Chem 151B
Inorganic Chemistry II
Spring 2018

Problem Set #1

Due May 1st, 2018 ***<u>at start of class</u>***

25 marks 1. 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-}.

15 marks 2. Using Wade's Rules, predict the structures of the following clusters: (a) B_5H_{11}; (b) $C_4B_2H_6$; (c) $C_2B_3H_5Fe(CO)_3$; (d) $Fe_4(CO)_{13}C$, where the carbon is in the center of the cluster; (e) $Fe_2Rh_2(CO)_{12}$.

20 marks 3. Sketch the ^{29}Si and ^{1}H NMR spectra of gaseous monochlorosilane, SiH_3Cl. Indicate coupling constants and relative intensities on your sketches (^{29}Si: N = 4.7%, I = 1/2; ^{1}H: N = 99.9%, I = 1/2).

15 marks 4. Account for the following observations in the ^{129}Xe NMR spectra of XeF_4: a 1:4:6:4:1 quintet is observed when dissolved in BrF_5, whereas a 1:2:1 triplet is seen when dissolved in SbF_5, with each component further split into a doublet (^{129}Xe: N = 26%, I = 1/2; ^{19}F: N = 100%, I = ½; hint: SbF_5 is a Lewis acid).

Total: 75 marks

For practice only, will not be graded:

Consider the paramagnetic cluster compound $Co_3(CO)_9S$, where the cobalt atoms define a triangular geometry, the chalcogenide caps the cluster, and the unpaired electron resides in an antibonding MO localized in the plane of the three cobalt atoms (Co: I = 7/2). How many EPR lines would you expect if: (i) all cobalts are equivalent; (ii) only two are equivalent; (iii) all three are non-equivalent. The sample is diluted in diamagnetic $FeCo_2(CO)_9Se$, and you do not need to give the intensity ratio.