Inorganic Chemistry Laboratory

CHEM 3520

Spring 2017

Tuesday: 2:30 – 5:20 pm

Widtsoe 113

Professor Yujie Sun
Teaching Assistant: Camden DeBruler
Office: Widtsoe 345
Phone: 797 – 7608
Email: yujie.sun@usu.edu (preferable)
Office Hour: appointment via email

Text: None; Material are available via Canvas prior to lab sessions. Each student should purchase a **bound notebook** for use as a laboratory notebook.

We have been reminded to provide lab fee information on the syllabi of lab courses that includes the dollar amount ($75 in our case for all labs) and a sentence summarizing what the fee goes for. Our lab fees go toward equipment and supplies, and for a small fraction of Teaching Assistant support. The only exception is CHEM 5680 that has no contribution for TA support.

Co-requisite: CHEM 3510

Lab Fee: $75 to cover expenses of chemicals and supplies for the experiments, as well as access time on instrumentation. A small portion of the fees is also used to support the presence of a teaching assistant.

Grading: total of 800 points including 10 possible extra credit points for taking the Gain Score Assessment Test. Points are distributed as follows:

10 pre-lab quizzes @ 10 pts (the lowest will be dropped):	90 pts
10 lab notebook checks @ 10 pts:	100 pts
5 lab reports @ 100 pts:	500 pts
Final exam @ 100 pts	100 pts
*Gain Score Assessment Tests (Extra credit)	10 pts
Total	800 pts

Tentative Grading Scale
(Brackets could be lowered but not be raised):

A–/A	90 – 100%
B–/B/B+	80 – 89%
C–/C/C+	70 – 79%
D/D+	60 – 69%

Course Objectives/ Goals:

Chemistry 3520 should be taken concurrently with the Chem 3510 lecture course. Students conduct experiments to synthesize and characterize a variety of main group and transition metal compounds. UV-visible absorption spectroscopy, infrared spectroscopy, cyclic voltammetry, and X-ray diffraction are important tools used in the class.

Course Design:

I will be utilizing Canvas management system for Chem 3520. Laboratory descriptions and other materials will only be available via Canvas.

Prelab Quizzes: The prelab quiz each week will be developed from the laboratory description. Therefore prior to coming to lab each week you should read this description, carefully analyze the experiments to be performed, and make sure that you understand the chemistry. You will be given a maximum of 10 minutes each week to complete the quiz. A model quiz is available on the CANVAS site for the class.

Notebook Checks: At the end of each lab period, you must have your notebook reviewed by Dr. Sun or Nan Jiang for clarity and completeness. A possible total of 20 points will be awarded for each laboratory. You are expected to keep a clear notebook for each laboratory including at least the following items:

1. Title
2. Reactions clearly written and balanced, if there are clear chemical reactions involved.
3. Description of procedure including amounts of reagents used IN YOUR OWN WORDS.
4. Detailed observations and comments IN YOUR OWN WORDS.
5. Answers to all questions/directions put forth in the experimental section of the laboratory description (Note: There are additional questions for each laboratory that must be answered in the discussion portion of your report).

At the end of the semester you should have a notebook that includes a table of contents and page numbers. This will be evaluated in the final notebook check.

Required Lab Report Format (see model report on Canvas):

1. Typed and printed out, 2–3 page length (not including attached spectra, supporting information)
2. Abstract (25 words maximum) (~10%)
3. Introduction with stated purpose of experiment (~10%)

4. Experimental Outline: reaction(s) carried out, apparatus sketch(es), special experimental details (~20%)
5. Results (not conclusions) (~30%)
6. Discussion of results and conclusions (~30%)
7. Attached copies of spectra, raw data, etc (required as part of results)
8. Spectra, data must be clearly labeled and documented as referenced in Results and Discussion sections.

Final Exam: The final laboratory exam will be comprehensive and will cover aspects from all portions of the class.

"Gain-Score" Assessment Tests: Two short tests (~10 min) will be given – one at the beginning of the semester and one at the end. These short tests are given to assess your ability to apply, analyze, and synthesize information that is delivered throughout the course. These questions are not designed to test you specific knowledge of the subject, but rather how to apply this knowledge. You will receive 5 extra credit points for simply taking each "gain-score" assessment test, regardless of performance.

Missed Exam Policy: If a student misses, or will miss an exam, due to illness or family emergency, the student should speak to Dr. Sun as soon as possible. Make-up exam will be offered if the absence is supported by appropriate documentation (e.g. signed note from physician or parent).

CHEM 3520 Class Schedule (Spring 2017)

Date	Experiment	Pre-lab Quiz	What's Due
1/10	Check-in; Syllabus; Safety; Gain Score Test		
1/17	**#1a**: Synthesis of $Al(acac)_3$	Quiz 1	
1/24	**#1b**: Characterization of $Al(acac)_3$	Quiz 2	
1/31	**#2a**: Synthesis of $[Co(NH_3)_6]Cl_3$	Quiz 3	Report #1
2/7	**#2b**: Synthesis of $[Co(NH_3)_4(CO_3)]NO_3$		
2/14	Monday schedule, no lab		
2/21	**#2c**: Conductivity of cobalt complexes	Quiz 4	
2/28	**#3a**: Synthesis of $[M(bpy)_3](PF_6)_2$ (M: Fe and Ru)	Quiz 5	Report #2
3/6 – 3/10	Spring break, no lab		
3/14	**#3b**: UV-Vis absorption and luminescence of $[M(bpy)_3](PF_6)_2$ (M: Fe and Ru)	Quiz 6	
3/21	**#3c**: Cyclic voltammetry of $M(bpy)_3(PF_6)_2$ (M: Fe and Ru)	Quiz 7	
3/28	**#4**: Acylation of Ferrocene	Quiz 8	Report #3
4/4	**#5a**: Synthesis of MOF	Quiz 9	Report #4
4/11	**#5b**: Synthesis of MOF		
4/18	**#5c**: Powder XRD of MOF	Quiz 10	
4/25	Gain Score Test; Final Exam; Check Out		Report #5

Withdrawal Policy and "I" Grade Policy: The administration of Chem 3510 will adhere strictly to the academic regulations stipulated in the most recent Schedule of Classes and the USU General Catalog. Withdrawal from the course will follow official USU procedures. Students are required to complete all courses for which they are registered by the end of the semester. In some cases, a student may be unable to complete all of the coursework because of extenuating circumstances, but not due to poor performance or to retain financial aid. The term 'extenuating' circumstances includes: (1 incapacitating illness which prevents a student from attending classes for a minimum period of two weeks, (2) a death in the immediate family, (3) financial responsibilities requiring a student to alter a work schedule to secure employment, (4) change in work schedule as required by an employer, or (5) other emergencies deemed appropriate by the instructor.

University Standards of Academic Integrity – "The Honor System": Each student has the right and duty to pursue his or her academic experience free of dishonesty. The Honor System is designed to establish the higher level of conduct expected and require o all Utah State University students.

The Honor Pledge. To enhance the learning environment at Utah State University and to develop student academic integrity, each student agrees to the following Honor Pledge: "I pledge, on my honor, to conduct myself with the foremost level of academic integrity." A student who lives by the Honor Pledge is a student who does more than not cheat, falsify, or plagiarize. A student who lives by the Honor Pledge espouses academic integrity as an underlying and essential principle of the Utah State University community; understands that each act of academic dishonesty devalues every degree that is awarded by this institution; and is a welcomed and valued member of Utah State University.

Grievance Process (Student Code): Students who feel they have been unfairly treated (in matters other than (i) discipline or (ii) admission, residency, employment, traffic, and parking – which are addressed by procedures separate and independent from the Student Code) may file a grievance through the channels and procedures described in the Student Code.

Plagiarism: Plagiarism includes knowingly "representing, by paraphrase or direct quotation, the published or unpublished work of another person as one's own in any academic exercise or activity without full and clear acknowledgment. I also includes the unacknowledged used of materials prepared by another person or agency engaged in the selling of term papers or other academic materials." The penalties for plagiarism are severe. They include warning or reprimand, grade adjustment, probation, suspension, expulsion, withholding of transcripts, denial or revocation of degrees and referral to psychological counseling.

Sexual Harassment: Sexual harassment is defined by the Affirmative Action/Equal Employment Opportunity Commission as any "unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature." If you feel that you are a victim of sexual harassment, you may talk to or file a complaint with the Affirmative Action/Equal Employment Opportunity Office located in Old Main, Room 161, or call the AA/EEO Office at 797–1266.

Students with Disabilities: The Americans with Disabilities Act states: "Reasonable

accommodation will be provided for all persons with disabilities in order to ensure equal participation within the program." If a student has a disability that will likely require some accommodation by the instructor, the student must contact the instructor and document the disability through the Disability Resource Center (797−2444), preferably during the first week of the course. Any request for special consideration relating to attendance, pedagogy, taking of examinations, etc., must be discussed with and approved by the instructor. I cooperation with the Disability Resource Center, course materials can be provided in alternative format, large print, audio, diskette, or Braille.

Learning Objectives:

Students emerging from Chem 3520 should be able to:

1. Prepare neutral, organic chelate complexes; use spectral data to describe the structures.
2. Prepare and characterize octahedral 1^{st}- and 2^{nd}-row transition metal complexes containing ligands like ammonia, carbonate, 2,2'-bipyridyl, etc.
3. Evaluate the solution properties of cobalt complexes using conductance measurements.
4. Perform cyclic voltammetry studies involving organometallic complexes.
5. Perform UV-visible absorption studies of coordination complexes to interpret their electronic transitions.
6. Prepare metal organic frameworks involving 1^{st}-row transition metals.
7. Perform X-ray diffraction studies of prepared MOFs to understand their crystal structures.