Advanced Inorganic Chemistry
Fall 2014

Text: *Inorganic Chemistry*, 4th Ed. by J.E. Huheey, E.A. Keiter, and R.L Keiter

Location: Lecture: Science 307, Pre-lab Science 374, Lab Science 414

Handouts: **All available on-line** @ http://science.marshall.edu/castella/C448.html

Lecture notes for all chapters	This syllabus and the lab syllabus
Homework assignments	A set of old tests & answer keys
Study suggestions	

Course Description: Study of physical properties and periodic relationships of inorganic materials. 3 lec. – 4 lab. (PR: CHM 356 and either 307 or 358)

Instructor: Michael Castellani
Office: 450 Science Hall **Phone**: x66486
Lab: 407 Science Hall **Email:** castella@marshall.edu

Learning Objectives: 1) to apply the principles of quantum mechanics learned in Physical Chemistry to chemical bonding, 2) to introduce the relationship between molecular structure and chemical reactivity, 3) to learn to determine molecular symmetry and to understand its effects on molecular properties and spectroscopy.

Date	**Subject** (all dates tentative)	**Chapter**
Week 1	Introduction, Atomic Structure	2
Week 2	Atomic Structure	2
Week 3	Symmetry	3
Week 4	Symmetry	3 (Test 1)
Week 5	The Ionic Bond: General Information	4
Week 6	The Ionic Bond: Theory	4
Week 7	The Covalent Bond: Valence Bond Theory	5
Week 8	The Covalent Bond: Molecular Orbital Theory	5
Week 9	Structure and Reactivity	6 (Test 2)
Week 10	Solid State Chemistry	7
Week 11	Chemical Forces	8
Week 12	Coordination Chemistry, Valence Bond Theory	11
Week 13	Crystal Field and Molecular Orbital Theories	11
Week 14	Boranes	Handout (Test 3)

Final Exam: Tuesday, Dec. 9 from 8:00 - 10:00 a.m.

Office hours: MWF 10:00 to 11:00 a.m., other times by appointment or walk-in.

Grading:		
	3 tests x 20%	60%
	Laboratory	10%
	Elements assignment	5%
	1 final exam	25%
		100%

Tests will cover Chapters 2 & 3, 4 – 6, and 7, 8 & 11, plus handouts as described below or assigned in class.

There are **no** make-up exams. Those students with excused absences must see me in advance if at all possible. Students requiring accommodation because of a disability must obtain appropriate documentation (from the HELP Center or Sandra Clements) and contact me sufficiently far in advance of a test that necessary accommodation can be made.

Grading for the laboratory portion of the class will be discussed during the first meeting of the lab (Sept. 3).

Handouts: There are 9 handouts available online.

Elements – You are responsible for knowing the method of isolation (except where told otherwise), physical and chemical properties, and reactions for each of the elements. You may find the remaining information interesting, but it won't be tested. These handouts will be tested as follows: (this is separate from the "elements assignment")

Test 1: Groups IA - IIIA, VIIIA	Test 3: First transition series, Uranium
Test 2: Groups IVA - VIIA	Final exam: All handouts

Periodic table – This handout contains two blank periodic tables. You will need to memorize the location of all elements in it. Use these tables to help you. Please note you are not responsible for the lanthanides, actinides, and new synthetic elements. You should know the symbol for each element and its name. You are not responsible for other information (except for the handouts as described above).

Particle-in-a-box – This handout will help clarify some of the discussion in Chapter 2.

Ion names – You will not be tested on this, but I may use these names in the lecture notes and in class. You may also see them in lab. Knowing them will help you.

Transition metal electron configurations – This handout goes into greater depth than do the Chapter 2 notes in explaining why the 4*s* electrons are filled before the 3*d* electrons, but are also emptied first.

Molecular structure – This handout supplements the text in Chapter 6 (pp. 233 – 237).

Boranes – This handout will touch on one of the more interesting series of inorganic compounds.

Elements Assignment

You will write a short paper 2-3 pages, double-spaced, 12 pt Times New Roman or 10 pt Arial font on two elements to be assigned to you randomly. Roughly half of the paper should be devoted to each element. It should have references using formatting from the ACS Style guide. This should have multiple references from print media. They should also include original references. i.e. The paper should not simply be the expansion or synopsis of reviews. You may find the references online (e.g. Some journals publish online or have old issues online, but the reference should be to where it appears in print.)

You should select some property or application of each element that is interesting and discuss it. One of the "interesting" features could come from an elements handout. Part of your grade will come from the originality of your choice so going with something off the handout would hurt you in that category. The element could be part of a molecule, but the element itself would have to be central to the functioning of the molecule. For example, replacing the hydrogens on linear hydrocarbons with fluorine results in a molecule that can act as artificial blood. A person could discuss how and why the fluorine allows that to happen. Likewise, writing a page on why the atomic weight of carbon is 12.011 amu/atom, would not be a good choice.

The paper will be due on Thursday, September 25 as a Word document emailed to me by 5:00 p.m. unless there is a test that week. If there is, the due date will be Thursday, October 2.

You will also make an up-to-10-minute presentation in either a class or a lab period that will be determined later. In it you will present a short summary of both your elements to the class.

Marshall University's polices regarding academic honesty, excused absences, and disabled students may be found at http://www.marshall.edu/wpmu/academic-affairs/?page_id=802.

If an assignment falls on a day that is cancelled by the university (e.g. a snow day), it should be turned in to me on the next day the university opens before 5:00 p.m.

Please turn off cell phone ringers before class. Failure to do so may result in you being removed from the room, even during an assignment.

Chemistry 448 Laboratory

Textbook: *Advanced Inorganic Chemistry Laboratory Manual* and handouts

Instructor: Michael Castellani
TA: Hannah Bott
Pre-lab: Room 374 Science Hall

A list of the experiments we will be doing follows (the schedule of dates is tentative):

Date	Expt
8/27	No lab
9/3	Check-in and annealing iron (handout)
9/10	Expt. 1: Group theory (in Room 405)
9/17	Expt. 2: Bis(glycinato)copper(II) monohydrates
9/24	Expt. 3: Silicone Polymer
10/1	Transparent conductors: qualatative (handout)
10/8	Transparent conductors: quantatative (handout)
10/15	Expt. 4: Ferrocene synthesis
10/22	Solar cell – part 1
10/29	Solar cell – part 2
11/5	Solar cell – part 3
11/12	Nickel(II) complex magnetism and spectroscopy – part 1
11/19	Nickel(II) complex magnetism and spectroscopy – part 2 & check-out
12/3	Make up day if necessary.

You must have the usual safety equipment on the first day of lab and complete the TA training by Friday, Sept. 12. This includes safety goggles. If you wear contact lens, you must also notify the TA and me prior to the beginning of each lab period and notify me in writing before you begin work in the lab. I strongly urge anyone wearing contact lenses to use your prescription glasses during the lab.

Many of the chemicals you work with are corrosive and for that reason you may want to wear a lab apron or lab coat. In any case, open toe shoes and sandals are not allowed. Also slacks or long dresses are required. You are encouraged to wear long sleeve shirts. Anyone violating these regulations will be sent home to change.

Grading

There are two types of labs, with each graded on a 10 point scale. For labs labeled, Expts 1, 2, 3, 4, and Ni(II) complex, there are 3 components to your laboratory grade: notebook (60%), quality of product (20%), and product yield (20%).

i) The notebook is graded on the quality of your description of your work. In general, the outome of your experiment will not influence this grade. It will be graded on a 0 – 6 point scale.
ii) Your product will be judged on the basis of its purity. This may be done by spectroscopy, appearance, or other technique we discuss in pre-lab. Grades are on a 0 – 5 point scale. Attempting the experiment will guarantee a minimum of 1 point.
iii) Your product yield will be evaluated on a 0 – 5 point scale. It may never exceed your purity score. Attempting the experiment will guarantee a minimum of 1 point.

For the conductor and solar cell experiments, your grade will come from 10 point lab reports. The will be graded using the following distribution:

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 Section – 15%: This should be a description that allows the reader to repeat your experiment exactly as you did it. It should include the 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, percent 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 – 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.