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

1. GENERAL INFORMATION

Course Format	**Lectures**: 13 sessions of 2h30 / week	**Wed**	**18:00–20:30**	**LOY–CC–425**
	Labs: 4h / week, starting **Oct. 01**	**Tue**	**18:30–22:30**	**LOY–SP–210**
Instructor	Dr. Xavier Ottenwaelder Office hours: by appointment	SP–201.19 dr.x@concordia.ca		ext. 8934
Teaching assistant	M. Steven Maurizio Office hours: **Thu, 13:30–15:30**	SP–S175.29 steven.maurizio@mail.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 tests and the final examination 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.

5. 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)

6. GRADING

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% (in December, scheduled by Exams Office)

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.

Problem sets must be handed in at the beginning of class on the due date (typically 2 weeks after being handed out). Late submissions or papers slid under an office door 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, the student will receive a **zero** grade for the missed work.

For the mid-term and final examinations, only non-programmable calculators will be accepted.

7. LABORATORY INFORMATION

The labs in CHEM 341 will further your experience of the practical aspects of inorganic 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 located in SP-210 and start on **Oct. 02** (later than for other courses!). The lab schedule and instructions are provided in a separate document (see Moodle website). **All questions on matters related to the lab component of the course should be addressed to the TA** (info above).

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.

Students who are repeating the course and who have passed the lab component within the last two (2) years may be eligible for a 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. Applications for the exemption (forms available in SP 201.01) must be submitted by September 08; late applications will not be accepted. Signed and completed forms are to be returned to Hilary Scuffell, (SP 275.01). Students MUST register for the appropriate lab exemption lab/tutorial section (section 56); students registered in any other lab/tutorial sections will be required to complete the lab portion of the course (NO EXCEPTIONS).

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.

8. ACADEMIC INTEGRITY, PLAGIARISM AND OTHER FORMS OF ACADEMIC DISHONESTY

(Source: http://www.concordia.ca/students/academic-integrity.html)
Please go to the link above and familiarize yourself with what you are supposed to do and what you are supposed to avoid doing.
The Academic Code of Conduct can be found in section 17.10 of the academic calendar (http://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html). Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied. The Department of Chemistry and Biochemistry offers a short (1 hour) seminar on the academic conduct code and the appropriate use of information sources which aims to clarify what practices will be considered unacceptable with regards to work submitted for grading in Chemistry and Biochemistry courses. Attendance at this seminar is highly recommended and represents a clear and fair opportunity to learn what our faculty regards as academic misconduct. Failure to take part in this learning opportunity and thus ignorance of these regulations is no excuse and will not result in a reduced sanction in any case where academic misconduct is observed. See the Departmental office (SP 201.01) for scheduling (note that late-comers will not be admitted).

CHEM 341 – Inorganic Chemistry III: The Transition Metals

CHEM 341 Lectures — Dr. Xavier OTTENWAELDER — dr.x@concordia.ca — Wed 18:00-20:30 — LOY–CC–425

Class #	Chapter topic	A glimpse of the lecture content	M [a]	W [b]	S [c]	H [d]
1 Sept. 04	**I. Structure**	Introduction, coordination numbers Isomerism	9	7	7	16
2 Sept. 11	**II. Symmetry**	Symmetry and group theory Character tables	4	3	6	5
3 Sept. 18	**III. Bonding**	Crystal-field theory Ligand-field theory	10	20	20	17
4 Sept. 25		Molecular orbitals π-bonding, backbonding				
5 Oct. 02		Jahn-Teller effect Angular overlap model	10	–	–	–
6 Oct. 09	**IV. Electronic Spectra**	Spectroscopic terms, correlation diagrams Tanabe-Sugano diagrams	11	20	20	18
7 Oct. 16		Charge transfer Luminescence, photochemistry				
8 Oct. 23	**V. Reactions (d-block)**	Ligand exchange mechanism, kinetics *trans* effect and influence	12	21	21	20
9 Oct. 30		Redox reactions, Marcus law Inner-sphere electron transfer				
10 Nov. 06	**VI. Organometallics**	Electron count and oxidation states Ligand types	13	22	22	21
11 Nov. 13		Metal–metal bonds Organometallic reactions	14			
12 Nov. 20		Catalysis		22	25	22
	VII. Bioinorganic chem.	Metal ions in biological chemistry	16	26	26	23
13 Nov. 27		Transport and electron transfer 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 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.