Advanced Inorganic Chemistry I CHM 448 Fall 2017

Instructor: Dr. Michael L. Norton
Office: Science BBSC 241K
email: Norton@Marshall.edu
Office Hours: T, Th 11 – 12 or other hours by appointment
Course Meeting times: Class: 9:30 – 10:45 am TR in Room S-405
Laboratory: 1:00 – 4:50 pm W in Room S-405/414

Text: Inorganic Chemistry, Shriver, Weller, Overton, Rourke and Armstrong 6th edition

Catalog description of the course: Advanced Inorganic Chemistry I. 4 hrs. Study of physical properties and periodic relationships of inorganic materials. (PR: CHM 356 and either 307 or 358)

Statement of Student Learning Outcomes: What is the purpose of this component of your education? It is to prepare you to enter the next phase in your professional career and exercise your ability as an effective problem solver. You should be given the opportunity to demonstrate that you are literate, numerate, computer literate, communicative, work well in groups, responsible, informed (up to date), possess advanced cognitive skills, think logically and understand the atomistic basis for many everyday phenomena. Professionals are expected to learn through a variety of different modalities and to be able to teach themselves and test themselves in order to ascertain the level of their own understanding of material. It is the objective of this course to sharpen these skills and enable you to demonstrate them through the many modalities discussed below.

Schedule:

Week Of:	**Chapter**	**Exams - Approx.**
Aug. 21	1 Intro, Atomic Structure	
28	2 Molecular Structure and Bonding	
Sept 4	2 Molecular Structure and Bonding	
11	3 Structure of Simple Solids	1st Exam
18	3 Structure of Simple Solids	
25	5 Oxidation and Reduction	
Oct. 2	6 Molecular Symmetry	
9	6&8 Molec Sym and Phy Tech	Midterm Exam
16	8 Physical Techniques	
23	7 Intro to Coordination Compounds	
30	20 Electronic Structure and Properties	
Nov. 6	21 Reactions of Complexes	
13	22 Organometallic Chemistry	3rd Exam
20	no class all week, cerebration	
27	Review/Conceptual synthesis	
Dec. 4	Review/Conceptual synthesis	

Dec. 12, 2017 Tuesday, 8 – 10 a.m. Comprehensive Final Exam Final Exam (time listed in MU Course Schedule)

Your grade will be determined as follows:
20% Laboratory Grade
30% Team Term Project (including presentations)
45% Top Three of Four Exams, 15% each
5% Quizzes/Questions/Class participation
No makeup tests will be given without University excused absence. Any absences should be discussed in advance (if possible) with me.
Talking, sharing electronics/calculators is not permitted during exams.
Learning the correct approach to answering questions remains your responsibility after the test.

Each test will be graded and scaled depending on the difficulty of the test. After grading, you will be given a formula used to place your test grade on a 100 point scale.

Your numerical course grade can be calculated using the weighing factors given above.

Your course letter grade may then be determined using this table:
100 - 90 A
80 - 89 B
70 - 79 C
60 - 69 D
59 or lower F

Active, participatory learning:
Homework: As a student, you should prepare for each class by re-reading the material covered in the previous class, answering the relevant problems at the end of the current chapter, and previewing the textbook material in order to anticipate the next class. Written or electronic quizzes may be administered to evaluate your preparation for class and/or lab.

Semester Long Team Research Term Project/ Report:
Rarely in your life will you have the opportunity to invest significant time into considering, and perhaps contributing to the solution(s) for major world problems. As part of this course, we would like to provide you with this challenge. The following is a listing of well recognized significant problems facing the world:

Top Ten Problems Facing Humanity Over the Next 50 Years

1. Energy
2. Water
3. Food
4. Environment
5. Poverty
6. Terrorism & War
7. Disease
8. Education
9. Democracy
10. Population

This project has 4 phases. First, you should select one of these problems, then identify two other students in the class who rate the same problem at high priority. These persons should become your partners for the term project. The second phase is to identify 2 solutions (2 per person) forwarded by world class external researchers, which use inorganic chemistry to address facets of "the" problem. You will present these "solutions" to the class early in the semester (Wed, Aug 30), essentially debating the solution that is most worthy of a semester of dedicated literature studies. You and your partners should decide on one or at most two solutions which you will develop over the course of the semester. Third, near the midpoint of the semester, you will present a discussion of molecular orbital treatments relevant to your topic(s)(October 18th). Finally, at the end of the semester you will be scheduled to present a team report and submit a term paper based on your investigation of the topic(s). You should feel free to suggest (or even develop) extensions or modifications to the solutions you have investigated in the literature. As a component of the paper, you can develop a laboratory exercise which demonstrates some issues relevant to the problem. If you develop or determine this experiment sufficiently early in the semester, we can discuss substitution of "your lab" for one of the laboratory experiments already scheduled for this semester.
To assure yourself of the viability of the topic you have selected, it would be valuable for you to find a funded research project in the NIH or NSF grant database related to the topic. Submit an abstract of the proposal along with your preliminary summary on Wednesday, Sept 6th . I will critique the scope and appropriateness of your summary and discuss it with you during lab on Wednesday, Sept 13th. To avoid multiple use of the same topic, a sign up sheet will be posted outside of the Inorganic Lab, Science Building Room 414.

Since there is plenty of time for this project, it is possible for anyone to score 100% on this exercise. If this assignment is unclear, please ask me for clarification.

The length and detail of the report and/or the extent of experimentation is up to you, of course. One could expect there to be some correlation between the length of the report, the completeness of the project and the grade evaluation. Some topics will be easier to research and to perform than others, however an average of 10 typed pages (excluding figures)per group member may be expected. You will turn in a finished paper/report (hardcopy and on CD including pdf's of references) by November 17th (Friday before Thanksgiving Break). Do not submit papers late.

Report Format:
Typed, 12 point, double spaced, times new roman font.
The document is to be bound at the top left hand corner using one staple.

Cover page: your names, class, date of submission and title (for example: "Fluorescent Chelates of X, Y and Z")

The report itself should be divided into an appropriate number of logical sections, each with a heading, for example:

Abstract (Paragraph or two giving a concise listing of major points of the paper) (200 word max)

Index (less than 1/2 page may suffice) listing sections of the paper and pages on which they appear, also indexing the analytical thoughts page and a references cited page.

Introduction
(General overview of the topic, and its historical development. It serves to introduce the reader to what the paper will cover and why it is important)
(the body of the paper has topic headings) such as:

Pathways for Introduction of the Elements X, Y and Z into Ground Water. Another example heading: Examples of Values of X,Y and Z Levels Detected in Water Supplies Worldwide and Nationwide
(in the body of the text, when you want to cite (i.e. refer the reader to your source of information) a reference, place a number (a reference number) in parenthesis (1).

Specific Informational topics which you may consider including in your paper:
Although a chapter by chapter approach is not recommended, you should use this paper as a mechanism for indicating your "inorganic" vocabulary and your depth of understanding of the literature. As suggested above, some topics will be more difficult than others. A total of 20 total text pages (text plus graphics minus graphics) is likely a minimum to rate a potential grade of 70% for your team's term paper.

Analytical Thoughts and Conclusions section (what your literature research has led you to believe, your analysis) You may contact any authority you wish for this section of the paper. You may wish to consider telephoning a manufacturer for their product information. Comment on who could benefit most from the information you have gathered (such as a link between aluminum in the brain and Alzheimer's disease (a disease which is unusually common in West Virginia)).

References and Notes (Informs the reader where you obtained any information you did not discover in a lab personally. This listing goes at the end of your paper.)
Format for References and Notes:
1. P.G. Drazin and W.H. Reid, Science, 261, 578 (1993).
(note that the names of the authors, the Journal's name, the volume of the Journal, the number of the first page of the article and the date are included in the citation so that anyone can look it up to learn more about the topic.)
Examples of papers using similar formats can be readily found in any issue of the Journal of the American Chemical Society or the journal named Science.
For information taken from a book: (note that books are generally out of date sources for reference information. Although they can be used, they should not be your primary source of information.
2. John Goodenough, Phosphor Processing, Chapman and Hall, publishers, New York, 1994, pg. 103.
Your textbook and magazines such as Time, Life, Newsweek, etc are not primary sources of information, and should only be used to lead you to primary sources. Primary sources report all the information required to reproduce and understand research results, and the author of a primary source is responsible for the procedures used to conduct the study.

Appendix: This section usually contains any documentation that you wish to submit to enhance the paper, or support your conclusions. For example, any information supplied by the manufacturer (or photocopies of this information) can be attached to the end of the paper.
Photocopies/printouts of relevant publications that you have collected during your research can also be stapled individually, then added into your 3 ring binder as part of an appendix included in your portfolio.

A copy of the document and "copies" of relevant pdf's you have located can be turned in along with the paper copy of your paper on a USB drive I will supply to you.

Avoid any appearance of plagiarism by properly citing the author of any material you include in your report. Any apparent deviations from the university honor code will be dealt with according to Official University Policy.

General University Policies:

University Policies are listed completely on this page: http://www.marshall.edu/academic-affairs/policies/

A short discussion of some of the policies is included below, however this short discussion is not meant to substitute for knowledge of the full University Policies.

Dropping a class: It is your responsibility to understand the University's procedure for dropping a class. If you stop attending this class but do not follow proper procedure for dropping, you will receive a failing grade and may be financially obligated to pay for the class.

Statement of nondiscrimination: MU is an equal opportunity/affirmative action institution, and maintains a grievance procedure incorporating due process available to any person who believes he or she has been discriminated against. At all times, it is your right to address inquiries or concerns about possible discrimination to the Equal Opportunity Officer, Office of Human Resources. Concerns about discrimination can also be brought directly to your instructor's attention, and/or to the attention of your instructor's Department Chairman.

Statement on disability accommodation: You may request academic accommodations for a disability. Marshall University is committed to equal opportunity in education for all students, including those with physical, learning and psychological disabilities. University policy states that it is the responsibility of students with disabilities to contact the Office of Disabled Student Services (DSS) in Prichard Hall 117, phone 304 696-2271 to provide documentation of their disability. Following this, the DSS Coordinator will send a letter to each of the student's instructors outlining the academic accommodation he/she will need to ensure equality in classroom experiences, outside assignment, testing and grading. The instructor and student will meet to discuss how the accommodation(s) requested will be provided. For more information, please visit the web page or contact Disabled Student Services Office at Prichard Hall 11, phone 304-696-2271.

The University Computing Services Acceptable Use Policy: All students are responsible for knowing this policy, which can be found on the web at **http://www.marshall.edu/academic-affairs/policies/**

The Affirmative Action Policy specifies that all students will be afforded equal opportunity without regard to race, color, sex, religion, age, disability, national origin, or sexual orientation.

The Inclement Weather Policy (and other policies) are located at the following link: http://www.marshall.edu/academic-affairs/policies/

If any part of this assignment is unclear, please ask me for clarification immediately.

CHM 448 Lab Fall 2017

Instructor: Dr. Michael L. Norton
Office: Science BBSC 241K
Phone 696-3489 email: Norton@Marshall.edu
Office Hours: T, Th 11 – 12 or other hours by appointment

Text:CHM 448/548 Advanced Inorganic Chemistry Laboratory, Marshall Faculty (MU Bookstore)

Statement of Purpose of Course:
What is the purpose and goal of the component of this course? It is to exercise your ability as an effective problem solver in a laboratory environment. It should provide an opportunity for you to not only learn more about synthesis, but to also learn experientially the relationship between composition of matter and the properties of matter. As an experimentalist, I do hope that the laboratory is an enjoyable as well as educational component of the course.

Schedule:

Date:	**Experiment:**
Aug. 23	Simple symmetry, Atomic spectroscopy, check-in
30	Teaming/projects, Intro to methods
Sept. 6	Molecular Symmetry, Group Theory (Ex 2) + Chpt6(pg 188-195)
13	bis(glycinato) copper(II) (Expt. 3)
20	Silicone Polymer (Expt. 4)
27	Transparent Conductors
Oct. 4	Electrochromics
11	Tetraphenylporphyrin Compounds synthesis/characterization
18	Molecular Models & MO's (students present)
25	Solar Cell construction
Nov. 1	Solar Cell Construction, Characterization
8	Solar Cell re-construction, Characterization
15	Nickel(II)Complex Magnetism and Spectroscopy
22	no class all week, celebration !
29	Nickel(II)Complex Magnetism and Spectroscopy
Dec. 6	finish and check out

Safety Training and Testing:
Instructions on how to get to the lab safety quiz/training are posted at https://www.marshall.edu/chemistry/safetyquiz instructions.asp and all students are required to pass the quiz. You are given two chances at the quiz but the system will not give you the second chance until 24 hours after the first attempt so be sure not to wait until the last minute. Students will not be allowed into the laboratory the second week of classes until a passing safety score has been recorded. Someone will be available in the main office to help students who are having problems getting logged in.

Your laboratory grade will be determined as follows:
5% laboratory results/technique
5% laboratory reports
5% laboratory notebook
5% laboratory quiz
Learning the correct approach to asking and answering questions remains your responsibility in the laboratory. A bottled product with your name, product formula and product name, product mass and % yield should be turned in for each experiment where a product is synthesized (except bouncing putty)
Reports will be required for these three experiments:
Bis(glycinato)copper(II) monohydrates
Electrochromics
Solar Cell

Active Participatory Learning:
Homework: Prepare for each lab class by reading the material for the experiment before class time. Quizzes/Questions may be administered to evaluate your level of preparation for lab, which is a part of your course grade.

Semester Long Research Project and Report:
The flexibility of time use in the laboratory makes it an ideal time to discuss your project and progress in your project, particularly for anyone electing to develop a laboratory experiment.
Possible Elements of Independent Experiment Projects:
Crystal Structure, Physical Properties, Photodocumentation and Video Documentation, Scanning Electron Microscopy, Methods and Materials, Methods of preparation/ synthesis/purification, Surface Chemistry, Materials Acquisition, Characterization(UV-Vis, Particle Size Analysis, titration, contact angle, reactivity, fluorescence), Documentation, Graphics, Molecular Models, Quantum Mechanics, Budget, full documentation.

LABORATORY REPORTS: (discussion adapted from: **Dr. John Woolcock; E-mail: woolcock@iup.edu** (http://wey238ab.ch.iup.edu/woolcock/CH410/ch410syllabus.htm) These should be prepared and submitted separately from the lab notebook. The report will be due no later than two weeks after the completion of the last part of the experiment. A late penalty of 10% per day will be assessed after this date. An experiment report should contain the following sections:

Abstract/Introduction-10% These may be combined into one section. Don't just paraphrase the introduction to the experiment in the lab manual. Include in this section how the experiment is linked to concepts in your lecture text, the type of reaction used to synthesize each compound, the methods of characterization used and any unusual or unexpected results. Although placed at the beginning of the report, this section is typically best written last.

Experimental-15% To save time and effort, you can very briefly outline steps in the protocol, however do provide more depth in describing any changes you made to the procedure found in the text or handout. In this section you should also describe how your procedure was related to the ones performed by others in the class. This is a good place to include particulars of equipment and instrumentation used in the lab.

Summary of Data-25% This should include tables of raw data, both qualitative and quantitative, tables of calculated values and all spectra. An evaluation of the quality of the spectra will also be included in this section. A quality spectrum should have peaks labeled, have good signal-to-noise and resolution, have no significant background peaks and an appropriate title. You must submit original spectra of all the samples you prepare. No photocopies of spectra from other students are allowed except as provided by the instructor. In this

section you should also have example calculations worked out in detail (such as determination of limiting reagent, % yield, etc).

Discussion-25% This should include a discussion of the significance of the qualitative and quantitative data and correct assignment or chemical interpretation of all peaks in the spectra. Reference data and spectra from literature sources should be included with the report and explained.

Conclusions and Study Questions-15% In this section list the "take home" lessons you learned from this experiment. Limit these to no more than three. Also included here are the answers to any assigned study questions.

References -10% You must use the ACS Style Guide format for the inclusion and citation of references.

LABORATORY NOTEBOOK: (discussion adapted from: **Dr. John Woolcock; E-mail: woolcock@iup.edu** (http://wey238ab.ch.iup.edu/woolcock/CH410/ch410syllabus.htm) The laboratory notebook should be sewn and/or glued at the binding, numbered pages are preferable. This notebook will be evaluated two times during the semester, near midterm and at the end of the semester. The notebook will be graded based on the following criteria (see chapter 3 of the Szafran, Pike and Singh - 10% each):

Clear table of contents with each page numbered. Each experiment in the lab notebook has a heading indicating the experiment title.

General neatness of entries; the use of ink throughout the notebook; mistakes scratched out with one line and deleted pages crossed out. Note sheets or other pieces of paper with information related to the experiment should be cut to fit the notebook page or are taped/pasted in and folded so that no edge protrudes.

Suppliers, purity and hazards associated with the reactants and solvents.
Clear and complete notation of changes in the procedure.
Sketches or descriptions of equipment and instruments used.
Raw and calculated data is tabulated with clear headings that include units and a description of each type of data collected.
All personal observations; include at least one for every experiment.
All data (melting points, IR and NMR bands, etc.) obtained from reference sources are listed with an abbreviated bibliographic citation.
Preliminary conclusions or other comments.
Answers to assigned questions posed on the notes sheets or
at the end of the experiment.

Avoid issues of plagiarism by giving appropriate credit to the original authors using footnotes and/or references. Issues of academic dishonesty in this course will be dealt with according to Official University Policy.

CELL PHONE POLICY: As a member of this learning community you have many responsibilities. When cell phones or pagers ring it disrupts the class. Therefore we must prohibit the use by students of cell phones, pagers, or similar communication devices during scheduled classes. All such devices must be turned off or put in a silent mode and cannot be taken out during class. At the discretion of the instructor, exception to this policy is possible in special circumstances. Sanctions in this class for violation of this policy are dismissal from the class. In testing situations, use of cell phones or similar communication devices may lead also to a charge of academic dishonesty and additional sanctions.(the above paragraph and the following text have been adapted from *Dr. Tamera Jahnke, SMSU, CHM 311/312 Organic Chemistry II syllabus)*

Safety issues: This course is experimental chemistry class that requires laboratory bench top work with both solid and liquid chemicals and their solutions. These include crystalline and powdery materials, some of which represent toxic substances, as well as strong acids and bases. All laboratory chemicals are considered to be hazardous materials. Therefore, constant and extreme caution as well as common sense should be exercised all the time during lab sessions. Application of general lab safety rules is a must in this class. All generated wastes should be appropriately segregated in specialized containers and then disposed accordingly. If you are pregnant or become pregnant during the Fall semester, you should discuss the laboratory and its experiments with your physician, possibly considering dropping the course because many substances used in the course are of unknown/undetermined toxicity or teratogenicity.

Safety goggles, shoes which are closed at the toes (preferably waterproof) and appropriate clothing (lab coats are suggested) must be worn during the in laboratory sessions at all times. Some vapors pose hazards for contact lens wearers. If you wear contacts, consider removing them before lab or using extreme precautions when using solvents/reagents which irritate eyes or interact with contact lens materials.

If any part of this syllabus is unclear, please ask me for clarification immediately.