

Chemistry Across the Periodic Table

- Chemistry 311, including lab: 4 credit hours (Traditional Carnegie Definition: 2 hr. lecture, 1 hr. active learning, 4 hr. discussion/lab per week)
- Whole Class Meetings: 1:20 PM: MF 1315 Chemistry; W 214 Ingraham (usually)
- Pre-Lab Discussion Sessions: 7:45 AM: T or R, B371 or 1315 Chemistry
- Laboratory Sessions: 8:50 – 11:50 AM: T or R, 1329 Chemistry
- Instructor Information: Professor Clark Landis
6112 Chemistry (262-0362)
<http://www.chem.wisc.edu/users/landis>
landis@chem.wisc.edu
- Instructor Office Hours: M 4:00 – 5:00 PM, R 12:00 – 1:00 PM
6112 Chemistry or call or email for an appointment
- TAs and Office Hours: 603 Michael Roy, mroy6@wisc.edu
Office Hours: W 2:15 – 3:15 pm, Room 1201 Desk 46
601, 602 Katherine Ziebarth, kziebarth@wisc.edu
Office Hours: T 1:00 – 2:00 pm, Room 1201 Desk 46
- Canvas Course URL: <https://canvas.wisc.edu/courses/89845>
- Instructional Mode: Face-to-face.
- Course Guide Description: Explores the properties, reactions and uses of elements and compounds, with emphasis on coordination chemistry of transition-metal ions, bioinorganic chemistry, solid-state structure and main-group elements. The weekly three-hour laboratory introduces students to the synthesis and characterization of inorganic compounds.
- Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S

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, environmental, and industrial applications. The course will emphasize coordination chemistry of the transition metals, solid-state chemistry, and specific properties of the representative elements. 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. 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. Landis or your TA.

Evaluation Strategies: Three midterm exams, a final exam, ten problem sets, nine collaborative learning sessions, and 15 laboratory assignments (see p 4) will be the basis for your grade in Chem 311. The midterm exams will be held during class on: Fri., Sept. 27; Fri., Oct. 25; and Fri., Nov. 15. The final exam will be held at 2:45 to 4:45PM on Monday, Dec 16. Please notify Prof. Landis and your TA of any conflicts promptly.

Required Text & Materials

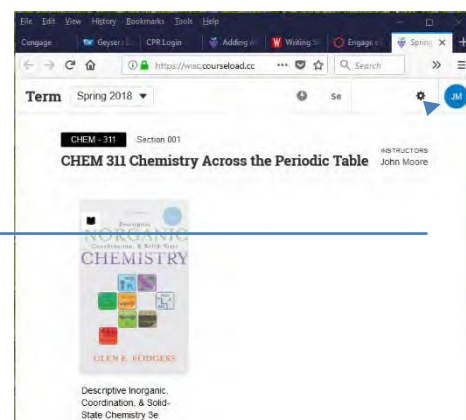
Textbook: *Descriptive Inorganic, Coordination, and Solid-State Chemistry*, 3rd Edition, Glen E. Rodgers, Brooks/Cole Cengage, 2012, available within the Canvas course as an eTextbook. As noted in the Course Guide, this course is participating in the UW-Madison Engage eText Pilot. On your tuition bill there will be a charge of \$20.62 for the eText (compared to the print textbook's list price of \$159.95). *You do not need to purchase a print version of the textbook.* Your eText is available via the Engage tool in your Canvas course page. Engage works best when viewed online in Firefox or Chrome.

To access your eText, follow these steps:

1. In the menu at the left of the screen, click on “Engage eText” to open the Engage reading platform.
2. Click on “Launch Unizin Engage”.
3. Read the EULA and click on “I agree” at the end.
4. Click on the image of the textbook’s cover to read the book.

To learn more about how the eText works, follow these steps:

1. Follow steps 1 and 2 above.
2. In the top right corner of Engage, click on your initials/photo.
3. Click on the Help link.
4. Click on “Students” to access quick overviews of how to navigate the platform and all the general studying/learning features – reading, note-taking, highlighting, questioning, printing, bookmarking, searching, and collaborating.



Please familiarize yourself with the Engage platform before the first day of class. A short demo of Engage can be found [here](#). Additional resources can be found in the [Engage](#) and the [UW-Madison](#)

[KnowledgeBase](#). If you wish to [opt-out](#) of using the Engage eText, please contact me at landis@chem.wisc.edu before doing so.

If you wish to request an accessible version of the eText, please contact the McBurney Disability Resource Center as soon as possible. More information is available [here](#).

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.

Required for Lab: These materials may be purchased from Alpha Chi Sigma (AXΣ) in room 1375 of the chemistry building; tentatively from Tuesday, September 4, to Friday, September 14, between the hours of 7:45 AM and 4:45 PM. Purchases through AXΣ can be made with Wiscard or cash, as indicated below.

Lab Manual *Chemistry 311, Laboratory Manual*, Fall 2019 edition. (Wiscard only, \$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. (Cash only, \$15)

Lab Coat: A lab coat is required at all times when you are in the lab. (Wiscard only, \$12)

Safety Goggles: Industrial quality eye protection is required at all times when you are in the lab (must be indirectly vented and completely seal around the eyes and fit over regular glasses if you wear glasses). (Cash only, \$5.00)

Local bookstores sell appropriate lab notebooks and safety goggles, for a higher price.

Optional Materials: It is useful to be able to refer to a general chemistry textbook with which you are familiar. 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.

Course Learning Outcomes

Upon completion of this course students will be able to...

- recall concepts of atomic electronic structure and use those concepts to predict properties of chemical elements and periodic groups of elements
- apply the concept of orbitals to a variety of aspects of chemical bonding
- use Werner coordination theory to interpret structure and isomerism in coordination complexes
- understand the concepts of crystal-field and ligand-field theories and use them to interpret spectra, stabilities, reaction rates, and structures of transition-metal compounds
- apply concepts such as crystal lattice, unit cell, closest packing, radius ratio, and lattice energy to the structures and properties of solids
- interpret the properties of conductors, semiconductors, and metallic conductors in terms of band theory
- recall important and interesting properties of the representative elements and their periodic groups and relate those properties to atomic structure and bonding theories
- use appropriate laboratory techniques, apparatus, and instrumentation to synthesize and characterize inorganic compounds

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.

Problem Sets: Problem sets are always due on Wednesday at the beginning of class (which will be in 214 Ingraham 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 class will meet in a Collaborative Learning Classroom, 214 Ingraham (all sections). 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.

Chem 311 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. 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	CPR	10
Prussian Blue		10
UV-Vis Tutorial		10
IR Tutorial		10
Rhodium Rainbow		10
Rhodium Rainbow Follow-up		10
Lewis Acid-Base Adduct	CPR	20
DMSO Complexes		20
Magnetic Susceptibility	CPR	20
Nickel Series		40
Cobalt(salen)	CPR	40
Nickel Nanotechnology		20
OLED		10
Total		245

Calibrated Peer Review (CPR): Four 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. 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 other students' work.

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 three 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.

Chem Tutor Review Assignments

Much of the content of Chem. 311 depends on things you learned in general chemistry, either Chem 103-104, or Chem. 109. In particular, you need to review electron configurations and covalent bonding. To help you review that material we have provided seven assignments in Chem Tutor, a new online tutoring system for general chemistry that is being developed at UW-Madison by Professor Martina Rau in the Department of Educational Psychology.

Most Chem Tutor assignments consist of three parts: a pre-test, a tutorial unit, and a post-test. To get credit for an assignment you must do all parts before the deadline—you will get zero credit unless all parts have been completed in the order they are listed below.

Here is a list of the Chem Tutor assignments and their due dates. Each complete assignment is worth three points.

Assignment 1	Mental Rotations Test Electron Configuration – Unit 0 – Introduction	Monday, Sept. 9, 11:55 PM
Assignment 2	Electron Configuration – Pre-Test Unit 1 Electron Configuration – Unit 1 Electron Configuration – Post-Test Unit 1	Monday, Sept. 9, 11:55 PM
Assignment 3	Electron Configuration – Pre-Test Unit 4 Electron Configuration – Unit 4 Electron Configuration – Post-Test Unit 4	Monday, Sept. 16, 11:55 PM
Assignment 4	Covalent Bonding – Pre-Test Unit 9 Covalent Bonding – Unit 9 Covalent Bonding – Post-Test Unit 9	Monday, Sept. 16, 11:55 PM
Assignment 5	Covalent Bonding – Pre-Test Unit 5 Covalent Bonding – Unit 5 Covalent Bonding – Post-Test Unit 5	Monday, Sept. 23, 11:55 PM
Assignment 6	Covalent Bonding – Pre-Test Unit 7 Covalent Bonding – Unit 7 Covalent Bonding – Post-Test Unit 7	Monday, Sept. 23, 11:55 PM
Assignment 7	Electron Configuration – Pre-Test Unit 6 Electron Configuration – Unit 6 Electron Configuration – Post-Test Unit 6	Monday, Sept. 30, 11:55 PM

How to Access Chem Tutor.

- Go to <https://chem.tutorshop.web.cmu.edu/>

- Username: same as your WISC ID (e.g., bbadger). (*Do not* include @wisc.edu)
- Password: chemistry

What you need to know before you start

- The system works best in Chrome
- It will *not* work on your smart phone or tablet
- There is an automatic check of
 - whether you spent less time on each problem than it would take to read the problem
 - whether you randomly guessed each answer

If you run into issues with the software, contact marau@wisc.edu.

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. Landis by email if you have questions about anything to do with the management or content 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. Landis’ email address is landis@chem.wisc.edu.

Because Prof. Landis 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 may go unread!*

Piazza: This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

Find our class page at: <https://piazza.com/wisc/fall2019/fa19chem311001/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. **Communicate, communicate, communicate!** 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. Landis before the scheduled exam time.** We recognize that in an emergency situation, you may not be able to contact us in a timely way but do the best you can.

Chemistry Resource Facilities - Computer Room, Study Room, Undergraduate Chemistry Office:

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.

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.

Academic Integrity: By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to <https://conduct.students.wisc.edu/academic-integrity/>

Accommodations for Students with Disabilities: The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. <http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php>

Institutional Statement on Diversity: Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world. <https://diversity.wisc.edu/>

Grades:

Your grade will be based on a maximum of 671 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
Seven Chem Tutor assignments @ 3 points each	21 points
Laboratory reports/assignments (including 5-point LabWrite worksheet and 10-point TA personal evaluation of your overall lab work) (each week's experiment is listed in the schedule)	255 points
Three midterm exams @ 60 points each (dates and times are listed in the course schedule)	180 points
Final Exam (date and time is listed in the course schedule)	120 points
Course Total	671 points

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	604 points or more	≥90%
AB	577 to 604 points	86-90%
B	544 to 577 points	81-86%
BC	517 to 544 points	77-81%
C	456 to 517 points	68-77%
D	402 to 456 points	60-68%
F	<402 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.