



COURSE OUTLINE

1. **Course:** CHEM 433, Inorganic Chemistry: Transition Metals - Winter 2021

Lecture 01: MWF 11:00 - 11:50 - Online

Instructor	Email	Phone	Office	Hours
Dr Warren Piers	wpiers@ucalgary.ca	220-5746	EEEL 548	By Appointment

Start date of Labs: Week of January 25, 2021. The first session will also include check-in.

In Person Delivery Details:

Five wet labs will be completed **in person** at the scheduled time and location (EEEL 253).

All laboratory groups will be split into two groups of 10 students attending the wet labs in alternating weeks. The complete **laboratory schedule will be available on D2L by Monday, January 18, 2021**.

Students will need to contact the instructor as soon as possible if unable to attend any in-person component (wet lab). We will follow mask wearing protocols as per the [Government of Alberta guidelines](#).

Re-Entry Protocol for Labs and Classrooms:

To limit the spread of COVID-19 on campus, the University of Calgary has implemented an Instructional Space Re-Entry Protocol that must be followed. Details are found in the [Covid-19 Protocol for Class and Lab re-entry.pdf](#) document. **Online Delivery Details:**

This course is being offered online in real-time via scheduled meeting times, you are required to be online at the same time.

To help ensure Zoom sessions are private, do not share the Zoom link or password with others, or on any social media platforms. Zoom links and passwords are only intended for students registered in the course. Zoom recordings and materials presented in Zoom, including any teaching materials, must not be shared, distributed or published without the instructor's permission.

Lectures in this course will be delivered online via Zoom, synchronously (live) OR asynchronously via prerecorded videos; a more detailed schedule will be announced on D2L when the semester starts. All lecture slides will be provided via D2L, but lecture notes or recordings of synchronous lectures will not.

Course Site:

D2L: CHEM 433 L01-(Winter 2021)-Inorganic Chemistry: Transition Metals

Note: Students must use their U of C account for all course correspondence.

2. **Requisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Prerequisite(s):

Chemistry 201 or 211, and 203 or 213, and 331 or 431. Also known as: (formerly Chemistry 333)

See section 3.5.C in the Faculty of Science section of the online Calendar.

Prerequisite(s): [Chemistry 201](#) or [211](#); and [203](#) or [213](#); and 331 or [431](#).

Also known as: (formerly Chemistry 333)

3. **Grading:**

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar.

In determining the overall grade in the course the following weights will be used:

Component	Weighting (%)	Date	Location
Laboratory Experiments	25		EEEL 253
Midterm 1	15	February 5, 2021	online, synchronous
Midterm 2	15	March 12, 2021	online, synchronous
Midterm 3	15	April 14, 2021	online, synchronous
Final Assignment	30	Due April 29, 2021	asynchronous

The Midterm Tests will be held in class, Friday, February 5th, Friday, March 12th, and Wednesday April 14th, 2021. These exams will be written synchronously online (live, during class time) on the scheduled dates. Exams will be designed to be doable within 30 minutes but you will have the full 50 minutes to complete the exam and email your answers to the instructor. All midterm exams are cumulative.

For any synchronous assessment, time will be adjusted for SAS students if needed. As well, accommodations for students facing a significant barrier to writing the assessment during the scheduled time will be done on a case-by-case basis, *e.g. different time zones, caregiving responsibilities, ability to secure an appropriate test-taking environment*. Students who need accommodation for the midterm or final exam must contact Dr. Piersat **least 14 days in advance of the scheduled assessment**.

There are no deferred midterm tests. The weight of a legitimately missed term test will be handled as discussed in section 4 below.

The Final Assignment will be disseminated no later than April 15, 2021 and will be due on April 29, 2021, the last day of exams. It is not an exam and is not closed book. Further details on the form of this assignment will be discussed in the course, but it will have to be done individually without discussing with peers, and sources consulted in preparing your answers must be cited. Your answers must be in your own words. To avoid the risk of plagiarizing accidentally from other sources (including a peer, the internet, or your instructor's notes), consider taking rough notes from any source you consult, and then writing your answer while looking only at your notes and not the original reference. This strategy can help you avoid accidentally using phrases or wording that are not your own thinking.

This course does not have a registrar-scheduled final examination.

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	95 %	85 %	80 %	75%	70%	65 %	60 %	55%	50%	45 %	40 %

Notes:

Students will be expected to understand at every stage the material covered in all components of the course. In order to satisfy the prerequisite requirements (i.e., C-) for further Chemistry courses, a student must meet the following requirements: (1) achieve a minimum 50% in the laboratory grading, *and* (2) achieve a minimum 50% weighted average on the midterm examinations and Final Assignment.

This means that if a student scores below 50% in either the laboratory component or the examinations/assignment, then the *maximum* course letter grade they can obtain in CHEM 333 is a D+.

4. Missed Components Of Term Work:

The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, then the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course.

There are no deferred Midterm examinations in this course.

Any missed components for which an excused absence is not approved will receive a grade of zero.

5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

6. **Course Materials:**

Recommended Textbook(s):

Gary L. Miessler, Paul J. Fischer, Donald A. Tarr, *Inorganic Chemistry*: Pearson.

Lab coats and safety glasses must be worn in the laboratory at all times.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC [ELearning](#) online website.

7. **Examination Policy:**

All three midterms will be cumulative and in closed book format. You may not access your lecture notes or any other resources during exams. No other aids are allowed on tests or examinations, including accessing internet resources such as search engines (Google, etc.), other websites, shared documents (Google docs etc.) or chat servers (Discord, WhatsApp, etc.), etc., and you are specifically prohibited from working with or contacting any other individuals while you complete the exam. Violation of these rules is considered academic misconduct (see also Item 12(d), below).

Students should also read the Calendar, [Section G](#), on Examinations.

8. **Approved Mandatory And Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course.

9. **Writing Across The Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also [Section E.2](#) of the University Calendar.

10. **Human Studies Statement:**

Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

11. **Reappraisal Of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

- Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections [I.1](#) and [I.2](#) of the University Calendar
- Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

12. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- b. **SU Wellness Services:** For more information, see www.ucalgary.ca/wellnesscentre or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (syva@ucalgary.ca) or phone at [403-220-2208](tel:403-220-2208). The complete University of Calgary policy on sexual violence can be viewed at (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>)
- d. **Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional [Code of Conduct](#) and promote academic integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

[Student Handbook on Academic Integrity](#)
Student Academic Misconduct [Policy](#) and [Procedure](#)
[Research Integrity Policy](#)

Additional information is available on the [Student Success Centre Academic Integrity page](#)

- e. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accommodations-for-students-with-disabilities.pdf](#).

Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Chemistry, Dr. Yuen-Ying Carpenter by email ahugchem@ucalgary.ca or phone 403-220-6908. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See [Section E.4](#) of the University Calendar.

- f. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.
- g. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](tel:403-220-3911) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](tel:403-220-3913) Email: sciencerep@su.ucalgary.ca. [Student Ombudsman](#), Email: ombuds@ucalgary.ca.
- h. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.
- i. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be

pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

13. Laboratory Information: Laboratory activities will begin on **January 25th, 2021; the first week will include check-in procedures and safety introduction as well as the first experiment.** It is mandatory that students wear a lab coat and safety glasses at all times when working in the lab. Students wearing inappropriate laboratory attire will not be permitted to conduct experiments for safety reasons. The manual can be found online (course D2L site). You must consult the online laboratory manual prior to attending any of your scheduled lab periods and printout the required portion of the manual that outlines the procedures you will be doing.

14. Laboratory Safety Course. All undergraduate students taking chemistry laboratories are required to complete an introductory course (approx. 50 minutes) on laboratory safety. Students who have previously completed the Chemistry Safety Course at the University of Calgary in the past five years are NOT required to repeat it. The safety course is presented in an online format. The Safety Course must be completed before Tuesday, January 19, 2021. The material is considered to be part of the course and is therefore appropriate for inclusion into laboratory pre-labs and exams.

15. Laboratory Exemptions. Students repeating the course within the last two years can be exempted from the Laboratory Component of the course if a grade of 75% or higher was obtained on the lab portion. Students choosing to exempt from the lab should be aware that the lab grade achieved on the previous attempt will be carried forward.

Prior to applying for an exemption, students are encouraged to connect with their course instructor or coordinator to better understand the risks and benefits in their specific online course, as well as what access they will (or will not) have to lab materials or feedback as an exempt student.

Students applying for a lab exemption should contact the Undergraduate Science Center (science.advising@ucalgary.ca) no later than Monday January 18th, 2021 to apply. Students registering in the course after this date should contact the USC as soon as possible if they wish to apply for an exemption.

Course Outcomes:

- By completing this course, students will be able to:
- 1) write name, formula and charge of coordination compounds; recognize common ligands, their donor atoms and denticity; determine the oxidation state of the metal and its electronic configuration; perform conductivity test in the lab to identify the number of ions constituting a coordination compound (when dissolved in water), making a distinction between inner-sphere and outer-sphere coordination; recognize symmetry elements and operations in a coordination compound, and determine its Point Group.
- 2) distinguish between different types of isomers for coordination compounds; prepare geometrical isomers of an octahedral complex in the lab, recognizing differences in their colors and UV-vis absorption spectra; learn in the lab how to separate two optical isomers (enantiomers) in a racemic solution, and determine the optical purity of the isolated enantiomer by measuring its optical activity using a polarimeter.
- 3) use 18-electron rule, crystal field theory and MO theory to explain bonding in octahedral, tetrahedral, square planar complexes and organometallic compounds, and calculate their crystal field stabilization energies; predict a ligand's field strength (weak vs. strong) and its position in the spectrochemical series based on its ability to be sigma-donor, pi-donor or pi-acceptor, leading to high-spin vs. low-spin electronic state in a complex; generate MO energy level diagrams for different ligand field strengths in an octahedral field; recognize metal ions that gain further stability through tetragonal distortion (Jahn-Teller effect); synthesize metal complexes in the lab, explaining their colors based on the color wheel and absorption bands in their visible spectra, justifying those electronic transitions according to crystal field splitting of d-orbitals, recognizing their spin-state by measuring their magnetic susceptibilities, identifying the nature of isomers formed using IR spectroscopy; explain nature of bonding and orbital overlaps in complexes with metal-metal bonds (delta bonding); describe sigma-donation and pi-back-bonding in metal-carbonyl complexes, preparing such complexes in the lab, using IR spectroscopy to determine their structures.
- 4) recognize thermodynamic stability of a metal complex in solution; distinguish between metal ions that form kinetically inert or labile complexes; describe the mechanisms (Associative, Dissociative, Intermediate) of ligand substitution reactions for octahedral and square planar complexes, and interpret the corresponding rate laws; discuss the electronic and steric factors that influence the reactivity of square planar complexes (such as Trans effect); recognize the mechanism of electron transfer (inner-sphere vs. outer-sphere) in a redox reaction for metal complexes based on supporting evidence (rate constants, presence of bridging ligands, use of radioisotopes, etc), and discuss factors contributing in the "self-exchange" and "cross-exchange" outer-sphere redox reactions.
- 5) use their knowledge about structure, bonding and reactivity of transition metal complexes to describe the mechanism of some fundamental catalytic processes, and the role of transition metal ions and their complexes in selected biological systems.

Electronically Approved - Jan 05 2021 15:19

Department Approval

Electronically Approved - Jan 05 2021 16:33

Associate Dean's Approval