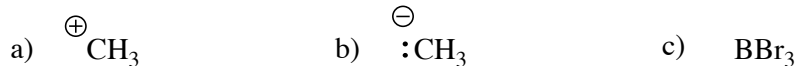


### Problem Set #2

Question 1. For each of the following molecules and ions, provide the hybridization state of the carbon or boron atom and draw a three-dimensional structure that clearly defines the molecular shape.

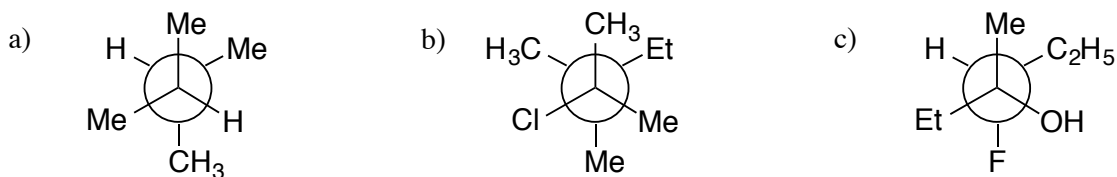


Question 2. You are an electron, and you have the choice to occupy an  $sp$ ,  $sp^2$ , or  $sp^3$  orbital. Which do you pick to minimize your energy (i.e., which orbital is lowest in energy)? Which orbital is highest in energy? Make sure to clearly justify your answer.

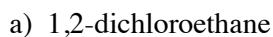
Question 3. Determine which of the following molecules has a molecular dipole. *Hint: the molecular dipole is the sum of all bond dipoles – even if a bond is polar, that does not necessarily mean the molecule is polar.*



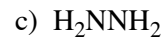
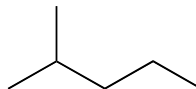
Question 4. Translate the following Newman projections into Lewis structures (line structures are OK).



Question 5. Translate the following compounds into staggered Newman projections (it is easiest to pick a “central” bond for the Newman projection perspective).



b)



Question 6. How many "different" carbons (different chemical environments) do the following compounds contain? How many "different" hydrogens? *Note: part b is tricky!*

a) 2-bromobutane

b) *cis*-1,2-dimethylcyclopropane

Question 7. Draw structures for all alkanes with the molecular formula  $C_5H_{10}$ . Can you name them?