-
	C2		D2			Exp. 3
13	A,C	Apr 4	B,D	Apr 5	Lab Make-Up	Exp. 4

 Computer Labs will be conducted at designated computer workstations in the Chemistry Resource Center

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of 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.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.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.

Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

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

Statement: <http://www.dal.ca/cultureofrespect.html>

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 (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

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

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

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Missed or Late Academic Requirements due to Student Absence (policy)

https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

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

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

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

Academic supports

Library: <https://libraries.dal.ca/>

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

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

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

Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

Other supports and services

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

Student Advocacy: <https://dsu.ca/dsas>

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

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

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

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

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