

**Chemistry 6170
Inorganic Chemistry
Fall 2015**

Class Meets:

MoSE 1222, MWF 10:05-10:55 AM

Textbooks (recommended):

Symmetry and Structure: Readable Group Theory for Chemists, 2nd edition, by S. F. A. Kettle
Symmetry and Spectroscopy: An Introduction to Vibrational and Electronic Spectroscopy, by Daniel C. Harris and Michael D. Bertolucci (optional)

Note: There is a 3rd Edition of *Symmetry and Structure*. It's fine, but I actually prefer the second for this course, and Ms. Edwards has requested that the bookstore make this edition available.

Symmetry and Spectroscopy is truly optional for this course, but it is an excellent treatment of its subject and a wonderful reference to have.

Other readings will be assigned from chemistry journals available through <http://library.gatech.edu>.

Instructor:

Dr. Joseph Sadighi
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Office: MoSE G022

Office Hours:

Will be determined after consultation with the students. Other times will be available by appointment.

Course Materials:

All course materials will be made available on the web at [T-Square](#).

Hour Exams:

Exam 1	Wednesday, 9/23
Exam 2	Friday, 11/6

Both hour exams will be given in class.

Final Exam:

Monday, 12/7, 11:30 AM – 2:20 PM; Conflict period: Saturday, 12/12, 9:00 – 11:50 AM

Make-up Exams:

Make-up exams will only be given as required by the Institute's General Catalog, Rules and Regulations, [Section 4B3](#), and then only when arrangements have been made **at least one week prior to the exam**

that must be missed because of a scheduled Institute activity. If you must miss an exam, please see me as soon as possible. Do not make travel arrangements that preclude taking the final exam at the scheduled time. All students except those with a [conflict as defined by the Registrar](#) must take the final exam at the regularly scheduled time.

Learning Disabilities:

It is the responsibility of any student with a certified learning disability to request special accommodation if it is desired. Such requests must be made well in advance of the time that the accommodation is required and a letter of documentation from the [ADAPTS office](#) must be presented at the time of any request.

Grading Policies:

Course grades will be determined based on problem sets, hour exams and the final exam according to the following distribution:

6 problem sets, 4 pts each:	24 pts
2 hour exams, 24 pts each:	48 pts
Final Exam:	28 pts

After the return of each graded assignment or exam, I will announce an estimate of how scores correspond to letter grades. There is no predetermined distribution curve: I will record an A for everyone who does excellent work, a C for anyone who does mediocre work, and so forth.

Re-grades of hour exams must be requested within one week of receiving the graded exam. Please email questions to joseph.sadighi@chemistry.gatech.edu with CHEM 6170 in the subject line.

Academic Honesty:

I expect all students to adhere strictly to the Georgia Tech Academic Honor Code. For questions involving any Academic Honor Code issues, please see the information at honor.gatech.edu, or feel free to ask me.

I will supply all information required for exams. The use of electronic devices other than non-programmable calculators during exams and quizzes is not allowed. Consultation with classmates or reference to texts or other documents during exams is cheating. Passing off anyone else's work as one's own, in any way, is cheating. It is a direct violation of the GT Academic Honor Code, and will be dealt with accordingly.

Questions, Complaints, Comments, Suggestions:

Please make me aware of any problems as they arise. Feel free to contact me in person, or by a note left in my mailbox or sent via e-mail. For any communication concerning the class, please identify yourself by name in the e-mail, and include CHEM 6170 in the subject line. I will do my best to answer questions, and address problems, promptly.

Syllabus:

Reading assignments will be announced in class.

The planned lecture sequence is listed below, but will probably change as we go along: We may choose to spend longer on a given topic, as discussions develop, than I expect before we've begun.

I. Bonding

1. Mon, 8/17 Course Overview; Valence bond and VSEPR approach.
2. Wed, 8/19 Bonding in homonuclear diatomic molecules.
3. Fri, 8/21 Bonding in other linear small molecules.
4. Mon, 8/24 Molecular symmetry: Symmetry operations and symmetry elements.
5. Wed, 8/26 Point group assignments for 3D objects and molecules.
6. Fri, 8/28 Character tables. Problem Set 1 (PS1) due.
7. Mon, 8/31 Intro to SALCs; MO theory for water.
7. Wed, 9/2 Matrix representations.
8. Fri, 9/4 MO theory for NH_3 .
9. Mon, 9/7 Introduction to group theory and vibrational spectroscopy.
10. Wed, 9/9 Frontier MO interactions: Brønsted Acids and Bases.
11. Fri, 9/11 Frontier MO interactions: Lewis Acids and Bases.
12. Mon, 9/14 Introduction to Frustrated Lewis Pairs.
13. Wed, 9/16 Intro to coordination chemistry. PS2 due.
14. Fri, 9/18 Pi-donors and acceptors: High-spin vs low-spin complexes.
15. Mon, 9/21 Bonding in tetrahedral and square planar geometry.
- Wed, 9/23 First Hour Exam – covers material through Lecture 12.

II. Introduction to Spectroscopy; Reaction Mechanisms and Catalysis

16. Fri, 9/25 Electronic structure of free atoms and ions.
17. Mon, 9/28 Splitting of free ion terms: Correlation diagrams and Tanabe-Sugano diagrams.
18. Wed, 9/30 Electronic spectra: d-d transitions.
19. Fri, 10/2 Electronic spectra: Charge transfer transitions.
20. Mon, 10/5 Redox mechanisms: Outer-sphere vs Inner-sphere.
21. Wed, 10/7 Oxidative addition.
22. Fri, 10/9 Ligand substitution mechanisms
- Mon, 10/12 No class – Fall recess.
23. Wed, 10/14 Reductive elimination. PS3 due.
24. Fri, 10/16 Redox-non-innocent ligands. Principles and reactivity consequences.
25. Mon, 10/19 Introduction to cross-coupling.
26. Wed, 10/21 1,1-Migratory insertion reactions.
27. Fri, 10/23 1,2-Migratory insertion / β -Hydride elimination from metal alkyls.
28. Mon, 10/26 Hydrogenation, hydroformylation and related catalysis.
29. Wed, 10/28 Ziegler-Natta polymerization.

30. Fri, 10/30 Abstraction reactions of ligand C–H bonds.
31. Mon, 11/2 Metal alkylidene/metal carbene complexes. PS4 due.
32. Wed, 11/4 Olefin metathesis
 Fri, 11/6 Second Hour Exam – covers Lectures 13-30.

III. Bioinorganic and Bioinspired Chemistry.

33. Mon, 11/9 Dioxygen activation.
34. Wed, 11/11 Biological C–H bond activation.
35. Fri, 11/13 Synthetic C–H bond activation. PS5 due.
36. Mon, 11/16 Photosynthesis.
37. Wed, 11/18 Synthetic catalysts for H–H bond formation.
38. Fri, 11/20 Synthetic O–O and X–X bond formation.
39. Mon, 11/23 Biological CO₂ fixation.
 Wed, 11/26 Official Campus Break: No classes - campus open
 Fri, 11/28 No class: Thanksgiving break.
40. Mon, 11/30 Synthetic CO₂ fixation: Reductive processes.
41. Wed, 12/2 Biological nitrogen fixation. PS6 due.
42. Fri, 12/4 Synthetic nitrogen fixation.