Chemistry 322
Inorganic Chemistry
Spring 2007

Exam 1 Objectives

The first exam will cover the material presented in Chapters 1, 2 & 7 of Shriver and Atkins, but only those sections that are specifically mentioned on the first reading schedule. Sections 2.5-2.9 will NOT be on this first exam. Bring your character tables to the test.

1. Identify all the symmetry operations in a molecule or object.

2. Determine the point group symmetry of any molecule. It is assumed that you can correctly generate the Lewis structure of a molecule and predicts its shape using VSEPR theory.

3. Create a transformation matrix for an operation of a point group and derive the character associated with that transformation.

4. Determine, based on symmetry, whether a given molecule can be chiral.

5. Determine, based on symmetry, whether two protons in a molecule will have the same NMR resonant frequency (chemical shift).

6. Use and understand a character table.

7. Predict the IR- and Raman-active vibrations in a molecule using group theory.

8. Understand the mathematical origin of the atomic orbitals and their shapes.

9. Predict the shapes of the nodal surfaces in a given atomic orbital.

10. Predict the shape of a given atomic orbital or identify an orbital from its shape.

11. Understand the concepts of exchange and Coulombic energy of repulsion (pairing energy).

12. Understand the concept of shielding and apply Slater's rules to determine the effective nuclear charge felt by any electron in an atom.

13. Account for simple chemical properties (i.e. electron configurations, ionization potentials, electron affinities, atomic or ionic radii) using arguments about electron interactions & shielding.

14. Correctly assign an oxidation state and an electron configuration to an element in a compound.

    Example: The oxidation state and electron configuration of Sn in $K_2Sn_2O_3$ are:
    a.) 2+ or II (oxidation state), b.) [Kr] $5s^2$ $4d^{10}$ (electron configuration)

15. Understand how atomic orbitals can be combined to form bonds between two atoms.

16. Understand the fundamental differences between covalent, polar-covalent, and ionic bonding.

17. Understand the fundamental principles of valence-bond (localized-bonding) theory.