

CHEM 3503/3507

Syllabus

Title

Inorganic Chemistry I

Course Description

Symmetry, identification of Raman and infrared active vibrations, symmetry-adapted molecular orbital theory of polyatomic molecules, electron-deficient bonding, bonding in coordination complexes, solid-state bonding, and ionic lattices. The laboratory will introduce the student to a range of synthetic techniques and physical methods of characterization.

Prerequisite

[CHEM 2501](#)

Preclusion

[CHEM 3507/CHEM 3503](#)

Lectures

Tuesday and Thursday, 8:35 am – 9:55 am, Tory Building 238

The lectures will be offered *in person* only.

Tutorial

Wednesday

8:35 am – 9:25 am

Tory Building 236

The tutorial will be offered *in person* only. The TA will take up the previous week's assignment in the tutorial, as well as answer any questions that you have. Please email your questions in advance so he can offer a considered (and coherent) answer.

Drop-In Hours

Monday and Thursday

11:00 am – 11:30 am

Steacie Building 203b

Laboratory

The lab is run by Daniel Sun, and he has an extensive website about it on Brightspace.

Exams

In-Term: Thursday, 8:35 am – 9:25 am, October 17

Tory Building 238

Final:

to be determined

Grading Scheme

CHEM 3503: the lab is 30% of your mark.

For **CHEM 3507**, there is no lab.

The other 70% is split up as follows:

- Assignments 14%
- In-term exam 21%
- Final exam 35%

The course is split up as follows:

- Assignments 20%
- In-term exam 30%
- Final exam 50%

Text

Gary L. Miessler, Paul J. Fischer, Donald A. Tarr, *Inorganic Chemistry, 5th edition*, Pearson, ISBN: 978-0321812001

Topics

1. Inorganic Chemistry

- Coordination, nomenclature, and isomerisation
- Electron counting and the 18 and 16 electron rules
- Thermodynamics of complex formation: formation constants, enthalpy, and entropy
- Steric effects and ligand basicity (pKa)

- Hard-Soft Acid-Base Theory
- The chelate effect

2. Coordination Chemistry

- Crystal field theory and crystal field stabilization energy
- Strong field and weak field ligands; low spin and high spin electron configurations
- Term symbols
- Microstate analysis and the d-orbitals
- Ligand field spectroscopy
- Russell-Saunders coupling terms, ligand field terms, correlation diagrams
- Assignment of d-d transitions using Tanabe-Sugano diagrams
- Determination of d-orbital splitting energies
- Repulsion terms and the nephelauxetic effect

3. Symmetry and Group Theory

- Symmetry elements
- Symmetry point groups of molecules
- Character tables, symmetry labels

4. Molecular Orbitals

- Fragment molecular orbital theory
- Molecular Orbital (MO) theory and non-directed symmetry adapted LCAOs
- application to organic and main group compounds
- Symmetry labelled molecular orbital schemes
- Molecular orbital theory of transition metal complexes, symmetry labelled MO schemes, the effect of a ligand's pi-acceptor or pi-donor properties on d-orbital splitting
- Paramagnetism and magnetic moment, and the determination of the number of unpaired electrons

5. Motion

- Chemical applications: chirality, IR and Raman spectroscopy

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Requests for Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. Please contact your instructor with any requests for academic accommodation (pregnancy, religion, disability, etc.) during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

For an accommodation request, the processes can be found here:

carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting an accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline

Caveat

Obviously, I reserve the right to make adjustments or changes throughout the semester. Remember that you are responsible to learn about these changes, which will be posted on this website.

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