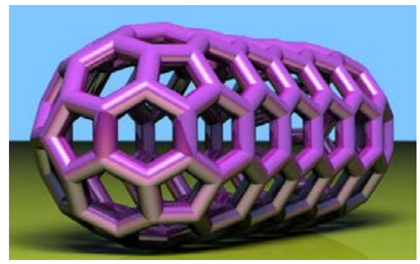
LaurentianUniversity
UniversitéLaurentienne

Department of Chemistry and Biochemistry
Syllabus

1. CHMI 3316 EL – Inorganic Chemistry II (Fall 2020) 3 cr

2. Instructor:



Dr. Stefan Siemann
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Web: www.bioinorganic.ca

Office Hours: There are no designated office hours this term. For questions regarding the course, please email me, and we can set up a Zoom meeting.

3. Course description (from Calendar), including prerequisites.

This course examines coordination chemistry with emphasis on the d-block elements, including structure, reaction mechanisms, kinetics, and spectroscopy. Various bonding models such as valence bond theory, crystal/ligand field theory and molecular orbital theory are described. Electronegativity models, acid/base concepts, elements of symmetry (point groups) as well as aspects of organometallic chemistry, industrial processes and bioinorganic chemistry are also discussed. PREREQ: CHMI 2316. (lec 3, lab 3) cr 3.

Class hours: Mon/Thu 11:30 a.m. to 12:50 p.m. – via Zoom

4. Learning objectives

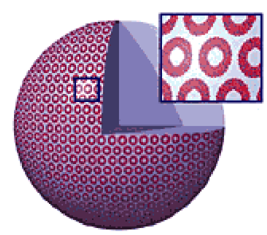
The students will learn:

- How to apply different acid-base concepts to predict the reactivity and stability of coordination compounds
- How to name coordination compounds bearing a wide variety of ligands
- Common concepts and theories describing the bonding between transition metals and their partner ligands
- The physicochemical basis of colour in complexes
- By which mechanism and at which rate transition metals react to form new complexes
- Two mechanisms by which electrons are transferred between redox-active complexes
- The chemical processes underlying the industrial production of transition metals

5. Outline of Topics:

Week 1	*Acid-base concepts (review and extension); electronic configuration of transition metals*
Week 2	*History of coordination chemistry; nomenclature of complexes; overview of structures and geometries of complexes*
Week 3	*Valence bond theory, electroneutrality and back-bonding*
Weeks 4 & 5	*Crystal field theory (CFT): stabilization energies, splitting diagrams, Jahn-Teller effect, applications of CFT*
Week 6	*Ligand field theory (molecular orbital extension to CFT) and* π*-bonding*
Weeks 7 & 8	*Electronic spectroscopy of coordination compounds (colour of complexes, term symbols, Hund's rules, selection rules, Tanabe-Sugano diagrams, charge-transfer transitions)*
Week 9	*Kinetics and reaction mechanisms*
Week 10	*Redox chemistry (inner and outer sphere electron transfer)*
Week 11 &12	*Industrial inorganic chemistry of transition elements (production and applications of titanium, vanadium, chromium, pig iron and steel, coinage metals)*

6. Methods of Evaluation:



Assignments: 20%
Attendance/Participation: 5%
Midterm: 20%
Final exam: 40%
Lab: 15%*

**The lab (albeit virtual) is mandatory and must be completed in order to pass the course. The final grade is determined by the course grade (85%) and lab grade (15%).*
<u>Minimum requirement to pass this course</u>: *50% of the course grade*
50% of the lab grade

7. Methods of Delivery or method of teaching

- *Via Zoom*

8. Learning outcomes

At the end of the course, students will be able to:

- *apply IUPAC (International Union of Pure and Applied Chemistry) rules of nomenclature to name coordination compounds*
- *apply crystal field theory to assess trends in physicochemical properties of coordination compounds (e.g., lattice energies, complex formation enthalpies, radii)*
- *construct molecular orbital diagrams for coordination compounds of different geometries*
- *predict the stability of organometallic compounds by applying the 18 valence-electron rule*

- *interpret electronic spectra of coordination compounds, and estimate critical parameters (e.g., splitting and Racah parameters)*
- *predict the mechanism and relative rates of reactions involving coordination compounds*
- *devise synthetic routes towards various classes of coordination compounds*
- *predict the mechanism of electron transfer in redox reactions involving transition metals*
- *explain the chemistry behind the industrial production of transition metals (e.g., iron, titanium, chromium, copper)*

9. Readings/Textbooks necessary

Inorganic Chemistry (5th Edition) by G. L. Miessler, P. J. Fischer & D. A. Tarr (Pearson, 2014)
ISBN-13: 978-0321811059

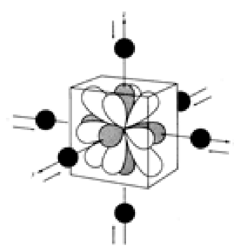
10. Policies

- *Students must be familiar with the University Policies, including*
  - *Policy on Student Academic Integrity:* https://intranet.laurentian.ca/policies/2017.09.19%20-%20Policy%20and%20Procedures%20on%20Academic%20Integrity%20-%20EN.pdf
  - *Grade Appeal Policy:* https://intranet.laurentian.ca/policies/2017.09.19%20Grade%20Appeal%20Policy%20-%20EN.pdf

11. Other

- ***Important dates:***

September 10	*First class*
October 12 – October 16	*Study Week – No classes!*
December 07	*Last class*
Midterm:	*Monday, October 26*
Assignments:	
#1: September 21	*due September 28*
#2: October 05	*due October 19*
#3: November 02	*due November 09*
#4: November 23	*due November 30*



- *Lecture material, presentations and further information regarding the course can be found on the class website:* ***www.bioinorganic.ca/teaching/chmi3316.html****.*