

**UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF CHEMISTRY
COURSE SYLLABUS
FALL 2019**

1. Course: CHEMISTRY 431, Inorganic Chemistry: Main Group Elements

LEC	DAYS	TIME	ROOM	PROFESSOR	OFFICE	EMAIL	OFFICE HOURS
L01	MWF	13:00-13:50	ST 143	Dr. R. Roesler	SB 339	roesler@ucalgary.ca	M 11:00 - 12:00 W 14:00 - 15:00

To avoid IT problems, it is recommended that the students use their U of C account for all course correspondence. Please use "CHEM 431 inquiry" as the Subject of your e-mail.

Desire 2 Learn (D2L): CHEM 431 L01 - (Fall 2019) - Inorganic Chemistry: Main Group Elements
<https://d2l.ucalgary.ca/d2l/home/278277>

Departmental Office: Room SA 229, Tel: (403) 220-5341, e-mail: uginfo@chem.ucalgary.ca

- 2. Course Description: Lectures:** The structure of many-electron atoms; bonding, stereochemistry and symmetry in inorganic compounds; solid-state science and aspects of inorganic solution chemistry. The chemistry of the main group elements. **Laboratory:** Applications of chemical principles to inorganic synthetic and qualitative analytical problems.
- 3. Recommended Textbook:** Missler, G. L.; Fischer, P. J., and Tarr, D. A., "Inorganic Chemistry", 5th Ed., Pearson, 2014 (available in the Bookstore)
- 4. Topics Covered and Suggested Readings:**

COURSE CONTENTS	Lectures^a	Chapter in Textbook (not all sections will be covered)
ORIGIN OF THE ELEMENTS	1	N/A
ELECTRONIC STRUCTURE OF THE ATOM	2	Chapter 2
Basics Atomic Orbitals Penetration and Shielding Periodic Trends		
NUCLEAR MAGNETIC RESONANCE	3,4	N/A
BONDING MODELS: DISCRETE STRUCTURES	5 through 7	Chapter 3
Lewis Structures VSEPR Theory Valence Bond Theory Molecular Orbital Theory: Diatomic Molecules		
BONDING MODELS: MOLECULAR SYMMETRY	8 through 12	Chapter 4, 5
Symmetry Operations and Symmetry Elements Point Groups and Group Theory Vibrational Spectroscopy Molecular Orbital Theory: Polyatomic Molecules		

BONDING MODELS: EXTENDED STRUCTURES	13 through 17	Chapter 7
Packing of Spheres		
The Unit Cell		
Metallic and Ionic Lattices		
Semiconductors: Band Theory		
Lattice Energy		
Born-Haber Cycle		
MAIN GROUP ELEMENTS: GENERAL PRINCIPLES	18, 19	N/A
Electronegativity		
Valence		
Oxidation number/state		
Coordination Number		
d- and f-Block Contraction		
SINGLE-CRYSTAL X-RAY CRYSTALLOGRAPHY	20, 21	N/A
CHEMISTRY OF THE MAIN GROUP ELEMENTS	22 through 32	Chapter 8
Group 1		
Hydrogen		
Alkali Metals		
Complex Ions: Crown Ethers and Cryptands		
Lithium Batteries: Primary and Secondary		
Group 2		
Water Hardness		
Group 13		
Boron		
Electron Deficient Compounds		
Lewis Acidity		
Positive Hyperconjugation		
Boranes and Carboranes		
Wade-Mingos Rules		
Al, Ga, In, Tl		
Inert pair Effect		
Chemical Vapor Deposition		
Group 14		
Carbon Allotropes		
Si, Ge, Sn, Pb		
Hypervalent Compounds		
Semiconductor Grade Silicon		
Negative Hyperconjugation		
Group 15		
Nitrogen		
P, As, Sb, Bi		
Lewis Basicity		
Multiple bonds to oxygen		
Group 16		
Oxygen		
S, Se, Te, Po		
Group 17		
Group 18		
Xenon		

^a The number of lectures allocated to each topic is tentative

5. Laboratory Experiments:^b (10 weeks, 3 hours/ week)

PROJECT I: Chemistry Databases: SciFinder

PROJECT II: Chemistry Databases: Reaxys

PROJECT III: Water hardness

PROJECT IV: Ionic Structures

PROJECT V: Boron Compounds

PROJECT VI: Positive Oxidation States of Halogens

PROJECT VII: Synthesis and Chemistry of $K_2S_2O_8$

PROJECT VIII: Polythionates (Oxoanions of sulphur)

PROJECT IX: Halogen Oxoacids and their Salts

PROJECT X: Multiple Oxidation States

^b This is a work in progress, subject to change

Department Approval _____ Electronically Approved _____ Date September 2019