INTRODUCTION TO INORGANIC CHEMISTRY  
Spring 2016

Instructor: Professor Alexander J. M. Miller (ajmm@unc.edu)

Graduate Assistants: Seth M. Barrett (barretts@email.unc.edu)  
Andrew G. Walden (agwalden@email.unc.edu)

Peer Mentors: Alexander Li, Tony Li, and Scott McLaughlin

Schedule: Monday, Wednesday, and Friday 11:15 am – 12:05 pm; Murray G202

Office: Kenan Laboratories A400 (919-962-4618)

Office Hours: Tuesdays 8-9a (Kenan C143)  
  • Free-ranging discussion on course concepts and practice problems  
  • For one-on-one appointments to discuss course performance, please e-mail Prof. Miller

Recitation: Wednesdays 5-6p, led by Graduate Assistants and Peer Mentors

  Student solutions manual available online: http://bcs.whfreeman.com/descriptive6e/

Clicker: iClicker2 (other iClicker models will work, but you may not be able to answer a small number of free response questions. TurningPoint clickers will not work.)

Reserves: The following books are available through the UNC Library Reserves system through Sakai:  
  “Inorganic Chemistry” by Housecroft & Sharpe  
  “Inorganic Chemistry” by Miessler & Tarr

Course Website: sakai.unc.edu  
Course Number: CHEM251.001.SP16

COURSE DESCRIPTION
CHEM 251 provides an introduction to the diverse world of inorganic chemistry, probing the properties of metals and main group elements from single atoms to bulk materials composed of billions of atoms. The fundamental inorganic chemistry learned in this course has applications in biology, medicine, chemical industry, and alternative energy. CHEM 251 explores a diverse array of topics, including thermodynamics, molecular bonding, and periodic trends, all in the context of alternative energy applications. CHEM 251 is a prerequisite for advanced inorganic courses such as CHEM 450 (Intermediate Inorganic Chemistry).

PREREQUISITE
CHEM 102 or CHEM 102H, with a grade of C– or better, or equivalent course credit from another institution. Please speak with the instructor if you have any questions about course eligibility.
LEARNING OBJECTIVES
The goal of the course is to understand the properties of inorganic molecules and materials, highlighting the relationship between bonding and reactivity relevant to cutting-edge applications. During the course, students will:
1. Become familiar with the properties of molecules featuring elements across the full periodic table.
2. Draw atomic and molecular orbitals and correlate the orbitals with reactivity.
3. Introduce spatial recognition concepts to chemistry, including symmetry and atomic packing.
4. Connect transition metal bonding and structure with observed reactivity.
5. Contextualize inorganic chemistry with contemporary global energy challenges.

APPROXIMATE COURSE OUTLINE (PROBLEM SESSIONS IN BOLD):

<table>
<thead>
<tr>
<th>WEEK</th>
<th>TOPIC (APPLICATION)</th>
<th>DATES</th>
<th>READING</th>
<th>NOTES</th>
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</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Elements, atomic structure &amp; the Periodic Table (Intro to Global Energy)</td>
<td>1/11, 1/13, 1/15</td>
<td>Chapters 1 &amp; 2</td>
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<tr>
<td>Week 2</td>
<td>Small Molecules</td>
<td>1/20, 1/22</td>
<td>Chapter 3</td>
<td>No class 1/18</td>
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<tr>
<td>Week 3</td>
<td>Symmetry (The Hydrogen Economy)</td>
<td>1/25, 1/27, 1/29</td>
<td>Chapter 3</td>
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<td>Week 4</td>
<td>Metals (Electricity and the Grid)</td>
<td>2/1, 2/3, 2/5</td>
<td>Chapter 4</td>
<td></td>
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<tr>
<td>Week 5</td>
<td>Ionic solids</td>
<td>2/8, 2/10, 2/12</td>
<td>Chapter 5</td>
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<tr>
<td>Week 6</td>
<td>Complex Salts and Oxides (Photovoltaics)</td>
<td>2/15, 2/17</td>
<td>Chapter 5</td>
<td>EXAM 1 Fri 2/19</td>
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<tr>
<td>Week 7</td>
<td>Inorganic Thermodynamics (Synthetic fuels)</td>
<td>2/22, 2/24, 2/26</td>
<td>Chapter 6</td>
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<td>Week 8</td>
<td>Bronsted Acids and Bases</td>
<td>2/29, 3/2, 3/4</td>
<td>Chapter 7</td>
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<tr>
<td>Week 9</td>
<td>Lewis Acids and Bases (Hydrogen Storage)</td>
<td>3/7, 3/9, 3/11</td>
<td>Chapter 7</td>
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<td>Spring break 3/12 - 3/20</td>
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<td>Week 10</td>
<td>Transition Metal Complexes</td>
<td>3/21, 3/23</td>
<td>Chapter 19</td>
<td>No class 3/25</td>
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<tr>
<td>Week 11</td>
<td>Transition Metal Complexes</td>
<td>3/28, 3/30, 4/1</td>
<td>Chapter 19</td>
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<td>Week 12</td>
<td>Transition Metal Reactivity</td>
<td>4/6, 4/8</td>
<td>Chapter 19</td>
<td>EXAM 2 Mon 4/4</td>
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<tr>
<td>Week 13</td>
<td>Organometallic Chemistry (Catalysis)</td>
<td>4/11, 4/13, 4/15</td>
<td>Chapter 23</td>
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<td>Week 14</td>
<td>Oxidation-Reduction Reactivity</td>
<td>4/18, 4/20, 4/22</td>
<td>Chapter 8</td>
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<td>Week 15</td>
<td>Special Topic: Splitting water with sunlight</td>
<td>4/27</td>
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<td>EXAM 3 Mon 4/25</td>
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<td>Week 16</td>
<td>Finals Week</td>
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<td>FINAL EXAM 5/6 12:00pm</td>
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GRADING
Your course grade will be determined from three components:

I. **Clicker questions**: 0 (unanswered), 0.5 (incorrect) or 1 (correct) points (10% of total grade).
II. **Homework**: Five problem sets, 10 points each (10% of total grade).
III. **In-Class Exams (3)**: 50 min, 100 points each (40% of total grade). Lowest score will be dropped.
IV. **Final Exam**: 3 hours, 200 points (40% of total grade). **Friday May 6th, 2015 12–3pm**.

EXAMS
Two in-class exams will be given, worth 100 points each. One final exam will be given, worth 200 points. The final exam will be cumulative, covering all of the material from the semester. Note that the **final exam date** is fixed and cannot be changed; make sure that your schedule can accommodate the exam time.

MISSED EXAM POLICY
No makeup exams will be given. In the case of a missed in-class exam, your percentage score on the Final Exam will be used instead. The Final Exam is cumulative, so the material covered on the missed exam will be (partly) included in the Final Exam. If a conflict or medical problem arises, feel free to contact the instructor to discuss the situation.

PROBLEM SETS
Roughly five problem sets will be assigned during the semester. Each problem set will be worth a total of 10 points. **Only one question will be graded in detail for each problem set.** One selected problem will be graded in detail (worth up to 5 points) and the other problems will be graded for effort (five points for attempting every problem, 0 points if any problems are left blank). Problem sets are due **before the start of class on the due date**! Submissions received after the start of class will have 50% taken off. Submissions received after class on the due date will not be graded — score of 0 will be given. Problem sets can be handed in via Sakai as a PDF or at the podium in G202. **No e-mail submissions are accepted.**

NOTES AND CLASS TIME
The course will be taught primarily through presentation slides projected on a screen. **Slides will be posted on Sakai ahead of time.** Approximately one class period per week will be used as a problem solving session — practice in actually applying the knowledge learned during the prior week. The other two sessions will be a mix of lecture, problem solving, and other activities. **Attendance is factored into your final grade through the use of in-class “clicker questions.”**

CLICKER QUESTIONS
Over the course of the semester, about 75 in-class clicker questions will be posed. Each lecture will begin with a clicker quiz to assess comprehension of assigned reading. No collaboration is permitted on this clicker question, and the room should be silent. Later on in the class period, clicker questions will be used to practice the material as it is being presented. These questions are meant to be collaborative and you are encouraged to work with your neighbors, so the room should be loud with chatter! The specific clicker can be found described above and should be purchased before the start of the course.

PROBLEM SESSIONS
Once a week (usually Friday or Monday), the class period will be used as a problem session. These sessions are strongly recommended, and will feature example problems, review of course material, and preparation for exams. Problem sessions are a great place to pose questions, and are de facto office hours.

RECITATION SESSIONS (WEDNESDAYS AT 5PM)
An optional weekly recitation section will be led by a graduate assistant and a peer mentor. The goal of these sessions is to recap some of the key concepts of the previous week and address any questions or confusion.
OFFICE HOURS (TUESDAYS AT 8AM)
Prof. Miller is available every Tuesday at 8am in Kenan C143 (Chemistry Resource Center). The office hours are open-ended, student-led discussions about course topics. Feel free to come with questions about the material. Questions about course performance are also welcome, but if you feel more comfortable with a one-on-one meeting, please e-mail to make a separate appointment.

RESEARCH EXPOSURE
CHEM 251 strives to put inorganic chemistry in a greater context, including ongoing research at UNC and the resulting technology products that result from research efforts around the world. To help strengthen the research-exposure aspects of the course, you will be working with a Graduate Research Consultant (GRC), Marsha Massey. In addition to research-based activities in class, you will have opportunities to do participate in researching and implementing inorganic chemistry learning aids. The GRC Program is sponsored by the Office for Undergraduate Research (http://our.unc.edu), and you may be able to use this research-exposure course to meet a requirement of the Carolina Research Scholars Program (http://our.unc.edu/students/crsp). Please visit the OUR website to learn about how you might engage in research, scholarship and creative performance while you are at Carolina. The class size of CHEM 251 prohibits hands-on chemical research, so the projects introduced during the semester will involve research into the primary chemical literature and the development of interacting learning tools. If you are interested in performing undergraduate research, contact OUR or the instructor to learn more.

STUDYING
The course covers a wide range of chemistry. Review your notes daily (don’t wait until the night before an exam to study!) and work practice problems from textbooks. Studying in groups is encouraged, but each student must turn in their own independent problem sets. Make sure you are not relying on others in your study group: they won’t be there to help you on the exam. The Sakai site will feature a bulletin board where you can post questions that Prof. Miller or your classmates can weigh in on. Please note: Prof. Miller is unable to respond to e-mails regarding course content; please do e-mail about setting up a one-on-one meeting to discuss any aspect of the course.

CHEMISTRY RESOURCE CENTER
Additional help is available in the Chemistry Resource Center in Kenan C143! The resource center opens on Jan 18, 2016, and there are students available to help with general questions from 2-7pm Monday through Thursday.

COURSE WEBSITE
Please refer to the Sakai Website (sakai.unc.edu) for all class assignments and announcements as well as the syllabus and exam schedule. The class site can be found under the following section: CHEM251.001.SP15. The CHEM 251 Learning Aid Inorganic Resource (LAIR) has been established as a source of additional materials (https://chem251.web.unc.edu). Organized by concept, the resource includes alternative explanations to difficult materials, web apps that provide interactive components, as well as fun chemistry videos (yes, there are some explosions) and links to the recently published research findings.

CLASS CITIZEN ETIQUETTE
Please be respectful: turn off cell phones and computers and focus on the material. Students whose behavior is detrimental to the learning environment will be asked to leave.

E-MAIL POLICY
Prof. Miller is looking forward to hearing from you! Before you click “send” please read the following guidelines: (a) please be sure that your subject starts with the header “CHEM 251”; and (b) please refrain from asking content-based questions. Inorganic chemistry covers a variety of complex topics, none of which are easily addressed in writing over e-mail. These topics are best addressed in person, at office hours. If the
normal office hours conflict with your schedule, please e-mail to set up an appointment.

HONOR CODE
The Honor Code is the cornerstone of academic integrity at Carolina. Students are expected to uphold and abide by the Honor Code. All suspected Honor Code violations will be reported promptly. More information on the Honor System and the Honor Code can be found online at http://studentconduct.unc.edu/.

A statement clarifying collaboration as it pertains to the honor code is particularly important for this course. No collaboration is permitted on graded work because these assignments will be used to determine academic progress. When collaboration is permitted (for example, on an in-class clicker question), an explicit statement encouraging teamwork will be made. As discussed elsewhere in the syllabus, studying in groups is encouraged; however, graded assignments must be your own independent work.

HOW TO SUCCEED IN THIS COURSE
• Come to class prepared. This is a no-brainer. Read the assigned textbook chapters or handouts before lecture. Most class sessions will start with a clicker question about the assigned reading.
• Study in groups. Study groups are effective when everyone collaborates and works hard. Study groups are encouraged, but remember that each student must submit his or her own work. Beware of false confidence when the group arrives at answers that you don’t fully understand!
• Get help early. If you are having problems with the material, seek help early in the semester. Halfway through the course is way too late.

DISCLAIMER
The professor reserves the right to make changes to the syllabus, including assignment and test dates (excluding the officially scheduled Final Exam), when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules