

Advanced Inorganic Chemistry

Chem 4380, Spring 2021

Lecture (Manion 105): T and Th 8:00 am – 9:15 am

(1) Address:

<https://zoom.us/j/6127591153?pwd=K2JOckJWV0pwbWpnYUJ6TW9IM3hodz09>

(2) Zoom meeting ID - **6127591153**

(3) Zoom Password – **5tn0Fe**

Instructor: Lei Yang

Office: Manion Hall 203B

Phone: 501-852-0711

Email: lyang@uca.edu

Website: <https://faculty.uca.edu/lyang/Site/Home.html>

Office hours: Monday, Thursday and Friday, 1:00 pm – 3:00 pm*

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*If you are not admitted immediately when you try to join the Zoom office hours, it's probably because I'm in a private meeting with a student. Please wait online if you can or schedule another time with me through emails.

Text: *Inorganic Chemistry (7th Ed.)* by Weller & Overton, Oxford University Press, 2018

Note: *UCA library has a copy of the textbook and offers a two-hour reserve service.*

Grading	Possible points
Individual presentation	250
Homework (30 pts each)	150
Two Exams (100 pts each)	200
Final exam (May 6, 8:00-10:00 am)	200
TOTAL POSSIBLE	800

Grades: A = 720 – 800 points

B = 640 – 719.99

C = 560 – 639.99

D = 480 – 559.99

F < 600

Important Dates April 12 (Monday) Last day to drop a course with a W

Course Description Required course for the ACS-certified chemistry BS degree and an elective in the non-ACS certified chemistry BS degree. Emphasis on the periodic properties of the elements and how these derive from modern atomic theory. Uses modern theories of chemical bonding, including molecular orbital theory and symmetry, to outline the systematic chemistry of the transition metals as well as representative main group elements. Introduce bioinorganic chemistry. Emphasizes current primary inorganic literature sources. Three hours of lecture per week. Prerequisite: Grade of C or better in CHEM 4450.

Presentation At the end of the semester (see the schedule on page 5), students will give an 18-minute individual oral presentation (15 minutes talk and 3 minutes questions). The whole presentation (including preparation) will be 250 points.

Presentation timelines:

1. Select **ONE** of the topics listed on page 3 to prepare your presentation. You have 10 days (Jan. 19 – Jan. 29) to decide which topic you want to take. Please let me know the topic you want before **5:00 pm of Jan 29 (Friday)**. If two students picked the same topic, first come first service. If students failed to pick a topic before the deadline, a topic will be assigned by instructor. We will draw straws to determine the order of the presentations in our first class.

2. Once the topic is selected, the student and instructor will meet **before 5:00 pm of Feb 5 (Friday)** to discuss the topic. The instructor will recommend journal papers for students to read, but it's students' responsibility to search more references from **major refereed literature sources (See "Useful links" on my personal website <https://faculty.uca.edu/lyang/Site/Home.html>)**.

3. Before **5:00 pm of Apr 2 (Friday)**, students need to show me the **draft** of the presentation (**30 pts**) and I will provide suggestions.

My expectation for the draft:

(a) The structure of the presentation/story should be clearly shown by using an outline slide or titles of slides.

(b) Pictures/phrases/key works are shown on each slide to illustrate/explain/demonstrate the ideas/examples/materials.

(c) References should be clearly shown on each slide.

4. **ONE** week before the formal presentation, students need to make a practice presentation (**30 pts**) to me. I will provide suggestions and students will make revisions accordingly. For instance, if the presentation is on April 22, the student needs to practice no later than April 15.

PowerPoint slides preparation guidelines:

1. Suggested sections: **title slide, Introduction, Review of the selected important results and Future Research/perspective/direction**. The introduction will summarize the background materials needed to understand the topic. The review will summarize and evaluate the research advancement. This is the major section of the presentation and subsections might be necessary. The future work will discuss what questions/problems have to be answered/solved or any new directions in future. You don't have to follow my suggestions. Be creative! But you do have to have your own insight to your topic.

2. Font format and size should be consistent through the whole presentation.

3. Use high-resolution pictures. When you try to enlarge pictures, lock the aspect ratio first. Avoid stretching/compressing the pictures on vertical/horizontal directions only.

4. Do NOT use full sentences. Use key words or short phrases. Whenever possible, use pictures to illustrate the ideas/examples.

5. Instead of a separate slide with all the references at the end of your presentation, references should be cited on each slide.

Reference format: *Inorg. Chem.* **2020**, *59*, 17224

Grading policies:

1. Total grade for the presentation project is 250 pts. It contains four parts:

Part 1 (30 pts): Draft of your presentation before 5:00 pm of **Apr 2 (Friday)**.

Part 2 (30 pts): Practice presentation **ONE** week before the formal presentation.

Part 3 (100 pts): Your presentation grade from the audience.

The presentation from each speaker will be graded by other students and instructor based on the grading rubric (see next page). The average value will be the final grade of the part 3 (out of 100).

Part 4 (90 pts): Your **constructive criticism** for other speakers.

Your grading sheets for the eleven speakers will be graded by the instructor. Each grading sheet 90 pts/9 presentations = 10 pts/per presentation. Feel free to give positive/favorable feedback/comments, **but the credit will only be awarded to constructive criticism that can help speakers improve their presentation skills**. Credit won't be awarded for simple comments such as "Great job", "Nice presentation" et al. You will give constructive criticism for at least **four** criteria (see below) to get total 10 pts/per presentation.

2. The grading sheets with constructive comments/feedback will be returned to the speaker after the final exam. **The name on the grading sheet will be erased before returning.**

Grading criteria for presentation (part 3):

The students and instructor will give grades (out of 100) for the presentation based on the following grading rubric. The highest and lowest grades will be dropped and the average value will be the grade of the presentation.

1. **Chemistry content – 20 points** (goes beyond material covered in book and lecture; contains relevant reactions, mechanisms and explanations)

2. **Context/background/relevance/interest – 15 points** (background/purpose/context of presentation is clear; material is relevant and designed to evoke interest).

3. **Speaker's own insight/ideas/thoughts – 15 points** (Speaker presents his/her explanation/new thoughts/new ideas/proposals)

4. **Visual – 10 points** (good use of figures, pictures, models, videos etc.)

5. **Speaking – 10 points** (clarity, not reading from notes)

6. **Organization – 10 points** (flows logically in an understandable fashion; transitions clear, not too short or too long)

7. **References – 10 points** (material is taken from sources other than text; all references cited properly on each slide; quality of sources will be taken into account)

8. **Question and answer – 10 points** (questions answered knowledgeably)

Topics:

Note: You are not restricted to the topics listed below. If you are interested in other topics, you have to discuss with me before you start.

1. Metal organic framework for methane storage
2. Structural/functional models of Cu₂ site in nitrous oxide reductase
3. Platinum anticancer agents
4. Methane monooxygenase – protein and models
5. Non-heme Iron oxygen chemistry – hemerythrin and models
6. C-H bond activation with copper complexes
7. Metallozeolites and metalloenzymes
8. Water splitting by cobalt catalysts
9. Activation of CO₂ by frustrated Lewis acid and base
10. C-H fluorination catalyzed by manganese porphyrin complexes
11. Iron-sulfur cluster – electron transfer center and synthetic models
12. Artificial photosynthetic systems inspired by photosystem II (PSII)
13. Nitric oxide sensing by transition metal complexes
14. Characterization of structure, metal environment, or function of a recently discovered metalloenzyme.
15. Engineering of a metalloprotein to tune or alter function
16. Development of metal-based imaging agents for medicine (MRI contrast agents or radiopharmaceuticals) or therapeutic radiopharmaceuticals.
17. Nitrogenase – protein and structural/functional models
18. Fluorescence sensing by lanthanide metal complexes
19. Gold nanoparticles for cancer thermal therapy
20. Copper and Alzheimer's Disease
21. Ring opening polymerization of lactide by metal catalysts
22. CO₂ capture by ionic liquid systems
23. Catalytic oxidation of organic molecules by polyoxometalates
24. Methane generation catalyzed by Methyl-coenzyme M reductase
25. Potential anti-tumor application of metal-N-heterocyclic carbene complexes
26. Recovery of uranium by inorganic absorbents
27. Photodynamic therapy based on quantum dots
28. Light harvesting by synthetic chlorin systems
29. Metal complexes as drug-delivery systems
30. Transition metal signaling in biological systems
31. Lithium-ion battery
32. Metallodrugs against neglected tropical diseases

Exams **Exams (75 minutes)** dates are posted on the syllabus. Plan your schedule accordingly; these dates rarely change. These timed exams typically consist of short answer questions and questions requiring numerical work. If students missed an exam with a suitable excuse (medical/family emergency with documentations), the value of the final exam will be 200 + 100 = 300 points. **There will be no make-up exams and exams can't be dropped.**

Homework Assignment Homework problems are necessary to develop your mastery of material discussed in lecture. The homework assignments with deadlines will be posted on Blackboard. **Please turn in the electronic copy of homework assignments on Blackboard before deadlines.**

Policies **1. Attendance**

People who miss classes typically do poorly in this course. Do not be one of these people. **Three unexcused absences will result in a W grade.** It is the student's responsibility to obtain information covered during an absence.

2. Office Hours

This time is specifically set aside for you to ask me questions and receive help on course material. Use this time! If you cannot make the scheduled times, make another arrangement with me.

3. Regrade

All regrade requests should be made to the instructor **within two weeks** after the grades posted on Blackboard. When inquiring about a possible regrade, please do NOT make any marks on the item in question.

4. Deadline

All of the assignments have to be turned in before their deadlines. Late assignments won't be accepted.

5. Academic Integrity Statement:

The University of Central Arkansas affirms its commitment to academic integrity and expects all members of the university community to accept shared responsibility for maintaining academic integrity. Students in this course are subject to the provisions of the university's Academic Integrity Policy, approved by the Board of Trustees as Board Policy No 709 on February 10, 2010, and published in the Student Handbook. Penalties for academic misconduct in this course may include a failing grade on an assignment, a failing grade in the course, or any other course-related sanction the instructor determines to be appropriate. Continued enrollment in this course affirms a student's acceptance of this university policy.

6. Disabilities Act Statement:

The University of Central Arkansas adheres to the requirements of the Americans with Disabilities Act. If you need an accommodation under this Act due to a disability, please contact the UCA Office of Disability Services, 450-3613.

7. Building Emergency Plan Statement:

An Emergency Procedures Summary (EPS) for the building in which this class is held will be discussed during the first week of this course. EPS documents for most buildings on campus are available at <http://uca.edu/mysafety/bep/>. Every student should be familiar with emergency procedures for any campus building in which he/she spends time for classes or other purposes.

8. Title IX Disclosure

If a student discloses an act of sexual harassment, discrimination, assault, or other sexual misconduct to a faculty member (as it relates to "student-on-student" or "employee-on-student"), the faculty member cannot maintain complete confidentiality and is required to report the act and may be required to reveal the names of the parties involved. Any allegations made by a student may or may not trigger an investigation. Each situation differs and the obligation to conduct an investigation will depend on those specific set of circumstances. The determination to conduct an investigation will be made by the Title IX Coordinator. For further information, please visit: <https://uca.edu/titleix>.

Tentative Lecture and Exam Schedule

Date	Topic	Date	Topic
Jan 19 (T)	Ch 1. Atomic structure	Jan 21 (Th)	Ch 2. Molecular structure and bonding
Jan 26 (T)		Jan 28 (Th)	Ch 5. Acids and bases
Feb 2 (T)	Ch 6. Oxidation and reduction	Feb 4 (Th)	Ch 3. Molecular symmetry
Feb 9 (T)		Feb 11 (Th)	
Feb 16 (T)	Exam 1	Feb 18 (Th)	Ch 7. Coordination Chemistry
Feb 23 (T)		Feb 25 (Th)	
Mar 2 (T)		Mar 4 (Th)	
Mar 9 (T)	Ch 8. Physical techniques in inorganic chemistry	Mar 11 (Th)	
Mar 16 (T)		Mar 18 (Th)	Exam 2
Mar 23 (T)	Spring Break	Mar 25 (Th)	Spring Break
Mar 30 (T)	Ch 27. Bioinorganic Chemistry	Apr 1 (Th)	
Apr 6 (T)		Apr 8 (Th)	
Apr 13 (T)		Apr 15 (Th)	
Apr 20 (T)		Apr 22 (Th)	Presentation (1-4)
Apr 27 (T)	Presentation (5-8)	Apr 29 (Th)	Presentation (9-10)
May 4 (T)	No class	May 6 (Th)	8:00am-10:00am Final Exam