Chem 151A, Inorganic Chemistry
Spring 2015
Problem Set #1

DUE: MONDAY APRIL 13, 2015, 9:30 am

Chem 151A Mail Slot in PSB Mail Room (Next to PSB 238)

10 marks   1. Write the ground state electronic configurations, and indicate the number of unpaired electrons, for: (a) Ti (titanium); (b) Ti^+; (c) Ti^{6+}; (d) the first excited state of Ne; (e) the as-yet undiscovered alkali metal that would begin the 8th row of the periodic table (under Fr).

25 marks   2. Draw the Lewis dot diagrams for the following molecules. If applicable, include formal charges and all reasonable resonance structures. What is the molecular geometry and the general AB_xE_y formula on which the structure is based? (a) SO_3^{2-}; (b) $XeOF_4$; (c) $HONH_2$; (d) ICl_4^-; (e) SbF_5^{2-}.

10 marks   3. Discuss shielding in atoms, using Al and Si as examples. How do the values of r, IE, EA and en compare for Al and Si, and why?

20 marks   4. Sketch the MO diagram for the following molecules. For each, indicate the ground state electronic configuration, bond order, magnetic properties, HOMO and LUMO of the molecule. (a) linear H_4; (b) F_2; (c) Li_2^{2+}; (d) cyclic H_5^+; (e) BeH_2.

10 marks   5. Using your diagram from 4(b), give the bond order for F_2^{2+}, F_2^+, F_2, F_2^- and F_2^{2-}. Which would have the shortest bond length? Which is most common, if you consider the Lewis dot diagram?

25 marks   6. For the following atomic orbitals, give the quantum numbers n, l, and m_l and sketch the orbital with axes and centrosymmetry (g or u) labelled. Also account for any nodes using spherical coordinates and/or radial distribution functions): (a) $4p_z$; (b) 6s; (c) $5d_{z2}$; (d) $3d_{x2-y2}$; (e) $2p_y$.

Total: 100 marks