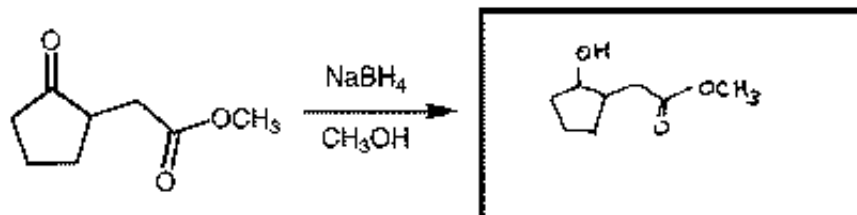


Question 1 (15 points)

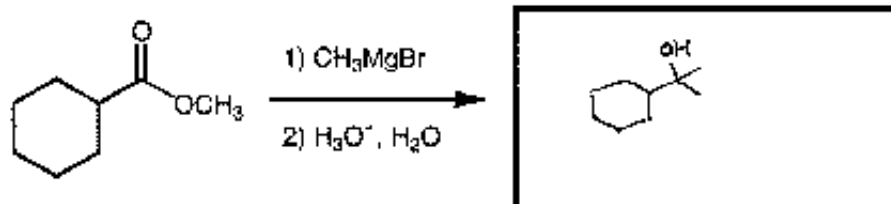
Name key

Give the complete structure of the major organic product(s) for the following reactions. Put your answer in the box provided. Be sure to indicate stereochemistry where appropriate. Write N. R., if no reaction occurs.

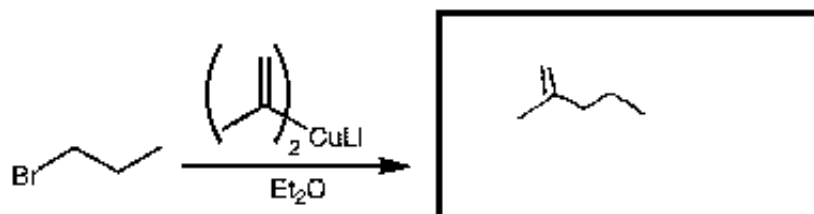
a. (3 pts)



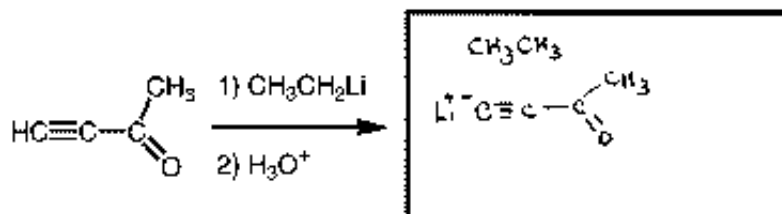
b. (3 pts)



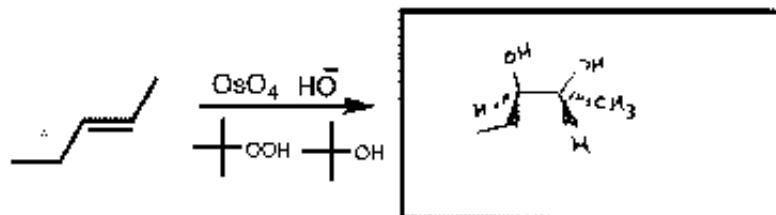
c. (3 pts)



d. (3 pts)



e. (3 pts)

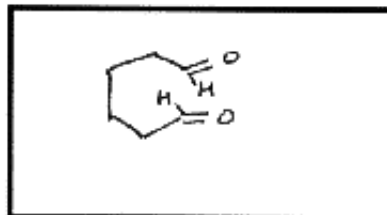
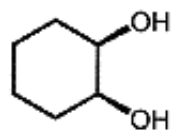


Question 2 (19 points)

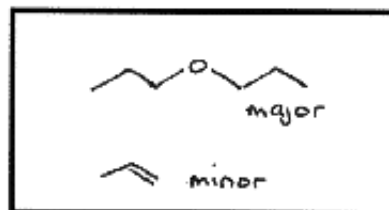
Name key

Give the complete structure of the major organic product(s) for the following reactions. Put your answer in the box provided. Be sure to indicate stereochemistry where appropriate. Write N. R., if no reaction occurs.

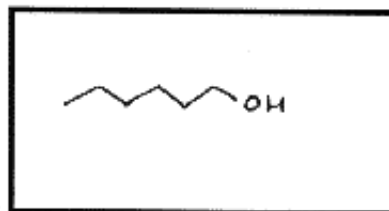
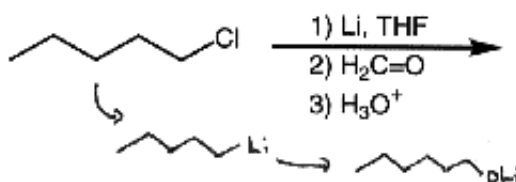
a. (3 pts)



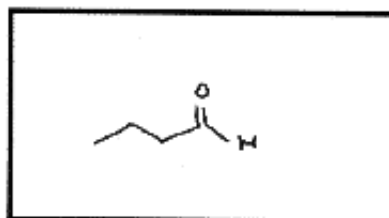
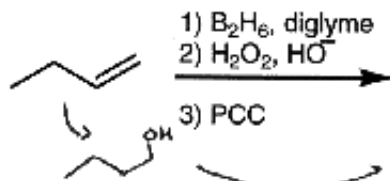
b. (3 pts)



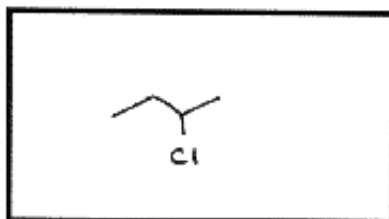
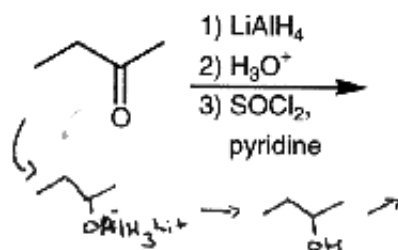
c. (4 pts)



d. (5 pts)



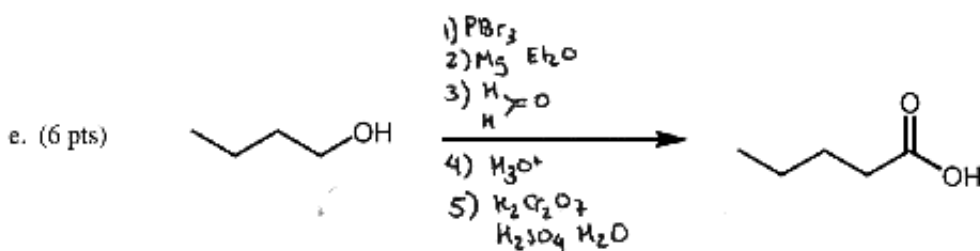
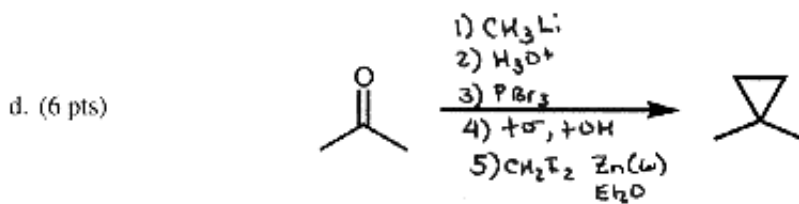
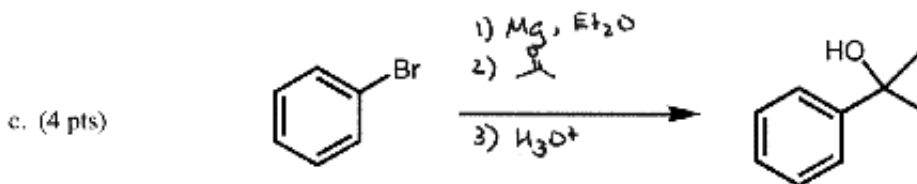
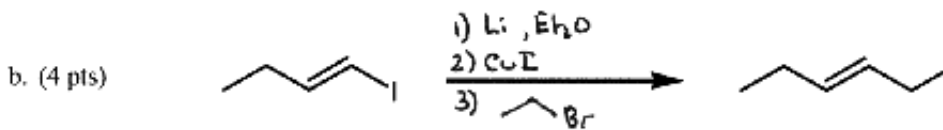
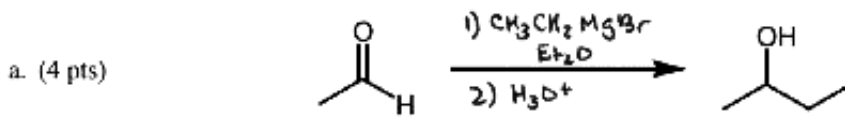
e. (4 pts)



Question 3 (24 points)

Name KCU

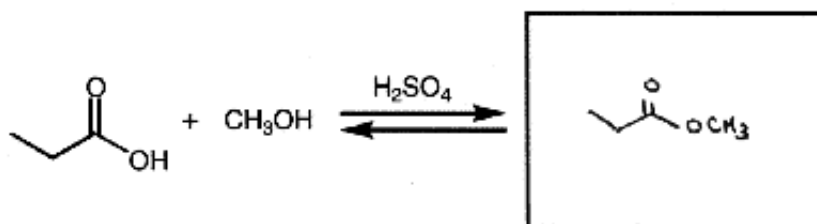
Provide the missing reagents for the following transformation. The reagents should be listed in order of use if more than one synthetic step is necessary.



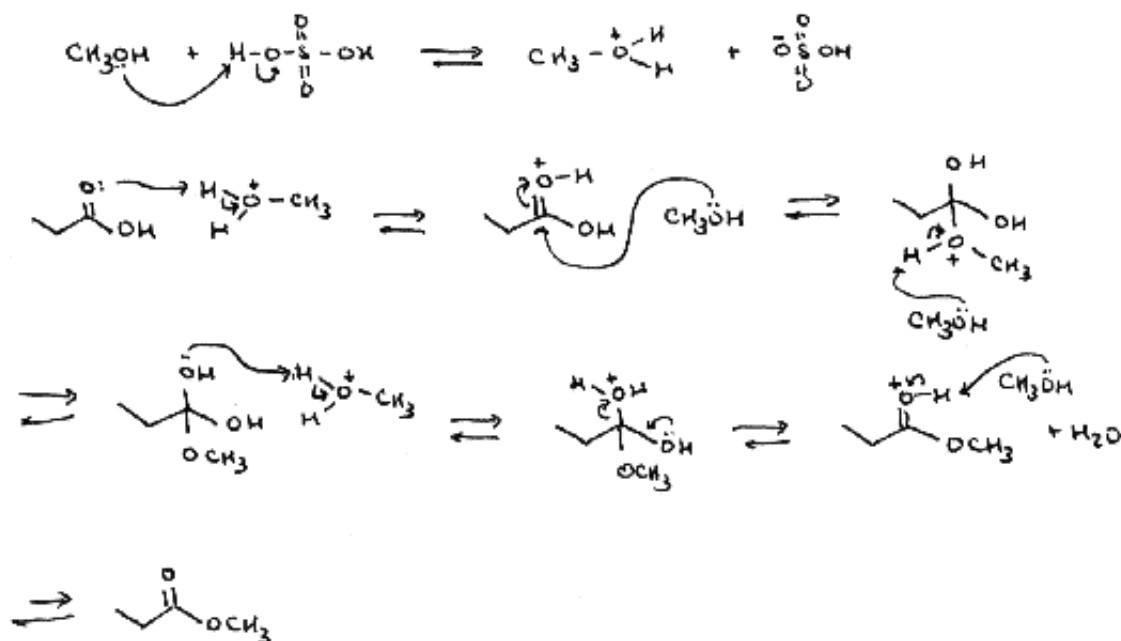
Question 4 (16 points)

Name key

Using the correct curved arrow formalism, draw the best mechanism for the following reaction. Draw the product of the reaction in the box provided.



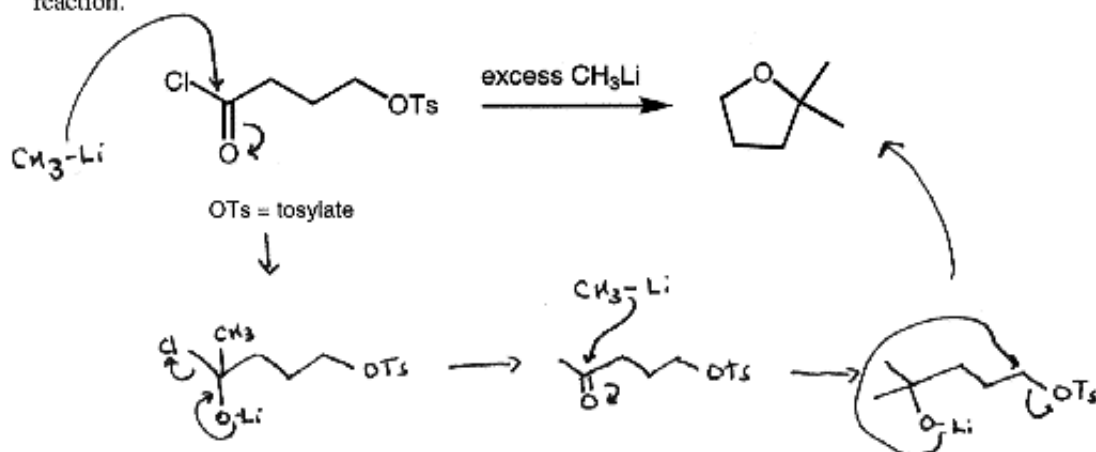
Mechanism:



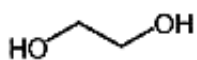
Question 5 (11 points)

Name key

a. (7pts) Using the correct curved arrow formalism, draw the best mechanism for the following reaction.



b. (4 pts) An unknown compound is known to have one of the two structures shown below. Pick the best spectroscopic technique to distinguish the two compounds and describe the difference you would see in the spectra of the two compounds that would allow you to identify the unknown. (*Hint: mass spectrometry is not a spectroscopic technique.*)



IR will show a broad peak at $3200 - 3500 \text{ cm}^{-1}$ for the O-H stretch in $\text{HO-CH}_2\text{-CH}_2\text{-OH}$

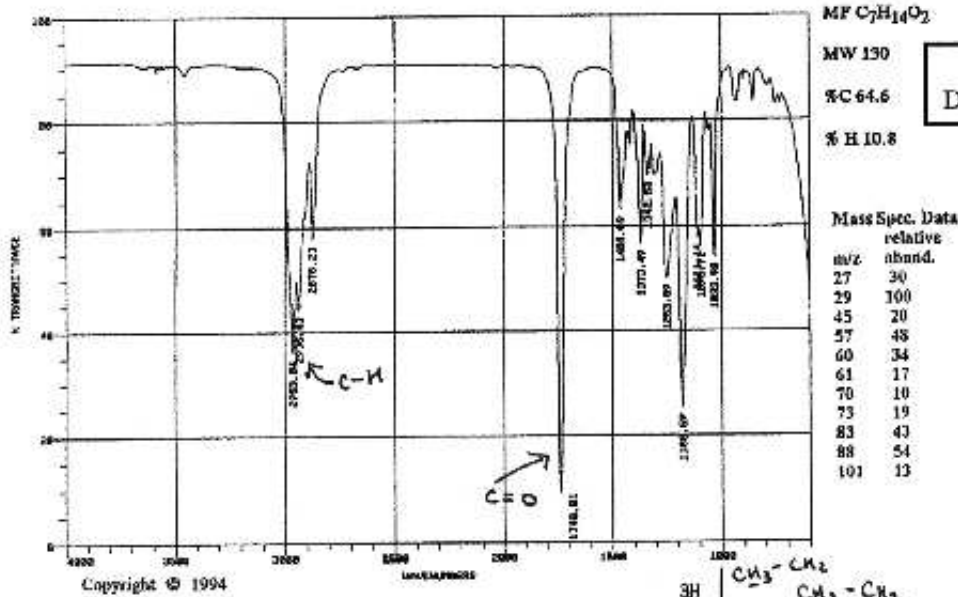
Question 6 (15 points)

Name key

The ^1H NMR, ^{13}C NMR, and IR spectra and mass spectrometry data are given for an unknown compound. Propose a structure that is consistent with the data. Be sure to label the key spectroscopic peaks and determine the degree of unsaturation.

$$\frac{16-14}{2} = 1$$

Degree of Unsaturation 1



$\text{MFC}_7\text{H}_{14}\text{O}_2$

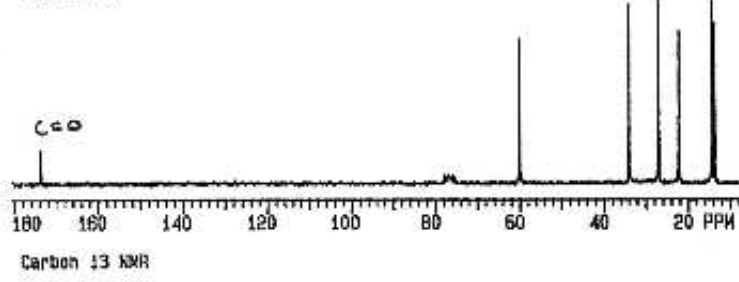
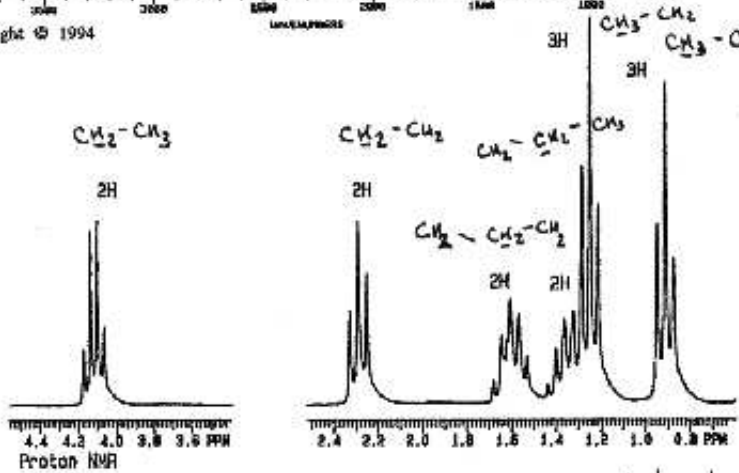
MW 130

%C 64.6

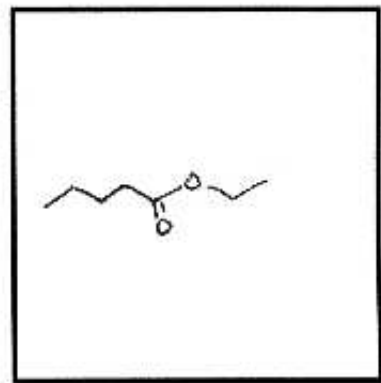
%H 10.8

Mass Spec. Data relative

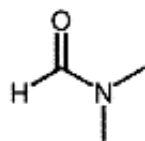
m/z	abund.
27	30
29	100
45	20
57	48
60	34
61	17
70	10
73	19
83	43
88	54
101	13



Proposed structure

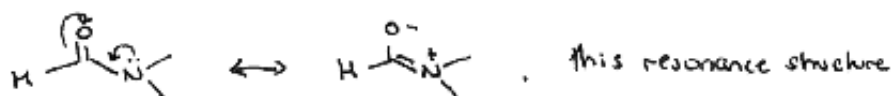


Explain the following observation. At 28 °C, the ^1H NMR of N,N-dimethylformamide has the following peaks: δ 2.8 (s, 3H), 2.9 (s, 3H), 8.0 (s, 1H). When the sample is heated to 150 °C, the ^1H NMR has the following peaks: δ 2.35 (s, 6H), 10.8 (s, 1H).



N,N-dimethylformamide

N,N dimethylformamide has an important resonance structure.



is so important that at room temperature, rotation about the C-N bond is slow. the C-N bond is almost a C=N. therefore the methyl groups are slightly different and can be distinguished by NMR. At higher temperatures, the C-N bond can rotate freely and the methyl groups become indistinguishable and appear as a singlet in the NMR.