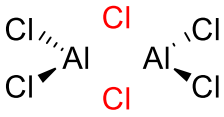
This set consists of 5 problems and the total points is 4.

3.68. (0.9 point) Mixing $SbCl_3$ and $GaCl_3$ in a 1:1 molar ratio (using liquid sulfur dioxide as a solvent) gives a solid ionic compound of empirical formula $GaSbCl_6$. A controversy arises over whether this compound is $(SbCl_2^+)(GaCl_4^-)$ or $(GaCl_2^+)(SbCl_4^-)$.

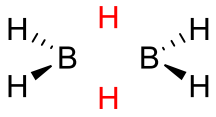
(a) Using the VSEPR theory, predict the molecular structures of the two *anions(阴离子)*.

(b) It is learned that the *cation* in the compound has a bent structure. Using the VSEPR theory, predict the molecular structures of the two *cations*. Based on this fact, which formulation is more likely to be correct?

(0.6 point) $AlCl_3$ and BH_3 form dimer molecules in the gas phase. In the dimer molecules Al_2Cl_6 and B_2H_6, Al and B are located in tetrahedral centers and are 'bridged' by two Cl and H atoms, respectively. In the following, complete the bridging Al–Cl and B–H bonds and calculate their bond orders. Draw additional resonant structures when necessary.

(a) 

Bond order of bridging Al–Cl = ?

(b) 

Bond order of bridging B–H = ?

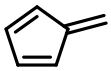
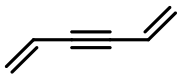
7.28. (0.9 point) Acrylic fibers are polymers made from a starting material called acrylonitrile, $H_2C(CH)CN$. In acrylonitrile, a –C≡N group replaces a hydrogen atom on ethylene.

(a) Draw the Lewis diagram for this molecule and give the hybridization of each carbon atom.

(b) describe how the π orbitals are formed, describe the number of electrons that occupy each π orbitals.

(c) Draw the three dimensional skeletal formula structure of the molecule, showing all angles.

7.40. (1.0 point) Consider the following proposed structures for benzene, each of which is consistent with the molecular formula C_6H_6.

(i)  (ii)  (iii)  (iv)  (v) 

(a) When benzene reacts with chlorine to give C_6H_5Cl, **only one isomer** of that compound forms. Draw **all possible 'chlorobenzene' isomers for each of the five structures**. Then, which of the five proposed structures for benzene are consistent with this observation?

(b) When C_6H_5Cl reacts further with chlorine to give $C_6H_4Cl_2$, exactly three isomers of the latter compound form. How many isomers will be formed for each structure? Which of the five proposed structures for benzene are consistent with this observation?

(0.6 point) Draw the resonance structures of the molecule: NH_2CHO (two resonance structures)