Chemistry 5520
Advanced Inorganic Chemistry

Fall, 2009

Class time : 9:00 am MW, Maeser Lab 151

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Text:

General readings and review: "Inorganic chemistry" by Housecroft and Sharpe; supplemental material provided via web.

Objectives:

To cover in depth advanced topics of structure, bonding, and reactivity in inorganic compounds. The major objective is to use principles of spectroscopy and structure determination for understanding issues of bioinorganic chemistry and related topics (see details of official *Learning Objectives* below)

Note: Thorough reading of the text and supplementary material is required and advanced preparation for class discussion and problem solving (by students) is required.

Grading:

Problem assignments (semester total of 100 pts).....100 pts
as determined for each chapter (text problems) and as handed out

Exams: 2 mid-term exams (@ 100 points) .....200 pts
Comprehensive final (200 points)…..... 200 pts
total 500pts

Letter grade ranges : 100-90% **A** 89-80% **B** 79-60% **C** 59-50% **D**

Planned Coverage

The Study of atomic structure via Photoelectron spectroscopy:
- Quantum Numbers, Terms, States, and "photolines" via X-ray and U.V photoelectron techniques

Applications of Symmetry and Group theory

Covalent Bonding and Photoelectron spectroscopy- relationship to vibrational quanta and excited states

Structure and Reactivity of (small) molecules

Solid State – molecular orbital theory in metals and semi-metals

Coordination Chemistry- Spectra, Bonding, Magnetism

Coordination Chemistry- Structure

Organometallic and biological systems- catalysis, electron transfer,

In accordance with the Americans with Disabilities Act, reasonable accommodation will be made for all persons with disabilities in order to assure equal participation in Chem 5520. Please meet with Dr. Hubbard during the first week of class to make arrangements.

BlackBoard Web- Resources:

I will use BlackBoard to deliver supplemental material for the course. In addition, I will use the BlackBoard utilities to manage e-mail questions, after-class discussions, and to post notes and sample exam materials.

You will be automatically enrolled in the BlackBoard system at the beginning of the semester. Your BlackBoard ID is your Banner ID and your password is your Banner password.

Class meetings:

We only have 2 meetings per week (2 credit class). Therefore, it is imperative that we utilize the time effectively. Since this is an upper-level class, it is expected that you arrive prepared to participate in discussions and group problem solving.

I will announce the readings in advance of class and pose a number of "questions for discussion" for each meeting. I will try to avoid the tedium of "lecturing" – rather I will arrive to address questions and stimulate discussions.

Exams:

We will have two mid-term "take home" exams and one "take home" final. These will be extensions of the 10 problem sets that will be posted weekly.

Learning Objectives for Advanced Inorganic Chemistry
Chem 5520

Students emerging from Chem 5520 should be able to:

1. Use basic aspects of group theory to describe Molecular Orbitals for small molecules and for coordination complexes
2. Use group theory to generate and factor reducible representations for molecular vibrations, rotations, translations.
2. Draw and interpret molecular orbital correlation diagrams for small molecules.
3. Describe the electronic structure of transition metal complexes using ligand field theory.
4. Apply concepts of electronic term symbols to identify the ground states of transition metal complexes.
5. Use Tanabe-Sugano diagrams to predict the number and energy of electronic transitions for metal complexes.
6. Use delocalized bonding models to describe the bonding in metals, semiconductors; describe the fundamental properties of a solid-state diode, transistor, photocell using band theory models.
7. Describe and interpret formation constants, hydration enthalpies, ligand field stabilization energies, Jahn-Teller effects chelate effect; kinetic aspects: ligand substitution and electron transfer mechanisms, fluxionality, tautomerism, and sterochemical nonrigidity.
8. Describe selected industrial catalytic processes and important industrial processes, such as hydrogenation, hydrocyanation, hydrosilylation, hydroformylation, Ziegler-Natta polymerizations, Wacker processes, Fischer-Tropsch reactions.
9. Describe selected models of bioinorganic chemistry, including model system approaches, regulation and transport of ions, metalloproteins, iron-sulfur proteins, vitamin B12 and other cobalamins, and metalloenzymes.

"Gain Score" Assessment Strategies

In order to gauge the effectiveness of the Chemistry 5520 course, several different methods of "Gain Score Analysis" will be employed. A "gain score" is a measurement of how much a student's capability has (hopefully) increased between the beginning of a class and the completion of the course. One measurement is the comparison of the performance on weekly quizzes and to the performance on the midterm exams. Another measurement is how the midterm exam scores compare to the comprehensive final exam grade. It is possible that the final exam could be a nationally "standardized" exam designed to cover the material in Chem 5520. Throughout the semester, "embedded questions" will be presented. These kind of questions

emphasize the above-mentioned “Learning Objectives” and help us assess the overall quality of the Chem 5520 course.