

Course Description

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TOPICS IN INORGANIC AND ORGANOMETALLIC CHEMISTRY CHEM/ENCH 423 (Winter 2022)

Course instructor:

Dr Lucia Lee
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Office hours: by appointment

Course website: this course is supported by an OnQ site associated with course registration. See <https://onq.queensu.ca>

Intended Student Learning Outcomes:

- (1) The students will be able to identify and understand common ligands used in organometallic complexes
- (2) The students will understand common reactions of organotransition metal complexes that occur at the metal centre
- (3) The students will understand reactions involving changes in the ligand
- (4) The students will be able to identify and describe different physical methods used to study organometallic complexes
- (4) The students will be able to apply the principles of organometallic chemistry in describing materials and biological applications

Course outline: See end of this document.

Textbooks (not required):

Organometallic chemistry by Gary Spessard and Gary Miessler

The Organometallic Chemistry of the Transition Metals by Robert Crabtree

Grading Scheme

5 quizzes (best 4 scores out of 5)	4 × 10%
Jan 27, Feb 3, Feb 17, Mar 10, Mar 24	
Illustration	5%
Literature presentation (groups of 2)	25%
Exam	30%

Grading Method: All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale:

Queen's Official Grade Conversion Scale

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56

D-	50-52
F	49 below

Calculator Policy: As noted in Academic Regulation 9.2, Calculators acceptable for use during quizzes, tests and examinations are intended to support the basic calculating functions required by most Arts and Science courses. For this purpose, the use of the **Casio 991** series calculator is permitted and is the **only approved calculator for Arts and Science students**. This calculator sells for around \$25 at the Queen's Campus Bookstore, Staples and other popular suppliers of school and office supplies.

Accommodations Statement

Queen's University is committed to achieving full accessibility for people with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in November 2016. If you are a student with a disability and think you may need academic accommodations, you are strongly encouraged to contact the **Queen's Student Accessibility Services (QSAS)** and register as early as possible. For more information, including important deadlines, please visit the QSAS website.

Academic Considerations for Students in Extenuating Circumstances

Academic consideration is a process for the university community to provide a compassionate response to assist students experiencing unforeseen, short-term extenuating circumstances that may impact or impede a student's ability to complete their academics. This may include but is not limited to:

- Short-term physical or mental health issues (e.g., stomach flu, pneumonia, COVID diagnosis, vaccination, etc.)
- Responses to traumatic events (e.g., Death of a loved one, divorce, sexual assault, social injustice, etc.)
- Requirements by law or public health authorities (e.g., court date, isolation due to COVID exposure, etc.)

Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances. For more information, please see the Senate Policy on Academic Consideration for Students in Extenuating Circumstances.

Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. Arts and Science undergraduate students can find the Faculty of Arts and Science protocol and the portal where a request can be submitted. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

For guidance on **submitting requests**, please see refer to the Resource Guides available on the Academic Consideration website under "Applying for Academic Consideration."

N.B: The COVID-19 pandemic is an evolving situation. If you have symptoms or are deemed a close contact of someone with COVID, please access our **COVID-Related Absence Reference Guide** on the Academic Consideration website. This guide will provide you with information on applying for consideration, the types of documentation (including non-medical documentation) you can use to support your request, as well as insight into how the Faculty office will assess these requests.

If you need to request academic consideration for this course, you will be required to provide the following name and email address to ensure it reaches our team accordingly:

Instructor/Course Coordinator Name: Lucia Lee

Instructor/Course Coordinator email address: lucia.lee@queensu.ca

Students are encouraged to submit requests as soon as the need becomes apparent and to contact me (Lucia Lee) as soon as possible once Consideration has been verified. Any delay in contact may limit the Consideration options available.

Academic Integrity:

The following statement on academic integrity builds on a definition approved by Senate and is designed to make students aware of the importance of the concept and the potential consequences of departing from the core values of academic integrity. It is highly recommended that this statement be included on all course syllabi. Instructors may also consider including this statement with each assignment.

Queen's students, faculty, administrators and staff all have responsibilities for upholding the fundamental values of academic integrity; honesty, trust, fairness, respect, responsibility and courage (see www.academicintegrity.org). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and their behaviour conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 <http://www.queensu.ca/arts/sci/academic-calendars/regulations/academic-regulations/regulation-1>), on the Arts and Science website (see <https://www.queensu.ca/arts/sci/students-at-queens/academic-integrity>), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Turnitin Statement: Queen's University has partnered with the third-party application Turnitin to help maintain our standards of excellence in academic integrity. Turnitin is a suite of tools that provide instructors with information about the authenticity of submitted work and facilitates the process of grading. Submitted files are compared against an extensive database of content, and Turnitin produces a similarity report and a similarity score for each assignment. A similarity score is the percentage of a document that is similar to content held within the database. Turnitin does not determine if an instance of plagiarism has occurred. Instead, it gives instructors the information they need to determine the authenticity of work as a part of a larger process.

Copyright of Course Materials: Course materials created by the course instructor, including all slides, presentations, handouts, tests, exams, and other similar course materials, are the intellectual property of the instructor. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate an instructor's course materials or to provide an instructor's course materials to anyone else for distribution, posting, sale or other means of dissemination, without the instructor's *express consent*. A student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face adverse legal consequences for infringement of intellectual property rights.

Course Outline (tentative):

Chapter 1: Brief review of 18-electron rule

Chapter 2: Ligands

- a. Carbonyl ligands
- b. Phosphine ligands
- c. Pi ligands
- d. Main-group ligands

Chapter 3: Organometallic Reactions I

- a. Ligand Substitution
- b. Oxidative Addition
- c. Reductive Elimination

Chapter 4: Organometallic Reactions II

- a. Insertion and Elimination
- b. Addition and Abstraction

Chapter 5: Characterization Methods

- a. NMR spectroscopy
- b. IR spectroscopy
- c. Crystallography
- d. Electrochemistry and EPR

Chapter 6: M-L Multiple Bonds

- a. Carbenes
- b. Carbynes
- c. Bridging Carbenes and Carbynes
- d. N-heterocyclic Carbenes
- e. Multiple Bonds to Heteroatoms

Chapter 7: Applications in Materials and Biology

- a. Porous materials

- b. Nanoclusters and nanoparticles
- c. Coenzyme B12 and anticancer drugs

Proposed list of presentation topics:

Topic #	
# 1	Organometallic chemistry in Pepto-Bismol
# 2	Heteronuclear NMR spectroscopy
# 2	Silver nanoparticles in nanomedicine
# 3	MOFs as storage materials
# 4	Gd ³⁺ contrast imaging agents
# 5	Protein crystallography
# 6	Pincer ligands
# 7	Organometallic reactions in gas phase
# 8	Lithium carbonate in medicine
# 9	Ruthenium anticancer drug
#10	Role of Zn(II) in brain

Each topic presentation includes 15 minutes of speech including 3-5 minutes of questions (both will be assessed). It is anticipated that 3 groups will present per class session of 50 minutes. All presentations will take place in the last two weeks of classes (weeks 11 and 12).

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