Chemistry 405: Advanced Inorganic Chemistry

Professor: Dr. Matthew Bork
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Lecture: MWF 11-11:50 Starr 227; Lab: Th 1-3:50 Starr 236
Office Hours: TBD or by appointment

Inorganic chemistry utilizes pieces from multiple areas of chemistry: general, organic, physical, analytical, and biochemistry. This course will study the concepts surrounding atomic and molecular structure focusing on applications to inorganic compounds. General course concepts include: chemical bonding, symmetry, group theory, chemistry of the chemical groups, ionic solids, oxidation-reduction reactions, spectroscopy, and organometallic compounds.

Course Discription:

"CHEM 405 Advanced Inorganic Chemistry – 4 Credit Hours
With the entire periodic table at their disposal, students will explore the diverse nature of inorganic chemistry. Starting with atoms, the course explores principles of bonding and chemical reactivity of inorganic compounds. Also, several special topics may be covered such as organometallic catalysis, bioinorganic chemistry, and group theory. The laboratory work will illustrate ideas covered in the classroom and will include techniques used routinely by working inorganic chemists. Lecture 3 hours; lab 3 hours. PRQ: CHEM 206 Scheduled: On Request Classified: T Meets: N,O Credits: 4."

Text:

Inorganic Chemistry, 5th Ed., by Miessler and Tarr (Prentice-Hill). Laboratory experiments will be taken from *Microscale Inorganic Chemistry* by Szafran, Pike, and Singh.
Other course materials will be provided (articles, labs, etc.).

Grading Scheme:

Three exams	300 pts
Laboratory work	200 pts
Homework	200 pts
Article Review	100 pts
Final exam	150 pts
Attendance and Participation	50 pts
	1000 pts total

Academic Concern with this Course

Meet with the course professor to discuss your concern. If the issue is not resolved, then you may follow the chain-of-command: Department Chair, the Dean of your College, and the University Provost, in that order. To appeal a final course grade, complete the grade appeal form (located on the Portal under forms/undergraduate student documents or graduate student documents). A description of the grade appeal process is included on p. 55 of the Academic Catalog.

Exams:

Three exams will be given during lab to allow for extra work time. Each exam will be worth 100 points. Exams may include an assigned literature article as well as the material covered in class. A cumulative exam will be given during finals week, worth 150 pts.

Labs:

Work done in lab is designed to correlate with and enhance the material discussed in lecture. There will be eleven labs as shown in the tentative schedule. Each lab will include a written lab report due the following week (40pts); a total score on lab reports will be scaled to 200 pts. One lab report will be a formal report, weighted to be worth two reports (80 pts), with a write-up similar to a journal style.

Homework:

Each chapter will contain its own homework set. Problems will be graded on both completion and correctness. The total homework grade will be scaled to 200 pts. Homework due dates will be given when the problem set is assigned. Late work will result in loss of completion points.

Article Review:

In addition to research, reading contemporary literature helps students gain an understanding of current chemistry. Students will select an article (most likely from *Inorganic Chemistry*) and present a review on what was learned. The review will be in the form of an oral presentation. Further details and requirements will be discussed later in class.

Attendance:

Attendance to lectures and lab will be a vital component to success in this course. Questions on exams will be drawn from the materials both in the book and covered in lecture. The text may not include materials covered in class or to the depths that are covered in lecture. Although attendance will not be taken, you are expected to be in class. Missing class will have a negative impact your learning and therefore your grade. Excessive absences will result in an academic alert. That being said, absences are likely to occur. Keep them to a minimal and be sure to let me know. The participation and attendance portion of the grade is at my discretion based both on your attendance and how actively you engage in the course. Senior day will be allowed unless it occurs on a lab day. Excessive absences will result in a loss of points.

Course Objectives:

By the end of the semester, students should have a general understanding of the following concepts:

- quantum mechanics applications such as energies, electron position, and angular momentum
- atomic properties and periodic trends
- bonding schemes and structures
- valence bond and molecular orbital bonding theories
- molecular symmetry and applications of group theory

- acid-base chemistry
- crystalline structures and properties
- general coordination chemistry and nomenclature
- crystal field, ligand field, and molecular orbital methods in coordination compounds
- relate bonding and structure of coordination compounds to their spectra
- chemical kinetics
- trans effect in coordination and applications to the synthesis of complexes
- 18-electron rule for coordination complexes
- reaction mechanisms: oxidation addition and reductive elimination for synthesis
- real world uses of organometallic complexes and instrumental and synthetic laboratory techniques

Expected Work Load

This 4-credit course will meet for 50 minutes per session three times a week and 2 hours and 50 minutes for each lab throughout the semester. A minimum of 2-3 hours of student preparation time outside of class is expected for each credit hour. Thus, please be prepared to devote 12-18 hours per week to this course (including class and lab time).

Disability Services:

If you believe you are eligible to receive any type of academic accommodation, through such federal laws as the ADA, please contact the Lang Center for Health, Wellness, Counseling and Disabilities Services, 815- 226-4083. The Lang staff manages disability services for Rockford University.

Honor Code Policy on Cheating and Plagiarism:

In this course the policies and procedures concerning the Rockford University Academic Honor Code, including definitions of cheating and plagiarism as they appear on the appropriate pages of the current Rockford University Handbook, will be applicable. The Rockford University Honor Code can be found through the university's website at http://www.rockford.edu/?page=StudentHandbook. It is your responsibility to read and comply with these policies and procedures.

Tentative Schedule:

WEEK OF	TOPIC	BOOK CHAPTER
1/21	Origin of the Elements, distribution of the elements	1
1/28	Quantum mechanics: wavefunctions; properties of elements	2
2/4	A review of Lewis structures, resonance, and formal charge	3
2/11	Symmetry elements and operations	4
2/18	Point groups: properties and representations, applications	4
	EXAM I	
2/25	Applications of Group theory	5
3/4	Molecular Orbitals	6
3/11	Spring Break	
3/18	History and development of Acid/Base (A/B) concepts	6
	EXAM II	
3/25	Frontier orbitals, solid state	7
3/27	Trends in main group chemistry	8
4/1	Coordination Chemistry	9
4/8	Bonding (valence bond theory, crystal field theory)	10
	EXAM III	
4/15	Spectra, Beer-Lambert law Selection rules	11
4/22	Organometallic chemistry	12/13
5/29	Bioinorganic Chemistry	16
	FINAL EXAM	