Syllabus: CHEM 4610/5560
Advanced Inorganic Chemistry I
Fall Semester 2014
3 credit hours; lecture only

Instructor: Dr. LeGrande M. Slaughter
Chemistry Building Rm. 307E
Office phone: 565-4350; legrande.slaughter@unt.edu

Lecture: Monday, Wednesday 11:00 am – 12:20 pm, CHEM 352


Office Hours: Monday and Friday, 1:30 – 3:00 pm; other times by request

Prerequisites: None for Ph.D. and M.S. students (5560); CHEM 3520 for undergraduates (4610). A basic knowledge of thermodynamics and atomic theory is expected.

Objectives: This course covers the basic principles of structure, bonding and reactivity of inorganic compounds. The emphasis is conceptual rather than descriptive, with a goal of preparing you for more advanced topics in inorganic chemistry.

Grades: Problem sets: 200’ (180†) points [4 X (50’ or 45†)]
Examination #1: 250’ (225†)
Examination #2: 250’ (225†)
Final Examination: 300’ (270†)
Term Paper (5560 only): (100†)  
1000 points total
*4610 students. †5560 students (see below for details)

Letter grade scale:
A  880-1000 points
B  750-879
C  620-749
D  500-619
F  0-500
# CHEM 4610/5560

## Topic Outline (subject to adjustments)

<table>
<thead>
<tr>
<th>I. Atomic Structure</th>
<th>Text Sections</th>
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<tbody>
<tr>
<td>Atomic orbitals; periodicity</td>
<td>Ch. 2</td>
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<tr>
<th>II. Molecular Structure and Bonding</th>
<th>Text Sections</th>
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<tr>
<td>Lewis structures and VSEPR theory</td>
<td>Ch. 3</td>
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<tr>
<td>Introduction to molecular orbital theory</td>
<td>Ch. 5 (Sec. 1-3)</td>
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<th>III. Molecular Symmetry</th>
<th>Text Sections</th>
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<tr>
<td>Point groups and group theory</td>
<td>Ch. 4</td>
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<tr>
<td>SALCs and molecular orbital theory</td>
<td>Ch. 5 (Sec. 4)</td>
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<th>IV. Acids and Bases</th>
<th>Text Sections</th>
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<tr>
<td>Brønsted and Lewis acidity; hard-soft theory</td>
<td>Ch. 6</td>
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<th>V. $d$-Metal Coordination Chemistry</th>
<th>Text Sections</th>
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<tr>
<td>Coordination geometries and isomerism;</td>
<td>Ch. 9</td>
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<tr>
<td>Metal-ligand bonding and ligand field theory</td>
<td>Ch. 10</td>
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<th>VI. Electronic Spectra of Metal Complexes</th>
<th>Text Sections</th>
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<tr>
<td>Absorption of light;</td>
<td>Ch. 11</td>
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<tr>
<td>Term symbols; correlation diagrams</td>
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<th>VII. Additional Topics (as time permits)</th>
<th>Text Sections</th>
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<tbody>
<tr>
<td>Organometallic chemistry</td>
<td>Ch. 13</td>
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<tr>
<td>Solid structures</td>
<td>Ch. 7</td>
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## Assignments & Policies

### Problem Sets:

Four problem sets will be assigned. These are intended to help you learn the material, and each student should work on them individually. It is acceptable to discuss problems with other students, but sharing or copying answers is unacceptable and may result in penalties. Problem sets will be due at the beginning of class one week after they are assigned. The instructor will be available during office hours to answer questions and clarify relevant concepts, but solutions will not be provided until after the due date. Any late assignments will receive a grade penalty of 10% for each day until turned in.
**Midterm Examinations:**
Two midterm exams will be given during regular class hours (October 1 and November 5; 75 min each). Exams will be closed book, i.e. no notes or textbooks may be used. Students may miss exams only with valid excuses that can be documented (e.g. death in the family, serious illness with note from doctor). In such an event, no make-up exam will be given; the final grade will be calculated based on the other components (e.g. a point total of 750 will correspond to a grade of 100%).

**Final Examination:**
The final exam will take place on Tuesday, December 8 from 10:30 am -12:30 pm in the regular lecture room. The final will be cumulative and will be a closed book examination. Students missing the final exam who notify the instructor of the reasons for their absence by noon of the day following the scheduled time for the exam will receive a grade of incomplete (“I”) for the course and must arrange a time for a make-up examination with the instructor (not later than the end of the first week of spring classes). If there is no valid excuse for the absence, there will be a fifteen-percent penalty on the exam. Students who miss the final exam and do not notify the professor by noon of the following day will receive a score of zero on the exam.

**Term Paper:**
M.S. and Ph.D. students (i.e. those enrolled in 5560) must complete a term paper that will count for 10% of the final grade. Topics will be due on November 12, and the paper must be turned in by the end of Pre-Finals Week (December 5).

**Grading Scheme for 4610 versus 5560 Students:**
All problem sets and exams will be graded initially on the same scale for 4610 and 5560 students. However, the point totals used in final grade determination for 5560 students will be scaled by a factor of 0.90 in order to accommodate the points from the term paper (see the Grades section on p. 1). If percentage grades for 4610 students are significantly below those for 5560 students, a curve may be applied at the end of the course (at the discretion of the instructor).

**Extra Credit:**
There is no provision for extra credit in this course.

**Attendance:**
There is no grade for attendance, but you are expected to attend all lectures. For many of the topics in this course, there will be additional information presented in lecture that you will miss if you are relying only on the text. If you must miss a lecture, please inform the instructor in advance and make arrangements to pick up handouts for the class you missed.
CHEM 4610/5560

Important Dates

**August 29**  Last day to add a course (end of add/drop)

**October 1**  Midterm Exam #1

**November 3**  Last day to drop a course with instructor’s approval

**November 5**  Midterm Exam #2

**November 12**  5560 Term Paper topics due

**November 27-30**  Thanksgiving Break

**Nov. 29 – Dec. 5**  Pre-Finals Week; 5560 Term Papers dues

**December 8**  Final Examination 10:30 am - 12:30 pm.

**Molecular Models:**
I am requiring purchase of a molecular model set to help you learn to visualize molecular structures and symmetry in three dimensions. The recommended set for this course is the Advanced General & Organic Chemistry set sold by Mega Molecules, LLC. It is available at the UNT bookstore, or you can order it online (list price $21.99; ask for a student discount):

[http://www.megamoleculesllc.com/general-chemistry.html](http://www.megamoleculesllc.com/general-chemistry.html)

You will be allowed to use this model set during examinations. It may be possible to substitute a different model set, if you have one, with the instructor’s approval.

**Use of Computational Chemistry:**
Some of you may have access to computational chemistry programs, such as Gaussian09 and GAMESS, for ab initio and density functional theory (DFT) calculations of molecular properties. While these types of calculations are powerful tools for chemical research, over-reliance on them at early stages of learning can hinder your ability to grasp basic concepts. The use of computational chemistry in graded assignments for this course is not allowed. Any use of these methods may result in grade penalties. After the semester ends, I encourage you to use computations to solidify the knowledge you have gained in the course.
**Academic Integrity:** Students are responsible for honoring UNT’s academic integrity policies ([http://vpaa.unt.edu/academic-integrity.htm](http://vpaa.unt.edu/academic-integrity.htm)). The penalty for cheating on an examination will be a grade of zero on that examination.

**Special Accommodations for Students:** If you feel that you have a disability or any other circumstances requiring special accommodation, please contact the Office of Disability Accommodation (Sage Hall Suite 167, Phone 565-4323). If possible, please meet with the instructor during the first week of classes to discuss the needed arrangements.

**Online Resources for Learning:**

**Course Web Page:**
The instructor will make limited use of the Blackboard Learn page for this course. It will be used primarily to post grades and old exams (to aid in studying). Enter your EUID and password at the following Web address to log in:

[https://learn.unt.edu/](https://learn.unt.edu/)

Old examinations posted on Blackboard are meant to give you an idea of the types of questions and the level of difficulty to expect. However, different material was covered on some of these, and the types of questions given may vary significantly from year to year. These are NOT meant to provide a substitute for studying the lecture notes, and they should not be used as your primary study material.

**Atomic & Molecular Orbitals**
The following website has cool-looking, yet mathematically correct, depictions of atomic orbitals and a few examples of MOs. Especially useful for understanding nodal properties of AOs.

[http://winter.group.shef.ac.uk/orbitron/](http://winter.group.shef.ac.uk/orbitron/)

**Symmetry & Group Theory**
Try the following Web site to help you understand molecular symmetry. It is the only useful Web-based molecular symmetry resource that I know of. However, I think many of you will find physical models more useful for grasping the three-dimensional aspects of symmetry.

[http://symmetry.otterbein.edu/index.html](http://symmetry.otterbein.edu/index.html)

**Note on Using the Internet for Information:** You should be aware that many sources of chemical information on the Internet are unreliable. Simply “Googling” certain terms or using popular Web sites such as Wikipedia will sometimes lead to false or incomplete information. In most cases, you would be better off going to the library to consult published textbooks and reference works, which, unlike some Web resources, have been authored and reviewed by reputable scientists.
**Additional Reading:**

These books will be available for 2 hour loan at the Willis Library Services Desk. Bring your ID and give the passcode `inorglms`.

**General Inorganic Chemistry**

**Descriptive Inorganic Chemistry**
A newer, online eBook version is also available to UNT students:

http://eds.a.ebscohost.com/ehost/detail/detail?sid=a730b4f0-3f39-4dee-beb6-a5fd9ad593ac%40sessionmgr4004&vid=0&hid=4103&bdata=JnNjb3BfPXNpdGU%3d#db=nlebk&AN=33994

**Molecular Orbital Theory**

**Molecular Symmetry and Group Theory**

