

CHEM 362: Descriptive Inorganic Chemistry

Spring 2020 SYLLABUS

MWF 10:20-11:10 am, CHEM 255

INSTRUCTOR: **Prof. Dr. Janet Bluemel**
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Homepage Bluemel: <http://www.chem.tamu.edu/rgroup/bluemel/>

OFFICE HOURS: **MWF 11:15 am - 12:15 pm, or by appointment**

TEACHING ASSISTANT: **Rahym Ashirov** — RMD, room 428
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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, 4th Edition.
ISBN-13: 9780273742753

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

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

COURSE GRADING:

Exam I (Friday, February 28, 2020, 10:20-11:10 am, CHEM 255)	20%
Exam II (Friday, March 27, 2020, 10:20-11:10 am, CHEM 255)	25%
Exam III (Friday, April 24, 2020, 10:20-11:10 am, CHEM 255)	25%
Final Exam (Monday, May 4, 2020, 8:00-10:00 am, CHEM 255)	30%

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. 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

E. 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.

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845-1637 or visit <http://disability.tamu.edu>. Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

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

HONORS STUDENTS

For Honors students a special program will be offered that may include some work in a research lab, oral presentations in class, and poster presentations at local events. Individual plans will be made with the students, depending on their interests and preferences.