

Dr. Jason Smee

Contact Info

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• 903.566.7069

• RBS 3030

Office Hours

• MWF 10:30-11:30

• TR 9-10

• or by appointment

• [Zoom link to office hours](#) (please email in advance if meeting by Zoom so I can get my Zoom up and running)

Inside the Syllabus

Student Learning Outcomes 2

Course Requirements 2

Canvas 2

Homework 3

Exams 3

Grading 3

Important Dates 4

Topics Covered 4

Class Courtesy 4

Email Policies 4

CHEM 4330.001

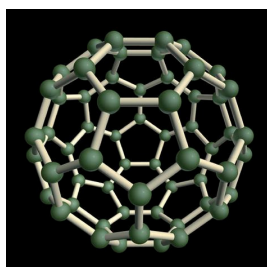
Adv. Inorganic Chemistry

Syllabus—Fall 2023

RBS 2015, MWF 9:05—10:00 AM

Course Description

This course will focus primarily on symmetry and group theory, molecular orbital theory, acid-base theories, electronic spectroscopy of transition metals, organometallic chemistry and catalysis, metal-metal bonds, the isolobal analogy and cluster compounds, and bioinorganic chemistry.

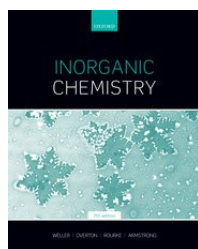


"...To awaken an interest in chemistry in students we mustn't make the courses consist entirely of explanations, forgetting to mention what there is to be explained."

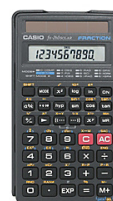
~Linus Pauling (Nobel Prize winning chemist)

In other words, we did not "lie" to you in General Chemistry and subsequent courses, it's that we did not tell you the whole story because you didn't have the tools to understand the rest of the story. We will learn some of those "tools" in this class!

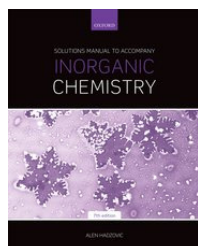
Required & Recommended Materials



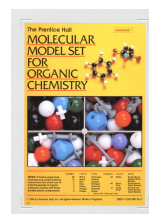
The **required** text: *Inorganic Chemistry 7/e* by Weller et al. ISBN-13: 9780198768128.



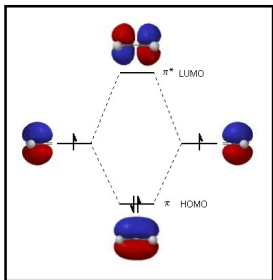
A scientific calculator (capable of exponents and logarithms) is **required**.



Solutions Manual to accompany Inorganic Chemistry 6/e is **recommended**, but not required. ISBN-13: 9780198814689. **All** assignments are handwritten by Dr. Smee. No Achieve access codes are required.



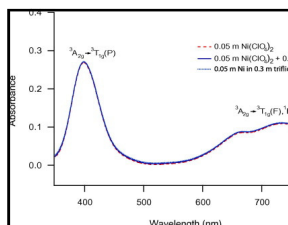
An organic/inorganic model kit (see example at left) is **recommended**, but not required. The kit should have a minimum of two six-coordinate atoms.



The molecular orbital diagram showing the pi bonding and antibonding interactions in a molecule of ethylene.

“The mathematical sciences particularly exhibit order, symmetry, and limitation; and these are the greatest forms of the beautiful.”

~Aristotle (philosopher)



Visible electronic spectrum of $\text{Ni}^{2+}(\text{aq})$ with the two major peaks labeled according to the symmetry of the allowed transition. A third peak, arising from the third allowed transition, is too low in energy to be seen in this spectrum.

Student Learning Outcomes

By the end of this course, students should be able to

- 1) apply group theory concepts to a variety of chemical topics,
- 2) prepare and analyze molecular orbital diagrams for simple compounds,
- 3) demonstrate a mastery of the basic concepts of electronic spectroscopy,
- 4) recognize common types of ligands and reactions in organometallic chemistry,
- 5) use Wade's rules to classify metal carbonyl and main group clusters, and
- 6) describe specific examples/applications of bioinorganic chemistry.

Course Requirements

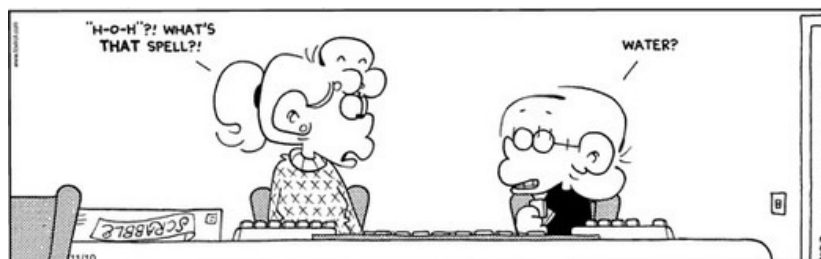
- 1) CHEM 3320/3121 (Inorganic Chemistry and Lab) is a pre-requisite
- 2) CHEM 3344/3145 (Organic Chemistry II and Lab) is a pre-requisite
- 3) Class meets MWF from Aug 21 — Dec 1 (except Labor Day, Sept 4, and during Thanksgiving week, Nov 20—24). Attendance **will be taken** and class participation will be sought throughout the semester in various forms to nurture student communication and presentation skills. Participation will not be graded *per se*, but will be taken into account in the final grade.
- 4) You must take the final exam in order to pass the class. You will the second-semester, standardized, inorganic ACS exam on **December 4 (Mon) 8 – 10 am**.

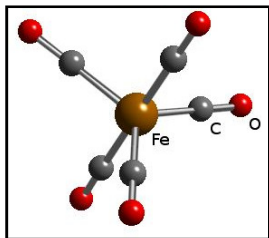
Canvas

I will utilize Canvas to post the following items

- 1) syllabus
- 2) lecture notes
- 3) grades (the Excel file on my desktop PC is the official grade book)
- 4) homework assignments
- 5) links to interesting websites

I recommend that you are set to receive notifications daily.

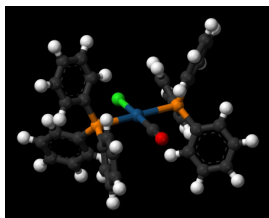




Pentacarbonyliron(0) or $[\text{Fe}(\text{CO})_5]$. A common organometallic compound that is the classical example of the Berry mechanism of pseudo-rotation.

“There's so much plastic in this culture that vinyl leopard skin is becoming an endangered synthetic.”

*~Lily Tomlin
(comedienne/
actress)*



The $[\text{IrCl}(\text{CO})(\text{PPh}_3)_2]$ complex, Vaska's complex, is used as a catalyst in many homogeneous catalytic reactions due to its tendency to undergo oxidative-addition.

Homework

- 1) Homework counts for 20% of your overall grade.
- 2) Paper assignments for each chapter will be assigned during the semester. There will be some short, in-class, group assignments too.
- 3) Due dates will be posted on Canvas.
- 4) A penalty of 5 percentage points will be deducted each day for all problems not completed by the due date.
- 5) Please don't wait until the night before to start on your homework because some of the topics simply cannot be mastered overnight.

Exams

- 1) Four exams will be given during class time and are collectively worth 60% of your overall grade. They will be mostly short answer/calculation questions and some multiple choice.
- 2) The final exam will be a standardized ACS exam. It will cover material from Inorganic Chemistry and even a little Gen Chem too! ☺
- 3) Missed exams due to an unexcused absence will result in a grade of zero. In the event of an excusable situation, please give me at least two days' notice (if possible) to schedule an alternate time.
- 4) Cell phones, smart watches, and any similar electronic devices must be turned off and put away during exams. If they observed out in a visually accessible place (i.e. between legs, on the floor, etc.), it will be assumed that they are being used to cheat; your exam will be taken away, you will receive a zero score (0 points) for the test, and you will be referred to the Office of Judicial Affairs.

Grading

| | |
|-----------------------|--------|
| In-class exams | 60% |
| Cumulative final exam | 20% |
| Homework | 20%* |
| Total | 100%** |

*The homework grade shown on Canvas will be the cumulative percentage score for all of your homework assignments.

**Grades will be tentatively based on a 90/80/70 scale, but they may be adjusted based upon my evaluation of the class's overall performance.

Important Dates (exam dates and the material on exams are tentative)

- September 1 (Friday!): Census date – deadline for grade replacement
- September 4 (Monday): Labor Day – no classes
- **September 25 (Monday): Exam 1 (Chapters 3A and 3B)**
- **October 1 (Sunday): FINAL deadline for Fall graduation**
- **October 16 (Monday): Exam 2 (Chapters 20B and 20C)**
- **October 30 (Friday): Last day to drop with a “W”**
- **November 6 (Monday): Exam 3 (Chapters 22A, 22B, and 25)**
- November 21–25 (Mon–Fri): Thanksgiving holiday – no classes
- **November 29 (Wednesday): Exam 4 (Chapters 22C and 26)**
- **December 4 (Monday): FINAL EXAM 8:00–10:00 am (day/time is negotiable)**

Topics to Be Covered (listed by chapter in the textbook)

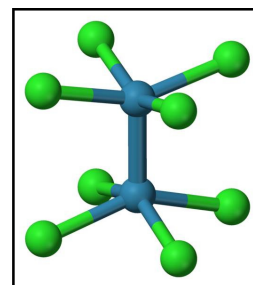
- Symmetry and Group Theory: Chapter 3.1 – 3.5, 3.9 + handouts (Chapter 3A)
- Molecular Orbital Theory: 3.6, 3.7, 3.10 + handouts (Chapter 3B)
- Electronic Structure: Chapter 20.2 + handouts (Chapter 20B)
- Electronic Spectroscopy: Chapter 20.2 – 20.7 (Chapter 20C)
- Intro to Organometallics: Chapter 22.1 – 22.19 + handouts (Chapter 22A)
- Organometallic Reactions: Chapter 22.21 – 22.26 + handouts (Chapter 22B)
- Catalysis: Chapter 25.1 – 25.15, 25.18 + handouts (Chapter 25)
- M-M Bonds, Clusters, Isolobality: Chapter 22.20 + handouts (Chapter 22C)
- Bioinorganic Chemistry: Chapter 26.1 – 26.14 (Chapter 26)
- Lanthanides/Actinides (time permitting): Chapter 23.1 – 23.13 (Chapter 23)

Classroom Courtesy

- Be as quiet as possible if arriving late or leaving early.
- Silencing all cell phones, pagers, iPods, etc. during class.
- Do not text or call during class. Please leave quietly if you must do either.
- Use electronic devices for taking notes, not doing homework or playing games.
- Refrain from derogatory remarks and profanity in class.
- Do not talk during class presentations or over top of another person during discussions. The room is designed for sound to travel; you are not as quiet as you think when you whisper in class.

Email Policy

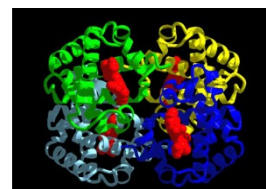
- I will respond to email regularly throughout normal business hours.
- After hours and on week-ends I will respond as my life activities allow. Please don't expect responses to email sent after 11 pm until at least 9 or 10 am the next day.



The $[\text{Re}_2\text{Cl}_8]^{2-}$ ion. The first quadruple-bonded species characterized by X-ray crystallography.

“I try to show the public that chemistry, biology, physics, astrophysics is life.”

~Neil deGrasse Tyson (physicist)



Hemoglobin tetramer (For clarity, the heme groups are shown in red.) One of many important examples of bioinorganic chemistry!

