**Syllabus**

Title: Inorganic Chemistry II

**Course Description**

Physical properties of coordination complexes, ligand substitutions and electron transfer reaction mechanisms, organometallic chemistry: bonding, nomenclature, and catalysis. The laboratory will introduce the student to a range of synthetic techniques and physical methods of characterization.

**Prerequisite**

CHEM 3503 (3507)

**Preclusion**

CHEM 3508 (3504)

**Lectures**

Tuesday and Thursday, 4:00 – 5:30 pm, Tory Building 238

**Tutorial**

Monday 10:35 – 11:25 am, Steacie 115 (run by Eden)

**Laboratory**

The lab is run by Daniel Sun, and he has an extensive Brightspace site for it.

**Exams**

In-Term: Thursday, February 15, 4:00 – 5:30 pm, in class

Final: Wednesday, April 26, 2 pm – 5 pm, location TBD

**Grading Scheme**

***CHEM 3504: the lab is 30% of your mark.***

The other 70% is split up as follows:

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

***For CHEM 3508, there is no lab.***

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**

*Organometallic Chemistry*

* Nomenclature of organometallic complexes
* Electron counting and the 18 and 16 electron rules
* Special ligands: carbonyl, nitrosyl, hydride
* Bonding to a metal via π-bonded electrons by ligands with extended π-systems
* Carbene, and carbyne (alkylidyne) complexes
* Characterization

*Reactions and Mechanism*

* Potential energy diagrams
* Kinetic terms: Inert and labile complexes
* Thermodynamic terms: Stable and unstable
* Mechanisms and rate laws of ligand substitution: Dissociative, Associative and Interchange
* Octahedral complexes showing Dissociative, Associative, and Conjugate Base mechanisms
* Stereochemistry ligand substitution
* Square planar complexes showing associative and dissociative mechanisms
* The Trans effect
* Electron transfer reactions: inner and outer sphere mechanism

*Organometallic Reactions and Mechanisms*

* Reactions involving gain or loss of ligands:
* Ligand dissociation and substitution, oxidative addition, reductive elimination, nucleophilic displacement
* Reactions involving modification of ligands:
* Insertion, carbonyl insertion (alkyl migration), hydride elimination, abstraction
* Organometallic catalytic processes:
* Deuteration, Hydroformylation, Monsanto acetic acid process, Wacker (Smidt) process, Hydrogenation by Wilkinson’s catalyst, Olefin metathesis, Ziegler-Natta polymerization, Water Gas reaction
* Analogies with surface chemistry

*Parallels Between Main Group and Organometallic Chemistry*

* Survey of main group organometallic chemistry
* π-bonding in Period 3 elements
* Inert pair effect
* 3c2e bonding and bridging
* Hydrometallation
* Displacement
* Isoprene catalysis
* The Friedl-Crafts reaction
* Low valency in group 13

*Cluster Chemistry*

* Polyatomic Cations
* Inert-Gas Shell
* Synthesis and preparation
* Wade’s Rule(s) and PSEPT

*Magnetism*

* Spin
* The Bohr Magneton and Gyromagnetic ratios
* Magnetic Susceptibility
* Guoy Balances and Evan Method

**Survivors of Sexual Violence**

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated and is 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.