

UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF CHEMISTRY
COURSE SYLLABUS
FALL 2018

1. COURSE: CHEMISTRY 331, Inorganic Chemistry: Main Group Elements

LEC	DAYS	TIME	ROOM	INSTRUCTOR	OFFICE	PHONE	EMAIL	OFFICE HOURS
L01	MWF	13:00-13:50	ST 141	Dr. R. Roesler	SB 339	220-5366	roesler@ucalgary.ca	M 11:00 - 12:00 W 14:00 - 15:00

Desire 2 Learn (D2L) course name: <https://d2l.ucalgary.ca/d2l/home/235271>

Departmental Office: SA 229, 220-5341, chem.undergrad@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. TEXTBOOK:** Gary L. Miessler, Paul J. Fischer, Donald A. Tarr., "Inorganic Chemistry", Pearson, Fifth Edition (2014).

4. TOPICS COVERED AND SUGGESTED READING:

COURSE CONTENTS	Lectures^a	Chapter in Textbook <i>(not all sections will be covered)</i>
ORIGIN OF THE ELEMENTS	1	N/A
ELECTRONIC STRUCTURE OF THE ATOM	2, 3	Chapter 2
Basics		
Atomic Orbitals		
Penetration and Shielding		
Periodic Trends		
NUCLEAR MAGNETIC RESONANCE	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	
Group 1		Chapter 8
Hydrogen		Chapter 8
Alkali Metals		
Complex Ions: Crown Ethers and Cryptands		
Lithium Batteries: Primary and Secondary		Chapter 8
Group 2		
Water Hardness		Chapter 8
Group 13		
Boron		
Electron Deficient Compounds		
Lewis Acidity		
Positive Hyperconjugation		
Boranes and Carboranes		
Wade-Mingos Rules		Chapter 8
Al, Ga, In, Tl		
Inert pair Effect		
Chemical Vapor Deposition		Chapter 8
Group 14		
Carbon Allotropes		
Si, Ge, Sn, Pb		
Hypervalent Compounds		
Semiconductor Grade Silicon		
Negative Hyperconjugation		Chapter 8
Group 15		
Nitrogen		
P, As, Sb, Bi		
Lewis Basicity		
Multiple bonds to oxygen		Chapter 8
Group 16		
Oxygen		
S, Se, Te, Po		Chapter 8
Group 17		Chapter 8
Group 18		
Xenon		

5. LABORATORY EXPERIMENTS^b:

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

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

Department Approval: Approved by Department Head

Date: September 7, 2018