CHEM 341 – INORGANIC CHEMISTRY III: THE TRANSITION METALS – 3 CREDITS

1. GENERAL INFORMATION

Course Format:

Lecture 01	– – W – F	11:45-13:00	CC 425
Lab 51	– T – – –	18:30-22:30	SP 210
Lab 56	*Only* for students granted a lab exemption		

			Office Hours
Instructor	Dr. Xavier Ottenwaelder	dr.x@concordia.ca	Tue, Thu 12:30-13:30, SP 201.19
Teaching assistant	Alyson MacKay	alyson.mackay@mail.concordia.ca	Lab Tue 15:00-16:00, SP S175.25
Lab coordinator	Jennifer Romero	jennifer.romero@concordia.ca	

2. COURSE DESCRIPTION

Theories of bonding in transition metal complexes, including ligand field theory, applied to structure, physical properties, and reactivity of transition metal complexes: organometallic chemistry and catalysis. Metals in biological systems. Lectures and laboratory.

Prerequisites CHEM 217, 218, 241, 242.

3. OBJECTIVES

You will learn in-depth descriptions of molecules containing a transition metal ion: symmetry, bonding, spectroscopic properties and main reactions, including an introduction to organometallic species and, if time permits, bio-inorganic chemistry. You will be expected to achieve a high level of analytical and critical thinking. This course is intense, and it is highly recommended that you **work the material *before* class**. In this course, mere learning is not sufficient, and you will be expected to apply the concepts learned in class to new situations. The in-class and final examinations will test this.

4. SCHEDULE (May be subject to change)

See last page for a detailed schedule. Assignments will be announced in class or via Moodle.

Important dates:	
Lectures begin:	Wed, Sep. 07
Reading Day (no class):	Wed, Oct. 12
Lectures end:	Wed, Dec. 07
Lab orientation/check-in:	Wed, Sep. 14 at the start of **class**
Labs begin:	Tue, Oct. 04 **for all groups**
Last day to hand in lab reports:	Fri, Dec. 02
Exam period starts:	Fri, Dec. 09
Final exam date(s):	TBD
Deadline to withdraw with tuition refund (DNE):	Mon, Sept. 19
Deadline to withdraw (DISC):	Thu, Dec. 08

5. BEHAVIOUR

All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the Code of Rights and Responsibilities which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

6. INTELLECTUAL PROPERTY

Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

7. EXTRAORDINARY CIRCUMSTANCES

In the event of extraordinary circumstances and pursuant to the Academic Regulations, the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the changes.
http://www.concordia.ca/academics/undergraduate/calendar/current.html

8. COURSE MATERIAL

Required Textbook
- Miessler, Fisher & Tarr, *Inorganic Chemistry*, 5th ed., 2013 (Pearson) or Miessler & Tarr, *Inorganic Chemistry*, 4th ed., 2010 (Pearson/Prentice Hall)

Required Lab Text
- Szafran, Pike & Singh, *Microscale Inorganic Chemistry–a comprehensive laboratory experience* (Wiley), plus the instructions that will be distributed in class.

Other Textbooks
- Weller et al, *Inorganic* Chemistry 7th ed., 2018 (Oxford) or Shriver et al, *Inorganic Chemistry*, 6th ed., 2014 (Freeman)
- House, *Inorganic Chemistry*, 2nd ed. 2013 (Academic Press)

9. GRADING

9.1. Grading Scheme

To pass CHEM 341, **you must pass both the course and the laboratory parts**, by obtaining at least 50% on the coursework (problem sets, in-class tests and final exam) and at least 60% on the laboratory work. A failure in the laboratory part carries an automatic "R" grade, and a good lab mark will not compensate for a failure in the coursework part. The final grade will be weighted as follows:

Problem Sets and In-Class Tests	35%
Laboratory Marks:	25%
Final Exam:	40%

The grading scheme is as follows:

A grade ≥	0%	50.00	53.33	56.67	60.00	63.33	66.67	70.00	73.33	76.67	80.00	85.00	90.00
and <	50.00	53.33	56.67	60.00	63.33	66.67	70.00	73.33	76.67	80.00	85.00	90.00	100%
gets a:	F	D–	D	D+	C–	C	C+	B–	B	B+	A–	A	A+

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

All problem sets and in-class tests must be submitted by the deadline. Late submissions will not be accepted.

If absent from an examination, you must produce a written excuse on letterhead paper appropriately signed (e.g., by a doctor or employer) within one week after the exam. The Department determines the validity of the absence and necessary arrangements will be made. If no valid excuse is produced, you will receive a **zero** grade for the missed work.

For in-class and final examinations, only non-programmable calculators will be accepted.

9.2. Final Examination

The Final Examination will be held **in person**, as scheduled by the Exams Office. In the event of major changes (e.g., due to the Covid-19 pandemic), new instructions for the Final Examination will be provided.

Students who are unable to write an exam because they are unable to meet the above conditions and requirements **are advised that they will need to drop the course**. The next offering of this course will be Fall 2023. Students are advised that the drop deadline (DNE) for this course is September 19, 2022.

9.3. Laboratory Information

The **lab component of CHEM 341 is in-person on campus and is mandatory**. Lab-specific measures will be described during the **mandatory online check-in session on Sept 14th during class time.**

The labs in CHEM 341 will further your experience of the practical aspects of coordination chemistry and of the concepts studied in class. Remember, experimental chemistry can be dangerous; there is no shame and no penalty in asking any kind of questions. **A lab coat and safety glasses** are mandatory items to perform lab work; you will not be allowed to perform laboratory work without wearing them. Your lab grade will be decreased by one mark each time you don't follow this rule.

The CHEM 341 laboratories are in SP-210 and start on **Oct 04** (to be confirmed at orientation). The lab schedule and instructions are provided in separate documents posted on Moodle. **All questions on matters related to the lab component of the course should be addressed to the TA** (info above).

If you miss a lab, you must provide a written excuse on letterhead paper appropriately signed (e.g., by a doctor or employer) within one week or you will receive a grade of **zero**. Only one absence is allowed.

Your experimental skills will be evaluated in part during the laboratory courses (observation by instructors, questions…) and foremost through your reports. Hence, pay extra care for the **scientific significance** and the **scientific presentation** in your reports. Especially, the **discussion** section must be solid: it will be the most important element of grading. A good discussion goes beyond superficial questions and is based on **critical thinking**. In other words, you have to ask yourself constantly why you are doing this and that during the experiment and relate this to your knowledge.

Lab reports (on paper) must be handed in person to the TA at the respective due dates.

Lab exemption. Students who are repeating the course and have passed the lab component within the past two (2) years, may request a lab exemption. The application form can be found on the department website at: https://www.concordia.ca/content/dam/artsci/chemistry/docs/labexempt.pdf.

To get a lab exemption, you must (1) submit the application by e-mail to chemistry.reception@concordia.ca no later than Friday, September 10th at 4pm AND (2) register in lab section 5156 (students in all other lab sections must perform ALL labs). All late lab-exemption requests will be refused.

10. ETHICAL BEHAVIOR

10.1. Rights and Responsibilities of the Student

- **Read the Moodle site within the first week of classes:**

Full explanations of the course policies, activities, and helpful tips are provided there. By registering for the course, you are agreeing to follow the rules described in this syllabus and on Moodle. The information will remain accessible all term for your reference. If you have questions, please ask the professor and/or lab coordinator.

- **Be prepared for lectures & labs:**

Lectures: Read the lecture materials before class, and then be ready to (i) answer clicker/oral questions (including calculations) during the lecture and (ii) engage in discussion with small groups of classmates to clarify each other's understanding.

Labs: Read the experiment thoroughly & complete the pre-laboratory exercises (individually), and then be ready to (i) perform the experiment together with a lab partner and (ii) write a lab report based on your data (individually).

- **Contribute to a positive learning environment:**

Disruptive or disrespectful behaviour will not be tolerated in classrooms, online sessions or laboratories. Cell phones, other electronic communication devices, laptop computers and tablets may not be used in these settings, except for answering clicker questions and taking notes. Students engaging in inappropriate behaviour will be asked to leave, without the opportunity to make up the missed work.

10.2. Recommendation to complete the CHEM 101 seminar & quiz

Please go to the link hereafter and familiarize yourself with what you are supposed to do and what you are supposed to avoid doing. Academic Integrity Website: concordia.ca/students/academic-integrity

The Academic Code of Conduct can be found in section 17.10 of the academic calendar. Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied.

As part of this course, you are **required** to i) attend a Chemistry and Biochemistry Departmental Seminar on the academic conduct code and the appropriate use of information sources and ii) pass the online quiz associated with this seminar (the passing grade for the quiz is 100%). (**Note:** this quiz is graded by the Department of Chemistry and Biochemistry, and you do not have access to it until after you have attended the seminar. Therefore, any other quiz you may have taken on the academic code of conduct does not count toward the CHEM 101 requirement.) The aim of this seminar and quiz is to clarify the academic conduct code in terms of which practices will be considered unacceptable with regards to work submitted for grading in your CHEM course. **You are only exempt from repeating the seminar and the quiz if you have done both in Fall 2017 or more recently,*** otherwise you are required to repeat both this term. This short seminar (1 hour) will be held at the following times (note that you will not be given credit if you join too late and/or leave too early):

Date (Fall 2022)	Time	Mode	Registration link
Sept. 21 (Wednesday)	21:00-22:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZYkduivqDkpHtVmJJllg74uA5HiKQC-ZaM8

Sept. 22 (Thursday)	21:00-22:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZElc-6rrzwvE9WHVZfXXuhROaPhEUnVARTU
Sept. 26 (Monday)	19:00-20:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZAsc-iqqzkrGNIX7oPpwXcdqVH9Mc3inWP8

As space for each of the Zoom seminars is limited, please **register early** for your preferred slot (copy the corresponding link above into your browser, and make sure you do not introduce a space: it is "concordia-ca"). Then do not forget to **attend** that seminar slot on the date above!

We will take attendance at the Zoom seminar.

If you do not complete this course requirement, your final grade for the course may be lowered by one full letter grade with an incomplete (INC) notation until such time as this requirement is completed. Please refer to the undergraduate calendar (section 16.3.5) for details on removal of an incomplete notation.

* You are exempt if you can locate your ID in the pdf file located on the Departmental web site and if there is no entry in the "quiz" column for you (http://www.concordia.ca/content/dam/artsci/chemistry/docs/Compliance-list.pdf).

10.3. Plagiarism and Other Forms of Academic Dishonesty

Plagiarism: the most common offense under the Academic Code of Conduct is plagiarism, which the Code defines as "the presentation of the work of another person as one's own or without proper acknowledgement."

This includes material copied word for word from books, journals, Internet sites, professor's course notes, etc. It refers to material that is paraphrased but closely resembles the original source. It also includes for example the work of a fellow student, an answer on a quiz, data for a lab report, a paper or assignment completed by another student. It might be a paper purchased from any source. Plagiarism does not refer to words alone – it can refer to copying images, graphs, tables and ideas. "Presentation" is not limited to written work. It includes oral presentations, computer assignments and artistic works. Finally, if you translate the work of another person into any other language and do not cite the source, this is also plagiarism.

In Simple Words:

Do not copy, paraphrase or translate anything from anywhere without saying where you obtained it.

11. CONCORDIA UNIVERSITY SERVICES FOR STUDENTS (partial list)

- Access Centre for Students with Disabilities: http://www.concordia.ca/students/accessibility.html
- Counselling & Psychological Services: http://www.concordia.ca/students/counselling-life-skills
- Concordia Library Citation & Style Guides: https://library.concordia.ca/help/citing/
- Academic Integrity Website: https://www.concordia.ca/students/academic-integrity.html
- Student Advocacy Office: https://www.concordia.ca/offices/advocacy.html
- Financial Aid & Awards: http://www.concordia.ca/offices/faao.html
- Student Success Centre: http://www.concordia.ca/students/success.html
- New Student Program: http://newstudent.concordia.ca/
- Health Services: https://www.concordia.ca/students/health.html

At any time during the term and before the final examination, CHEM 341 students are welcome to inform the Professor with special circumstances they may have that pertain to their teaching experience.

CHEM 341 – Inorganic Chemistry III: The Transition Metals

CHEM 341 Lectures
Dr. Xavier OTTENWAELDER
dr.x@concordia.ca
Wed, Fri 11:45–113:00
CC 425

	Class #	Chapter topic	A glimpse of the lecture content	M [a]	W [b]	S [c]	H [d]
1	Sept. 07	I. Structure	Introduction, coordination numbers	9	7	7	16
2	Sept. 09		Isomerism				
3	Sept. 14	II. Symmetry	Symmetry and group theory	4	3	6	5
4	Sept. 16		Character tables				
5	Sept. 21	III. Bonding	Crystal-field theory	10	20	20	17
6	Sept. 23		Ligand-field theory				
7	Sept. 28		Molecular orbitals				
8	Sept. 30		π-bonding, backbonding				
9	Oct. 05		Jahn-Teller effect				
10	Oct. 07		Angular overlap model	10	–	–	–
	Oct. 12	*Reading day*	*No class*				
11	Oct. 14	IV. Electronic Spectra	Spectroscopic terms, correlation diagrams	11	20	20	18
12	Oct. 19		Tanabe-Sugano diagrams				
13	Oct. 21		Charge transfer				
14	Oct. 26		Luminescence, photochemistry				
15	Oct. 28	V. Reactions (d-block)	Ligand exchange mechanism, kinetics	12	21	21	20
16	Nov. 02		*trans* effect and influence				
17	Nov. 04		Redox reactions, Marcus law				
18	Nov. 09		Inner-sphere electron transfer				
19	Nov. 11	VI. Organometallics	Electron count and oxidation states	13	22	22	21
20	Nov. 16		Ligand types				
21	Nov. 18		Metal–metal bonds				
22	Nov. 23		Organometallic reactions	14			
23	Nov. 25		Catalysis		22	25	22
24	Nov. 30	VII. Bioinorganic chem.	Metal ions in biological chemistry	16	26	26	23
25	Dec. 02		Transport and electron transfer				
26	Dec. 07		Acid-base and redox catalysis				
	Dec. TBA	Final	FINAL EXAM (3 h, worth 40%)				

[a] Miessler/Fisher/Tarr 5th edition. [b] Weller et al, 7th edition. [c] Shriver et al, 6th edition. [d] House, 2nd edition.

Important notes:
- This schedule is approximate and subject to change.
- Chapter 8 of the Weller and Shriver textbooks describe some methods used to characterize metal complexes. Though we will not treat such topic in a full chapter, examples will be seen throughout the course. It is thus recommended that you read this chapter.
- The schedule of assigned readings will be updated as the term progresses.