Chemistry 520A: Advanced Inorganic Chemistry

Syllabus Fall 2025

Welcome to Chemistry 520A: Advanced Inorganic Chemistry! This senior capstone course is designed to deepen your understanding of inorganic chemistry, integrating concepts from physical, analytical, and organic chemistry. We'll explore the fascinating world of atoms, molecules, symmetry, and transition metal complexes, preparing you for advanced study or research in chemistry. Get ready for a challenging yet rewarding journey—let's dive in and work together to succeed!

Course Information

- Lecture: Tuesdays and Thursdays, 8:00 AM - 9:15 AM
- Location: GMCS 309
- Instructor: Dr. Yong Yan
- Office: GMCS 213F or CSL 407
- Office Hours: Tuesdays and Thursdays, 9:15 AM - 10:00 AM (right after lecture)
- Contact: **yong.yan@sdsu.edu**

Course Materials

- Primary Resource: Class materials (PowerPoint slides, reading materials, and study tools) provided by Dr. Yan during lectures. Your class notes are critical!
- Optional Textbooks:
    - Inorganic Chemistry, 6th Edition, Weller et al. (Oxford). Key chapters: 1, 2, 3, 4, 6, 7, 7.11, 19, 20, 20.6.
    - The Organometallic Chemistry of the Transition Metals, 6th Edition, Crabtree.
    - Molecular Symmetry and Group Theory, Robert Carter.
- Note: Lectures draw from a variety of sources, including cutting-edge inorganic chemistry research, so exams may include material beyond the textbooks. Regular attendance and thorough note-taking are essential.

Course Description and Major Topics

This course explores advanced concepts in inorganic chemistry, emphasizing atomic and molecular structures, bonding theories, symmetry, and the unique properties of transition metal complexes. Topics include:

1. Atoms: Atomic structure and electron configuration.
2. Inorganic Molecules: Inorganic bonding approaches and molecular orbital theory.
3. Symmetry and Group Theory: Applications in hybridization, vibrational spectroscopy, and sigma bonding.
4. Oxidation and Reduction: Redox processes in inorganic systems.
5. Coordination Chemistry I: Structures and bonding.
6. Coordination Chemistry II: Spectroscopy and catalysis.
7. Inorganic Characterization and Solid-State Chemistry: Techniques to analyze inorganic compounds.

Learning Outcomes

By the end of this course, you will be able to:

1. Understand atomic structures, electron configurations, redox states, formal charges, Lewis structures, and bonding in inorganic compounds, predicting element behavior based on periodic table position.
2. Apply molecular orbital theory and bonding principles to predict properties of small inorganic compounds.
3. Determine molecular symmetry, including point groups and symmetry elements, for complex molecules.
4. Use group theory to explain chemical applications, such as hybridization and vibrational spectroscopy.
5. Predict properties of transition metal complexes, including d-electron counting, coordination environments, crystal field theory, ligand field effects, color, and bonding.

6. Characterize inorganic compounds using rational principles and techniques.

Course Schedule

The course is divided into three periods, with exams covering specific topics:

- Exam 1 (Late September, ~Weeks 3-5): Topics 1 and 2 (Atoms, Inorganic Molecules).
- Exam 2 (Late October, ~Weeks 7-10): Topics 3 and 4 (Symmetry, Oxidation/Reduction). **Note:** This period is traditionally the most challenging.
- Exam 3 (Final, likely last class day): Topics 5, 6, and 7 (Coordination Chemistry, Inorganic Characterization, Solid-State Chemistry).

Exam Dates: Specific dates depend on lecture progress and will be announced at least one week in advance. The final exam date may adjust based on room availability.

Assessments and Grading

Exams (100% of Grade)

- Two In-Class Exams (30% each): ~75 minutes, likely on Thursdays, covering material from Exam 1 (topic 1, 2) and Exam 2 periods (topic 3 and 4).
- Final Exam (40%): Comprehensive, covering Exam 3 period (topics 5, 6,).
- Rescheduling: Exam rescheduling requires legitimate documentation per SDSU policy. Contact Dr. Yan immediately if you anticipate conflicts.
- Exam Preparation: A review session will be held ~1 week before each exam. Copies of past exams may be provided or lectured to guide your study.

Bonus Points (10% Extra Credit)

Up to 10% bonus points may be awarded based on:

1. Attendance: Attending all classes (unless excused with legitimate documentation).
2. In-Class Quizzes: Submitting all quizzes (not graded for points but tracked for bonus consideration).
3. Participation: Actively engaging in class discussions and completing homework.

Note: Bonus points are at the instructor's discretion, based on recorded participation.

Grading Scale

Your grade is based on your individual performance, not a curve. The flexible guideline is:

- A: 90% and above
- B: 80%–89%
- C: 70%–79%
- D: 60%–69%
- F: Below 60%
  +/- grades are at the instructor's discretion. High grades require dedication and mastery of advanced material. Good luck!

Course Policies

1. Attendance: Not formally recorded, but regular attendance is crucial for success and bonus point eligibility. Contact Dr. Yan if you must miss a class or exam to avoid miscommunication.
2. In-Class Quizzes: Frequent, short quizzes (often at the start or end of lectures) are not graded for points but are critical for bonus points and exam preparation. Quizzes may allow group discussion, so **form an in-class study group early**, especially for group theory and molecular orbital theory.
3. Homework: Assigned during lectures, collected before exams, but not graded. Homework is a key study tool and contributes to bonus point consideration.
4. Prerequisite: You must have completed Chem 410A (Physical Chemistry) with a passing grade. Concurrent enrollment is no longer sufficient, as over 80% of students taking Chem 520A concurrently with Chem 410A failed. Familiarity with Chapters 1 and 2 of Weller's Inorganic Chemistry is assumed.
5. Study Groups: Highly encouraged, especially for challenging topics like group theory and molecular orbital theory. Quizzes may allow collaborative work, and group study enhances understanding.
6. Exam Content: Exams draw from lectures, class materials, and research-based content, not just textbooks. Take thorough notes and review provided materials.

Diversity, Equity, and Inclusion (DEI) Statement

The Department of Chemistry & Biochemistry at SDSU is committed to fostering an inclusive intellectual community. We value diversity in race, ethnicity, national origin, gender, gender identity, sexuality, class, religion, and other dimensions, creating a supportive environment for all students to thrive.

Tips for Success

- Come Prepared: This is a senior capstone course, one of the most challenging at SDSU alongside P-Chem. Stay focused and engage with the material.
- Attend Lectures: Lectures include unique content from current research, not just textbooks. Your notes are your lifeline.
- Participate Actively: Engage in quizzes, discussions, and homework to maximize learning and earn bonus points.
- Form Study Groups: Collaborate with peers to tackle complex topics like group theory and coordination chemistry.
- Use Office Hours: Drop by GMCS 213F or CSL 407 after class (9:15-10:00 AM, Tu/Th) to clarify concepts or discuss challenges.
- Prepare for Exams: Use homework, quizzes, and review sessions to study. Past exams will give you a sense of what to expect.

Additional Notes

- Course Rigor: Chem 520A integrates advanced concepts from multiple chemistry disciplines. Expect a fast pace and challenging material, but we'll work together to overcome barriers.
- Communication: Reach out to Dr. Yan (yong.yan@sdsu.edu) with any questions or concerns. Prompt communication prevents misunderstandings.
- Resources: Use the optional textbooks for deeper understanding, but prioritize lecture materials and notes.

Let’s make this semester a success! I’m excited to explore the world of inorganic chemistry with you. If you have questions or need support, don’t hesitate to reach out. **Go Aztecs!**