CHEM 4367 – Advanced Inorganic Chemistry – Syllabus – Spring 2018

Section: 01 **Time:** 9:30-10:50 am T / Th **Room:** CFS 103
Instructor: Dr. Christopher (Kit) Zall **Email:** zall@shsu.edu **Office:** CFS 304
Office Hours: M/F, 3:00-4:00, or by appointment **Phone:** 294-1525

Required Textbooks:

Inorganic Chemistry, *5th Ed.*, Miessler, Fischer and Tarr, ISBN 978-0-321-81105-9 (or other recent editions)
Molecular Symmetry and Group Theory, *2nd Ed*, Vincent, ISBN 978-0471489399 (e-book available through the Library but a hard copy is highly recommended)

Other Recommended Materials:

Any general chemistry textbook, ebook, or virtual textbook (some of these are available on Blackboard)

A molecular model kit containing trigonal bipyramidal and octahedral atoms. The Inorganic-Organometallic Kit at darlingmodels.com is recommended. The Prentice Hall set for General and Organic Chemistry is often recommended for inorganic courses but is pricey. If you can find a cheap used set, go for it.

Other textbooks available on reserve at the Library:

Inorganic Chemistry, House
Inorganic Chemistry, Housecroft and Sharpe
Molecular Symmetry, Willock (available in hard copy or e-book)
Advanced Inorganic, Cotton and Wilkinson

Course Description:

This course will cover inorganic chemistry with a focus on complexes of the transition metals and their applications. The emphasis is on the underlying theoretical concepts of structure and bonding. No prior knowledge of inorganic chemistry is assumed, but you will need an understanding of structure and bonding principles from organic chemistry and the properties of atomic orbitals and electronic structure principles covered in general and physical chemistry courses.

Prerequisites:

Grades of C or better in CHEM 1411, 1412, 2323, 2325, and 4448 are required for this course.

Course Overview:

The course structure can be viewed as three sections:

- "Groundwork" for electronic structure of inorganic complexes
- Application of molecular orbital theory to complex inorganic molecules
- Reactions of transition metal and organometallic compounds

A more detailed breakdown of the topics is given on the next page

Course Breakdown:

- "Groundwork" for electronic structure of inorganic complexes
    - Review of basic principles of atomic structure and bonding
    - Molecular symmetry and elements of group theory
    - Basic Molecular Orbital theory applied to diatomic molecules and metal-ligand fragments
        - This section will draw heavily from the Vincent text and partly from Chapters 2, 3, 4, and 5 of the Miessler text.
- Application of molecular orbital theory to complex inorganic molecules
    - Polyatomic main-group ("AB_n") molecules such as H_2O and BF_3,
    - Transition-metal complexes ("ML_n") complexes such as $Ni(CO)_4$ and $[Fe(H_2O)_6]^{3+}$.
    - Properties of transition metal complexes: ligand types, oxidation states, electron configurations, and resulting spectroscopic/physical properties
        - This section will primarily draw from Chapters 5, 10, 11, and 13 of the Miessler text.
- Reactions of transition metal compounds
    - Reactions of coordination complexes
    - Organometallic chemistry
    - Catalysis
        - This section will draw from Chapters 12 and 14 as well as selected readings from the primary literature.

Grading Breakdown: You are responsible for keeping track of your grade in this class. Grades for individual items will be posted on Blackboard periodically as appropriate, but Blackboard will not calculate your overall grade. You can calculate your grades on your own using the weighting schemes listed below.

Item	% of grade/weighting factor
Exam 1	20% / 0.2
Exam 2	20% / 0.2
Exam 3 (Final Exam)	20% / 0.2
Quizzes	20% / 0.2
In-Class (Group) Problem Sets	10% / 0.1
Take-Home (Individual) Problem Sets	10% / 0.1
Total	**100%**

Your grade is the sum of your scores (as a percentage) for the items listed above multiplied by their respective weighting factors.

- For example, if you earned scores of 75%, 85%, and 80% on the exams and averages of 90% for quizzes and 100% the two types of problem sets, your overall grade would be:
  0.2*(75%) + 0.2*(85%) + 0.2*(80%) + 0.2*(90%) + 0.1*(100%)x2 = 86.7%

- Alternatively, because exams are collectively worth 60% of your grade, you can calculate your overall grade by multiplying your current exam average by a weighting factor of 0.6. This is convenient earlier in the term, when you do not have grades for all of the exams yet. For instance, in the example above, your grade after the exam 1 score of 75%, assuming the same scores for problem sets and quizzes, would be:
0.6*(75%) + 0.2*(90%) + 0.1*(100%)x2 = 83.0%

In-Class (Group) Problem Sets:
Nearly every class will include some number of worked questions. Occasionally these will be in the form of graded problem sets to be worked on by a group of 3-4 students. These problem sets will be *peer-graded*: your group will grade the work of another's, and vice versa, based on a rubric given in class. The grades will be double-checked by Dr. Zall as they are recorded. Honest and scrupulous grading is assumed, and any misconduct in grading may be subject to disciplinary action.

Take-Home Problem Sets:
There will also be occasional problem sets (probably 4-6 in total) assigned throughout the term that are to be completed *individually*. You may work on these in groups, but the work you turn in must be your own – you must use your own words and be able to explain any conclusions. These will be graded on a check-plus/check/check-minus basis.

Quizzes:
At least four and likely six quizzes will be given in class, with advance notice given at least one week prior to the quiz. The first two are primarily aimed at instilling stored (memorized) knowledge that you should have at your disposal as a working chemist. The first quiz will be on electronegativity values for the main-group elements, as defined by Pauling (1960). You will be given a periodic table and will fill in the values. The second quiz will be on the periodic table – you will get a blank table and fill in all of the main-group and transition-metal elements (no lanthanides, actinides, or transactinides). The third and fourth quizzes will cover concepts of symmetry and bonding as discussed in the lectures, and other likely quizzes will cover aspects of coordination chemistry including ligand properties, oxidation states, etc.

Policies for Late Work and Absences:
Your attendance in class will be recorded but not graded. Late problem sets will not be accepted, since we will go over the problem sets in class the day they are due. If you miss a class, arrange with another student to go over their notes – we will not go through the course material in the order it is presented in the textbook, so it is your responsibility to figure out what you missed. If you miss a quiz for an excused reason, we will arrange a time for you to make up the quiz outside of class. Make up exams will be given only in extreme circumstances. If you will need to miss an exam for such a reason (personal or close-family hospitalization, or similar unforeseeable circumstances), email the instructor immediately and obtain documentation. Only the course instructor can excuse your absences. A missed exam or quiz for an unexcused reason will count as a zero.

Academic Dishonesty:
Any student found guilty of dishonesty in their academic work will be subject to disciplinary action. The University may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating, plagiarism, and the abuse of resource materials. If the instructor believes that a quiz or exam is a copy of another student's work, BOTH copies will receive a grade of 0%, and disciplinary action will be considered.