CHEM 2101 01, Introductory Inorganic Chemistry, Winter 2020
Faculty of Science Course Syllabus
Dalhousie University

Lecturer & Laboratory Instructor **Marc Whalen (CHEM 110)**		
Office Hours	**Tues 2-3 and Thurs 10-11**	
email	**marc.whalen@dal.ca**	
Lectures (LSC 236) **see Lecture Schedule**	**Mon Wed Fri**	**11:35-12:25**
Laboratory (118P) **see Lab Schedule**	**Section B01**	**Thurs 1:05-4:55**
	Section B02	**Fri 1:35-5:25**

Course Description

In the lecture component of the course, you will gain a deeper understanding of fundamental models introduced in first year chemistry. This knowledge will enable you to explain and predict general aspects of the structure and reactivity of Main Group compounds, which will be surveyed in the context of these models. You will gain a foundational understanding molecular symmetry, which will provide insight into modern tools such as NMR (nuclear magnetic resonance), vibrational spectroscopy (IR and Raman) and molecular orbital theory, and prepare you for further studies in inorganic chemistry. Structures and thermodynamics of solids will also be introduced.

In the laboratory portion of the course you will develop inorganic synthesis and characterization skills using modern methods, and engage in active learning exercises that will support the lecture component.

Course Prerequisites

CHEM 1011/1012 or equivalent (minimum grade of C-)

Course Learning Outcomes

Upon completion of this course, you will be able to:

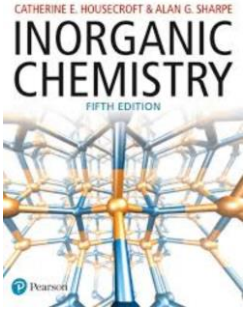
- Acquire knowledge of chemistry on your own from scientific texts
- Deliver an oral presentation summarizing results of a scientific experiment
- Explain and predict basic structures and reactions using the concepts of:
    - periodic trends
    - Bronsted and Lewis acidity/basicity
    - intermolecular interactions
    - modern bonding theories
    - thermodynamics
- Use symmetry principles to classify molecules and characterize them with modern methods
- Use systems thinking to identify roles of inorganic chemistry in complex world and societal systems
- Safely and efficiently perform procedures in a modern inorganic chemistry laboratory

Required Texts

"Inorganic Chemistry". **C.E. Housecroft** (2018). 5th ed. Pearson Publications.

Textbook: Essential readings and end-of-chapter problems

Solutions Manual: Detailed solutions to the end-of-chapter problems



Chem 2101 Lab Manual (2020)

The importance of textbooks. Deep reading of chemistry texts on a **daily basis** is necessary to develop proficiency in the language of chemistry. This development is essential if you plan to pursue a career in chemistry or a chemistry-related profession (medicine, pharmacy, science patent law, science entrepreneur, lab technician, professor, industrial or environmental scientist, science communication)

Title	Format	Price	Source
Inorganic Chemistry (Housecroft) 5th ed. ISBN 9781292134161	e-text (pdf)	$38.27 (1 year) $63.80 (lifetime)	Vital Source* (online)
CHEM 2101 Lab Manual	print	xxxx	Dalhousie Bookstore

*Vital Source URL:
www.vitalsource.com/en-ca/textbooks?utf8=%E2%9C%93&sort=&term=inorganic+chemistry

No Purchase Options

Title	Location	Number of Copies
Inorganic Chemistry (Housecroft)	Killam Library front desk (2 hour loan)	3
	ebook	3
Housecroft Solutions Manual	Killam Library front desk (2 hour loan)	1

Course Website (Brightspace)

Introductory Inorganic Chemistry, CHEM 2101 Winter 2020
Consult regularly for information and announcements

Course Assessment

Component	Details	Value (%)
Laboratory[1]	Lab notebook evaluation	25
	Lab quiz	
	Samples evaluation (each lab)	
	Post labs[2]	
	ALE 7 group presentation	
Team based learning assessment	Individual and team grades	10
Midterm 1	In lecture (Wed Jan 29)	10
Midterm 2	In lecture (Mon Mar 2)	10
Midterm 3	In lecture (Fri Mar 20)	10
Final Exam	Scheduled by registrar (3 hours)	35

[1]See CHEM 2101 Laboratory Manual p. 20 for more details.
[2]Post lab due dates **depend on your group** and are stated in the **Laboratory Schedule** (see below)

Requirements to Pass the Course

- Grade of at least 32.5/65 in the tested component (midterms + final exam).
- Grade of at least 12.5/25 in the laboratory component.

Performance Expectations

To manage your expectations and to help you achieve your goals, the following grading rubric provides definitions of performance expectations according to the **Dalhousie Common Grade Scale**. Please refer to these when considering how to prepare for testing and submitting assigned work.
https://www.dal.ca/campus_life/academic-support/grades-and-student-records/grade-scale-and-definitions.html.

Grade	Grade Point Value	Score	Definition	Performance
A+	4.30	90-100	Excellent	Considerable evidence of original thinking; demonstrated outstanding capacity to analyze and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base.
A	4.00	85-89		
A-	3.70	80-84		
B+	3.30	77-79	Good	Evidence of grasp of subject matter, some evidence of critical capacity and analytical ability; reasonable understanding of relevant issues; evidence of familiarity with the literature.
B	3.00	73-76		
B-	2.70	70-72		
C+	2.30	65-69	Satisfactory	Evidence of some understanding of the subject matter; ability to develop solutions to simple problems; benefitting from his/her university experience.
C	2.00	60-64		
C-	1.70	55-59		
D	1.00	50-54	Marginal Pass	Evidence of minimally acceptable familiarity with subject matter, critical and analytical skills (except in programs where a minimum grade of ‘C’ is required).
FM	0.00		Marginal Failure	Available only for Engineering, Health Professions and Commerce.
F	0.00	0-49	Inadequate	Insufficient evidence of understanding of the subject matter; weakness in critical and analytical skills; limited or irrelevant use of the literature.

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. These will not contain all information from the class (exercises and oral).
- **All concepts represented in assigned textbook problems**

Short-term Absence Policy for Missed Academic Requirements:

In this course, an academic requirement is defined as:

- Midterm
- Laboratory session (lab quiz and performing the experiment).
- Submittal of assigned work

If you miss an academic requirement, Dalhousie University requires a **Student Declaration of Absence (SDA)** form to be submitted **online** (course website). Sick notes should not be submitted.

For a full statement of the policy see below:
https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

SDA forms should be submitted within 24 hours of a missed or late academic requirement. Students can use the SDA form **twice** in this course.

Once an SDA is submitted, the student is also required to email the instructor ASAP to make arrangements for making up the academic requirement according to the discretion of the instructor and course policies.

Course Policies

- **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.
- **Late submittal of a graded assignment or laboratory report sheet:** For each weekday late after the posted due date, 10% will be deducted, to a maximum of 50%. A submitted SDA form will excuse **one weekday** (unless alternate arrangements are made with the instructor).

Laboratory 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 12, 2020 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.

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** (p. 19-22). 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 9, 2020). 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.

Class Schedule (subject to change)
Class activities are listed below for each date.
Lectures will **summarize** and **clarify** key concepts from readings from your textbook that should be completed beforehand. See **Reading Details** in the next table.

Week	Day	Date	Class	Activity
1	M	**Jan** 6	1	
	W	8	2	**Lecture: Chapter 2** Basic concepts: molecules
	F	10	3	
2	M	13	4	**Lecture: Chapter 3** Introduction to molecular symmetry
	W	15	5	
	F	17	6	
3	M	20	7	**Lecture: Chapter 5** Bonding in polyatomic molecules and Walsh Diagrams (posted on Brightspace)
	W	22	8	
	F	24	9	
4	M	27	10	**Lecture: Chapter 6** Structures and Energetics of metallic and ionic solids
	W	29	11	**Test 1**
	F	31	12	**Lecture: Chapter 6** continued
5	M	**Feb**3	13	**Lecture: Chapter 6** continued and **Chapter 9** Ionic liquids at ambient temperatures
	W	5	14	**Lecture: Chapter 7** Acids, bases and ions in aqueous solution
	F	7	Monroe Day (no classes)	
6	M	10	15	**Lecture: Chapter 7** continued
	W	12	16	**Lecture: Chapter 9** non-aqueous media
	F	14	17	**Lecture: Chapter 10** Hydrogen
7	Study week (no classes)			
8	M	24	18	**Lecture: Chapter 10** continued
	W	26	19	**Lecture: Chapter 11** Group 1: the alkali metals
	F	28	20	
9	M	**Mar**2	21	**Test 2**
	W	4	22	**Lecture: Chapter 12** Group 2: the alkaline earth metals
	F	6	23	
10	M	9	24	**Lecture: Chapter 13** The Group 13 elements
	W	11	25	
	F	13	26	**Lecture: Chapter 14** The group 14 elements
11	M	16	27	
	W	18	28	**Lecture: Group 15** The group 15 elements and "Systems Thinking in Chemical Education" (supplemental reading on Brightspace)
	F	20	29	**Test 3**
12	M	23	30	**Team based learning:** Systems thinking applied to the global industrial production of reactive nitrogen compounds
	W	25	31	
	F	27	32	**Lecture: Group 16** The group 16 elements
13	M	30	33	
	W	**Apr**1	34	**Lecture: Group 17** The group 17 elements
	F	3	35	**Lecture: Group 18** The group 18 elements
14*	M	6	36	**Review** (Q&A style)

* Monday April 6 is designated as a Friday in the Dalhousie University Calendar.

Reading Details.

All readings from Inorganic Chemistry (Housecroft) unless otherwise stated.

Refer to headings and subheadings below.	**End of Chapter Problems.** Detailed answers are found in the Solutions Manual.

Chapter 2 Basic Concepts: molecules
• 2.1 Bonding models: an introduction
  ○ A historical overview
  ○ Lewis structures
• 2.2 Homonuclear diatomic molecules: valence bond (VB) theory
  ○ Uses of the term *homonuclear*
  ○ Covalent bond distance
• 2.3 Homonuclear diatomic molecules
  ○ An overview of the MO model
  ○ MO theory applied to H_2
  ○ The bonding in He_2, Li_2, Be_2
  ○ The bonding in F_2 and O_2
  ○ What happens if the s-p separation is small?
• 2.4 The octet rule and isoelectronic species
  ○ The octet rule: first row p-block elements
  ○ Isoelectronic species
  ○ The octet rule: heavier p-block elements
• 2.6 Dipole moments
  ○ Polar diatomic molecules
  ○ Molecular dipole moments
• 2.7 MO theory: heteronuclear diatomic molecules.
  ○ Which orbital interactions should be considered?
  ○ Hydrogen fluoride
• 2.8 Molecular shape and the VSEPR Model
  ○ Valence-shell electron-pair repulsion model
  ○ Structures derived from a trigonal bipyramid
  ○ Octahedral species
  ○ Trigonal bipyramidal species
	2.1 - 2.5, 2.9 - 2.19

Chapter 3 Introduction to molecular symmetry
• 3.1 Introduction
• 3.2 Symmetry operations and symmetry elements
• 3.3 Successive operations
• 3.4 Point groups
• 3.5 Character tables: an introduction
• 3.6 Why do we need to recognize symmetry elements?
• 3.7 Vibrational spectroscopy
  ○ How many vibrational modes are there for a given molecular species?
  ○ Selection rules for an infrared or Raman active mode of vibration
  ○ Linear ($D_{\infty h}$ or $C_{\infty v}$) and bent (C_{2v}) triatomic molecules
  ○ Bent molecules XY_2: using the C_{2v} character table
• 3.8 Chiral molecules
	3.1 -3.20, 3.22, 3.24, 3.29, 3.34, 3.35

Chapter 5 Bonding in polyatomic molecules
• 5.1 Introduction
• 5.2 Valence bond theory: hybridization of atomic orbitals
  ○ What is orbital hybridization?
  ○ sp hybridization: a scheme for linear species
  ○ sp^2 hybridization: a scheme for trigonal planar species
  ○ sp^3 hybridization: a scheme for tetrahedral and related species
  ○ Other hybridization schemes
• 5.3 Valence bond theory: multiple bonding in polyatomic molecules
• 5.5 Molecular orbital theory: the ligand group orbital approach and application to triatomic molecules
  ○ Molecular orbital diagrams: moving from a diatomic to a polyatomic species
  ○ MO approach to bonding in linear XH_2: symmetry matching by inspection
  ○ MO approach to bonding in linear XH_2: working from molecular symmetry
  ○ A bent triatomic: H_2O
• 5.6 Molecular orbital theory applied to polyatomic molecules BH_3, NH_3, and CH_4
  ○ BH_3
  ○ NH_3
	5.1 (a, b), 5.2(a), 5.3-5.13

Supplemental reading (posted on Brightspace) Walsh diagrams applied to XY_2 and XY_3	-

Chapter 6 Structures and energetics of metallic and ionic solids (also Chapter 9)
• 6.1 Introduction
• 6.2 Packing of spheres
  ○ Cubic and hexagonal close packing
  ○ The unit cell: hexagonal and cubic close packing
  ○ Interstitial holes: hexagonal and cubic close packing
  ○ Non-close-packing: simple cubic and body-centered cubic arrays
• 6.3 The packing-of-spheres model applied to the structures of elements
  ○ Group 18 elements in the solid state
  ○ H_2 and F_2 in the solid state
  ○ Metallic elements in the solid state
• 6.4 Polymorphism in metals
  ○ Polymorphism: phase changes in the solid state
  ○ Phase diagrams
• 6.5 Metallic radii
• 6.10 Sizes of Ions
  ○ Ionic radii
  ○ Periodic trends in ionic radii
  ○ Box 6.4 Radius ratio rules
• 6.11 Ionic Lattices
  ○ The rock salt (NaCl) structure type
  ○ The caesium chloride (CsCl) structure type
  ○ The fluorite (CaF_2) structure type
  ○ The antifluorite structure type
  ○ The zinc blende (ZnS) structure type
  ○ The β-cristoballite (SiO_2) structure type
  ○ The wurtzite (ZnS) structure type
  ○ The rutile (TiO_2) structure type
• 6.13 Lattice Energy: estimates from an electrostatic model
  ○ Coulombic attraction within an isolated ion pair
  ○ Coulombic interactions in an ionic lattice
  ○ Born forces
  ○ The Born-Lande equation
  ○ Madelung constants
  ○ Refinements to the Born-Lande equation
  ○ Overview
• 6.14 Lattice energy: The Born-Haber cycle
• 6.15 Lattice energy: 'calculated' vs. 'experimental' values
  ○ The volume-based thermodynamic (VBT) approach
• 6.17 Applications of lattice enthalpies
• 9.12 Ionic Liquids
  ○ Ionic Liquids at room temperature
	6.1, 6.2, 6.7, 6.10, 6.11, 6.12 (a), 6.14, 6.15, 6.16, 6.17, 6.18, 6.19, 6.22
	9.17, 9.18

Chapter 7 Acids, bases and ions in aqueous solution
• 7.1 Introduction
• 7.7 Aquated ions: formation and acidic properties
  ○ Water as a Lewis base
  ○ Aquated cations as Bronsted acids
• 7.8 Amphoteric oxides and hydroxides
  ○ Amphoteric behaviour
• 7.9 Solubilities of ionic salts
	7.6 - 7.9, 7.14, 7.16, 7.17, 7.23, 7.24,

○ Solubility and saturated solutions ○ The energetics of the dissolution of an ionic salt: $\Delta_{sol}G^o$ ○ The energetics of the dissolution of an ionic salt: hydration of ions ○ Solubilities: some concluding remarks • 7.11 Coordination complexes: an introduction ○ Definitions and terminology • 7.13 Factors affecting the stabilities of complexes containing only monodentate ligands ○ Ionic size and charge ○ Hard and soft metal centers and ligands	
Chapter 9 Non-aqueous media • 9.1 Introduction • 9.4 Acid base behaviour in non-aqueous solvents • 9.5 Liquid sulfur dioxide • 9.6 Liquid ammonia • 9.8 Sulfuric acid and fluorosulfuric acid ○ Physical properties of sulfuric acid ○ Acid-base behaviour in liquid H_2SO_4 • 9.9 Superacids • 9.10 Bromine trifluoride	9.3, 9.4, 9.5(b), 9.10, 9.11, 9.12(b), 9.13, 9.14
Chapter 10 Hydrogen • 10.1 Hydrogen: The simplest atom • 10.2 The H^+ and H^- ions ○ The hydrogen ion (proton) ○ The hydride ion • 10.4 Dihydrogen ○ Occurrence ○ Properties ○ Synthesis and uses ○ Reactivity • 10.5 Polar and non-polar E-H bonds • 10.6 Hydrogen bonding ○ The hydrogen bond ○ Trends in boiling points, melting points and enthalpies of vaporization for p-block binary hydrides • 10.7 Binary hydrides: classification and general properties ○ Classification ○ Saline hydrides ○ Molecular hydrides and complexes derived from them (exclude transition metal hydrides) ○ Covalent hydrides with extended structures	10.1 (see also worked example 4.6), 10.2, 10.3, 10.4, 10.8, 10.9, 10.10, 10.11 (a, b, c, e), 10.12, 10.13, 10.14, 10.15, 10.16
Chapter 11 Group 1: The alkali metals • 11.1 Introduction • 11.2 Occurrence, extraction and uses ○ Occurrence ○ Box 11.1 ○ Extraction ○ Major uses of the alkali metals and their compounds	11.2, 11.3, 11.4, 11.8, 11.12, 11.13, 11.15 (a-e), 11.16, 11.19(a-d)

• 11.3 Physical properties
  ○ general properties
  ○ Atomic spectra and flame tests
• 11.4 The metals
  ○ Appearance
  ○ Reactivity
• 11.5 Halides
• 11.6 Oxides and hydroxides
  ○ Oxides, peroxides, superoxides and ozonides
  ○ Hydroxides	

Chapter 12
• 12.1 Introduction
• 12.2 Major uses of group 2 metals and their compounds
• 12.3 Physical properties
  ○ General properties
  ○ Box 12.1
  ○ Box 12.2
• 12.4 The metals
  ○ Reactivity
• 12.5 Halides
  ○ Beryllium halides
  ○ Halides of Mg, Ca, Sr, Ba (first paragraph only)
  ○ Box 12.4
• 12.6 Oxides and hydroxides
  ○ Oxides and peroxides
  ○ Box 12.5
• 12.8 Complex ions in aqueous solution
  ○ Aqua species of beryllium
  ○ Aqua species of Mg^{2+}, Ca^{2+}, Sr^{2+} and Ba^{2+} (first paragraph only)
• 12.10 Diagonal relationships between Li and Mg and between Be and Al
  ○ Lithium and magnesium
  ○ Beryllium and aluminium
	12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 12.11, 12.12, 12.15, 12.17

Chapter 13 The group 13 elements
• 13.1 Introduction
• 13.2 Occurrence, extraction and uses
  ○ Extraction (first paragraph)
  ○ Major uses of the group 13 elements and their compounds
• 13.3 Physical properties
  ○ Electronic configurations and oxidation states
  ○ Box 13.4
  ○ NMR active nuclei
• 13.4 The elements
  ○ Structures of the elements
• 13.5 Simple hydrides
  ○ Neutral hydrides
  ○ The MH_4^- ions
• 13.6 Halides and complex halides
  ○ Boron halides: BX_3 and B_2X_4
  ○ Al(III), Ga(III), In(III) and Tl(III) halides and their complexes
	13.1, 13.5, 13.7, 13.8, 13.9, 13.17(a), 13.18, 13.26, 13.27

• 13.7 Oxides, oxoacids, oxoanions and hydroxides
  ○ Boron oxides, oxoacids and oxoanions
  ○ Worked example 13.5 isoelectronic relationships
  ○ Aluminum oxides, oxoacids, oxoanions and hydroxides
• 13.8 Compounds containing nitrogen
  ○ Nitrides
  ○ Molecular species containing B-N or B-P bonds
• 13.11 Electron deficient borane and carbaborane clusters: an introduction	

Chapter 14 The group 14 elements
• 14.1 Introduction
• 14.2 Occurrence, extraction and uses
  ○ Occurrence
  ○ Uses
• 14.3 Physical properties
  ○ Ionization energies and cation formation
  ○ Some energetic and bonding considerations
• 14.4 Allotropes of carbon
  ○ Graphite and diamond: structure and properties
  ○ Fullerenes: synthesis and structure
• 14.5: Structural and chemical properties of silicon, germanium, tin and lead
  ○ Structures
  ○ Chemical properties
• 14.6 Hydrides
  ○ Binary hydrides
• 14.7 Carbides, silicides, germides, stannides and plumbides
  ○ Carbides
  ○ Silicides
• 14.8 Halides and complex halides
  ○ Carbon halides
  ○ Silicon halides
  ○ Halides of germanium, tin and lead
• 14.9 Oxides, oxoacids, and hydroxides
  ○ Oxides and oxoacids of carbon
  ○ Silica, silicates and aluminosilicates
• 14.10 Siloxanes and polysiloxanes (silicones)
	14.2, 14.3 (a,c), 14.6(b), 14.8, 14.10, 14.11, 14.21, 14.23, 14.25 (a,b), 14.29

Chapter 15 The group 15 elements
• 15.1 Introduction
• Box 15.1 Toxicity of arsenic
• 15.2 Occurrence, extraction and uses
  ○ Occurrence
  ○ Extraction
  ○ Uses
• 15.3 Physical properties
• 15.4 The elements
  ○ Nitrogen
  ○ Phosphorus
• 15.5 Hydrides
• Trihydrides, EH_3 (E = N, P, As, Sb, Bi)
	15.1, 15.2, 15.5, 15.9, 15.20, 15.22, 15.26(a-c)

• Box 15.3 Ammonia: the industrial giant
• 15.7 Halides, oxohalides and complex halides
  ○ Nitrogen halides
  ○ Phosphorus halides
• 15.8 Oxides of nitrogen
  ○ Dinitrogen monoxide, N_2O
  ○ Nitrogen oxide, NO
  ○ Dinitrogen tetraoxide, N_2O_4, and nitrogen dioxide, NO_2
  ○ Box 15.7 NO_x: tropospheric pollutant
  ○ Box 15.9 Nitrogen cycle and nitrates and nitrites in waste water
• 15.10 Oxides of phosphorus, arsenic, antimony, bismuth
  ○ Oxides of phosphorus
  ○ Box 15.10: Phosphate fertilizers: essential to crops but are they damaging our lakes?	

Chapter 16 The group 16 elements
• 16.1 Introduction
• 16.2 Occurrence, extraction and uses
  ○ Extraction
  ○ Uses
• 16.3 Physical properties and bonding considerations
• 16.4 The elements
  ○ Dioxygen
  ○ Ozone
  ○ Sulfur: Allotropes
• 16.5 Hydrides
  ○ Water, H_2O
  ○ Hydrogen peroxide, H_2O_2
  ○ Hydrides EH_2 (E = S, Se, Te)
• 16.8 Oxides
  ○ Oxides of sulfur (only SO_2 and SO_3)
  ○ Box 16.5 and Box 16.6
• 16.9 Oxoacids and their salts
  ○ Sulfuric acid, H_2SO_4
	16.4, 16.9, 16.10, 16.11, 16.14, 16.15, 16.17, 16.18,

Chapter 17: The group 17 elements
• 17.1 Introduction
• 17.2 Occurrence, extraction and uses
  ○ Occurrence
  ○ Extraction
  ○ Uses
• 17.3 Physical properties and bonding considerations
• 17.4 The elements
  ○ Difluorine
  ○ Dichlorine, dibromine, diiodine
• 17.5 Hydrogen halides
• 17.6 Metal halides: structures and energetics
• 17.7 Interhalogen compounds and polyhalogen ions
  ○ Interhalogen compounds
	17.2, 17.3, 17.4(a, b), 17.5, 17.6, 17.7, 17.8, 17.9,

○ Bonding in $[XY_2]^-$ ions (referring to Section 5.8)	
Chapter 18: The group 18 elements • 18.1 Introduction • 18.2 Occurrence, extraction and uses ○ Occurrence ○ Extraction ○ Uses • 18.3 Physical properties • 18.4 Compounds of xenon ○ Fluorides • 18.5 Compounds of argon, krypton and radon	18.2, 18.3, 18.4, 18.5, 18.6, 18.8, 18.9

Laboratory Schedule (consult Lab Manual p. 19 for more detail).

week	Thurs	Group	Fri	Group	Activities	Post Lab Due
1	Jan9	A1,A2	Jan10	B1,B2	Check-in, ALE1	-
2	Jan16	C1,C2	Jan17	D1,D2	Check-in, ALE1	-
		A1		B1	ALE3 (2h) / ALE4 (2h)	ALE1
		A2		B2	ALE4 (2h) / ALE3 (2h)	
3	Jan23	A1,A2	Jan24	B1,B2	ALE2 + ALE 5 weighings	ALE3,4
		C1		D1	ALE3 (2h) / ALE4 (2h)	ALE1
		C2		D2	ALE4 (2h) / ALE3 (2h)	
4	Jan30	C1,C2	Jan31	D1,D2	ALE2 + ALE 5 weighings	ALE3,4
		A1,A2		B1,B2	-	ALE2
5	Feb6	-	Feb7	-	Week of Monroe Day	-
6	Feb13	A1,A2	Feb14	B1,B2	ALE5	-
		C1,C2		D1,D2	-	ALE2
7	Feb20	-	Feb21	-	Study week	-
8	Feb27	C1,C2	Feb28	D1,D2	ALE5	-
		A1,A2		B1,B2	-	ALE5
9	Mar5	A1,A2	Mar6	B1,B2	ALE6	-
		C1,C2		D1,D2		ALE5
10	Mar12	A1,A2	Mar13	B1,B2	ALE7	-
11	Mar19	C1,C2	Mar20	D1,D2	ALE7	-
12	Mar26	TBD	Mar27	TBD	Flex week	-
13	Apr2		Apr3		Make up	
14	Apr 6	Make up labs due 12 noon (submit in drop box outside lab door)				

The instructor will post the groups on Brightspace by **5pm, Tues Jan 7.**

Groups A1, A2 and C1, C2 are in lab section 2101 B01 (Thursday labs)
Groups B1, B2 and D1, D2 are in lab section 2101 B02 (Friday labs)

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