CHE 430 ADVANCED INORGANIC CHEMISTRY
Spring 2007
Marian College
3200 Cold Spring Road, Indianapolis IN 46222

Instructor:	Dr. Roderick M. Macrae
Phone:	955-6064
E-mail:	rmacrae@marian.edu

Office Hours:	MWF 10.00-10.50 am W 2.00-4.00 pm
Lecture:	3 semester hours 12.00-12.50 am MWF Room 355
Laboratory:	N/A

Course Description: The structure and properties of solid materials and molecular inorganic compounds based on modern concepts of symmetry and chemical bonding.

Textbooks: Inorganic Chemistry – Principles of Structure and Reactivity, James E. Huheey, Ellen A. Keiter, Richard L. Keiter, 4th Ed., HarperCollins, 1993.

Supplementary texts/recommended reading:
Advanced Inorganic Chemistry, F. Albert Cotton and Geoffrey Wilkinson, Wiley.
Symmetry in Bonding and Spectra – an Introduction, Bodie E. Douglas and Charles A. Hollingsworth, Academic Press.
Structure and Dynamics – an Atomic View of Materials, Martin T. Dove, Oxford University Press.
Solid State Chemistry – Compounds, A. K. Cheetham and Peter Day (Eds.), Oxford University Press.

Other needs: Scientific calculator.

Course Summary: CHE 430 is an upper division course recommended for chemistry majors and is a required course for the BS in Chemistry. The course continues the exploration of inorganic chemistry from its introduction in CHE 151 and 152, but concentrates on developing a modern understanding of molecular structure, molecular and crystal symmetry, reactivity and spectroscopy. CHE 320/321 or instructor permission are prerequisites.

CHE 430 contributes towards General Education objectives in the areas of Scientific and Quantitative Understanding and of Effective Communication. Particular areas include:

- Scientific (empirical) method of problem-solving and inquiry.
- Fundamental laws of nature and their significance.
- Mathematical reasoning, techniques of understanding numerical data.
- Critical, analytical, and creative thinking skills in written and oral communications.

Assessment of the Course Objectives is through (1) 2-3 semester tests and a comprehensive final examination, and (2) a term paper and oral presentation focusing on an area of inorganic chemistry in the current chemical literature.

Course Objectives: The main goals of this course are to extend the student's acquaintance with inorganic chemistry both in breadth and depth from the introduction in CHE 151 and 152, making use of the principles of group theory and quantum mechanics to generate an organized picture of structure and bonding. In particular, on completion of CHE 430 students should:

1. Be able to use principles of symmetry and group theory to explain molecular energy levels and spectra.
2. Be able to give an account of the properties of atoms and ions using the terminology of quantum mechanics.
3. Be able to predict the stability and structure of ionic compounds based on Born-Landé theory.
4. Be able to use the concepts and terminology of valence bond theory and molecular orbital theory in describing observed patterns of bonding.
5. Show a knowledge of the principles behind the physical methods (X-ray diffraction, electron diffraction) used in the determination of molecular and solid-state structure.
6. Be able to discuss the conductivity properties of solids using the terminology of band theory.
7. Be able to describe the types of defect commonly found in crystalline materials.
8. Be able to discuss the reactivity between metals and ligands in terms of acid-base concepts.

9. Be able to apply the principles of valence bond theory, ligand field theory, and molecular orbital theory to discussion of the energetics and spectra of coordination complexes.
10. Be able to give an account of isomerism in coordination complexes.
11. Show familiarity with the common oxidation states of transition metal ions.
12. Show a knowledge of the characteristic features of transition metal, lanthanide, and actinide spectra.
13. Be able to apply the 18-electron rule in discussing the stabilities of organometallic compounds.
14. Show an acquaintance with typical chain, layer, cage and cluster compounds.
15. Show an understanding of bonding in compounds of the noble gases.

Laboratory Experiments: None.

Course Requirements and Assessment Method:

1. Assessment will be based on approximately 2-3 tests and a comprehensive final exam, to be held on Monday, April 30, from 1.00 to 2.45 pm. All exams must be taken on the scheduled days unless there is a valid reason not to take the exam at that time. If you miss an exam for a valid reason, the exam must be taken as soon as possible after the scheduled day.
2. You are encouraged to participate actively in class by reading the relevant material beforehand, asking questions, and taking notes. Ideally, the class should form a fertile environment for mastery of chemical ideas.
3. There will be a term paper and accompanying oral presentation based on a literature research project. The student will choose a topic of current interest in inorganic chemistry, carry out literature research on the topic, write a properly annotated literature review paper, and give an oral presentation on the same topic. Topics must be chosen by mid-term, first draft papers are due by Friday April 13, and final versions are due by reading day. Draft outlines of oral presentations are also due by April 13. Oral presentations will be given in the final week of the semester.
4. You are expected to understand and adhere to the College's policy on academic honesty. You should read the appropriate sections in the Code of Student Rights and Responsibilities (pp. 33-38) with care.

Attendance:
Regular attendance is important for your learning and for maximizing your interaction with the instructor and with others in the class. It is not usually necessary to impose grade penalties for absences, as students who miss a substantial fraction of classes tend to do poorly in examinations. However, if you are absent for more than 20% of the course, you will receive an F.

Grading Criteria:

1. The overall grade is calculated as follows:

Homework, class tests, and assignments:	40%
Final exam:	30%
Term paper:	15%
Oral presentation:	15%

   The letter grading scale follows common standards, with >90% corresponding to A, 80-89% corresponding to B, 70-79% corresponding to C, 60-69% corresponding to D, and <60% corresponding to F. The marks may be curved if needed. In the case of unsatisfactory marks in a semester test, it will be possible to retake the test within the same week, and the better of the two marks will count towards your grade.
2. The term paper should be word processed and on the order of 10 pages in length. It should make appropriate use of tables, figures, and citations from the chemical literature. The paper will be graded on use of technical language and style, clarity of expression, structure, and appropriateness of literature citations.
3. The oral report will be graded on clarity, structure, and use of technical language.