

# CHEM 362: Descriptive Inorganic Chemistry

## Fall 2016 SYLLABUS

T/Th 12:45-2:00 pm, CHEM 255

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**INSTRUCTOR:** **Professor Janet Bluemel** — Reed McDonald building (RMD), room 323 (via 321)  
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**OFFICE HOURS:** **T/Th 2:00 pm-3:00 pm, or by appointment**

**TEACHING ASSISTANT:** **Jordon Benzie** — RMD, room 428  
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**ASSISTANT:** **Jennifer Belcik** — RMD, 1-5 pm, room 321  
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### TEXTBOOKS/COURSE MATERIAL:

Some material required for the course will be provided in the form of hardcopies, lecture scripts, or electronic files. The first book is indispensable, the second and third may be used for additional reading.

[1] Inorganic Chemistry. Catherine E. **Housecroft** and Alan G. **Sharpe**. Pearson, 4<sup>th</sup> Edition.  
**ISBN-13: 9780273742753**

[2] Inorganic Chemistry. Gary **Miessler**, Paul J. **Fischer**, Donald A. **Tarr**. Pearson, 5<sup>th</sup> Edition.  
**ISBN-13: 9780321811059**

[3] Inorganic Chemistry. D. F. **Shriver**, P. W. **Atkins**, and C. H. **Langford**. Oxford Univ. Press, 6<sup>th</sup> Edition.  
**ISBN: 9780716723981**

### COURSE GRADING:

Exam I (Thursday, Oct. 6, 2016, 12:45-2 pm, CHEM 255)	20%
Exam II (Thursday, Nov. 10, 2016, 12:45-2 pm, CHEM 255)	30%
<b>Final Exam</b> (Wednesday, Dec. 14, 2016, 8-10 am, CHEM 255)	50%

### COURSE DESCRIPTION and LEARNING GOALS:

My aim is to provide a comprehensive and contemporary presentation of the diverse and fascinating discipline of inorganic chemistry. Inorganic chemistry deals with the properties of all the elements in the periodic table. These elements range from highly reactive metals to noble metals, such as gold. The nonmetals include solids, liquids and gases. Therefore, special emphasis is placed on spectroscopic techniques in this course, because only modern methods allow the thorough investigation of the diverse characteristics of inorganic molecules and materials. The purity of materials, dynamic effects, crystallographic features, and surface adsorption phenomena, for example, all play an important role in modern Inorganic Chemistry and this course will enable the students to fully understand the underlying principles. Achievements in recent research, as well as industrial aspects of inorganic chemistry and spectroscopy will be included. Examples taken from recent publications and seminar talks presented by visitors during the semester will be discussed.

## **COURSE OUTLINE:**

### **I. Introduction to Inorganic Chemistry**

#### **A. Brief Repetition: Atomic Structure**

- Origin of the Elements
- The Ordering Principles of the Elements: The Periodic Table
- Atomic Orbitals
- Atomic Parameters

#### **B. Molecular Structure and Bonding**

- Lewis Structures, Octet Rule and VSEPR Model
- Valence-Bond Theory
- Molecular Orbital Theory and Bond Properties

#### **C. Structures of Solids**

- Metals and Alloys
- Ionic Solids and Liquids
- Energetics and Electronic Structures of Solids

#### **D. Purification of Inorganic Compounds and Materials**

- Distillation and Sublimation
- Crystallization and Zone Melting
- Chromatographic Methods and Extraction

#### **E. Characterization of Inorganic Compounds and Materials**

- Elemental Analysis, Melting and Boiling Points
- X-ray Powder and Crystal Diffraction
- NMR and EPR of Liquids and Solids
- IR, Raman, UV-VIS, Mass Spectrometry
- Photoelectron and Atomic Absorption Spectroscopy
- Mößbauer Spectroscopy

#### **F. Coordination Chemistry and Organometallic Chemistry**

- Ligands
- Constitution and Geometry
- Reactions of Coordination Compounds

### **II. The Chemistry of the Main Group Elements: Following the Periodic System**

### **III. The Chemistry of the Transition Metals**

#### **A. The d-Block Metals and their Complexes**

- Trends in Chemical Properties
- Crystal- and Ligand-Field Theory and Electronic Spectra

#### **B. d-Metal Organometallic Chemistry**

- Ligands and their Bonding
- Compounds and Reactions

#### **C. f-Block Metals and their Chemistry**

- Lanthanoid Chemistry
- Actinoid Chemistry

#### **IV. Solid-State and Materials Chemistry in Academia and Industry**

- Oxide Glasses and Pigments
- Layered Materials and Intercalation
- Metal Organic Frameworks (MOFs)
- Fullerenes, Graphene, and Nanorods

#### **V. Introduction to Catalysis**

##### **A. Homogeneous Catalysts**

- Basic Principles
- Examples of the most Important Catalytic Reactions

##### **B. Heterogeneous Catalysts**

##### **C. Hybrid Catalysts**

- Solid/Liquid Systems
- Liquid/Liquid Biphasic Systems

**No electronic devices are allowed in the lecture hall during this class.**

The Americans with Disabilities Act (ADA) is a federal antidiscrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Cain Hall, Rm. B118, or call 845-1637.

*"An Aggie does not lie, cheat or steal, or tolerate those who do."*