

Chemistry 3371F - Transition Metal Chemistry (Fall 2021 Course Outline)

1. Course Information

NOTE: This course outline is subject to change with the evolving COVID-19 pandemic.

Description: The study of the effects of the electronic structure of transition metals on their properties, including coordination chemistry, electronic spectra, magnetic properties, and reactions. Introduction to organometallic chemistry. The laboratory experiments aim to illustrate and amplify concepts discussed in the lectures.

Course prerequisite: Chemistry 2271 and 2281, or the former Chemistry 251.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites. Please see <http://www.registrar.uwo.ca> for details.

2. Instructor Information

Instructor: Professor Joe B. Gilroy
MSA 3201
joe.gilroy@uwo.ca
(e-mail messages *must* be from your @uwo.ca account)

Office hours: By appointment (via Zoom)

3. Course Syllabus, Schedule, Delivery Mode

Course-Based Learning Outcomes:

Upon completion of Chem 3371F, students will be able to...

- (i) apply their understanding of inorganic nomenclature to describe a range of transition metal complexes.
- (ii) use their knowledge of common structural properties of coordination compounds (such as coordination numbers, stereochemistry, isomerism) to rationalize factors influencing the stability and reactivity of transition metal complexes.
- (iii) interpret and predict the physical and chemical properties of transition metal complexes in terms of their electronic structure and the bonding theories typically used to describe them.
- (iv) use their knowledge of structure and bonding properties of transition metal organometallic complexes to predict and rationalize their properties and reactivity.

- (v) conduct laboratory experiments safely and evaluate the potential impact transition metal chemistry may have on society, health, and the environment.
- (vi) prepare logical, organized, and concise written reports describing their experimental results in the areas of the synthesis and characterization of transition metal complexes.

Chemistry 3371F Syllabus Fall 2021:

The topics likely to be covered are outlined in the section below. The order of presentation and the number of lectures devoted to each are approximate.

i. Tentative Course Outline

- (a) Periodic Table, electronic configurations, d-block elements: the open d-shell (1–2 lectures)
- (b) Coordination Chemistry: nomenclature, terms, and examples (2–3 lectures)
- (c) Coordination numbers, stereochemistry, and isomerism (3–4 lectures)
- (d) Formation equilibria for complexes (1–2 lectures)
- (e) Crystal field theory: spectral properties (4–5 lectures)
- (f) Ligand field theory and Molecular Orbital theory of complexes (5–6 lectures)
- (g) More of spectroscopic properties (1–2 lectures)
- (h) Mechanisms of substitution (2–3 lectures)
- (i) Organometallic chemistry (6–7 lectures)

ii. Laboratory Experiments

The laboratory course is intended to augment the lecture course by providing experimental examples to illustrate general principles. It is also intended to teach experimental techniques that are commonly used in inorganic chemistry. Labs begin the week of September 13, 2021.

A lab report must be submitted for each experiment (details are provided in the 3371F lab manual). This will either be in the form of a formal, written report or data sheet format. You will be given your individual schedule during the first week of classes (not everyone performs the same experiment the same week). Important pre-lab information is available on the course OWL page for most experiments.

To help you find the hazards/safety information for the reagents that you will be using in the lab the following online resources will help you:

<http://www.uwo.ca/hr/safety/topics/msds.html>

Laboratory Teaching Assistants: Shaun Milkovich (smilkov7@uwo.ca), Mansha Nayyar (mnayyar2@uwo.ca), Amrit Singh (asing826@uwo.ca), and Alex Watson (awatso92@uwo.ca).

In order to maintain consistency across the entire course, please contact Alex (lead TA) with lab-related questions prior to contacting Dr. Gilroy or the other TAs. *All correspondence to TAs must be from your @uwo.ca email account.*

iii. Laboratory Schedule*

Week of...	
Sept 13	Experiments 1 & 2
Sept 20	Experiments 1 & 2
Sept 27	Experiments 1 & 2
Oct 4	No Labs
Oct 11	Experiments 3 & 4
Oct 11	LAB REPORTS DUE: Expt. 1 (Formal Report) & Expt. 2 (Data Sheet)
Oct 18	Experiments 3 & 4
Oct 25	Experiments 5a & 6
Nov 1	Reading Week – No Labs
Nov 8	Experiments 5a, 5b & 6
Nov 8	LAB REPORTS DUE: Expt. 3 (Data Sheet) & Expt. 4 (Data Sheet)
Nov 15	Experiments 5b & 6
Nov 22	Oral Presentations
Nov 29	LAB REPORTS DUE: Expt. 5 (Formal Report) & Expt. 6 (Data Sheet)

*Note - Formal Reports and data sheets must be submitted electronically via Gradescope before the beginning of your lab section the week that they are due.

iv. Short Formal Presentation

Must be PowerPoint/Keynote or similar. Everyone will have a 10 minute slot. Presentation should be 5–7 minutes max. You will be interrupted and cut off after 7 minutes. Your presentation will be followed by questions from the TAs and/or Dr. Gilroy. Scheduling details and format will be communicated via OWL in early November.

Topic choices include but are not limited to:

Metal-metal quintuple bonds, photonic ink, ferredoxins, redox active ligands, coordination polymers, side chain cobaltocenium polymers, complexes with CN>6, non 18-electron complexes (*e.g.*, 14, 16, 17, 19 electrons), IR of nitrile vs. isonitrile complexes, agostic interactions, ¹H NMR spectroscopy of Pt hydride complexes, linkage isomers, cool example of Δ/Λ complexes, cis-platin, K₂Cr₂O₇ in breathalysers, FLP chemistry, MO diagrams for tbp complexes with good examples...or anything you chose, **but this must be approved by Dr. Gilroy.**

***Topics must be submitted and approved by Dr. Gilroy before the start of reading week (*i.e.*, by the end of the day on Monday, Nov. 1). A 10% per day penalty on the presentation will apply for every day late on topic submission/approval.**

v. Important Dates

Classes begin: September 8, 2021

Reading Week: November 1–7, 2021

Classes end: December 8, 2021

vi. Contingency Plan for an In-person Class Pivoting to 100% Online Learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online as determined by the course instructor. In the event that online learning is required, a stable v1 (2021.09.03) internet connection with working microphone and webcam will be required. As has been the case in the past, the decision to pivot to online learning will be made by Western, and not individual instructors or departments (excepting temporary online instruction in the event of instructor illness).

Course Web Page: OWL (<https://owl.uwo.ca/portal>)

Course Schedule: Lectures
M, W, F; ChB 9; 9:30–10:20 am (in person unless stated otherwise)

Laboratory (one of)
T, W, Th; 1:30–5:20 pm

Labs are held in ChB 080 (lower ground floor). The general schedule for the experiments is given on page 5 of this handout.

4. Required Course Materials

Course Text: Inorganic Chemistry, 5th Edition (Miessler, Fischer, and Tarr). NOTE: this is the textbook you used in Chem 2271 and 2281. If you require a copy, this book is available for purchase at the UWO Campus Bookstore. Second hand copies are also generally available and don't forget to check the library!

Lab Manual: Chemistry 3371F Laboratory Manual Fall 2021 Edition. This is required and can be purchased from the UWO Campus Bookstore.

Safety glasses are required at all times when working in the laboratory. The UWO Undergraduate Chemistry Society sells these at the beginning of term should you require a pair. Students who normally wear prescription glasses must wear safety glasses or goggles over their regular glasses. A lab coat is also required.

A **Hayden-McNeil Organic Chemistry Laboratory Notebook with Carbon Copy** is required for recording all data and observations in the laboratory. This can be used for more than one (not concurrent) course.

5. Methods of Evaluation

Chemistry 3371 late policy: Laboratory reports handed in late will receive a penalty of 10% per day, with the weekend counting as two days. Academic considerations will only be given to students who get the required approval from the academic counsellors in the Faculty of Science.

Course Attendance: Course attendance is mandatory for Chem. 3371F. Information missed during unexcused absences will not be the grounds for academic appeal.

Evaluated Materials: All work submitted for a grade in this course must be your personal work (or yours and a team member as appropriate), use of answers obtained externally is prohibited.

Term Test #1	Wed. Oct. 6, 2021	10%
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*Term Test #2	Wed. Nov 10, 2021	15%
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*NOTE: Although the focus of this test will be primarily on material following the first midterm, you should consider it cumulative.

Final Exam (3 hours; cumulative) (December examination period – date to be set by the Registrar)	36%
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Quizzes (× 3) (3% each – will be announced the lecture prior)	9%
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Laboratory Component (Total 250 marks, see lab manual for details)	25%
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**5ish minute oral presentation	5%
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**NOTE: Grading will be conducted by TAs and/or Dr. Gilroy.

NOTE: In order to pass Chem. 3371F it is necessary to obtain a passing grade in the laboratory component and the combined marks from the term tests, quizzes, oral presentation, and final examination. Additionally, at least 75% (5 of 6) laboratory experiments and reports must be completed in order to obtain a passing grade in Chem. 3371F.

Problem Sets: Several problem sets will be assigned during the term. Solutions will be posted to OWL.

Accommodated Evaluations: If you are unable to meet a course requirement (including laboratory sessions) due to illness or other serious circumstances, you must seek approval for the absence as soon as possible (see below for details).

Midterm Tests: If a midterm test is missed for valid reasons, the weighting of the test will be transferred to the final examination. For those students who cannot write the midterm test on the date indicated because of religious or class conflicts, please contact Dr. Gilroy immediately.

Final Exam: If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

6. Student Absences

Academic Consideration for Student Absences: Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
 - an absence must be no more than 48 hours
 - an SRA for a lab report provides an automatic 48 hour extension from the original due date
 - an SRA for a lab session excuses that week of the experiment. Either the report will also be excused, or the instructor will provide data and/or materials to allow for multi-week experiments and reports to be completed
 - the assessments must be worth no more than 30% of the student’s final grade
 - no more than two SRAs may be submitted during the Fall/Winter term
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Religious Accommodation: When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

Course Absences due to Daily COVID Screening Questionnaire: Missed assessments (*e.g.*, presentations, quizzes, tests, midterms, etc.) require formal academic considerations (typically self-reported absences and/or academic counselling). Methods for dealing with missed work and course content are at the discretion of the instructor(s). Students should be aware that some learning outcomes cannot be easily made up and may need to be completed in a subsequent year. Your instructor will provide you with further information as to how this applies within this course. Students who demonstrate a pattern of routinely missing coursework due to self-reported COVID symptoms, and therefore do not demonstrate mastery of the learning outcomes of the course, will not receive credit for the course.

7. Accommodation and Accessibility

Accommodation Policies:

Students with disabilities work with Accessible Education (formerly SSD), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/AcademicAccommodation_disabilities.pdf

8. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Permitted aids for quizzes, tests and exams: Students will always be allowed to use model kits, point group flow chart and a periodic table. Any other information students require will be provided by Dr. Gilroy.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

9. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.health.uwo.ca/mentalhealth>) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <https://westernusc.ca/your-services/>.

10. Masking Guidelines

Students will be expected to wear triple layer, non-medical, masks at all times in the classroom as per University policy and public health directives. Students who are unable to wear a mask must seek formal accommodation through Western Accessible Education, and present medical documentation. Students are not permitted to eat or drink while in class to ensure masks stay in place. Students will be able to eat and drink outside of the classroom during scheduled breaks. Students unwilling to wear a mask as stipulated by Western policy and public health directives will be referred to the Dean, and such actions will be considered a violation of the student Code of Conduct.