

CHM 401 Inorganic Chemistry Laboratory Syllabus Fall 2018
Meets Mondays 1:30-5:30 PM Albertus Magnus 214

Required:

Safety glasses: These must be worn at all times in the lab. See me if you do not have a pair of safety goggles or glasses.

Bound lab notebook: All data must be recorded in the notebook, as it is generated.

Calculator

Safety Training:

Prior to the first experiment on Monday September 10, you must review the Standard Operating Procedure for Albertus Magnus 214 and complete safety training through the Flinn Prep website. To complete the training, login or create an account at www.flinnprep.com. You can access the training for this course with the student linking code 776ut.

Attendance:

You must complete each laboratory exercise and submit reports for each laboratory in order to pass the course. You are expected to be on time for the lab and to stay for the duration for all laboratory sessions. If you have an unavoidable conflict that precludes you from attending your normally scheduled laboratory session, you must inform me as soon as possible, so that we can reschedule the lab. Your lab grade counts 20% towards your final CHM401 grade.

Laboratory Notebooks:

Each student should use a bound composition book as their lab notebook. All recordings in the notebook should be neatly and legibly written in ink. Any mistakes should be crossed out with a single line, so that the original can still be seen.

Leave the first two pages of the notebook blank, to be used for a table of contents. Number each page of the lab notebook. The table of contents should be updated at the end of each lab period, with the experiment number and name, as well of the numbers of the pages on which relevant data was recorded.

Each page of the notebook should include the experiment number, experiment name, and the date. A pre-lab assignment must be completed for each lab. At a minimum, these assignments will include a statement of the purpose of the lab, important safety concerns, and a brief summary of the procedure to be followed. For synthetic procedures, a reagent table should be completed, the format of which is shown below. Some experiments will also include questions to be answered in the pre-lab. The pre-lab assignments are due by 5 PM on the Friday before the lab. The assignments must be submitted through Sakai. You can either scan or take a picture of the relevant notebook pages, but please submit the entire assignment as a single file (either PDF or word document). The lab cannot be completed until I have seen the pre-lab assignment.

Each new experiment is started on a new page of the laboratory notebook. All data and observations should be recorded, as well as the chemicals (with their sources) and the instrumentation used, as well as any deviations from the stated experimental procedure and any

(seemingly) odd occurrences. Calculations performed during the lab are recorded in the notebook. The more information recorded, the better the conclusions that can be drawn from the data.

I will periodically collect and grade the lab notebooks. The grades for pre-labs and notebooks will count 50 points towards the final lab grade.

Example reagent table:

Reagent Name	Chemical Formula	Molecular Weight (g/mol)	Mass (g or mg)	Density (g/mL)	Volume (mL)	Amount (mol or mmol)

The experiments in this manual can be divided into three categories: (1) **synthesis**, where the primary objective is the preparation of compound(s), (2) **synthesis and characterization**, where the compounds prepared will be investigated by instrumental methods, and (3) **characterization**, where previously prepared or store bought compounds will be investigated by instrumental methods. The nature of the lab report for each experiment will vary, depending into which category the experiment falls. Below you will find guidelines for each type of lab report. These are not meant to be rigid, all-inclusive sets of rules for reports. Each experiment is unique as will be your own results; you should always exercise your own judgment and initiative when presenting and explaining your results in a report.

Laboratory Reports

Literature Activity: Writing Experimental Procedures and Abstracts (20 points)

During our first lab meeting, Monday August 27, we will examine a number of experimental procedures and abstracts of papers from the journal *Inorganic Chemistry*. The experimental procedures and abstracts that you include in your lab reports throughout the semester should model these examples. At the end of the lab meeting, I will provide you with a paper that has the abstract and title removed. After reading the paper, you will need to write an abstract and a title for it. The assignment will be due at the beginning of lab on Monday September 10.

Synthesis Lab Reports (30 points each):

Experiments 1, 3, 6

These lab reports should be brief and include the following:

Experimental Procedure

Write a paragraph that tells how the synthesis was performed and any observations that you made during the experiment (e.g. color changes, precipitation, gas evolution). Careful observations are critical when performing synthetic procedures. When things go wrong, these observations become invaluable in determining which step in a synthesis didn't work as expected. The procedure should be written such that someone else could repeat it without having to consult other sources (such as the lab manual). Along with the procedure, you should also include relevant balanced chemical equations and yields for the reactions (**show your calculations**). The format of these experimental procedures should be that utilized in procedures published in *Inorganic Chemistry*.

Discussion

A brief summary of the experiment. Each experiment will be accompanied by a series of discussion questions. **These questions are meant to guide you in writing the discussion.** You should incorporate the answers to these questions into your discussion. Don't just answer the list of questions. Answering the discussion questions may require you to consult your textbook, as well as, other chemistry books. **You should not get answers from your classmates.** A significant part of your grade will depend on the discussion.

Synthesis and Characterization Lab Reports (45 points each): Experiments 5, 7

These reports require all that are in the Synthesis Lab Reports but, in addition, there will be spectra (IR and/or NMR) that require interpretation, which should be included in the discussion. The appropriate spectra should also be attached to the report, and spectral data should be listed in the experimental procedure.

Journal Article Style Reports (65 points each): Experiments 2/4, 8

These experiments will require much more time and effort. In each one a number of compounds will be analyzed by an instrumental method. You will be expected to organize the data gathered by the entire class and then explain it. These reports will take the format an article from the journal *Inorganic Chemistry*. I will provide additional details on these reports when we actually perform these experiments.

A written report will not be required for Experiment #9. Completion of the experiment and accompanying questions will be worth 20 points.

Late Policy

Lab reports are to be completed and handed in on the date specified in the schedule. That means at the **BEGINNING** of the laboratory period on that day. Lab reports handed in late will lose 10% of the total points for every day they are late (without a valid, approved excuse) for up to 5 days, after which they will no longer be accepted and a grade of 0 will be awarded.

Lab grades will be weighted as follows:

Assignment/ Assessment	Total Points
Lab Notebooks/ Pre-lab Assignments	50
Literature Abstract	20
Synthesis Reports	3 x 30 = 90
Synthesis and Characterization Reports	2 x 45 = 90
Journal Article Style Reports	2 x 65 = 130
Experiment #9	20
Total Possible	400

Schedule:

Week/ Date	Experiment
1 8/27	Literature Activity: Writing Experimental Procedures and Abstracts
2 9/3	No Lab: Labor Day
3 9/10	Prelab: Introduction to Coordination Chemistry Experiment #1: Preparation of Potassium Trisoxalatochromium (III) Trihydrate
4 9/17	Prelab: Introduction to Coordination Compounds Experiment #2: Isomerism in Transition Metal Thiocyanate Complexes: Synthesis of Complexes
5 9/24	Prelab: Oxidation-Reduction Reactions Experiment #3: Electrolytic Synthesis of Triphenylphosphonium Tetrachlorocobalt
6 10/1	No Lab: Exam #1
7 10/9	Prelab: Isomerism in Coordination Compounds Experiment #4: Isomerism in Transition Metal Thiocyanate Complexes: IR Spectroscopy
8 10/15	Experiment #5 (Part I): Cobaloximes: Models of Vitamin B ₁₂
9 10/22	Experiment #6: Syntheses and Analyses of Polyiodide Compounds
10 10/29	Experiment #5 (Part II): Cobaloximes: Models of Vitamin B ₁₂
11 11/5	No Lab: Exam #2
12 11/12	Experiment #7 (Part I): Synthesis and Oxidation of Ferrocene
13 11/19	Experiment #8: Magnetic Susceptibility of Transition Metal Complexes
14 11/26	Experiment #7 (Part II): Synthesis and Oxidation of Ferrocene Experiment #9: Cyclic Voltammetry of Organometallic Complexes
15 12/3	No Lab: Exam #3

Experiments and Report Due Dates:

Exp. #	Experiment	Report Format	Due Date
1	Preparation of Potassium Trisoxalatochromium (III) Trihydrate	Synthesis	Sept. 17
2	Isomerism in Transition Metal Thiocyanate Complexes: Synthesis of Complexes	Communication	Oct. 22
3	Electrolytic Synthesis of Triphenylphosphonium Tetrachlorocobalt	Synthesis	Oct. 9
4	Isomerism in Transition Metal Thiocyanate Complexes: IR Spectroscopy	Communication	Oct. 22
5	Cobaloximes: Models of Vitamin B ₁₂	Synthesis and Characterization	Nov. 12
6	Syntheses and Analyses of Polyiodide Compounds	Synthesis	Oct. 29
7	Synthesis and Oxidation of Ferrocene	Synthesis and Characterization	Dec. 7
8	Magnetic Susceptibility of Transition Metal Complexes	Communication	Dec. 7
9	Cyclic Voltammetry of Organometallic Complexes	No Written Report	-