Inorganic Chemistry I

Course Information

Instructor: Jake Soper (jake.soper@chemistry.gatech.edu)
Course Prefix and Number: CHEM 6170 A
Term: Fall 2026

Course Description

The class covers fundamental principles of electronic structure, bonding, and reactivity of transition metal elements and ions, with a focus on coordination chemistry of the d-block and structure–property relationships.

Course Learning Outcomes

An advanced ability to utilize knowledge of electronic structure and metal–ligand bonding interactions in transition metal complexes to make predictions about coordination geometry and reactivity will be developed through in-depth examinations of theories for structure and bonding and primary literature. Students will develop expertise and/or proficiency in the following subjects.

- Atomic structure and electron configurations in transition metals and ions
- Structures and bondings in metals and ionic solids
- Metal–ligand interactions
- The effects of varying σ- and π-donor ligand properties and metal oxidation state on ligand field
- stabilization in Werner complexes
- Descriptive chemistry of d-block ions and complexes
- Reactions of transition metal complexes, including e– transfer and ligand substitution
- Spectroscopic methods to assess reaction mechanisms
- Fundamental reactivity of organometallic complexes and connections to catalysis

Pre- and/or Co-Requisites

This section is designed for CHEM majors or those who have already taken a dedicated inorganic chemistry course (e.g. CHEM 3111 or equivalent). It will move quickly and assume significant background knowledge.

Required Course Materials

Course Text

1. [WORA] Inorganic Chemistry, 7th ed. by M. Weller, T. Overton, J. Rourke, and F . Armstrong

Supplemental Texts

2. [DG] Chemical Structure and Bonding, 2nd ed. by R. L. DeKock and H. B. Gray
3. [HB] Symmetry and Spectroscopy: An Introduction to Vibrational and Electronic Spectroscopy, by D. C. Harris and M. D. Bertolucci

A paper textbook is not required for this course. I will draw from all three of the texts listed above in preparing my lectures. Together they form a solid reference collection for an advanced, graduate-level understanding of the principles that govern structure, bonding, and reactivity in coordination complexes. You are encouraged to compare relevant sections from one or more of the above texts when studying or working on problem sets.

Listed below are several other books I frequently return to when I need to learn or review fundamental aspects of inorganic, organometallic, or coordination chemistry. You are encouraged to seek out these texts as needed. All are available via the library.

Reference Books

1. Advanced Inorganic Chemistry, 6th ed. by F . A. Cotton, G. Wilkinson, C. A. Murillo, and M. Bochmann
2. Chemical Applications of Group Theory, 3rd ed. by F . A. Cotton
3. Organotransition Metal Chemistry: From Bonding to Catalysis by J. F . Hartwig
4. Physical Methods for Chemists, 2nd ed. by R. S. Drago
5. Chemistry of the Elements, 2nd ed. by N. N. Greenwood and A. Earnshaw

Grading Policy

Graded Components

Midterm Exam 30% (300 points)
Final Exam 30% (300 points)
Problem Sets 30% (300 points)
Question of the Day 10% (100 points)
TOTAL 100% (1000 points)

Grading Scale

Your final grade will be assigned a letter grade according to the following scale:

A 90.0–100% (900—1000 points)
B 80.0–89.9% (800—899 points)
C 70.0–79.9% (700—799 points)
D 60.0–69.9% (600—699 points)
F < 60.0% (< 600 points)

I reserve the right to adjust this grading scale, but the cut-offs can only be lowered so adjustments will only benefit students. Adjustments are not guaranteed, and any that are made will be done at the end of the semester after all grades are calculated.

Description of Graded Components

Midterm Exam: One take-home midterm exam will be given during the semester. It will be distributed via Canvas and will be due via Canvas submission one week later.

Final Exam: A take-home final exam will distributed via Canvas on or around the last class meeting of the semester and be due on the final exam period set by the Georgia Tech Registrar's office.

Take home exams will detail allowed resources and rules for collaboration. All students, except those with a conflict as defined by the Registrar (https://registrar.gatech.edu/current-students/exams) or an Institute approved absence (https://registrar.gatech.edu/info/institute-approved-absence-form-for-students) , must turn in their exams by the deadlines above. Late or missing exams without a documented excuse will receive a failing (F) grade.

Readings/Problem Sets: Problem sets will be due approximately once per week. The problem sets will be a combination of worked problems and reading assignments from recent literature designed to test comprehension and stimulate critical review.

Problem sets will be due via Canvas at the beginning of the class period. Unless you make me aware of exceptional circumstances before the assignment is due, I will not accept late homework. Only online Canvas submissions will be accepted. Problem sets will comprise 30% of your overall class grade. Each problem set will be graded on a scale of 0-5 points. 2 points will be deducted for assignments submitted up to 24 h past the deadline; beyond 24 h students will receive a zero (0) for the submission. Points can be deducted for failing to make a good attempt at all of the assigned questions or for unwillingness to participate in classroom discussions of the homework questions.

At the end of the semester, your total homework points earned will be normalized to 300. For example: If a total of 10 problem sets are assigned over the course of the semester, then there are 50 possible points. If you earn 45 of these points, you have 45/50 = 0.90 of the possible homework points (i.e. 270/300).

Question of the Day (QOTD): Each lecture period will begin with a short answer Question of the Day (QOTD) designed to review recent, or preview upcoming, lecture topics. QoDs

will be scored 2, 1, or 0, with full credit generally awarded for good effort. Unless you make me aware of exceptional circumstances, there is no provision to accept late or remote QoD submissions.
At the end of the semester, QOTD points earned will be normalized to 100, per the representative calculation given above. The total number of QoD points available should total approximately 80, so each QOTD will equate to about 2.5 points towards your overall course grade.

Attendance Policy

Provided you are healthy (see below), in-person class attendance and participation are expected. Everyone benefits if you come to class prepared to be an active participant in the learning process. There are no plans to simulcast the lecture periods or to engage with an online audience. Full credit for homework is predicated on participation in in-class discussions, as noted above.

Academic and Research Honesty/Integrity Statement

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review the Student Code of Conduct and the Academic Honor Code, especially Appendix A: Graduate Addendum to the Academic Honor Code.

Allegations of scientific or scholarly misconduct are handled in accordance with the procedures outlined by the Policy for Responding to Allegations of Scientific or Other Scholarly Misconduct.

Core IMPACTS

Not applicable.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Expectations of Advisors and Advisees articulates some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.