



## COURSE OUTLINE

### 1. **Course:** CHEM 333, Inorganic Chem:Transition Metals - Winter 2019

Lecture 01: MWF 11:00 - 11:50 in ST 135

Instructor	Email	Phone	Office	Hours
Farideh Jalilehvand	faridehj@ucalgary.ca	403 220-3855	SB 213	By Appointment

Laboratory activities will begin on **January 15th, 2019**; the first week is for check-in and the experiments will start from **January 22nd, 2019**.

#### **Course Site:**

D2L: CHEM 333 L01-(Winter 2019)-Inorganic Chem:Transition Metals

<https://d2l.ucalgary.ca/d2l/home/252812>

**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.

<https://www.ucalgary.ca/pubs/calendar/current/chemistry.html#6516>

### 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(s)	Weighting %	Date
Laboratory Experiments	25%	
Assignments	5%	
Term Test 1	15%	<b>Monday, February 11, 7:00 - 9:00 pm, EDC 179</b>
Term Test 2	20%	<b>Monday, March 18, 7:00 - 9:00 pm, EDC 179</b>
Final Exam	35%	To be scheduled by Registrar

All exams are cumulative.

There will be several assignments during the course; 5% mark can be obtained by *scientifically* answering **ALL** questions in **ALL** assignments, demonstrating competency in the course. Failure to do so will reduce the final grade by **-1%** for each missed assignment.

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 %

This course has a registrar scheduled final exam.

**Notes:**

Students will be expected to understand at every stage the material covered in all components of the course. In order to achieve 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 examinations (Term Tests and Final).

**4. Missed Components Of Term Work:**

In the event that a student misses the midterm or any course work due to illness, supporting documentation, such as a medical note or a statutory declaration will be required (see [Section N.1](#); for more information regarding the use of statutory declaration/medical notes, see [FAQ](#)). Absences must be reported within 48 hrs.

The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize themselves with these regulations. See also [Section E.3](#) of the University Calendar.

There are no deferred Term test examinations. If a student misses a Term Test for a legitimate reason, then a statutory declaration will be required. The course coordinator will need to see the original documentation (not electronic copy) for review / decision and keep it (or a copy) for their records. The documentation must be provided to the course coordinator **within 15 days** of the date of the Term Test in order for an excused absence to be considered. If an excused absence is approved, then the percentage weight of a legitimately missed Term Test examination will be transferred to the final examination. Excused absence may be considered for only ONE of the two Term Tests.

If a student missed a Term Test, or did not perform an experiment, for non-legitimate reasons (e.g. vacation or incomplete pre-lab assignment), the contribution of that Term Test or experiment in the final course grade will be zero.

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

The following out of class activities are scheduled for this course.

Activity	Location	Date and Time	Duration
Term Test 1	EDC 179	Monday, February 11, 2019 at 7:00 pm	2 Hours
Term Test 2	EDC 179	Monday, March 18, 2019 at 7:00 pm	2 Hours

**REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY.** If you have a conflict with the out-of-class-time-activity, please contact your course coordinator/instructor no later than **14 days prior** to the date of the out-of-class activity so that alternative arrangements may be made.

## 6. Course Materials:

Recommended Textbook(s):

- Missler, G. L.; Fischer, P. J., and Tarr, D. A., *Inorganic Chemistry, 5th Ed*: Pearson (2014).  
Housecroft, C.E. and Sharpe, A.G., *Inorganic Chemistry, 4th Ed.*: Pearson (2012).  
Huheey, J. and Keither, E.A., *Inorganic Chemistry, 4th Ed.*: Harper and Row (1993).  
Porterfield, W.W., *Inorganic Chemistry: A Unified Approach*: Academic Press (1993).  
Szafran, Z., Pike, R.M. and Singh, M.M., *Microscale Inorganic Chemistry: A Comprehensive Laboratory Experience*: John Wiley & Sons (1991).  
Vogel A., *Qualitative Inorganic Analysis, 7th Ed.*: Longman (1996).  
Nakamoto, K., *Infrared & Raman Spectra of Inorganic & Coordination Compounds (Parts A & B), 6th Ed.* Wiley (2009) - available at U of C library - online.  
Lippard, S.J., *Principles of Bioinorganic Chemistry*: University Science Books (1994).

### Top Hat:

Students are highly encouraged to use their cell phone, tablet or laptop to participate during the Top Hat activity questions. There is no participation mark for this activity, and it is solely used to navigate students' learning progress. Top Hat is free for registered students. More information will be provided on the first day of lecture.

### Other Course Materials:

- Lab coat & safety glasses (required)  
Molecular Model Kit (Molymod recommended)  
A non-programmable scientific calculator (Casio FX 260 or equivalent)

## 7. Examination Policy:

All exams will be cumulative and in closed book format. During exams students are allowed to bring only pencils, pens, erasers, their ID card, and non-programmable calculators.

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

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

**Laboratory Breakage Fees and Locker Check-out:** The Department of Chemistry has a laboratory glassware breakage fee. At the start of the course, each student is assigned a locker and checks-in to establish that they have a complete set of usable glassware. By signing for check-in, a student agrees that they are now responsible for the glassware until check out. Any equipment that is missing, unusable or has been replaced during the semester will be charged to the student. All students, even those who withdraw early from the course, must check out of the laboratory before the last day of lectures (**Friday, April 12, 2019**). Any student who fails to check out before the last day of lectures for the term will be assessed a charge of \$30.00. If this fee is not paid by the last day of the final examination period of the term, an additional \$10.00 administrative fee will be charged and university services (registration, transcripts, etc.) may be withheld.

## 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.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course

coordinator/instructor within **15 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 immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a re-assessment of the work if, and only if, the student has sufficient academic grounds. See sections [I.1](#) and [I.2](#) of the University Calendar

- b. **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 Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see [www.ucalgary.ca/wellnesscentre](http://www.ucalgary.ca/wellnesscentre) or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. 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 ([svsa@ucalgary.ca](mailto:svsa@ucalgary.ca)) or phone at [403-220-2208](tel:403-220-2208).
- d. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/ fabrication of experimental values in a report. **These are only examples.**
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- f. **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. Farideh Jalilehvand by email [ahugchem@ucalgary.ca](mailto:ahugchem@ucalgary.ca) or phone [403-220-5353](tel:403-220-5353). 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.

- g. **Safewalk:** Campus Security will escort individuals day or night (See the [Campus Safewalk](#) website). Call [403-220-5333](tel:403-220-5333) for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

- h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). 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.
- i. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](#) Email: [suypaca@ucalgary.ca](mailto:suypaca@ucalgary.ca). SU Faculty Rep., Phone: [403-220-3913](#) Email: [sciencerep@su.ucalgary.ca](mailto:sciencerep@su.ucalgary.ca). Student Ombudsman, Email: [suypaca@ucalgary.ca](mailto:suypaca@ucalgary.ca).
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. **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.
- l. **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 begin on **January 15th, 2019**; the first week is for check-in and the experiments will start from **January 22nd, 2019**. 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 through 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. The grade for each activity plus a discretionary grade is outlined in the online manual.

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. The lab grade achieved on the previous attempt will be carried forward. Such students must contact the Chemistry Undergraduate Program Administrator in the Chemistry Main Office, SA 229 before the drop date (**January 17th, 2019**).

14. **Laboratory Safety Course:** All undergraduate students taking chemistry laboratories are required to complete an introductory course (approx. 50 minutes) on laboratory safety. This course is presented in an online format ([https://ucalgary.ca/chem/undergraduate/current\\_students/academics](https://ucalgary.ca/chem/undergraduate/current_students/academics)). The Safety Course must be completed before the first laboratory experiment. Students who do not complete the safety lessons will subsequently be denied admission to the laboratories. While it will not count directly to the final grade, the material is considered to be part of the course and is therefore appropriate for inclusion into laboratory pre-labs and exams. Students who have previously completed the Chemistry Safety Course at the University of Calgary in the past three years are NOT required to repeat it.

#### **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-backbonding 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.

Department Approval:

Electronically Approved

Date: 2019-01-03 10:43

Associate Dean's Approval for out of  
regular class-time activity:

Electronically Approved

Date: 2019-01-03 11:51