CHEMISTRY 220: INORGANIC CHEMISTRY
COURSE OUTLINE
WINTER 2004

A. General Information

Instructor: Neil Meanwell Office: F348B **Telephone**: 370-3448

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Office Hours: Monday: 1.30 pm to 2:30 pm, Tuesday: 11.30 am to 12.30 pm and 1.30 pm to 2:30 pm, Wednesday: 12.30 pm to1:30 pm, and Friday: 10:30 am to 11:30 am.

Scheduled Lectures: Monday, Tuesday and Wednesday, 9:30 am to 10:20 am, in F360.

Scheduled Labs: Tuesday: 2.30 pm to 5:20 pm, in F 356.

B. Course Textbook

Basic Inorganic Chemistry, 3rd Edition, F. A. Cotton, G. Wilkinson, and P.L. Gaus, Wiley, (ISBN 0-471-50532-3). Available from the Camosun Bookstore.

C. Lecture Material

The course will cover the following chapters in the textbook.

Topic

1. The Electronic Structure of Atoms (Chapter 2)

Fundamental particles, atomic number, mass number, and isotopes. Line spectra, Bohr's model of the hydrogen atom. Wave mechanics, orbitals of the hydrogen atom and quantum numbers. Multi-electron atoms and ground state electron configurations, the periodic table. Effective nuclear charge, Slater's rules. Periodic Trends in the Properties of the Elements, ionisation energies, atomic radii, ionic radii, electron attachment enthalpies, electronegativities

2. Structure and Bonding in Molecules (Chapter 3)

Localised bond approach, Lewis structures, resonance, hybridisation. Molecular shapes (VSEPR). The delocalised approach to bonding, molecular orbital theory, orbital overlap, MO theory for homonuclear diatomic molecules, Φ, B, and $*$ notation, heteronuclear diatomic molecules, some simple polyatomic molecules.

3. Bonding in Ionic Solids (Chapter 4)

Lattice energies, Born-Haber cycle, ionic radii, types of crystal lattices.

4. d-Block Chemistry: Coordination Complexes (Chapter 6)
Structures of coordination compounds, coordination numbers and coordination geometries, types of ligands, isomerism in coordination compounds, nomenclature in coordination compounds, stability of coordination compounds, chelate effect, reactivity of coordination compounds.

5. d-Block Chemistry: Ligand Field Theory (Chapter 23)
The crystal field approach, the molecular orbital approach, magnetic properties of transition metal compounds, high- and low-spin states, electronic spectra, charge transfer spectra, spectrochemical series, structural and thermodynamic effects of d-orbital splittings, ionic radii, Jahn-Teller effect.

6. d-Block Chemistry: General Chemistry of the First Transition Series
Topic overview, ground state electronic configurations, physical properties, reactivity of the metals. Some chemistry of the metals from scandium to zinc.

7. Chemistry of the Group 14 Elements (Chapter 15)

Introduction, occurrence, extraction and uses. Physical properties, allotropes of carbon. Structural and chemical properties of silicon, germanium, tin and lead. Hydrides, carbides, halides and complex halides, oxides, oxoacids and hydroxides. Silicones, sulphides, cyanogen and silicon nitride, aqueous solution chemistry. Silicates.

8. Chemistry of the Group 18 Elements (Chapter 21)

Introduction, occurrence, extraction and uses, compounds of xenon, krypton and radon.
9. Homogeneous and Heterogeneous Catalysis (Chapter 30)

Introduction and definitions. Introductory concepts. Homogeneous catalysis and industrial applications. Heterogeneous catalysis.

10. Bioinorganic Chemistry (Chapter 31)

General terminology, metal storage and transport, dealing with dioxygen, including hemoglobin, myoglobin, cytochromes P-450, biological redox processes, role of zinc.

Note: the above description of the course material is intentionally very brief. A more detailed description is given at the beginning of course text under “Table of Contents”. I will follow the text very closely but may at times hand out additional notes to supplement the book.

D. Assignments

Assignments questions will be set from the relevant chapters in the text as well as some additional questions of my own. The assignments will keep pace with the lectures. Your answers will not be marked but solutions will be posted outside my office. It is **highly recommended** that you do these assignments as they will prepare you very well for the exams.

E. Exams

You will be required to take the following exams:

Midterm 1 Week 7. A written exam of 120 minutes duration covering the material presented in the first six weeks of the course. Written during the lab period of Week 7.

Midterm 2 Week 12. A written exam of 120 minutes duration covering the material presented from Week 6 to Week 12 of the course. Written during the lab period of Week 12.

Final Exam - In the week following the end of the semester. A written exam of 180 minutes duration covering **all** the material presented in the course.

F. Laboratory Work

You will be required to perform a laboratory experiment each week of the semester except for the first and last weeks and when midterms are scheduled. More details will be given during the introductory lab meeting given in the first week.

G. Course Mark

The course mark is derived in the following manner:

2 Midterms	(@ 20%)	40%
Final		35%
Labs		25%

If it is advantageous to the student the theory mark will be solely derived from the final examination. Also, if you score lower in one or more of the midterms than the final exam, then the lower score(s) will be dropped and replaced by an equal weighting from the final exam mark.

H .The Letter grade

The following scale is used:

>95 A+ 80-84 B+ 65-69 C+ 50-59 D 0-49 F

90-94 A 75-79 B 60-64 C

85-89 A- 70-74 B-

Notes

1. You must score a **minimum of 50%** on lab marks to be permitted to take the final exam.

2. You must pass both the lecture portion and the laboratory portion in order to pass the course.

I. Intended Learning Outcomes

1. Utilize a detailed knowledge of the electronic structure of atoms to rationalize many of the physical and chemical properties of atoms.
2. Apply simple and sophisticated bonding theories to explain many of the properties of ionic and molecular substances.
3. Comment on the chemistry of the first row transition metals, especially in respect to formation of coordination compounds, their catalytic activity, and their relevance to bioinorganic chemistry.
4. Describe the major features of the chemistry of the main group elements of groups 14 and 18.
5. Use equipment associated with the preparation and analysis of inorganic compounds and perform reactions under an inert atmosphere for air- or water-sensitive compounds.
6. Outline the common approaches to synthesizing inorganic and coordination compounds in the laboratory.