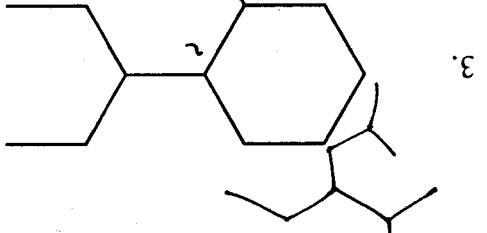


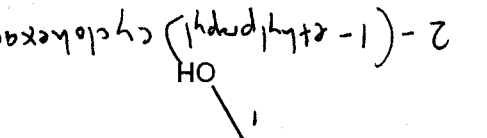
I. Give the IUPAC name for each structure. Give the complete structure for each name using any valid style you choose (Kekule, condensed, or line angle). 5 points each, 20 points total.

← illegal name

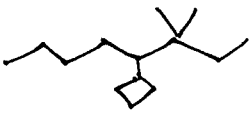
- 3-isobutyl-N-methyl-2-pentanamine (5-ary)



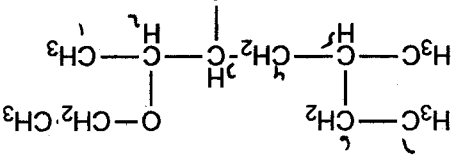
2-(1-ethylpropyl)cyclohexanol



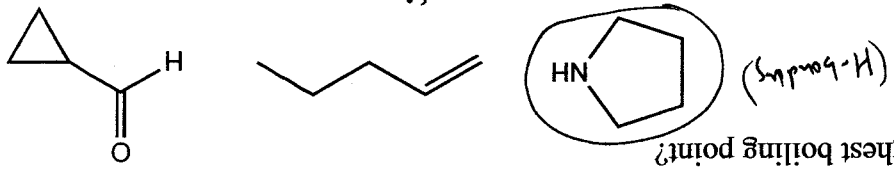
- 4-cyclobutyl-3,3-diethyloctane



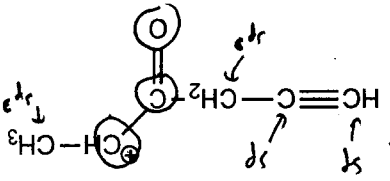
2-ethoxy-3,5-dimethylheptane



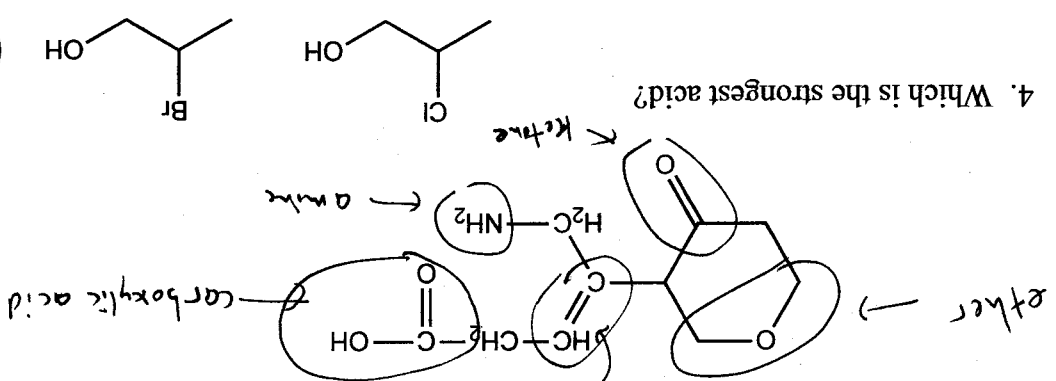
- Which compound has the highest boiling point?



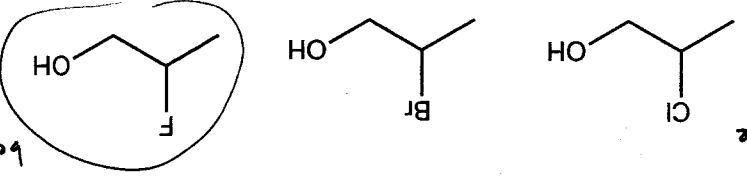
- Circle each atom that is  $sp^2$  hybridized in the compound shown.



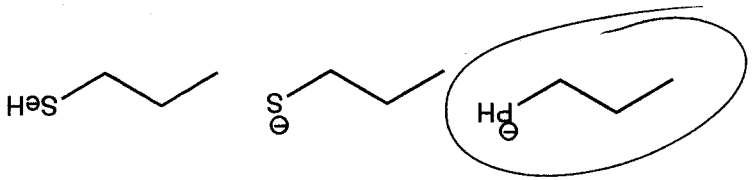
- Circle and identify the name of the class of compound for 3 of the functional groups in the compound shown.



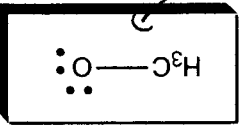
- Which is the strongest acid?



- Which is the strongest base?



- What is the formal charge on the oxygen? (all lone pairs and atoms are shown)



+3 +2 +1 0 -1 -2 -3

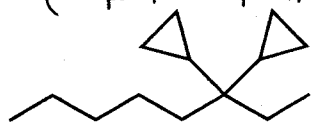
○ has 5 electrons  
○ has 6 electrons

7. A small percentage of impurity with a boiling point of 200 degrees contaminates substance X with a boiling point of 180 degrees. A simple distillation will likely result in

Pure substance X from the first drop until near the end, when the boiling temperature will decrease slightly and the purity will lessen.  
 Pure substance X from the first drop until near the end, when the boiling temperature will increase slightly and the purity will lessen.

Contaminated X for the first portion after which pure X will be collected until near dryness. Contaminated X throughout the distillation process

8. Which is bicyclo[3.3.0]octane?

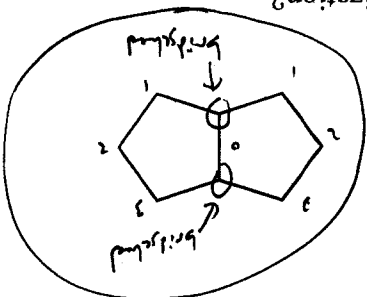


(3,3-dicyclopropylpropane)

(1,3-dimethylcyclooctane)

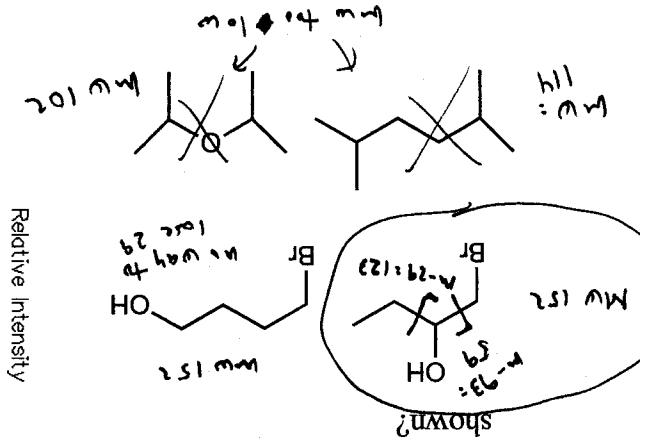
(bicyclo[3.1.1]heptane)

9. Which will assist in ensuring that you have a pure product from a recrystallization?



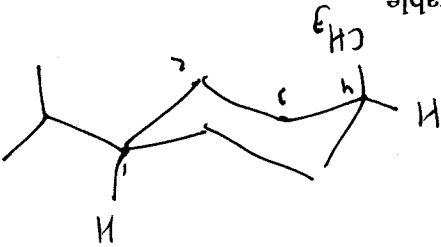
choose a solvent that the product does not dissolve in  
 keep the solution in the ice bath for an extra long time before final filtering  
 use a bit more solvent than you would have used to get a cloudy solution before cooling  
 boil down the solution until there is hardly any solvent left

10. Which compound structure would give the mass spectrum

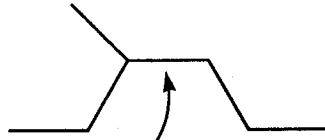
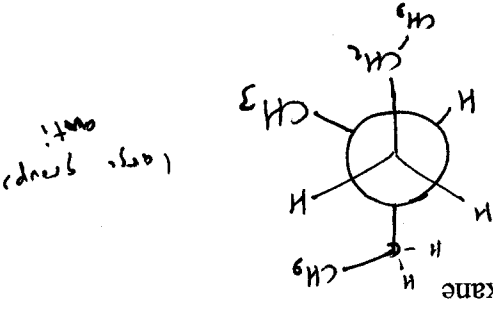


III. Conformations 7 pts each, 14 pts total

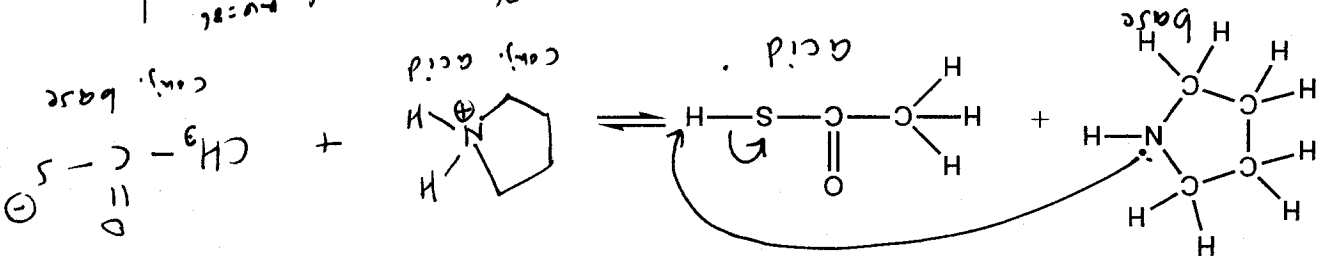
1. Draw the most stable chair conformation for cis-1-isopropyl-4-methylcyclohexane



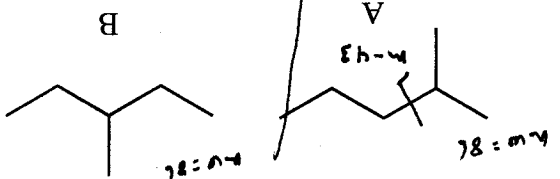
2. Draw the Newman projection for the most stable conformation of the C3-C4 bond of 3-methylhexane



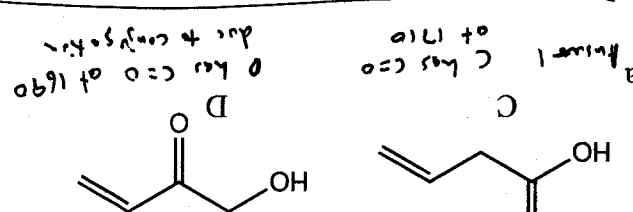
IV. 1. Complete the acid-base reaction shown by drawing the products.  
 2. Label each reactant and product as either an acid or a base  
 3. Use curved arrow formalism to show how the reactants reacted to give the products shown.



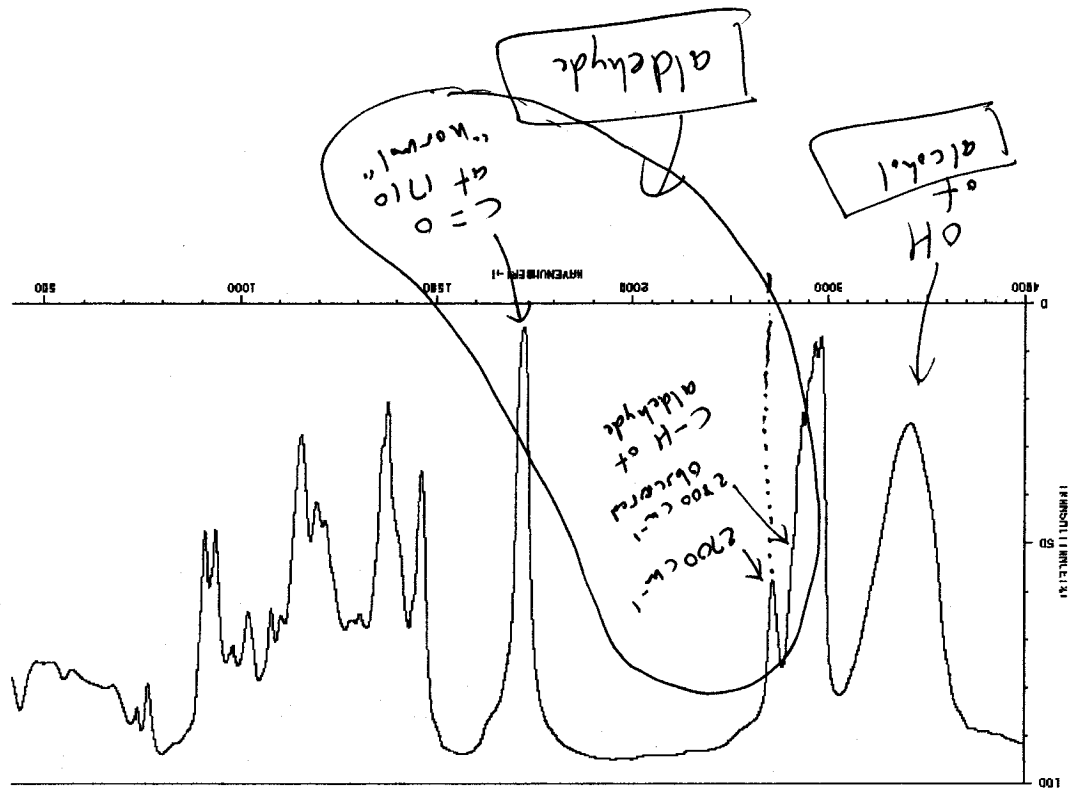
V. 1. Compounds A and B have at least one major difference in their mass spectra. One of them has a large peak that is either much smaller or absent in the spectrum of the other compound. Identify the m/z value of such a peak and in which molecule's MS it is significant.



2. Compounds C and D have at least one major difference in their IR spectra. One of them has a large peak that is not the same size and/or location in the IR spectrum of the other compound. Identify (a) the frequency (give the number) of such a peak, (b) which compound would have it (c) what structural feature led to it and (d) how it is different in the other compound.



VI. Interpret the IR spectrum shown by identifying the significant peaks, structural features responsible for each of these significant peaks, and the class(es) of compound present in the sample.



8 pts

6 pts

6 pts

10 pts