CH301 More Problems to think about

Rank the following in order of increasing crystal lattice energy:
Al2O3, LiCl, Na2O
LiCl < Na2O < Al2O3
+1/-1 < +1/-2 < +3/-2

Which of the following are ionic compounds

NO, Cl_2, NaI, LiCl, $CaCl_2$, CH_3Cl, CCl_4

Use the bond enthalpies in the text to calculate how much energy is either (absorbed or released) for the following reaction

$CH_4(g) + Cl_2(g) \longrightarrow CH_2Cl_2(g)$

Break two C-H bonds and a Cl-Cl
Form two C-Cl bonds and a H-H bond
You do the math

Rank the following in terms of largest dipole

HF, HI, H_2

H_2 no dipole < HI < HF
(electronegativity difference larger than size difference)

Which of the following has a dipole (there may be more than one)

CH_4, $CHCl_3$, H_2O, H_2S, NH_4^+, CO_3^{2-}

the other three have a symmetry that cancels their polar bonds

For each of the following draw a Lewis Dot structure, give the electron and molecule geometry from VSEPR, identify the hybridization of the central atom, and give the number of sigma and pi bonds.

CO_2, CH_2Cl_2, AlH_3, I_3^-, C_2H_4, NO_3^-, PCl_5

CO_2
Linear, Linear, 180*, sp, 2 sigma bonds, 2 pi bonds

CH_2Cl_2
Tetrahedral, tetrahedral, 109.5, sp^3, 4 sigma bonds

AlH_3
Trigonal planar, trigonal planar, 120°, sp^2, 3 sigma bonds

I_3^-
Trigonal bipyradmid, linear, 180°, dsp^3, 2 sigma bonds

C_2H_4
Trigonal planar (both Cs), trigonal planar (both Cs), 120° (both Cs), sp^2 (both Cs), 3 sigma, 1 pi

NO_3^-
Trigonal planar, trigonal planar, 120°, sp^2, 3 sigma, 1 pi

PCl_5

Trigonal bipyramid, trigonal bipyramid,

90°, 120°, 180°, dsp^3, 5 sigma

Identify the formal charges on each atom in
AlH_3, NH_2^-, SCN^-

AlH_3
Zero on all atoms

NH_2^-

N –1
H 0

SCN^-

S 0
C 0
N -1

For N_3^- do you think the structure with two double bonds or one single and one triple bond will contribute more to the true structure? Why?

The one with two double bonds has a formal charge of –1 on two of the N's at the ends and +1 in the middle, the one with a triple bond has a formal charge of –2 on one end and +1 in the middle. The one with only ±1 will contribute more.

Based on MO theory answer the following

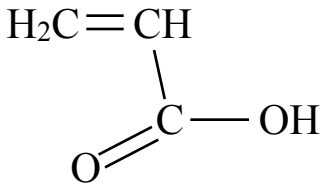
Between F_2, F_2^+, and F_2^- which do you think would have the highest bond order, strongest bond, longest bond length. Which (if any) would be paramagnetic?

F_2 has a bond order of 1
Adding an electron will add to an anti-bonding orbital and decrease the bond order to 0.5
Removing and electron will remove from an anti-bonding orbital and increase the bond order to 1.5

Therefore F_2^+ will have the highest bond order and strongest bond
F_2^- will have the weakest bond and therefore the longest bond.

Both F_2^+ and F_2^- will have an odd number of electrons and thus 1 unpaired electron. Both will be paramagnetic.

In the following compound identify the bond angles and hybridization around each of the carbon atoms (note that lone pair electrons are not show).



All the carbons will be sp^2 and have angles of 120°.