

# Chemistry 311

## *Chemistry Across the Periodic Table*

### Fall 2016

**Read This Syllabus Today. Keep It for Future Reference.**

Chemistry 311, including lab 4 credit hours

Whole Class Meetings: 1:20 PM: MF B371 Chemistry; W Ed. Sci. 212

Discussion Sessions: 7:45 AM: B371 or 1315 Chemistry T or R

Laboratory Sessions: 8:50 – 11:50 AM 1329 Chemistry T or R

Instructor Information: Professor John Moore

1305 Chemistry (262-5154)

<http://www.chem.wisc.edu/users/jwmoore>

[jwmoore@chem.wisc.edu](mailto:jwmoore@chem.wisc.edu)

Office Hours: MW 2:15 – 3:00 PM, R 1:30 – 2:15 PM

1315 Chemistry

or call or email for an appointment

The 118 known elements are the building blocks of every substance on earth. In Chem 311 you will learn about patterns of reactivity among chemical families, unique properties of selected elements, and how these reactivity patterns and properties are manifest in biological and industrial applications. The course will emphasize coordination chemistry of the transition metals, bioinorganic and solid-state chemistry. You will learn about reactivity through laboratory exploration and problem solving. Students in Chem 311 are expected to have successfully completed Chem 104, Chem 109, Chem 115 or an equivalent with a grade of C or above.

### **Course Organization and Expectations**

A recommended study strategy for this course is: 1) read the assigned material in the text before each whole class session, 2) attend class, take your own notes, and actively participate in class exercises, 3) as soon as possible after class, begin to work homework problems. When you encounter problems that you cannot solve, refer to the text, your notes, library resources, or your fellow students. Forming a study group with fellow students to review and problem solve is an excellent way to learn chemistry.

To help you to master the new material presented in this course, specific learning objectives are provided as part of each problem set and for each exam. The exam objectives are available within the Exam assignments in Canvas (see below). Use the learning objectives to guide your work on the problem sets and practice exams for that course unit. Practice exams keyed to the learning objectives are also available in the Exam assignments. Fully worked out answer keys will be made available for you to use to check your work on the practice exams two days before the exam.

Various learning activities are offered to meet the needs of different types of students; however, if you find that your learning needs are not being met or that you are not satisfied with some aspect of the course please bring your concern to Prof. M. or your TA.

**Evaluation Strategies:** Three midterm exams, a final exam, ten problem sets, nine collaborative learning sessions, and 16 laboratory assignments (see p 3) will be the basis for your grade in Chem 311. The midterm exams will be held during class on Fri., Sept. 30, Fri., Oct. 28, and Fri., Nov. 18. The final exam will be held at 2:45-4:45 PM on Thurs. Dec. 22. Please notify Prof. M. and your TA of any conflicts promptly.

**Required Text & Materials**

**Textbook:** *Descriptive Inorganic, Coordination, and Solid-State Chemistry*, 3<sup>rd</sup> Edition, Glen E. Rodgers, Brooks/Cole Cengage, 2012, available from local bookstores or on-line.

**Calculator:** An inexpensive calculator is required. It should have capabilities for square roots, logarithms and exponentiation (antilogarithms), and exponential (scientific) notation operations. You may use programmable calculators in this course.

**Auxiliary Materials:** The following materials may be purchased from Alpha Chi Sigma (AXΣ) in room 1375 of the chemistry building beginning at 7:30 AM on Tuesday, Sept. 6. Purchases through AXΣ can only be made with WisCard.

**Lab Manual** *Chemistry 311, Laboratory Manual*, Spring 2015 edition. (Only sold by AXΣ, \$20.00)

**Lab Notebook:** Carbonless laboratory notebook with duplicate pages. You will need a new notebook for Chem 311 because you will use all the pages. Sold by AXΣ (\$15.00) or the bookstore.

**Safety Goggles:** Industrial quality eye protection is required at all times when you are in the lab.

AXΣ sells safety goggles for \$5.00 that completely seal around the eyes and fit over regular glasses. These goggles meet our safety requirements.

**Optional Materials:** It is useful to be able to refer to a general chemistry textbook such as *Chemistry: The Molecular Science* by Moore and Stanitski. An online general chemistry textbook (OLT) is available in Canvas and some assignments refer to this online book. It is useful to have a molecular model kit that has several atoms with six bond sites at 90° angles.

**Chem 311 Canvas Web Site**

Much material for this course is only available via Canvas. You automatically have access to the 311 materials via Canvas (<https://canvas.wisc.edu/>) if you are enrolled in this course. If you have a problem logging in, and you have been registered for Chem 311 for at least two days, send an email to instructional technology specialist Dr. Rachel Bain, [rbain@chem.wisc.edu](mailto:rbain@chem.wisc.edu).

**Problem Sets:** Problem sets are always due on Wednesday at the beginning of class (which will be in Ed. Sci. 212 on most Wednesdays). Each problem set will take several hours to complete and some require software that you may need to install on your computer or use in the Chemistry Computer Room so start working on the problem set as early as possible. Problem sets will be graded on a low-resolution scale: 0 (not turned in), 3, 4, or 5 points. Working on the problem set for each week provides preparation for the Collaborative Learning Session held each Wednesday.

**Collaborative Learning Sessions:** Most Wednesdays during the semester the whole class will meet in a Collaborative Learning Classroom, Ed. Sci. 212. Each Collaborative Learning Session will be based on understanding of the problem set due at the start of class. You will work with a partner or with a larger group discussing concepts and questions on a Discussion Activities Worksheet. At the end of class you will turn in the worksheet with answers to the questions. Discussion Activities Worksheets will be graded on a low-resolution scale: 0 (not turned in), 3, 4, or 5 points.

**Laboratory:** The Chem 311 laboratory is designed to be an integral part of your learning experience. In the lab, you will focus on two primary objectives: the synthesis of compounds and the analysis of their structure. These are essential goals of modern inorganic chemistry research. Your lab exercises will give you the opportunity to explore the reactivity of a wide variety of elements with your own hands, and you will experience the beauty and variety of inorganic compounds. By the end of the semester, you will have prepared your very own rainbow of products. Many people who become inorganic chemists were inspired by their lab experience.

Laboratory Reports/Assignments and their point values are listed here.

LabWrite assignment	5
Malachite Bead	10
Polysiloxanes	10
Prussian Blue	10
UV-Vis Tutorial	10
IR Tutorial	10
Rhodium Rainbow	10
Thiatriazoles (CPR)	20
Lewis Acid-Base Adduct	20
DMSO Complexes (CPR)	20
Magnetic Susceptibility	20
Nickel Series	40
Cobalt Salen (CPR)	40
Nickel Nanostructures	20
Nickel Glyme	10
OLED	10
Total	265

### **Calibrated Peer Review (CPR)**

Three of your lab reports will be evaluated using Calibrated Peer Review (CPR) a system designed to help you learn how to write a scientific report or paper. Using CPR you will also learn how to recognize a well written scientific report, how to evaluate your own writing, and how to review and evaluate the work of other students.

CPR requires that you demonstrate your ability to recognize good scientific writing by a process called calibration. During calibration you will be asked to read three versions of the same laboratory report and to recognize the good and bad aspects of each report. CPR will then ask you questions about each report so that you can demonstrate that you can distinguish a poor report from an average and a good report. The calibration process is to ensure that when you evaluate the reports of other students you can do so in a consistent and fair way. It is also designed to teach you how to recognize when a report you have written is good enough to submit for evaluation by others.

CPR involves a process called *peer review* that is used to evaluate scientific papers to decide whether they should be published. When a scientist completes a research study, writes a report, and submits the report to a scientific journal for publication, the editor of the journal must decide whether to publish the report, to ask the author to revise it, or to decline to publish because the report is not good enough. Other scientists who do research similar to that reported in the paper—peer reviewers—are asked to review the paper and provide to the editor their opinions regarding its quality. Peer reviewers provide constructive, courteous criticism of the paper, which the editor returns to the author so that the author can improve the paper. In Chem 311 you will serve as a peer reviewer of your own laboratory report and of the reports of three other students.

For each experiment with a CPR report you will write an individual laboratory report and prepare it for upload to CPR. Then you will review three laboratory reports that your instructors have written. The three reports illustrate high quality, medium quality, and low quality. You will use these reports to calibrate

your ability to recognize a well written report; part of your grade will depend on how well you calibrate. Next, you will read and review three laboratory reports by other students in Chemistry 311. As is often true in peer review of scientific papers, the reports will be anonymous—you won't know who wrote each report you review. As is almost always true in peer review of scientific papers, the reviewers will also be anonymous—after the reviews are completed, you won't know who the three reviewers of your report were. At the end of the process you will be able to see the reviews of your work and use them to improve your subsequent lab reports. Chem 311 TAs have observed that after using CPR the quality of students' lab reports increases significantly, which is good because whatever your future career the ability to report scientific results is going to be an important skill that potential employers will value.

### **Lab Report Criteria**

Any scientific report should provide information in a format that is easily assimilated and interpreted by a reader. As you write each lab report consider these questions and make certain that you have addressed each of them in your report. Your TA will use these criteria to evaluate your report but note that some will be weighted more strongly than others; it is not sufficient just to check off each box but rather the overall presentation is what counts.

1. Does the title describe the report content concisely, adequately and appropriately?
2. Does the abstract convey a sense of the full report concisely and effectively? Is there a clear statement of the overall findings?
3. Does the introduction provide sufficient information for the reader to understand the concepts tested, the purpose, and the scientific context of this laboratory exercise?
4. Is the procedure clearly and completely described with an appropriate level of detail that would allow someone to reproduce the experiment?
5. Are the results described clearly and with sufficient support? Are the findings, observations and characterization data presented logically and appropriately?
6. Are figures and tables used effectively in this report, providing clear and accurate information?
7. Does this report successfully integrate figures and tables with the text? Do the figures and tables help to create a concise and effective presentation?
8. Does the discussion include a summary of the findings and back up this summary with specific reference to the results? Is there sufficient explanation of the results and is it presented logically? Are the results effectively placed in a broader scientific context?
9. Are the conclusions clearly stated and well supported?
10. Are there two or more references to appropriate sources of information and are they cited using ACS format?

You will also be evaluated on the attention to safety and effectiveness of your laboratory work and on the quality of your laboratory notebook, which should contain a legible and complete record of the experiment.

### **Course Schedule**

A schedule is posted in Canvas listing topics, readings and extra study questions from the textbook to guide your studying for Chem 311.

## **Exams**

**Learning Objectives, Study Questions and Practice Exams:** Learning objectives and a practice exam for each unit are posted in Canvas. The course topic schedule lists a selected set of additional study questions from the textbook, which are keyed to the learning objectives for that unit. The study questions are typical of those you should master and you should use them to build your mastery of the course content.

**How To Prepare For Exams:** A recommended strategy is: 1) review the learning objectives for the exam referring to your notes or the text if necessary, 2) work the study questions associated with each objective, spending more time working problems on those topics you find most challenging, 3) simulate the test taking situation by working the practice exam in 50 minutes in a quiet place, 4) “grade” your own test using the answer key as your guide, 5) review those areas that you identify as weak, working extra problems in these areas to reinforce your knowledge.

## **Important Administrative Information for Chemistry 311**

**Electronic Mail:** You are encouraged to contact Prof. Moore by email if you have questions about anything to do with the management of this course. Electronic mail is available at all times of day and night, so you can send messages whenever something comes to mind. Do not, however, expect immediate responses in the middle of the night! Prof. M.’s email address is [jwmoore@chem.wisc.edu](mailto:jwmoore@chem.wisc.edu).

Because Prof. Moore gets hundreds of messages every day to that account, he asks that you put the words “Chem 311” in the subject line of any message you send to him. NOTE: *Messages sent without this subject line will likely go unread!*

**Piazza:** For questions about chemistry content (as opposed to course management) Piazza is the tool to use. You can post questions and collaborate to edit responses to these questions. Instructors can also answer questions, endorse student answers, and edit or delete any posted content.

Piazza is designed to simulate real class discussion. It aims to get high quality answers to difficult questions, fast! The name Piazza comes from the Italian word for plaza--a common city square where people can come together to share knowledge and ideas. If you have any problems or feedback for the developers, email [team@piazza.com](mailto:team@piazza.com).

Go to the Chem 311 class page to register in Piazza: <https://piazza.com/wisc/fall2016/311/home>

**What to Do if You Are Sick or Otherwise Unable to Attend a Class, Exam, or Lab:** If you are unable to attend a specific class session because of an unavoidable schedule conflict, for example a religious observance, an athletic activity or a family obligation, contact your TA as soon as possible to reschedule. Make up labs can be arranged only during the week when the entire class is doing a lab exercise, so planning ahead is important. If you find that you are unable to attend lab because you are ill, contact your TA as soon as possible. He or she will discuss your situation and decide what to do. **If circumstances arise unexpectedly that preclude your taking an exam, please contact your TA and Prof. M. before the scheduled exam time.** We recognize that in an emergency situation, you may not be able to contact us in a timely way.

**Chemistry Resource Facilities - Computer Room, Study Room, Undergraduate Chemistry Office, Chemistry Library:** Computers are available for use in room 1375 Chemistry. Room 1371 is a study room for chemistry students. The staff in the Undergraduate Chemistry Office, room 1328, can assist you with enrollment, advising, and many other things. The Chemistry Library, on the second floor above the main lecture halls, is a wonderful place to study. Different textbooks, reference works, on-line database searching and other resources for chemistry students are available. Specific materials for this class are on reserve in the Chemistry Library.

**Cell Phone Policy:** If you bring a cell phone to class or lab, please silence it for the duration of the class or lab period. If there is a situation that absolutely requires you to answer your cell phone during a class, please set the phone to silent/vibrate and sit in a location where you do not disturb other students when leaving the classroom to accept a call.

**Course Schedule:** A Course Schedule is posted in Canvas to help you plan your study schedule for Chem 311. This schedule lists the due dates for all problem sets, the names of the weekly lab exercises, which experiments have peer-reviewed (CPR) lab reports, and the exam dates. Instructions for each problem set, lab exercise and exam may be found within the specific assignment in Canvas.

### Grades:

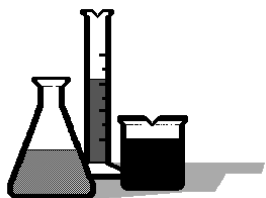
Your grade will be based on a maximum of 680 points divided as follows:

Ten Problem Sets @ 5 points each (see course calendar for due dates)	50 points
Nine Discussion Activities Worksheets @ 5 points each (see course calendar for due dates)	45 points
Laboratory reports/assignments (including 5-point LabWrite worksheet and 20-point TA personal evaluation of your overall lab work) (each week's experiment is listed in the schedule)	285 points
Three midterm exams @ 60 points each (dates and times are listed in the course calendar)	180 points
Final Exam (date and time is listed in the course calendar)	120 points
<b>Course Total</b>	<b>680 points</b>

**Letter Grades:** Final letter grades will be based upon the absolute scale shown below. If you score the number of points indicated, then you will receive the letter grade indicated, regardless of how many other students achieve the same grade. There is no curve. Therefore it is to your benefit (and to your friends' benefit) that you help other students learn and they help you learn.

A	610 points or more	≥90%
AB	585 to 610 points	86-90%
B	550 to 585 points	81-86%
BC	525 to 550 points	77-81%
C	460 to 525 points	68-77%
D	410 to 460 points	60-68%
F	<410 points	<60%

If necessary, adjustments will be made at the end of the semester, but these adjustments will never lower your final letter grade, only raise it.



Lecture, Laboratory, and Examination Schedule

Date	Subject	Reading/Web	Questions and Problems	Laboratory
<i>September</i>		Study before class	Work out before class	
W 7	Introduction; Atomic Electronic Structure.	OLT, Ch 5 (all); CMS, Review Ch. 7.	OLT, Ch 5, Q 8, 9, 10, 11, 12. (Q means end-of-chapter question)	<b>Malachite Bead, p 57</b> <b>Hand in Academic Integrity statement</b>
F 9	Schrodinger Equation; Wave Functions and Orbitals; Shielding;	ORBITAL OLT, Formal Charge	OLT, Ch. 5, Q 17, 22, 23, 27, 28, 29.	<b>LabWrite assignment</b> due Monday at 1:20 PM in class
M 12	Effective Nuclear Charge; Chemical Periodicity; Periodic Properties.	R, Ch 1, Ch 9, Sec 1-2 CMS, Rev. Ch. 8, 9.	R, Ch 9, Q 1, 4, 8, 11, 12, 15, 20, 23, 24, 26, 28.	<b>Polysiloxanes, p 59</b>
<b>W 14 Ed. Sci. 212</b>	Special Aspects of Periodicity	R, Ch 9, Sec 3-5	R, Ch 9, Q 32 34 39 40 46 47 53 54. Turn in <b>Problem Set 1</b> at start of class.	<b>Note that on dates shown in red the class will meet in Educational Sciences room 212.</b>
F 16	Molecular Orbital Theory	OLT, Ch 21 (all)		
M 19	Molecular Orbital Theory	CMS, Ch 8, Sec 12 MO Theory	OLT, Ch 21, Q 8, 9, 32, 33, 34, 36, 37, 39, 41, 43	<b>Synthesis of Prussian Blue, p 65;</b> <b>Infrared Spectroscopy Tutorial, p 69;</b> <b>Rhodium Rainbow, p 77;</b> <b>UV-Vis Spectroscopy Tutorial, p 83</b>
<b>W 21 Ed. Sci. 212</b>	Molecular Orbital Theory		Turn in <b>Problem Set 2</b> at start of class.	
F 23	Coordination Compounds; Werner Coordination Theory	R, Ch 2, Sec 1, 2	R, Ch 2, Q 8, 9, 11, 12, 13, 17	
M 26	Coordination Compounds: Nomenclature	R, Ch 2, Sec 3, 4	R, Ch 2, Q 19, 21, 23, 25, 26, 29, 30, 34, 35, 38.	<b>Thiatriazoles, p 89; Report via CPR after Midterm I</b>
<b>W 28 Ed. Sci. 212</b>	Coordination Compounds: Structure and Isomerism	R, Ch 3, Sec 1-2.	R, Ch 3, Q 4, 8, 12, 14, 15, 17, 18, 24. Turn in <b>Problem Set 3</b> at start of class	
F 30	<b>Midterm Exam I (in class)</b>			

R = Rodgers book (3<sup>rd</sup> ed.); CMS = Chemistry the Molecular Science (Moore, et al.); OLT = online textbook and end-of-chapter questions (Moodle).

Date	Subject	Reading/Web	Questions and Problems	Laboratory This Week
<i>October</i>				
M 3	Coordination Compounds: Structure and Isomerism	R, Ch 3, Sec 3-6.	R, Ch 3, Q 25, 29, 30, 32, 35, 37, 45, 48, 49, 52, 57.	<b>Lewis Acid-Base Complexes, p 93</b>
W 5	Crystal Field Theory	R, Ch 4, Sec 1, 2.	R, Ch 4, Q 1, 2, 3, 4, 5, 10, 11, 15, 16, 18, 21, 22, 27, 30.	
F 7	Crystal Field Theory: Applications	R, Ch 4, Sec 3.	R, Ch 4, Q 31, 32, 34, 35, 36, 38, 39, 41, 46, 47, 48, 49, 55, 56, 62, 66.	
M 10	Coordination Compounds: Reactions	R, Ch 5, Sec 1-3.	R, Ch 5, Q 1, 2, 3, 8, 10, 11, 12, 15, 17, 18, 24, 26.	<b>Fe and Ru Complexes of DMSO; p 99; Report via CPR</b>
<b>W 12 Ed. Sci. 212</b>	Coordination Compounds: Rates and Mechanisms of Reactions	R, Ch 5, Sec 3-5.	R, Ch 5, Q 28, 29, 31, 32, 37, 39, 41, 44, 47, 53, 54, 57, 58, 62. Turn in <b>Problem Set 4</b> at start of class.	
F 14	Coordination Compounds: Applications	R, Ch 6, Sec 1-4.	R, Ch 6, Q 1, 3, 4, 7, 10, 11, 12, 14, 15, 16, 19, 24, 26.	
M 17	Coordination Compounds: Bioinorganic Applications	R, Ch 6, Sec 5.	R, Ch 6, Q 30, 31, 32, 34, 35, 38.	<b>Magnetic Susceptibility, p 103</b>
<b>W 19 Ed. Sci. 212</b>	The Solid State: Types of Crystals; Metallic Bonding	R, Ch 7, Sec 1. OLT, Ch 22, Sec 1.	OLT, Ch 22, Q 4, 6, 7, 11, 12. Turn in <b>Problem Set 5</b> at start of class.	
F 21	The Solid State; Unit Cells	R, Ch 7, Sec 2	R, Ch 7, Q 2, 3, 4, 8, 9, 10.	
M 24	Ionic Solids: AB and AB <sub>2</sub> Structures; Radius Ratio	R, Ch 7, Sec 3-4 Web, Window on the Solid State, 1-4.	R, Ch 7, Q 11, 12, 15, 16, 18, 20, 23, 24, 27, 28, 29, 30, 33, 36, 39, 42, 44, 45, 50, 52.	<b>Nickel Series, p 105</b>
<b>W 26 Ed. Sci. 212</b>	Ionic Solids: Defects; Spinel	R, Ch 7, Sec 5-6;	R, Ch 7 Q 55, 56, 57, 59, 60. Turn in <b>Problem Set 6</b> at start of class.	
F 28	<b>Midterm Exam II (in class)</b>			



Date	Subject	Reading/Web	Questions and Problems	Laboratory This Week
<i>October</i>				
M 31	Crystal Lattice Energy	R, Ch 8, Sec 1; Lattice Energetics prog.	R, Ch 8, Q 2, 8, 13, 17, 22, 26.	<b>Nickel Series (ctd); Begin Cobalt(salen) Complexes; p 109</b>
<i>November</i>				
W 2	Crystal Lattice Energy: Born-Haber Cycle; Crystal Field Effects	R, Ch 8, Sec 2-3.	R, Ch 8, Q 28, 37, 40, 42, 44.	
F 4	Hydrogen and Hydrides	R, Ch 10, Sec 1-4 Read the chapter on nuclear chemistry in a gen chem book;	R, Ch 10, Q 1, 3, 5, 12, 14, 24, 26, 34, 42.	
M 7	Hydrogen and Hydrides	R, Ch 10, Sec 5-6.	R, Ch 10, Q 49, 51, 53, 60.	<b>Cobalt(salen) Complexes (ctd)</b>
<b>W 9 Ed. Sci. 212</b>	Oxygen and Oxides	R, Ch 11, Sec 1-3.	R, Ch 11, Q 3, 10, 14, 20, 24, 30, 34, 36, 38, 40, 42. Turn in <b>Problem Set 7</b> at start of class.	
F 11	Acids; Ozone; Greenhouse Effect	R, Ch 11, Sec 4-6.	R, Ch 11, Q 43, 45, 47, 48, 49, 52, 54, 56, 67, 68, 72.	
M 14	Alkali Metals	R, Ch 12, Sec 1-6.	R, Ch 12, Q 16, 18, 23, 25, 27, 29, 33, 35, 39, 40, 41, 47, 49, 55, 57.	<b>Cobalt(salen) Complexes (ctd.) Report via CPR; due after Exam III.</b>
<b>W 16 Ed. Sci. 212</b>	Alkaline Earth Metals	R, Ch 13, Sec 1-4.	R, Ch 13, Q 1, 6, 10, 14, 20, 21, 24, 28, 38, 40, 44. Turn in <b>Problem Set 8</b> at start of class.	
F 18	<b>Midterm Exam III (in class)</b>			

Date	Subject	Reading/Web	Questions and Problems	Laboratory This Week
<i>November</i>				
M 21	Group 3A Elements	R, Ch 14, Sec 1, 2, 4.	R, Ch 14, Q1, 4, 9, 11, 15, 24, 30, 36, 38, 44, 65.	
W 23	Group 4A Elements: Tin, Lead	R, Ch 15, Sec 1, p 433-438 (for Sn and Pb)	R, Ch 15, Q 1, 7, 8, 11, 19, 20, 22, 48, 51, 52.	
<i>Break</i>				
	Thanksgiving			
M 28	Group 4A Elements: Carbon	R, Ch. 15, Sec 1-4	R, Ch 15, Q 35, 38, 45.	<b>Nickel Nanotech, p 115</b>
W 30 Ch B371	Group 4A Elements: Silicon, Germanium--Semiconductors	R, Ch 15, Sec 5	R, Ch 15, Q 13, 15, 61, 63, 64, 68, 70.	Note that today we will meet in Chemistry room B371.
<i>December</i>				
F 2	Group 5A Elements: Nitrogen	R, Ch 16, Sec 1-3	R, Ch 16, Q 8, 15, 29, 35, 38, 42, 44, 46, 47, 49, 53, 55, 66.	
M 5	Group 5A Elements: Phosphorus	R, Ch 16, Sec 4-5	R, Ch 16, Q 17, 19, 23, 59, 73, 77.	<b>Nickel Dimethylglyoxime, p 119; Begin OLED, p 123 (Synthesis of [Ru(bpy)<sub>3</sub>](BF<sub>4</sub>)<sub>2</sub>)</b>
W 7 Ed. Sci. 212	Group 6A Elements: Sulfur, Selenium, Tellurium, Polonium	R, Ch 17, Sec 1-3.	R, Ch 17, Q 5, 7, 9, 11, 21, 23, 30, 32, 38, 45, 46, 49, 58, 60. Turn in <b>Problem Set 9</b> at start of class.	
F 9	Group 6A Elements: Acid Rain Group 7A Elements: Halogens	R, Ch 17, Sec 4-5 R, Ch 18, Sec 1-3.	R, Ch 17, Q 63, 64, 65, 68.	
M 12	Group 7A Elements: Interhalogens; Chlorofluorocarbons	R, Ch 18, Sec 4-6.	R, Ch 18, Q 4, 10, 12, 15, 19, 21, 27, 33, 37, 41, 52, 57, 68, 79.	<b>OLED (ctd); Check out.</b>
W 14	Review for Final Exam			

**FINAL EXAM Thursday, December 22, 2:45 to 4:45 PM; room to be announced.**