

# Chemistry 320

## Inorganic Chemistry

**Lectures:** Monday, Wednesday and Friday 10:30 – 11:30 E309

**Course Instructor:**

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Office hours: Monday 2 - 4, Wednesday 2 – 4

**Course Materials:**

- Housecroft and Sharpe, Inorganic Chemistry, Pearson/Prentice Hall, 2005, 3<sup>rd</sup> Edition.
- The following texts are useful for specific topics within Inorganic Chemistry:
  - D. F. Shriver and P. Atkins: “Inorganic chemistry”
  - Cotton, Wilkinson and Gaus: “Basic inorganic chemistry” (3rd ed., 1995)
  - Miessler and Tarr, “Inorganic Chemistry” (3rd. ed., Prentice-Hall, 2004)
  - W. H. Porterfield: “Inorganic chemistry: a unified approach” (2nd ed., 1993)
  - Gary Wulfsberg: “Inorganic Chemistry,” (University Science Books, 2000)
  - Huheey, Keiter and Keiter: “Inorganic chemistry: principles of structure and reactivity” (4th ed.,1993)
  - Cotton, Wilkinson, Murillo and Bochmann: “Advanced inorganic chemistry” (6th ed., 1999)
  - T. W. Swaddle: “Inorganic chemistry : an industrial and environmental perspective” (1997)
  - U. Muller, “Inorganic structural chemistry” (2nd. ed. 1992)
  - Winter, Mark J, "d-Block Chemistry" (Oxford Chemistry Primers #27, 1994)
  - Weller, Mark T, "Inorganic Materials Chemistry" (Oxford Chemistry Primers #23, 1994)
  - McCleverty, Jon, "Chemistry of the First-row Transition Metals" (Oxford Chemistry Primers #71,1999)

## Inorganic Chemistry

<b>Foundation.</b> Atoms, orbitals, periodic properties and bonding will be discussed.	<b>Chapter 1, 2</b>
<b>Nuclei.</b> The chemistry of nuclei.	<b>Chapter 3</b>
<b>Molecular Symmetry.</b> A discussion of operators and elements, point groups and the applications of molecular symmetry.	<b>Chapter 4</b>
<b>Bonding.</b> Valence bond and molecular orbital theories.	<b>Chapter 5</b>
<b>Solids.</b> The chemistry, reactivity and structure of solids.	<b>Chapter 6</b>
<b>Acids and Bases.</b> A discussion of the chemistry of aqueous acids and bases.	<b>Chapter 7</b>
<b>Coordination Chemistry.</b> The chemistry of d-block coordination compounds.	<b>Chapter 21</b>
<b>Reaction Mechanisms.</b> The reactivity of d-block coordination compounds will be discussed	<b>Chapter 26</b>
<b>Reduction and Oxidation.</b> The electrochemistry of various inorganic compounds will be discussed.	<b>Chapter 7</b>

**Problem Sets.** A list of assigned problems for the text will be posted on Blackboard each Monday. Selected problems from each list will be collected the following Monday. Due dates will always be specified on Blackboard. Students are encouraged to work together on the homework. However, each student **must** hand in his or her own copy of the problems that are to be graded.

**Oral Reports.** Each student will give a 10 minute presentation on a different inorganic compound. A list of compounds is attached. Some guidelines include:

- Please use Powerpoint. I will post Powerpoint files on Blackboard as is, including notes.
- Try to answer most or all of the following questions in your talk:
  - what is the molecular structure of the compound?
  - what are some of its physical properties, including state, color, etc?
  - how is the compound produced? is it commercially available?
  - how does the compound react?
  - how is the compound technologically useful?
  - is the compound part of a class of related compounds?
  - is there a recent example in the primary literature of the use of this compound?
- Students are required to preview talks with me two days before it is given to the class. Come with a finished talk.
- Please email 3 suggested homework problems to me before your class presentation. These questions should be fairly simple, but not so simple that everyone could answer the questions without hearing the talk.
- Talks will be schedule for the last four weeks of class (Feb 11 – Mar 7).
- **Please let me know if you have any preferences for specific compounds or dates of presentation by Wednesday Jan 28.**

**Exams.** Two exams will be given, including a non-comprehensive final. These exams will occur in the fourth and seventh weeks of the quarter. The first exam will be take-home and open-book. The second exam will be take-home but closed-book.

**Grading.**

Problem Sets	35 %
Oral report	10 %
Exam 1	20 %
Exam 2	30 %
Class participation	5 %

Students who think they may need accommodations in this course because of the impact of a disability are encouraged to meet with me privately early in the semester. Students should also contact Rick Webb, Coordinator, Office of Disabilities Services (rwebb@haverford.edu, 610-896-1290) to verify their eligibility for reasonable accommodations as soon as possible. Early contact will help to avoid unnecessary inconvenience and delays.

#### IV. List of Compounds for Oral Reports

Here is a list of suggested compounds (or, in one case, an element), grouped according to chemical themes. In preparing your report, I suggest you start by reading the appropriate sections of Housecroft and Sharpe (page numbers in parentheses), as this will give you some general background and perspective about your particular compound. You may find the references at the end of the chapters in Housecroft and Sharpe useful – also the books on reserve and on the reference shelf.

- Non-aqueous acids and bases (239-247)
  - o Liquid ammonia (see also 240-244)
  - o Antimony(V) fluoride (and magic acid)
  - o Bromine trifluoride
- Hydrides (pp. 278-281)
  - o Lithium Aluminum Hydride
  - o Hafnium Hydride (non-stoichiometric)
  - o Diborane (see also pages 141-144 and 334-336)
- Macrocyclic ligands for alkali metals: crown ethers and cryptands (pp. 296-301)
  - o 18-crown-6 (and its metal complexes)
  - o Valinomycin
- Silicates, Aluminosilicates and Zeolites (413-419, 930-931)
  - o Silica
  - o Tremolite (a type of asbestos)
  - o Molecular Sieves 3A, 4A and 5A (closely related structures)
- Sulfur and its compounds (498-500; 505-508; 509-512; 520-525)
  - o Elemental sulfur (not a compound)
  - o Sulfur hexafluoride
  - o Sulfur dioxide
  - o Sulfuric acid
- Metal carbonyl complexes (816-821)
  - o Tetracarbonylnickel
  - o Diiron nonacarbonyl
- Organometallic complexes (839-849; 909-911 and the NobelPrize.Org web site for 2005 Chemistry)
  - o benzylidene-bis(tricyclohexylphosphine)dichlororuthenium (Grubbs' catalyst)
  - o Decamethylferrocene
- Industrial Catalysts (913-914, 925-926)
  - o Wilkinson's catalyst
  - o Ziegler-Natta catalyst
- Coordination complexes
  - o (N,N'-Bis(salicylidene)ethylenediamine)cobalt(II) (a.k.a. cobalt salen) (972)
  - o Prussian Blue (718)
  - o cisplatin (746)
  - o Bis(2,4-pentanedionato)