

Problem Set #11 Chem. 216

1. Consider the two geometries



and

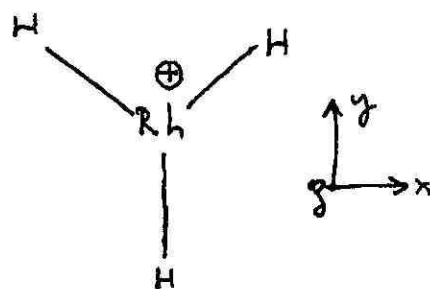
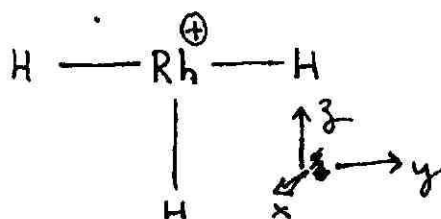


● = main group atom

• = H

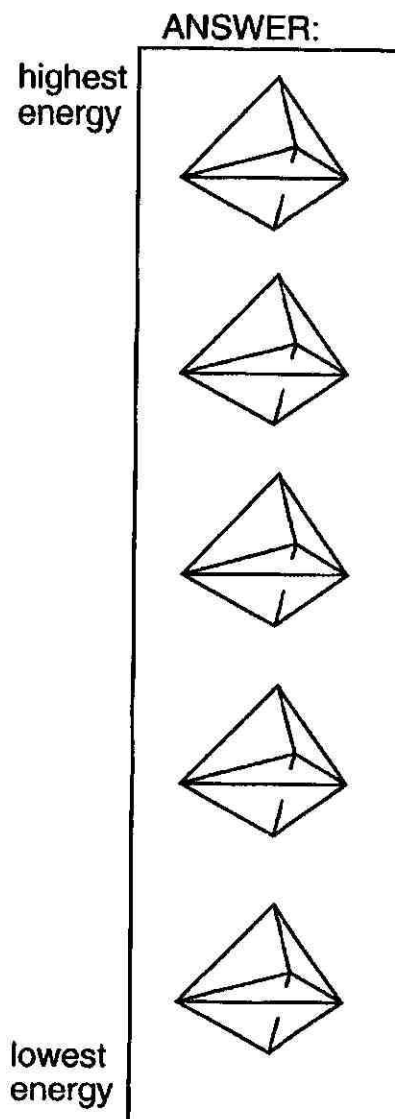
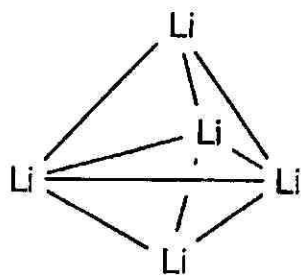
Just as in class, where we draw an orbital correlation diagram for NH_3 for the trigonal planar & linear geometries. Now compare the three geometries: trigonal planar, linear & trigonal bipyramidal. Decide for 6, 8 and 10 valence electrons what the preferred geometry is. From these results deduce what the structure of BF_3 , NF_3 and IF_3 are. (note F has one lone pair interacting w/ central main group atom & therefore behave like H).

2. Let's consider these same two geometries for transition metal complexes. Please draw an MO diagram for:



Please use the axes given & use only the d-orbitals (in both cases there are 6 d-electrons) for the Rh and the H 1s orbitals. Assume that only bonding & non-bonding orbitals are filled. Conclude if RhH_3^+ has T shape or Y shape.

3a. (25 pts) Please consider the $[\text{Li}_5]^{n+}$ cluster drawn below. It is a cluster composed of an equilateral triangle of Li atoms with additional Li atoms above and below this triangular plane. Please assume that the only valence orbital for Li is the s-orbital. In the space provided please draw an MO diagram for this cluster. If two MO's are of near equal or equal energy please indicate this in your answer.



3b. (5 pts) If all bonding and non-bonding MO's are filled, what is the value of n in the chemical formula $[\text{Li}_5]^{n+}$.

ANSWER: