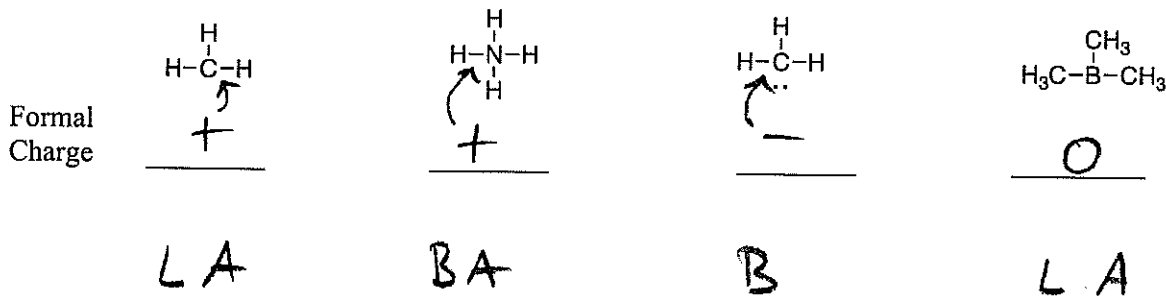


1 A) For the four molecules shown below, provide the formal charge for any charged atoms - indicate the charge and draw an arrow to the atom that bears the charge. All electrons are shown. 12 pts, -2 for each wrong answer.

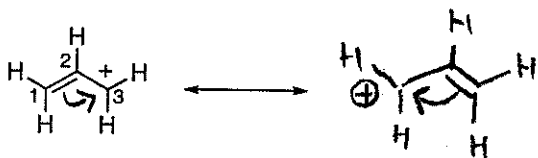


B) Is each molecule better described as Lewis Acid, Bronsted Acid, or base? Provide your answer on the lines above.

2) Fill in the following table. 6 pts, -2 for each wrong answer.

	pKa
HCl	-6
NH <sub>3</sub>	36
H <sub>2</sub> O	16
CH <sub>3</sub> CO <sub>2</sub> H	5
NH <sub>4</sub> <sup>+</sup>	11
H <sub>3</sub> O <sup>+</sup>	-2

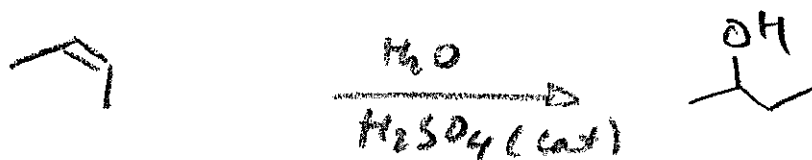
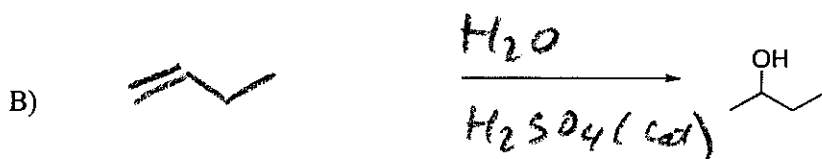
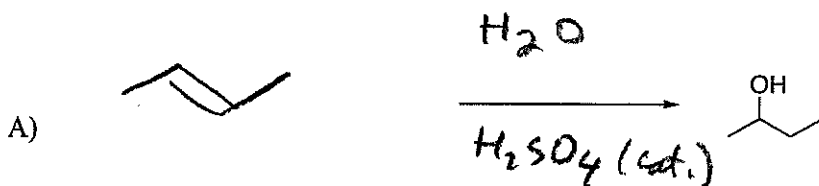
3 A) Draw the most important resonance structure for the molecule shown below. Show all arrows required to go from one resonance structure to the other (BOTH structures should have arrows). 6 pts



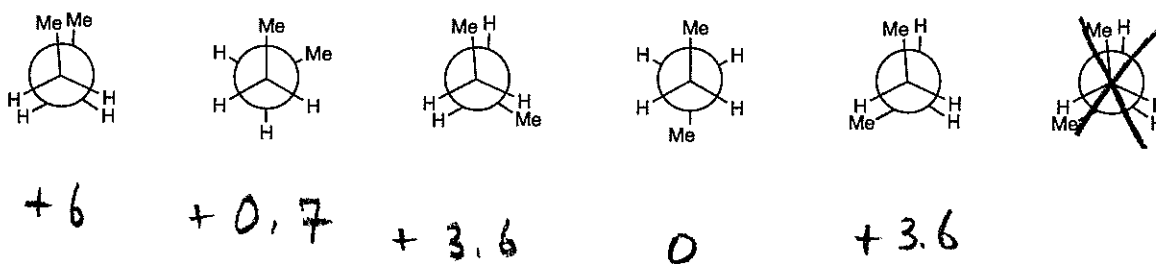
B) For the molecule shown in 3A above, how much positive charge resides on each carbon (C1, C2, and C3, give your answer in percentage positive charge on each carbon)? 3 points

b) percent + charge on C1 50% percent + charge on C2 0 percent + charge on C3 50%

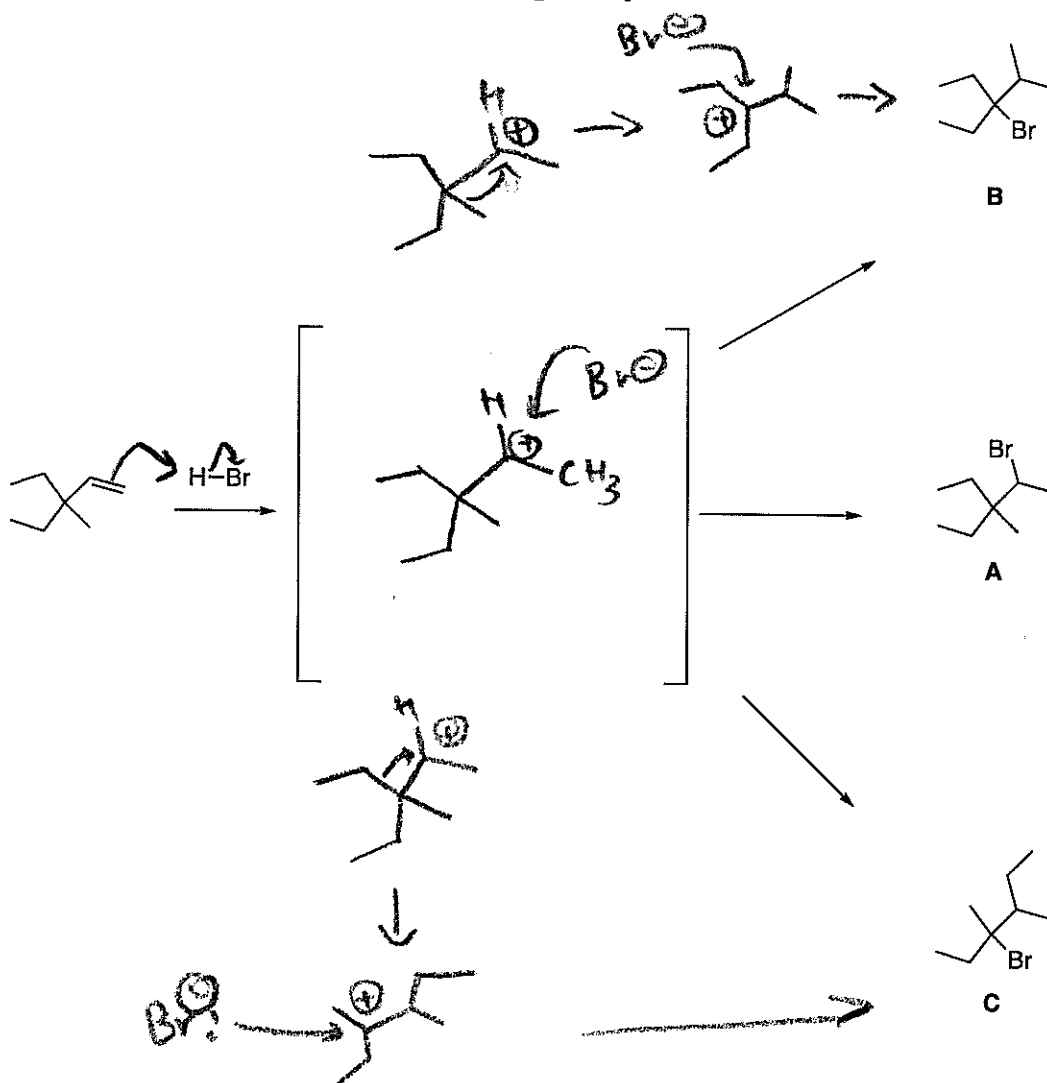
4) The alcohol shown below can be synthesized from three different alkenes. Provide two syntheses below. **DO NOT PROVIDE THREE, ONLY TWO!** Include the reagents required to accomplish your synthesis. 20 points total



5) What is the energy of each of the conformations of butane shown below. 6 pts, -2 for each wrong answer.



6) The reaction shown below provides three products in unequal amounts. The three products are formed from a common intermediate. Draw the mechanism for the formation of these products in the space provided below (might require more than one step from the intermediate). Be sure to include all arrows and all charges. 18 points

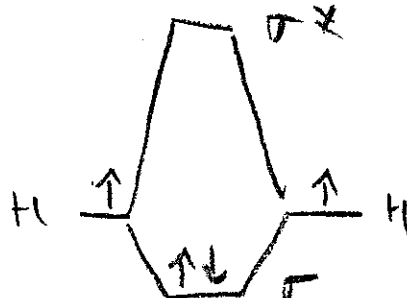


Which of these products would you expect to be formed in the **smallest** amount, A, B, or C? 3 points

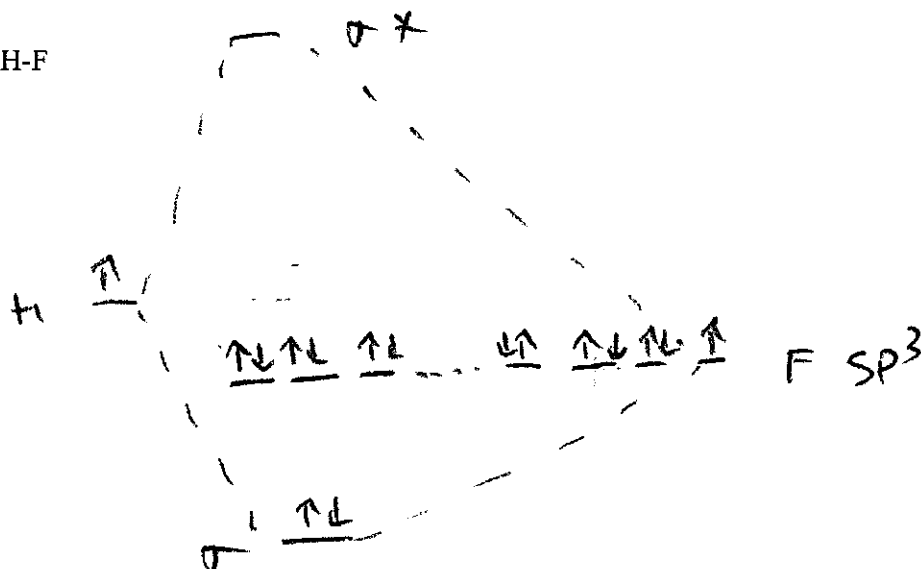
A

7) Draw the molecular orbital diagram of H-H and H-F. Be sure to pay attention to the starting energies of your atoms, and to the energy of the resulting orbitals. 15 points

H-H



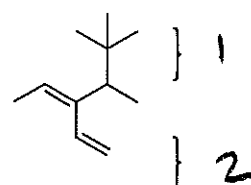
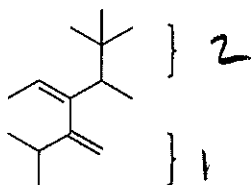
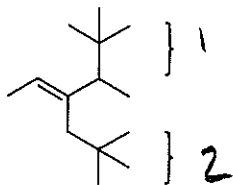
H-F



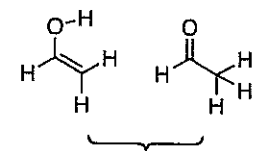
8) Define an antibonding orbital **in one sentence**. I'm looking for the right buzz words (in the right context), and once you write the correct answer, writing more will only give you a chance to write something that is wrong. So, no more than one sentence, please. 3 points

The antisymmetric combination of atomic orbitals on two atoms w/ a node perpendicular to the internuclear axis

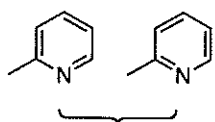
Rank each group with a bracket as priority 1 or 2 according to the CIP nomenclature system. 3 points, -2 for each wrong answer



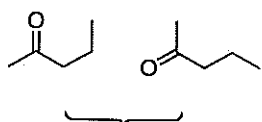
Are the following pairs of molecules **resonance structures**, **isomers**, **identical molecules** that are drawn differently, or **none of the above**? 5 points, -2 for each wrong answer.



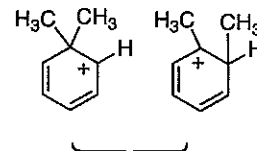
ISOMERS



Res-  
struct.



IDENT



ISOMERS