

# Chemistry 600 (Fall 2009) Advanced Inorganic Chemistry Inorganic Chemistry of Main Group Elements

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office hours: by appointment (please e-mail me)

<b>Class times:</b>	T, Th 11:00-12:20, 1-020 CST
<b>Location:</b>	1-020 CST
<b>Credits:</b>	3
<b>Prerequisites:</b>	Undergraduate level Inorganic Chemistry such as CHE 411

Main group derivatives are important in synthetic chemistry, as exemplified by organolithium or magnesium species, but are also of importance for the production of technically important materials such as ceramics, semiconductors and many more. This course will provide a survey of the factors that govern the chemistry of the s- and (and to a limited extent) p-block elements. This involves the discussion of chemical properties such as reactivity, structure and function and their applications. While discussing these different topics we will be touching organometallic, coordination chemistry and solid state aspects of inorganic chemistry. A major component of the course will focus on major developments and trends in modern main group chemistry.

In order to discuss the properties of main group compounds a multitude of physical methods (heteronuclear NMR and ESR spectroscopy, X-ray crystallography, IR and UV-Vis spectroscopy) will be discussed and applied.

## Possible Texts (none is required)

There is one text that is concerned with main group elements only:

- "Main Group Chemistry", A. G. Massy, Wiley, 1999, 2nd Ed. This is a decent book, but the references are very outdated, so it's not worth the money.

There are some other general Inorganic textbooks, but none of them is dedicated to s and p block chemistry only. The following books are general Inorganic texts.

- "Organometallics" by Elschenbroich and Salzer (VCH). I highly recommend it for anyone interested in inorganic, organometallic or even organic chemistry. I ordered five copies, they should arrive in the SU bookstore shortly.
- "Chemistry of the Elements" by Greenwood and Earnshaw (Butterworth and Heinemann) is a really nice to read and complete text. However, the graphics are low quality, it's paper bound and costs \$75 (!!!), but it's relatively current and well written. Before you buy you might want to look at my copy.

- "Advanced Inorganic Chemistry" 6th Edn. by Cotton, Wilkinson, Murrillo, and Bochman (Wiley) is the classic Inorganic text book. It's huge, well written and really good if you need to look up something. The new edition has an improved section on main group chemistry. If you consider to buy, ask to see my copy.

### **Requirements:**

- 1) Presentation of a 20 minute lecture. Students should discuss possible topics with the instructor before September 15. An outline should be prepared and discussed with the instructor. It is planned to implement the lecture when it will fit in most appropriately in the class schedule. Remember: YOU will be teaching the class for 30 minutes! So keep in mind when choosing your topic that it needs to be consistent with the theme of the class. Also: your topic should not be too specific. A good topic would be: "The chemistry of Grignard reagents" or: "Organoaluminum compounds: uses in synthetic chemistry" or something like that. If you need help with picking a topic see me!
- 2) One 10 minute "research nugget": 10 minute talks about a current (published during the last 6 month) research paper in Main Group Chemistry. Try to start thinking about a possible topic early! If you want to discuss a possible paper/topic please see me. Possible journals are: Angewandte Chemie, Int. Ed. Engl., Inorganic Chemistry, Organometallics, J. Organomet. Chem. and so on.
- 3) One written critique (limited to three pages without figures and references) of a full paper involving main group chemistry, which was published during the last six month. Nugget and critique can not have the same topic! About possible journals see (2).
- 4) One research proposal, 10 pages, fully referenced, encompassing an unexplored area of main group chemistry. Possible topics can and should be discussed with the instructor, who can also suggest topics.

### **Office hours:**

There are no officially assigned office hours. I am available for help by appointment. To make an appointment please call (x-1306) or send me an e-mail (kruhland@syr.edu), or leave a message in my mailbox in the main office.

### **Grading Scheme:**

Lecture, (20 minutes)	30%
"Research Nugget"	15%
Paper Critique	15%
Proposal	40%

### **The following topics will be covered:**

- Periodic trends, Periodic Anomalies, Relativistic Effects
- Bond Strength and Length
- Covalent and Ionic radii
- $\pi$ -Bonding and Multiple Bonding, d-Orbitals in  $\sigma$  and  $\pi$ -Bonding?
- Inversion Barriers
- Electron Deficient Compounds
- Alkali Metal Chemistry
- Alkaline-Earth Chemistry
- Boron Compounds
- Al, Ga, In and Tl compounds
- Silicon Chemistry
- Ge, Sn and Pb Compounds
- Phosphorous Chemistry
- As, Sb and Bi Compounds
- Sulfur Chemistry
- Se and Te Chemistry
- The Halogens
- He, Ne, Ar, Xe and Kr