CHEM.521 Inorganic Chem. I

C521Syll-28:Sept10

Relationship to other courses:

CHEM.521 starts off by briefly reviewing certain essential concepts of atomic & molecular properties, treats several typical inorganic structure types and subsequently lays the foundation for CHEM.522's symmetry-based treatment of the structures and properties of transition metal complexes and their experimental investigation. If you've not done Inorganic as an undergrad, it's inadvisable to do 522 without 521 first.

Here is an outline of the coverage for Fall 2010. I might render some improvements during the quarter.

- Electrons in atoms: AO's & atomic configurations. Working out oxidation states, configurations of main group ions and of and transition metal cations.
- Electronegativity as a guide to the natures of elements and their binary compounds: extended *vs*. molecular lattice formation ($PdCl_2$), (poly)silicates, zeolites, covalent lattices, layer lattices, fullerenes, H-bonding.
- Electron-counting methods for assembling molecules & molecular ions: applicability of 2- & 8-ē criteria; Lewis structures and Gillespie-Nyholm (VSEPR) rules.
- The coordinate bond: Lewis acids & bases, coordination compounds, ligands. Inorganic nomenclature. Survey of coordination numbers, structure types.
- Symmetry operations: C_n, S_n, s, i, E; symmetry elements in molecules.
- Assignment of molecules to symmetry (point) groups. Molecular dipole moments.
- Cohesion in the solid state. The X-ray diffraction method.
- Ionic lattices: coordination numbers, the radius ratio idea, lattice energy, Born-Landé model, Born-Haber cycle, Kapustinskii's model.
- Introductory molecular orbitals - a simple approach: from homonuclear diatomics to band structure of elements' lattices; electronic (semi)conductors.
- Metal ions in solution: hydration, common chelating agents, coordination geometries, simple isomerism. Chelate effect. Macrocyclic ligands. HSAB concept.

Objectives: Be able to:

deduce the electronic configurations of atoms and monoatomic ions.
work out oxidation states of elements in compounds, molecules, ions.
translate between names and formulæ for inorganic compounds.
draw Lewis structures of molecules and deduce their geometry *via* VSEPR.
give examples of metal-centred molecules with different coordination numbers
locate the various symmetry elements in molecular species.
assign objects to symmetry groups.
make reasonable deductions as to the natures of various binary compounds.
recognize molecular *vs*. ionic *vs*. covalent *vs*. other extended lattices.
be familiar with examples of different kinds of extended lattices.
apply certain fundamental concepts (radius ratio, Born models) to ionic lattices.
work out qualitative MO schemes for diatomic molecules and deduce the diatomics' properties.
correlate the properties of elemental solid phases with their band structures.
be able to visually dissect coordination complexes into correctly charged ligands and metal.
recognize Lewis acids and bases as parts of coordination complexes.
recognize and know examples of different kinds of ligands.
apply certain factors for deducing outcomes of the competition between ligands for metals.

Text:

- The course notes will be available, for the cost of photocopying.
- "Shriver & Atkins' Inorganic Chemistry", by Atkins, Overton, Rourke, Weller, Armstrong & Hagerman. 5th Edn. 2010, PB - ISBN 978-1-4292-1820-7. I do not rely heavily on the text, but if you are taking the 421-420-422 sequence, I advise buying it.

Other useful texts are:

- Housecroft & Sharpe: *Inorganic Chemistry*. 3rd Edn., Prentice-Hall 2008.
- Miessler & Tarr: *Inorganic Chemistry*, 2003.
- Douglas, McDaniel & Alexander: *Concepts & Models of Inorganic Chemistry*. Third Edn., Wiley 1994.

Other stuff: Work on the problem sets as soon as we have covered the material in class !! If you do not do the homework, you will find it hard to pass the exams, and virtually impossible to get a good grade. Answers are provided for some homework problems, while others require a descriptive/written answer. You are encouraged to discuss these with me at our mutual convenience, and people who take the trouble to do so generally do better in the course.

Your grade is based on the (usually three) exams: two midterms (15%, 25%) plus a final exam (60%). The new grade ranges are: D= 43-45; D+=46-49; C-=50-53; C=54-56; C+=57-59; B-=60-64; B= 65-69; B+=70-75; A-=76-83; A=84-91; A+=92-100. You may bring our periodic table and a molecular model kit to the exams (some of the assigned classrooms have no periodic table). If you are not officially registered in the course, no midterms or quizzes will be graded or returned, and you may not receive the distributed materials. Tentative mid-term dates are Oct. 12th, Nov. 9th.

Penalizable misspellings: "flourine", "valance", “pyrimidal”, “planer”.

Missed an Exam ?

Make-up exams are tentatively scheduled for the afternoon of Monday, Dec. 13th. You don't need an excuse to take the make-up exam if you miss a midterm or the final. But you *must* then attend the make-up at the finally designated time and place or take a zero on it.

The 15-Minute Rule: If I'm more than 15 minutes late and do not send word of what’s happening, consider the class cancelled. If you need to leave early, or be more than 15 minutes late for a class, please have the courtesy to inform me beforehand.

Email is a good way to get in contact with me - *e.g.*, to make an appointment to discuss course material.

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My “office hours” are (tentatively) Mondays 4-6.