

Chemistry 311

Chemistry Across the Periodic Table

Spring 2013

Read This Syllabus Today. Keep It for Future Reference.

Chemistry 311, including lab:	4 credit hours
Class Sessions:	1:20 pm MWF B371 Chemistry
Instructor Information:	Professor Daniel C. Fredrickson 6341 Chemistry (890-1567) http://www.chem.wisc.edu/~danny danny@chem.wisc.edu
Office Hours:	MW 2:20pm, 6341 Chemistry or call or email for an appointment

The 113 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 for each exam. These objectives are available under the Content and Exam Preparation Materials headings on the course webpage (see below). Use the learning objectives to guide your work on the problem sets and to review for the exams. Additional study questions keyed to the learning objectives are also available in the same location. Practice exams and fully worked out answers will be available for each 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 your professor or TA.

Evaluation Strategies: Two midterm exams, the best ten of twelve problem sets, and twelve laboratory exercises will be the basis for your grade in Chem 311. The midterm exams will be held at 5:40 pm on Wednesday, Mar. 6 and Wednesday, Apr. 24. The final exam will be held at 5:05-7:05 pm on Tuesday, May 14. Please notify Prof. Fredrickson and your TA of any conflicts promptly.

Required Text & Materials

Textbook: *Descriptive Inorganic, Coordination, and Solid-State Chemistry*, 3rd Edition, by Glen E. Rodgers, Brooks/Cole 2012, available from local bookstores or on-line. *Radioactive* by Lauren Redniss (Go Big Read selection), available free with coupon from libraries.

Lab Manual and Auxiliary Materials: *Chemistry Across the Periodic Table, Chemistry 311, Laboratory Manual*, Spring 2013 edition. These materials may be purchased from Alpha Chi Sigma in the Mills St. atrium.

Lab Notebook: Carbonless laboratory notebook with duplicate pages: available from Alpha Chi Sigma. You will need a new notebook for Chem 311 because you will use all the pages.

Safety Goggles: Industrial quality eye protection is required at all times when you are in the lab. Safety goggles that completely seal around the eyes and fit over regular glasses may be purchased from Alpha Chi Sigma.

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.

Chem 311 Course Web Site

Much of the material for this course is only available via the course webpage. You automatically have access to the 311 materials at <https://courses.moodle.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 rbain@chem.wisc.edu.

Coursework for Chem 311

Problem Sets: Problem sets will be due most Fridays in class. Each problem set should take about two hours to complete and will be graded on a low-resolution scale: 0 (not turned in), 6, 8, or 10 points. Your best 10 of 11 problem sets will be used in calculating your final grade.

Laboratory: The 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. For most experiments, written reports will be due one week of the lab session. **Important notes: Late reports will be penalized by 1 point per day overdue. In order to pass this class, students must achieve an average score of 50% or higher on the labs.**

Exams: Learning objectives for each exam, and a selected set of study questions from the textbook keyed to the learning objectives, can be found in the Exam Preparation Materials menu in the Content section of Learn@UW. Practice exams are also available. The study questions are typical of those you should master and you should use them to build your mastery of the

course content. Exams may also include questions testing your understanding of the experiments done in the laboratory portion of this course.

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.

Important Administrative Information for Chemistry 311

Electronic Mail: You are encouraged to contact Prof. Fredrickson by email if you have questions about anything to do with the course. Do not, however, expect immediate responses in the middle of the night! Prof. Fredrickson’s email address is danny@chem.wisc.edu. Because Prof. Fredrickson 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 be buried!*

What To Do If You Are Sick, Or Otherwise Unable To Attend An Exam or Lab: If you are unable to attend a specific lab 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 lab times can be accommodated 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 or professor 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 readily available. Specific materials for this class may be placed 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.

Individual Counseling: Individual counseling is also available at University Counseling and Consultation Services. For more information, call 262-1744 or stop by 115 N. Orchard Street.

Accommodations for students with disabilities: Students with disabilities should contact Prof. Fredrickson as soon as possible at the beginning of the semester to arrange accommodations. This applies to lecture, discussion, and laboratory, and to special accommodations for exams.

Grading Policies

Your grade will be based on a maximum of 1000 points divided as follows:

Best 10 of 11 Problem Sets @ 10 points each <i>(see course schedule for due dates)</i>	100 points
Twelve Laboratories will make up 30% of your grade* <i>(each week's experiment is listed in the schedule)</i>	300 points
Two midterm exams @ 150 points each <i>(dates and times are listed in the course schedule)</i>	300 points
Final Exam <i>(date and time is listed in the course schedule)</i>	300 points
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Total	1000 points

*Twelve laboratory exercises worth 280 points plus a 20-point spectroscopy assignment.

Letter Grades: Final letter grades will be based upon the absolute scale shown below, assuming that passing scores are achieved in the lab (see above). 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	860 points or more
AB	830 to 859 points
B	770 to 829 points
BC	710 to 769 points
C	600 to 709 points
D	500 to 599 points

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.

Exam regrades: Following each midterm exam, your text will normally be graded and returned by your next discussion section. At this discussion section, you will be given the opportunity to look through your exam for any grading errors. Requests to reevaluate scores on specific problems in the exam will be granted if they are made before the end of the discussion period. Simply write a *brief* description of the issue (*only the first three sentences will be read*) on a separate piece of paper, and give it to your TA along with the exam. *Under no circumstances should marks or annotations be made on the exam itself.*

Tentative Schedule for Chem 311, Spring 2013

Date	Subject	Reading	Problem Set	Laboratory
W, Jan. 23 F, Jan. 25	Part 1: Quantum Mechanics and the Periodic Table Schrödinger equation; The H atom Atomic orbitals; shielding; effective nuclear charge	Chapter 1 On-line reading		No Lab
M, Jan. 28 W, Jan. 30 F, Feb. 1	The periodic table; chemical periodicity Periodic trends, atomic properties Periodic trends, atomic properties	Chapter 9	PS#1 due	Malachite Bead
M, Feb. 4 W, Feb. 6 F, Feb. 8	Part 2: Chemical Bonding Concepts Chemical bonding Chemical bonding Chemical bonding	On-line reading	PS#2 due	Polysiloxanes
M, Feb. 11 W, Feb. 13 F, Feb. 15	Part 3: Coordination Chemistry Coordination compounds Coordination compounds Coordination compounds	Chapters 2, 3	PS#3 due	Prussian Blue
M, Feb. 18 W, Feb. 20 F, Feb. 22	Coordination compounds Crystal field theory Crystal field theory	Chapters 3, 4	PS#4 due	Thiatriazoles
M, Feb. 25 W, Feb. 27 F, Mar. 1	Reactions of coordination compounds Reactions of coordination compounds Applications of coordination compounds	Chapters 5, 6	PS#5 due	Lewis Adducts (CPR Report)
M, Mar. 4 W, Mar. 6 F, Mar. 8	Review for Exam I Review for Exam I, Exam I at 5:40pm (location TBA) No class			DMSO Complexes
M, Mar. 11 W, Mar. 13 F, Mar. 15	Part 4: Solid State Chemistry The solid state; types of crystals Unit cells; lattices Common structure types	Chapter 7		Magnetic Susceptibility (CPR Report)
M, Mar. 18 W, Mar. 20 F, Mar. 22	Common structure types, defects Sphere packing views; radius ratio rules Solid state synthesis	Chapter 7	PS#6 due	Nickel Series
Mar. 25-29	SPRING BREAK			No Lab
M, Apr. 1 W, Apr. 3 F, Apr. 5	Crystal lattice energies Crystal lattice energies Bonding, band structures, conductivity	Chapter 8	PS#7 due	Nickel Series Salen Synthesis
M, Apr. 8 W, Apr. 10 F, Apr. 12	Part 5: Descriptive Chemistry Hydrogen and hydrides Oxygen and oxides More on Oxygen	Chapters 10, 11	PS#8 due	Cobalt Salen Synthesis
M, Apr. 15 W, Apr. 17 F, Apr. 19	Alkali metals Alkaline earth metals Group 3A metals	Chapters 12-14	PS#9 due	Cobalt Salen O ₂ Adduct (CPR Report)
M, Apr. 22 W, Apr. 24 F, Apr. 26	Review for Exam II Review for Exam II, Exam II at 5:40pm (location TBA) Group 4A	Chapter 15		Ni Nanowires
M, Apr. 29 W, May 1 F, May 3	Group 4A Group 5A Group 5A	Chapters 15, 16	PS#10 due	Ru(bpy) ₃ Ni(glyme) ₂
M, May 6 W, May 8 F, May 10	Group 6A Group 7A Review for Final	Chapters 17, 18	PS#11 due	OLED Checkout

FINAL EXAM: May 14, 5:05 pm, location to be announced.