CHEM.421 Inorganic Chem. I

C421Syll-27:Sept07

Relationship to other courses:

CHEM.421 is the pre-requisite for CHEM.420. CHEM.421 starts off by reviewing material from CHEM.102, which is the pre-requisite. Chem Juniors follow 421 with 420 (MSGT/transition metals) in Winter term - either the same or the next year, and in the Spring of the Senior year, take Inorganic-II (CHEM.422) and Inorganic Lab (CHEM.425).

Here is an outline of the coverage for Fall 2007. I hope to 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.
- Term & state description of metal cations.
- Electronegativity as a guide to the natures of elements and their binary compounds.
- Electron-counting methods for assembling molecules: applicability of 2- & 8-ē criteria; Lewis structures and Gillespie-Nyholm (VSEPR) rules.
- Symmetry operations: C_n, S_n, σ, 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.
- The natures of binary compounds: extended *vs*. molecular lattice formation ($PdCl_2$), (poly)silicates, zeolites, covalent lattices, layer lattices, fullerenes, H-bonding.
- 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.
- The coordinate bond: Lewis acids & bases, coordination compounds, ligands. Inorganic nomenclature. Effects of coordination.
- 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.
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.

Atkins, *et al.*, *Shriver & Atkins Inorganic Chemistry*. 4th Edn., Freeman 2005. 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*. 2nd Edn., Prentice-Hall 2005.

Miessler & Tarr: *Inorganic Chemistry*, 2003.

Douglas, McDaniel & Alexander: *Concepts & Models of Inorganic Chemistry*. Third Edn., Wiley 1994.

I sent a few books like this to the UCRC.

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. 16th, Nov. 13th.

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

Missed an Exam ?

All make-up exams are intended to be held on the afternoon of Monday, Dec. 17th. 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.