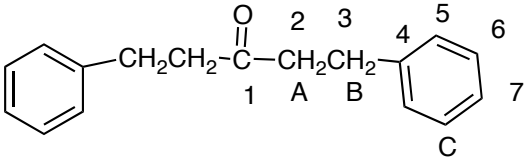
ANSWER KEY

Long Island University, Department of Chemistry

Chem. 122, Sect 012, Exam 2, 150 pts, Spring, 2011

1. Predict the NMR spectrum for the following molecule, giving (a) the number of carbon signals (b) the number of proton signals and the multiplicities of the proton signals and (c) give three significant IR absorptions and indicate what functional group each absorption corresponds to. (15 pts)

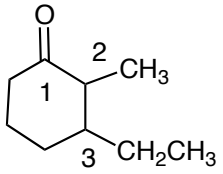


There are 4 kinds of proton signals and 7 kinds of carbon signals. H_A = triplet, 4H; H_B = triplet, 4H; H_c= multiplet, 10 H.

Characteristic IR peaks are: C=O at 1730-1750 cm $^{-1}$; Sp^3 C-H at 2800-3000 cm^{-1}; Sp^2 C-H at 3000 - 31000 c^{-1}.

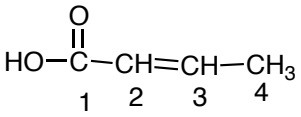
2. Name the following molecules. (15 pts)

(a)



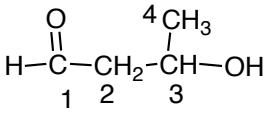
3-ethyl-2-methyl-cyclohexanone

(b)



2-butenoic acid

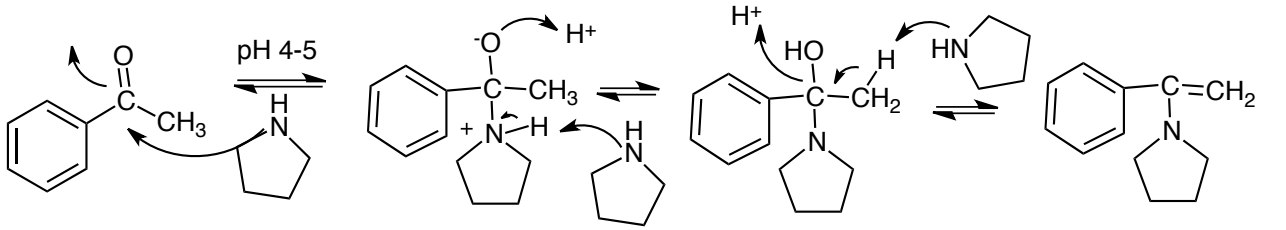
(c)



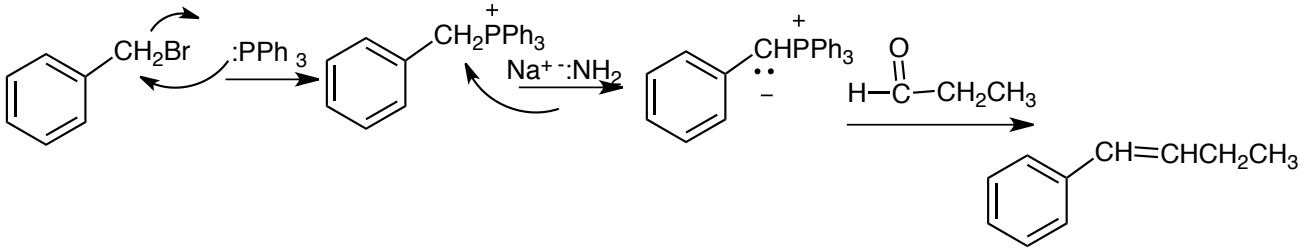
3-hydroxy-butanal

3. Give the product of the following reactions. It is not necessary to show the reaction mechanism but do show all intermediates formed. (30 pts, 10 pts each)

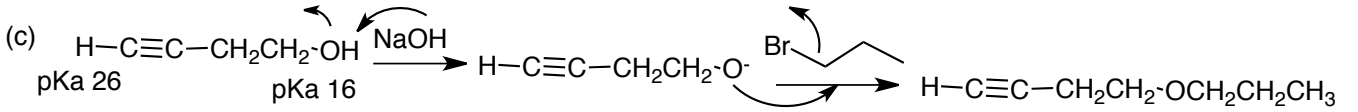
(a)



(b)

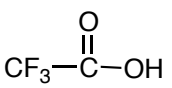


(c)

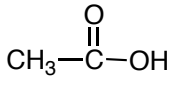


4. (a) Look A and B and choose which is the stronger acid and briefly explain your reasoning. (b) For **C** and **D** choose which molecule would form the greater concentration of hydrate and briefly explain your choice and show the reaction for the hydration in acidic conditions. (15 pts)

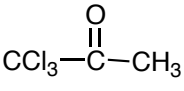
(a) **A**



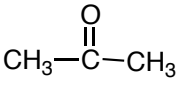
B



(b) **C**

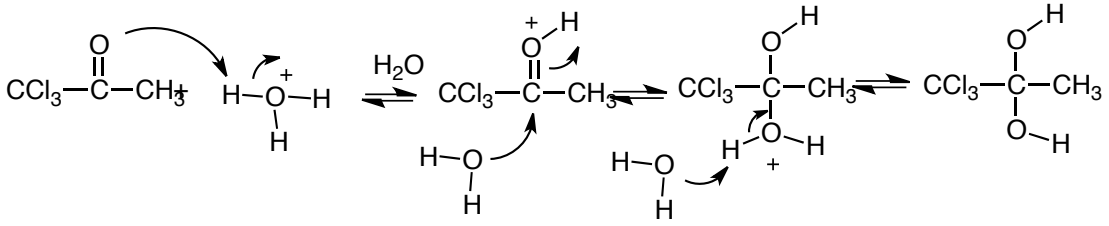


D

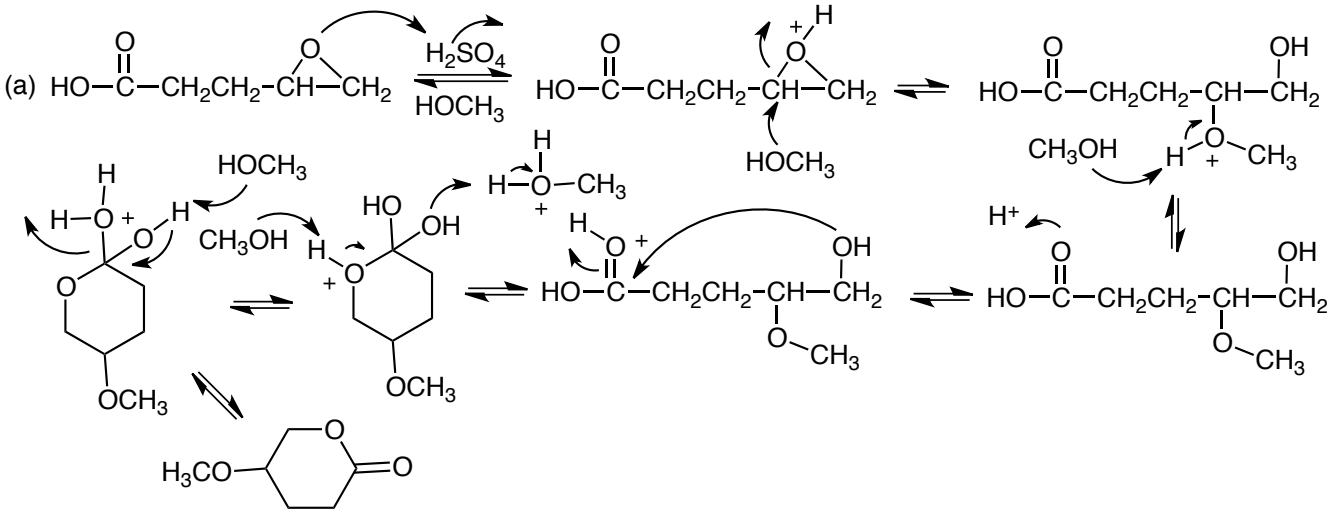


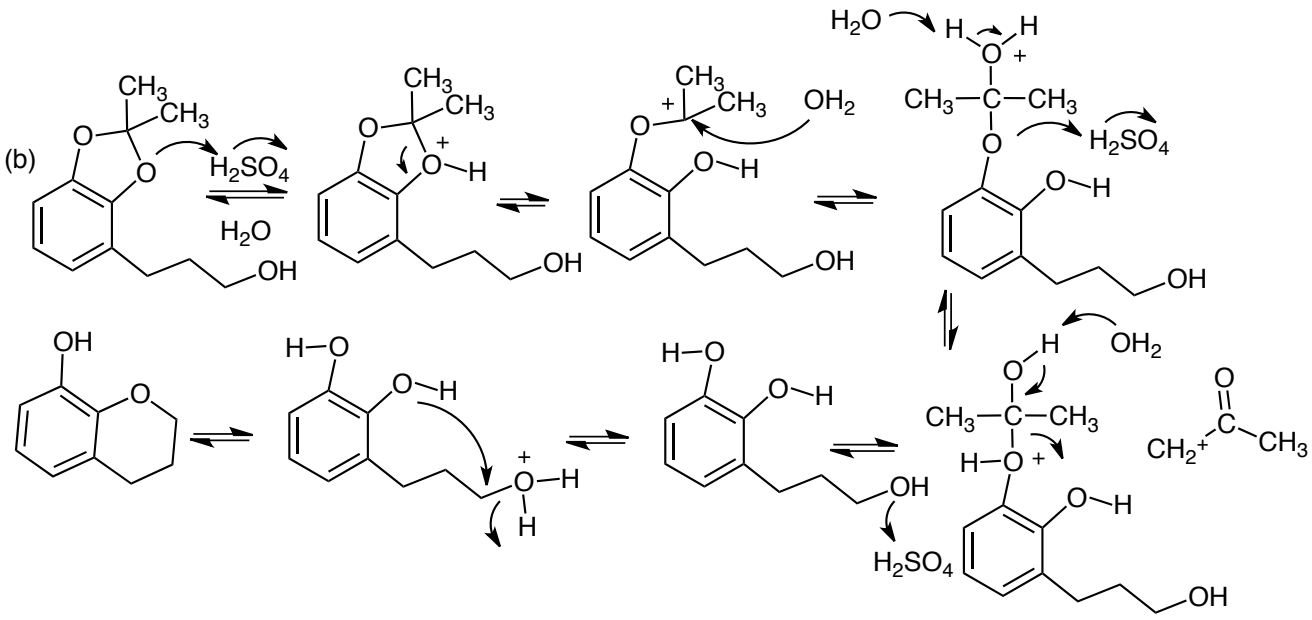
(a) **A** is a stronger acid than **B** due to the influence of the CF_3 group, which is a strong electron withdrawing group. The CF_3 group makes the carbonyl carbon more electron deficient and

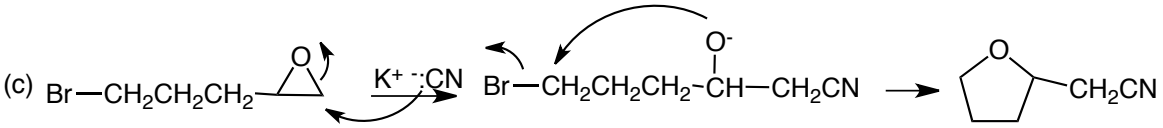
therefore more electron withdrawing, weakening the O-H bond and it also makes the carbonyl group better at stabilizing the resulting anion by helping to disperse the negative charge. (b) **C** will form the greater concentration of hydrate due to the strong electron withdrawing nature of the CCl_3 group. This will make the carbonyl carbon more electron deficient and more subject to nucleophilic attack by water.



5. Show how the following transformations occur, giving all of the steps of the mechanisms. Not other reagents are needed except for those given. (45 pts)







6. Synthesize **two** of the following **three** molecules from the starting materials given on the left as shown. Do all **three** for extra credit. (30 pts)