

Department of Chemistry Online Course Syllabus Template

CHM 338: Intermediate Inorganic Chemistry

I CONTACTS

**COURSE INSTRUCTOR**

Name: Professor Douglas Stephan

Email: dstephan@chem.utoronto.ca or douglas.stephan@utoronto.ca

Availability for online student hours: 1:00-5:30 pm (M-F) see:

<https://outlook.office365.com/owa/calendar/DouglasStephan@utoronto.onmicrosoft.com/bookings/>

**LABORATORY INSTRUCTOR**

Name: Professor John De Backere

Email: john.debackere@utoronto.ca

Office: Lash Miller Labs, room 223

In-Person Student hours: 1:00-2:00 pm (R,F)

*** Online student meetings available by appointment*

II COURSE OVERVIEW

COURSE DESCRIPTION:

This course will cover the following topics:

Coordination Chemistry: bonding, electronic spectra, magnetic properties, reactivity trends, and reaction mechanisms.

Organometallics: M-C and M-H compounds, synthesis and reactivity.

Catalysis: Hydrogenation and various other industrial processes, mechanisms of action and applications.

STUDENT LEARNING OUTCOMES:

To give the student a clear understanding of the basics of the properties and chemistry of transition metals and its application in catalysis.

PREREQUISITE COURSE:

The prerequisite for this course is CHM 238.

III HOW THE COURSE IS ORGANIZED

Videos of summary lecture materials will be available on-line for asynchronous viewing. The lecture materials covered in 2 lectures will be broken into sections. Students are expected to view the lectures prior to the normal lecture slot. At that

time, we will review the material, discuss the material and answer students' questions. Each Friday (most weeks) will be short on-line tutorial quizzes, designed to encourage help students stay up to date with the material. One practical in-person lab session occurs every week (*activities and dates to be announced*) with accompanying lab reports.

COURSE SCHEDULE & RELEVANT SESSIONAL DATES:

LECTURE DATES	UNIT	SUBJECT
Sept 13/15	Introduction to the Transition metals	1.The periodic table 2. Basic terms
Sept 20/22	Ligand and coordination chemistry	3. classical ligands 4. non-classical ligands 5. Ligand Properties 6. isomers and chirality
Sept 27/20	Survey of the Transition metals.	7. first row of transition metals 8. heavy metals
Oct 4/6	Bonding theories and Absorption Spectroscopy	9. crystal field theory 10. CFT-part 2 11. molecular orbital theory 12. multiple electron systems 13. Other Absorptions
Oct 10	THANKSGIVING	
Oct 12 Oct 18	Magnetism and spectroscopy	14. Magnetism 15. EPR spectroscopy 16. NMR spectroscopy-basics 17. NMR spectroscopy-special
OCT 20	MIDTERM	
Oct 25/27	Species with Metal-Carbon σ -bonds.	18. Metal Carbonyl preparation 19. Metal-Carbon bonds
Nov 1/3	Species with Metal-Carbon π -bonds, Metal-Hydrides and metal-small molecule interactions	20. Metal-olefins 21. Metal-alkynes 22. Metal-Allyl species 23. Cyclopentadienyls etc. 24. Metal Hydrides 25. Interactions with small molecules
Nov 8/12	READING WEEK	
Nov 15/17	Reactions of Organometallics and Hydrogenation Catalysis	26. substitution reactions 27. Oxidative Addition 28. Reductive elimination 29. Insertion 30. Hydrogenation catalysis 31. Wilkinson's catalyst 32. P3RhCOH 33. Schrock's catalyst
Nov 22	MIDTERM	
Nov 24	Other Catalysis	34. Asymmetric reductions 35. Hydrosilylation 36. Monsanto acetic acid 37. Hydroformylation

		38. Polymerization 39. Metathesis 40. Fischer Tropsch
Nov 29/Dec 1 Dec 6/8	Frustrated Lewis pairs	41. The concept 42. Hydrogenation 43. Activation of small molecules

TUTORIAL OBJECTIVES:

Synchronous tutorials will be held during the normal lecture slot. Students are expected to have viewed the lectures to discuss and review the material. During these tutorials, student questions will be addressed. Each week, there will be short on-line tutorial quiz due by the end of class (4 pm) on Wednesday. These are open-book and designed to encourage the student to stay up to date with the lecture material.

LABORATORY OBJECTIVES:

Upon completing the experiments of this course, you will be able to:

- i) safely synthesize and characterize a variety of inorganic compounds using standard laboratory techniques and spectroscopic methods;
- ii) apply the fundamental principles learned in lecture to explain the properties and aspects of the inorganic systems investigated;
- iii) work both independently and collaboratively when appropriate to share and interpret data, and clearly/concise communicate results using proper scientific writing through lab reports or presentations.
- iv) use the scientific literature to prepare for, understand, and evaluate experimental procedures and results.

IV EVALUATION/GRADING SCHEME

Tutorial Quizzes	10% (quizzes as part of tutorials)
Mid-terms	30% (Oct 21, Nov 22)
Laboratory	30%
Final Exam	30% (Date to be determined)

V COURSE POLICIES

- I will make every effort to respond to email within 24 hrs on weekdays (Douglas.stephan@utoronto.ca).
- Office hours: I will be available M-F (1-5:30 pm); barring other commitments. Please use the link below to arrange a TEAMS meeting using the booking webpage: <https://outlook.office365.com/owa/calendar/DouglasStephan@utoronto.onmicrosoft.com/bookings/>

- *The University of Toronto is committed to equity, human rights, and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities."*
- Privacy language and appropriate use of course materials:
<https://teaching.utoronto.ca/ed-tech/audio-video/sample-statements/>
- The Deadlines for tutorial quizzed posted on Quercus are also posted on the course webpage. Late submissions will not be accepted.
- The midterm will be posted and a 2h time limit placed on submission. Students are expected to answer these questions without aid or notes. If you are absent for a medically documented reason, there will be no make up exam, rather your average will be calculated with increase weight on the final assessment.

VI TECHNOLOGY REQUIREMENTS

Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here:

<https://www.vicereprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/>

Advice for students more broadly regarding online learning is available here:

<https://onlinelearning.utoronto.ca/getting-ready-for-online/>

This course requires the use of computers, and of course sometimes things can go wrong when using them. You are responsible for ensuring that you maintain regular backup copies of your files, use antivirus software (if using your own computer), and schedule enough time when completing an assignment to allow for delays due to technical difficulties. Computer viruses, crashed hard drives, broken printers, lost or corrupted files, incompatible file formats, and similar mishaps are common issues when using technology, and are not acceptable grounds for a deadline extension.

VII INSTITUTIONAL POLICIES AND SUPPORT

ACADEMIC INTEGRITY

On Academic Integrity:

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong

signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (<https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019>) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:

1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any assignment.

On tests and exams:

1. Using or possessing unauthorized aids.
2. Looking at someone else's answers during an exam or test.
3. Misrepresenting your identity.

In academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see <https://www.academicintegrity.utoronto.ca/>).

Use of Turnitin

Normally, students electronic laboratory reports will be submitted to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site.

COPYRIGHT

Course videos and materials belong to your instructor, the University, and/or other source depending on the specific facts of each situation and are protected by copyright. In this course, you are permitted to download session videos and materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor. More information

regarding this is available here: <https://teaching.utoronto.ca/ed-tech/audio-video/copyright-considerations/>

ACCESSIBILITY NEEDS

Students with diverse learning styles and needs are welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact [Accessibility Services](#) as soon as possible.

ADDITIONAL SERVICES and SUPPORT

The following are some important links to help you with academic and/or technical service and support

- General student services and resources at [Student Life](#)
- Full library service through [University of Toronto Libraries](#)
- Resources on conducting online research through [University Libraries Research](#)
- Resources on academic support from the [Academic Success Centre](#)
- Learner support at the [Writing Centre](#)
- Information for [Technical Support/Quercus Support](#)