Name: KEY

Practice Test –Chemistry II
Molecular Structure

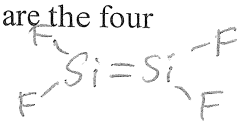
1. Draw the Lewis Structure, assign formal charges to all atoms, and predict the molecular shape, bond angles, and molecular polarity for PCl_3, SeF_4, SO_3, NH_4^+, and $C_2H_2Br_2$.

See back

2. Which ONE of the above is most likely to exhibit…
   a. …resonance? SO_3
   b. …a coordinate covalent bond? NH_4^+, SO_3
   c. …geometric isomerism? $C_2H_2Br_2$

3. Which TWO structures in #1 use pi bonding? SO_3 & $C_2H_2Br_2$

4. How many sigma bonds and how many pi bonds are there in Si_2F_4? In this molecule, are the four fluorine atoms co-planar? (YES) NO DEPENDS… (Circle one and explain…)



leftover p orbitals must be parallel to each other and the are ⊥ to their respective sp^2 hybrid orbitals

5. Of the seven commonly diatomic elements, only one exhibits paramagnetism. Identify which one and explain why. Also, explain what is meant by this property. O_2, 2 unpaired e⁻ in the (2) π_{2p}^* orbitals attracted by a magnetic field

6. Using the energy level diagram in Fig. 9.36 on p. 432 of your text as a framework, predict the bond order for the odd electron molecule, NO (nitrogen monoxide). Would this molecule to exist based on bond order? Would it be expected to be paramagnetic or diamagnetic? Would you expect it to have longer or shorter bonds than a molecule with B.O. = 2? Would its bonds likely be weaker or stronger than a B.O. = 2 molecule?

$B.O. = \frac{(8-3)}{2} = 2.5$ exist? Yes! paramagnetic shorter bonds stronger bonds

7. How many electron domains around the central atom would typically indicate sp hybridization? sp^2? sp^3? dsp^3? d^2sp^3? Which type of hybridization would you expect to find on an atom with two double bonds? A triple bond and a single bond? A double and two singles?

2 doubles = sp trip/sing = sp

sp - 2 domains sp^2 - 3 domains sp^3 - 4 dom. dsp^3 - 5 dom d^2sp^3 - 6 dom. doub/2sing = sp^2

8. Anticipating the energy change…Label each of the following terms with a + for those which are typically endothermic, a – for those which are typically exothermic, and a ? for the ONE which could most easily go either way. For the one which could go either way, explain what type of circumstances would lead to it being endothermic and which would lead to it being exothermic.
   a. Bond energy +
   b. Enthalpy of sublimation +
   c. Ionization energy +
   d. Electron affinity (?)
   e. Lattice energy −

if electroneg. is high, E.A. is likely (−)
if " " low, E.A. is likey (+)
secondary e.a.'s are usually (+),

9. Rationalize the comparisons between the following lattice energies…
   a. CaSe = -2862 kJ/mol
   b. Na_2Se = -2130 kJ/mol
   c. CaTe = -2721 kJ/mol
   d. Na_2Te = -2095 kJ/mol

a & c have greatest charge (+2, −2 comp. to +1, −2)
∴ MOST EXOTHERMIC
a vs. c: Se is smaller in radius than Te, so CaSe is more exothermic than CaTe.
b vs. d: Same logic as a vs. c