

Revised 03/31/02

CHEM3120
Chemical Systems II
Spring Quarter 2002

Professor G. R. Eaton

Description:

This course is described in the bulletin as follows: "Interpretation of the chemistry of the elements in terms of orbital interactions. Most examples will be taken from the 3d transition metals and the boron and carbon groups." Throughout, there will be an emphasis on periodic properties.

Background assumed:

This course will use your undergraduate education in descriptive chemistry of the elements, some of the content of MS&E I and MS&E II and small amounts of introductory biochemistry.

Text: The text titled Inorganic Chemistry by Wulfsberg, which you were advised to purchase for MS&E I in Autumn Quarter 2001, will be the primary text for this course. A list of additional sources of information that you may find useful will be given to you from time to time.

In MS&E I, you were assigned reading in Wulfsberg concerning molecular orbitals, symmetry, character tables, and IR spectra, including most of chapters 9 and 10. We will apply the information in these sections of Wulfsberg to topics covered in this course.

Method of Instruction:

Instruction will be by assigned reading, homework problems, and lectures. Students are encouraged to work together to learn the material. Homework will not be graded. Instead, the understanding of the material taught via homework problems will be sampled via short quizzes.

Schedule: MWF 9:00-9:50, in Olin 103, plus other times by mutual agreement to replace classes I will miss.

I will be away from Denver for scientific meetings April 6-13, May 2-3, and May 23-24. These meetings will cause me to miss a total of 5 classes. During one of these there will be an exam. The other classes 4 will be rescheduled. We will have to find mutually agreeable times to make up these classes. The timing of replacement classes is an attempt to avoid conflict with the schedule of CHEM4800.

Course outline: The following is a very rough and tentative course outline. It will be refined and firmed up a week or so into the course.

class	Date	Topic	reading	homework
1	M 3/25	Periodicity	Ch. 1, 6.5, 7.4, 13.2	
2	W 3/27	“		
3	F 3/29	Bond energies and complex ions	3.1, 3.2, p. 127	
4	M 4/1	Lattice energies and solubility	4.8	
5	W 4/3	Coordination complexes and equilibria	5.1, 5.2	
6	W 4/3	Electronic Structure of Metal Complexes	Ch. 8	
7	F 4/5	“	“	
8	M 4/15	“	“	
9	W 4/17	Organometallic compounds and catalysis	Ch. 11	
10	F 4/19	“	“	
11	M 4/22	Elements and Their Physical Properties	Ch. 12	
12	W 4/24	Oxides of the Elements	Ch. 13	
13	F 4/26	Halides, Nitrides, and Sulfides of the Elements	Ch. 14	
14	M 4/29	Hydrides and alkyl compounds	Ch. 15	
15	W 5/1	“	“	
16	F 5/3	Exam (through lecture 15)		
17	M 5/6	Reaction mechanisms	Ch. 16	
18	W 5/8	“		
19	F 5/10	“		
20	M 5/13	“		
21	W 5/15	Excited electronic states, Tanabe-Sugano diagrams, etc.	Ch. 17	
22	W 5/15	“		
23	F 5/17	“		
24	F 5/17	“		
25	M 5/20	“		
26	M 5/20	“		
27	W 5/22	“		
	M 5/27	DU holiday		
28	W 5/29	A survey of interesting inorganic compounds and their spectra		
29	F 5/31	Summary example		
30	M 6/3	Review		
	T 6/4	Final exam	8:00-9:45	

Bibliography of potentially useful books.

The background material assumed for this course can be found in books such as:

Rodgers, Glen E., Descriptive inorganic, coordination, and solid state chemistry
Brooks/Cole, 2002, 2nd ed. (or the prior edition, published by McGraw-Hill)

Rayner-Canham, Geoffrey. Descriptive Inorganic Chemistry, 2nd ed., W.H. Freeman,
New York, 2000 (1st ed., 1996).

F. Albert Cotton, Geoffrey Wilkinson, Paul L. Gaus, Basic Inorganic Chemistry, 3rd ed.
New York, J. Wiley, 1995.

When searching for specific aspects of chemistry covered in this course, you may find it
useful to refer to one of the other text books used in this course in prior years,

Keith F. Purcell, John C. Kotz, Inorganic chemistry, Philadelphia, Saunders, 1977.

Bodie E. Douglas, Darl H. McDaniel, John J. Alexander, Concepts and models of
inorganic chemistry, 3rd ed., New York : Wiley, c1994.

Duward F. Shriver, Peter Atkins, Cooper H. Langford, Inorganic Chemistry, 2nd ed.,
New York : W.H. Freeman, 1994.

The following text, used in an undergraduate course by one member of the class, is also
useful for reference.

G. L. Meissler and D. A. Tarr, Inorganic Chemistry, Prentice-Hall, Englewood Cliffs, NJ,
1991 and later editions.

I commonly refer to the following books:

N.N. Greenwood and A. Earnshaw, Chemistry of the elements. 2nd ed. Butterworth-
Heinemann, Oxford, Boston, 1997.

F. Albert Cotton ... [et al.] ; with a chapter on boron by Russell Grimes. Advanced
Inorganic Chemistry. 6th ed., New York, Wiley, 1999, or prior editions.

Inorganic chemistry / founded by A.F. Holleman ; continued by Egon Wiberg ; translated
by Mary Eagleson, William Brewer ; revised by Bernhard J. Aylett. 1st English ed.,
edited by Nils Wiberg., Academic Press ; San Diego, Berlin, New York : De Gruyter,
2001. (I have the library copy of this book – please ask me for it when you want to read
it.)

A.B.P. Lever, Inorganic electronic spectroscopy, 2nd ed., Elsevier, Amsterdam, New York, 1984.

Additional information may be found in one of the comprehensive treatises on inorganic chemistry.

Comprehensive coordination chemistry : the synthesis, reactions, properties and applications of coordination compounds, 1st ed., editor, Sir Geoffrey Wilkinson, executive editors, Robert D. Gillard, Jon A. McCleverty, Oxford, England ; New York : Pergamon Press, 1987.

Comprehensive inorganic chemistry. Editorial board: J. C. Bailar, Jr., H. J. Emeléus, Sir Ronald Nyholm [and] A. F. Trotman-Dickenson (executive editor) Pergamon Press; distributed by Compendium Publishers, Elmsford, N.Y., 1973

Comprehensive organometallic chemistry : the synthesis, reactions, and structures of organometallic compounds, editor, Sir Geoffrey Wilkinson ; deputy editor, F. Gordon A. Stone ; executive editor, Edward W. Abel, Oxford, [Oxfordshire] ; New York : Pergamon Press, 1982.

Comprehensive organometallic chemistry II : a review of the literature 1982-1994, editors-in-chief, Edward W. Abel, F. Gordon A. Stone, Geoffrey Wilkinson, Oxford ; New York : Pergamon, 1995.

Dictionary of inorganic compounds, executive editor, J.E. Macintyre ; assistant editors, F.M. Daniel, V.M. Stirling,. London ; New York : Chapman & Hall, 1992.

Encyclopedia of inorganic chemistry / editor-in-chief, R. Bruce King, Chichester ; New York : Wiley, 1994.

WWW

If you have ready access to the web, you may want to bookmark www.webelements.com
This is a good source of information about the elements.

A searchable table, with links to many other sites, is available at
<http://chemlab.pc.maricopa.edu/periodic/periodic/html>

Another useful site is www.chemicool.com/

An artistic interpretation of the elements is at www.chemsoc.org/viselements/