Advanced Inorganic Chemistry - Chem 471/571
Fall 2020

Monday 10:40am – 12pm/ Wednesday 10:40am – 12pm
Presented over Webex

Professor Mark Lipke

Office: CCB 2202
Office Hours: Friday 11am – noon
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Prerequisites (for undergraduates enrolled in 471): Chem 371 *Inorganic Chemistry*

Text: *Inorganic Chemistry* (5th Ed.) by Miesslar, Fischer, and Tarr.

Other suggested texts: "Orbital Interactions in Chemistry" by Albright, Burdett, and Whangbo; "Chemical Structure and Bonding" by DeKock and Gray; "Atkins' Physical Chemistry" by Atkins and De Paula.

Sections of these textbooks are useful for providing a better/deeper understanding of some course material, and will be used as references for material covered in lecture.

Other Resources: Lecture slide will be posted on the Canvas site, usually shortly before the start of each lecture. Lectures will partially follow the content of the text by Miesslar and Tarr, but will include a significant amount of material that draws from other texts or the primary literature.

Grading: A total of 475 points are possible. Points are distributed as follows:

Class Participation: 75 pts
Exams 1 - 3: 300 pts (100 pts each)
Final Presentation: 100 pts
Total: 475 pts

Course Description:

The >100 known elements exhibit significant variation in their individual properties and the types of bonds/structures they form with each other. Understanding the rich chemistry of the elements is an enticing intellectual challenge with practical benefits that arise from the useful properties of many elements and compounds. This course will build upon previous courses in inorganic and physical chemistry to deepen students' understanding of the concepts of electronic structure and chemical bonding that underlie the diverse behavior of the elements. The physical and mathematical foundations of atomic orbitals and their use in constructing molecular orbitals will be examined, including the use of group theory to predict the form of molecular orbitals in various molecular symmetries. These concepts will be illustrated with classic examples of inorganic compounds along with recent examples drawn from the primary literature. Thus, students will develop a strong intuitive understanding of molecular orbital theory as it applies in many common areas of research.

Specific Objectives

1) Reinforce students' understanding of material from undergraduate courses in inorganic chemistry and chemical bonding (e.g. atomic structure, molecular orbital theory, acid/base chemistry, spectroscopy, coordination chemistry of transition metals, solid state chemistry, etc.)

2) Develop a stronger understanding of the mathematical and physical foundations of atomic structure and quantum mechanical theories of chemical bonding

3) Develop a stronger understanding of molecular orbital theory as it applies to a wide range of elements, especially those in the d-block of the periodic table (i.e. transition metals).

4) Demonstrate mastery of the course material by using knowledge gained in this course to analyze the primary chemical literature.

Course Policies

Grades, Presentations, and Examinations: There will be three exams, each worth 100 pts towards a 450 pt total in this course. The exams can be completed on your own time, with a specific date listed below. Exams will be released at least one week before the due date.

Part of the course grade will also consist of class participation and in-class presentations, worth a total of 175 pts. Students will be required to present solutions to select suggested homework questions (75 pts). Each student will also be required to give a final presentation of a paper from the recent or classic literature, worth 100 pts.

Tentative Class Schedule Fall Semester 2018

Day	Date	Lecture #	Topic	Chapter (Sections)
W	9/2	1	Introduction	2.1
T	9/8	2	Quantum Mechanics and Atomic Structure	2.2
W	9/9	3	QM/Atomic Structure/Periodic Trends	2.3
M	9/14	4	Molecular Orbital Theory	5.1
W	9/16	5	Molecular Orbital Theory	5.2 – 5.3
M	9/21	6	Acidity	6.3 – 6.4
W	9/23	7	Lewis Acids	6.4 – 6.6
M	9/28	8	Group Theory (no class one of these dates, tbd)	4.1 – 4.2
W	9/30			
M	10/5	9	Group Theory	4.3 – 4.4
W	10/7	10	Group Theory and Molecular Orbitals	5.4
M	10/12	11	Exam 1 Due / Ligand Field Theory	10.3
W	10/14	12	Ligand Field Theory in Other Geometries	10.3
M	10/19	13	Jahn-Teller Distortion	10.5, supplement
W	10/21	14	Substitution Mechanisms	12.1 – 12.4

M	10/26	15	Mechanisms	12.6 – 12.7
W	10/28	16	Electron Transfer Mechanisms	12.8, supplement
M	11/02	17	Electronic Spectra	11.1, 11.2
W	11/04	18	Electronic Spectra	11.3
M	11/09	19	Characterization of Unpaired e^-	Supplement
W	11/11	20	review	—
M	11/16	21	Exam 2 due / Solid State Chemistry	7.1
W	11/18	22	Solid State Chemistry	7.2, 7.3
M	11/23	23	Solid State Chemistry	
W	11/25		No Class	
M	11/30	24	Additional Topics / Student Presentations	TBA
W	12/2	25	Additional Topics / Student Presentations	TBA
M	12/7	26	Additional Topics / Student Presentations	TBA
W	12/9	27	Additional Topics / Student Presentations	TBA
W	12/16	Exam 3	Exam 3 due	