Descriptive Inorganic Chemistry

CHEMISTRY 362
SPRING 2008

TEXT Cotton, Wilkinson and Gaus "Basic Inorganic Chemistry," Third edition Wiley & Sons, Inc., 1995

ADDITIONAL REFERENCE Housecroft and Sharpe "Inorganic Chemistry" Third Edition Pearson, Prentice Hall, 2008.

INSTRUCTOR Professor Kim R. Dunbar, RM 2311 Chemistry Building

CLASS TIME **MWF, 1:50 – 2:40 PM, CHAN 2102**

OFFICE HOURS Professor Dunbar will be available, Wed and Fri, 3:00 – 4:00 PM.

GRADER Mr. Edward Funck, Room 2312, Chemistry Building

This course begins with a review of basic bonding and structural concepts and then moves into descriptive chemistry of transition metal and main group elements. **Descriptive chemistry** is the term applied to the understanding of how compounds react with one another to form new compounds (much in the same manner as pure elements react to form compounds). It is a unified body of information resulting from periodic trends and fundamental chemical concepts and not a collection of unrelated facts and observations. Many students in a class like this one try to memorize everything rather than attempting to understand the underlying principles behind the reactions. With the exception of the periodic table, which everyone should memorize, try to avoid mere memorization and instead identify the reasons why a reaction occurs in a particular manner. If you adopt this approach, you will be better equipped to predict when and how related compounds will react. *Bear in mind that the periodic table is the main tool of the inorganic chemist.* To make educated guesses about chemical reactivity one must understand some basic principles and then apply these principles to the compounds in question.

In this course, we first discuss numerous concepts – many of which you have already encountered – and then apply them to representative examples. Please study the appropriate sections of the text (and other chemistry books that you find helpful) prior to the class session in which the material is discussed. You must be prepared to invest time in this course in order to reap the benefits of a more than superficial comprehension. Reading the test, attending lectures as well as asking questions are prerequisites for success in this course.

Examination questions generally cover topics that are discussed in lecture, are assigned for homework, or are extensions of these topics. Also, note that some of the topics covered in the text will be omitted from my lectures.

LECTURE CHAN 2102, MWF, 1:50 – 2:40 PM

QUIZZES **Six (6) 30 minute "Mini Exams" will be given the last 30 minutes of lectures on the days designated in the course outline or dates that will be announced in class if the schedule changes**

HOMEWORK There will be eleven (11) homework assignments. You may omit one set without losing points. If all are completed, the lowest grade will be deleted.
Each homework set will be scaled to 25 points, for a maximum homework grade of 250 pts. Note that only representative problems will be graded.

COURSE POINTS

Homework	(10 @ 25 pts/each)	250 pts
Mini Exams	(6@50 pts/each)	300 pts
Final Examination		150 pts
Total		700 pts

SCHEDULE HOMEWORK & EXAMS Problem assignments will be collected by the grader. ONLY SELECTED PROBLEMS WILL BE GRADED.
Mini Exams will be given during the last 30 minutes of class on the designated dates.

GRADING SCHEME The anticipated course grading scale is indicated below

>85% A	≥65% C
≥75% B	≥55% D

ADA STATEMENT: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Room 126 of the Koldus Building or call 845-1637.

AGGIE HONOR CODE: "An Aggie does not lie, cheat, or steal or tolerate those who do."Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes. For additional information please visit: www.tamu.edu/aggiehonor/

CHEMISTRY 362, SPRING 2008
Descriptive Inorganic Chemistry
Topic Outline

A lecture outline is provided in the following pages. It lists the topics and appropriate pages numbers from the main textbook, Cotton, *et al*. Lectures will adhere to a schedule that is in accord with the pace of the class comprehension.

CLASS TIME: AND LOCATION: 1:50 – 2:40 PM, CHAN 2102

Week	Chapter: Pages	Topics
	1:3-25	Independent study and review, as appropriate.
1	1:3-25	**Preliminaries/Review**
	2:35-63	Quantization & quantum numbers: transitions; Atomic H-like orbitals. Many-electron atom; The *Aufbau* principle. Periodic trends of atoms: electronegativity; ionization enthalpies; Atomic Radii.
2	3:73-120	**Structure and Bonding**
Mon, Jan. 21, Holiday		
	3:73-98	Localized Electron-paired bonds: Lewis Structures; Formal charge, resonance. Molecular shape: Hybridization and VSEPR; Bond Lengths and Covalent radii; van der Waals radii;
	3:98-111	Delocalized Bonding: Molecular Orbital Theory Homonuclear diatomic molecules; Heteronuclear diatomic molecules
3	3:111-120	**Polyatomic Molecules**
	4:125-142	M.O. Construction; Multicenter Bonding in Electron Deficient Molecules
	Mini Exam I	**30 Minute Mini Exam over Topics in Chapters 1 and 2: Mon, Feb 4**
4	5:147-162	**Ionic Solids** Crystal Lattices and Lattice energy; Born-Haber cycle; Geometries of Crystal Lattices; Structures of Ionic Solids -Close Packing of spheres; Ionic Radii; Mixed Metal Oxides
5	6: 165-198	**Chemistry of Selected Anions** Oxides, Hydroxides, and Alkoxides Non-Metal Polyoxoanions of N,P,S and Halogens; Transition Metal Polyoxoanions.

	Mini Exam II	**30 Minute Mini Exam over Topics in Chapters 3: Feb 18.**
Week 6	6: 199-211	**Coordination Chemistry** Coordination Number, Types of ligands; Isomerism in Coordination Compounds; Chiral complexes; Nomenclature; Stability and Reactivity of Coordination Compounds.
7	6:199-211	Coordination Chemistry continued: Substitution Reactions; Electron – Transferred Reactions; Sterochemical Non- Rigidity.
	23:503-518	**Bonding in Coordination Complexes of the Transition Metals** Ligand Field and Crystal Field Theories. Molecular Orbital Approach for Octahedral Complexes. Correlation of Theory with Experiment. Magnetic Properties Other Geometries – Tetrahedral/Square Planar
	Mini Exam III	**30 Minute Mini Exam over Topics in Chapters 4, 5, 6: March 3**
8	23:519-537	**Electronic Spectra of Atoms** Spectroscopic Terms: Ligand-field (d-d) Transitions. Charge Transfer Bands (Metal-to-ligand and ligand-to metal) Selection Rules and Intensities; Spectrochemical Series.
	Appendix I 785-791 804	Symmetry in Molecules; Symmetry Elements and Operations Determination of Point Groups
Spring Break March 10-14 (so skip this week in the numbering scheme)		
9	8:241-268	**The Periodic Table and the Chemistry of the Elements**
Friday, March 21, Reading Day, no Classes		The Nature and Types of Elements: Mono versus Polyatomic Molecules; Extended Structures. Periodic Trends and chemistry of the Elements of the First Short Period. Elements of the Second Short Period Remainder of Non-Transition Elements. Transition Elements of the d and f Blocks.
	9:273-283	**The Main Group Elements** Hydrogen. Bonding of Hydrogen; The Hydrogen Bond; Ice and Water Hydrates; Hydrides - Saline Hydrides; Metallic Hydrides Hydrogen as a Ligand.
	Mini Exam IV	**30 Minute Mini Exam over Topics in Chapter 23, Appendix I: March 24**

10	10: 287-302	**Group IA Elements**. Alkali metals
	11: 307-314	**Group IIA Elements**. Alkaline earth metals. Beryllium; Magnesium; Binary Compounds; Oxo Salts, Ions and Complexes; Summary of Trends.
	12: 319-333	**Boron Chemistry** Oxygen Compounds; Halides; Hydrides – Boranes.
11	13: 357-365	**Group IIIB Elements** Al and Ga; In, TI, and GA; summary of Trends
	14: 369-380	**Carbon Group** Diamond, Graphite, the Fullerenes and Carbides; Chemistry of Carbon with O, N S
	15: 383-392	**Group IVB** Si, Ge, Sn, Pb Multiple Bonding; Isolation and Properties; Hydrides; Chlorides; Complex Compounds; The Divalent State; Summary of Trends

Mini Exam V 30 Minute Mini Exam over Topics in Chapter 8, 9, 10, 11, and 12: April 7

12	16: 399-412	**Nitrogen** Multiple Bonds; Hydrides; Oxides; Acids; Halides; Summary of Reactions.
	17: 417-428	**Group VB: P, As, Sb, Bi** The Elements; Hydrides; Halides; Oxohalides; Oxides; Sulfides; Oxo Acids. Complexes of Group VB Elements: P,N Compounds; Double Bonds; Summary of Trends.
	18: 435-447	**Oxygen** Occurrence, Properties and Allotropes; Ozone Ionic Oxides; Covalent or Molecular Oxides
13		**Chemistry of Oxygen Continued** Acid-Based Properties; Hydrogen Peroxide; Peroxides; Superoxides; Oxygen Compounds Ligands
	19: 451-461	**Group VIB: S, Se, Te, Po** Occurrence; Hydrides; Halides; Oxides; Acids.
	20: 465-478	**The Halogens: F, Cl, Br, I, At** Occurrence of the Elements; Halides; Oxides; Interhalogens; Organofluorine Compounds.

Mini Exam VI 30 Minute Mini Exam over Topics in Chapter 13-16: April 21

Week 14- end of classes
If time permits and we are on schedule
Forefront Topics in Inorganic Chemistry- to be announced

Note that April 29 is the last day of classes. Although it is a Tuesday, it is a re-defined day and Friday classes are to meet.

FINAL EXAM (EXAM WEEK)
May 2 and 5-7