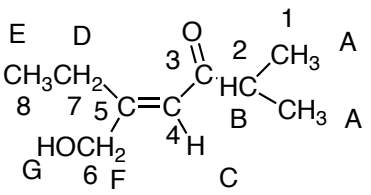
ANSWER KEY

Long Island University, Department of Chemistry

Chem. 122, Sect 008, Exam 2, 150 pts, Spring, 2011

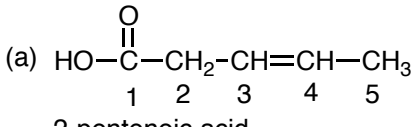
1. For the following molecule, predict (a) the number of carbon signals (b) the number of proton signals and their multiplicities and (c) give three significant IR absorptions and indicate what functional group each absorption each corresponds to. (15 pts)



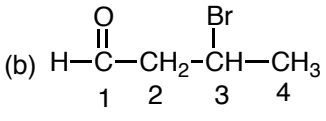
There are 8 carbon and 7 proton signals; H_A = doublet, 6H; H_B = septet, 1H; H_c = singlet, 1H; H_D = qurtet, 2H; H_E = tripet, 3H; H_F = singlet, 2H; H_G = singlet, 1H.

Characteristic IR peaks: C=O at 1730-1750 cm^{-1}; Sp^3 C-H at 2800-3000 cm^{-1}; Sp^2 C-H at 3000-3100 cm^{-1}; C=C bond at 790-840 cm^{-1}; O-H at 3200-3500 cm^{-1}.

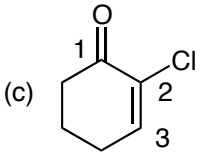
2. Name the following molecules. (15 pts)



2-pentenoic acid

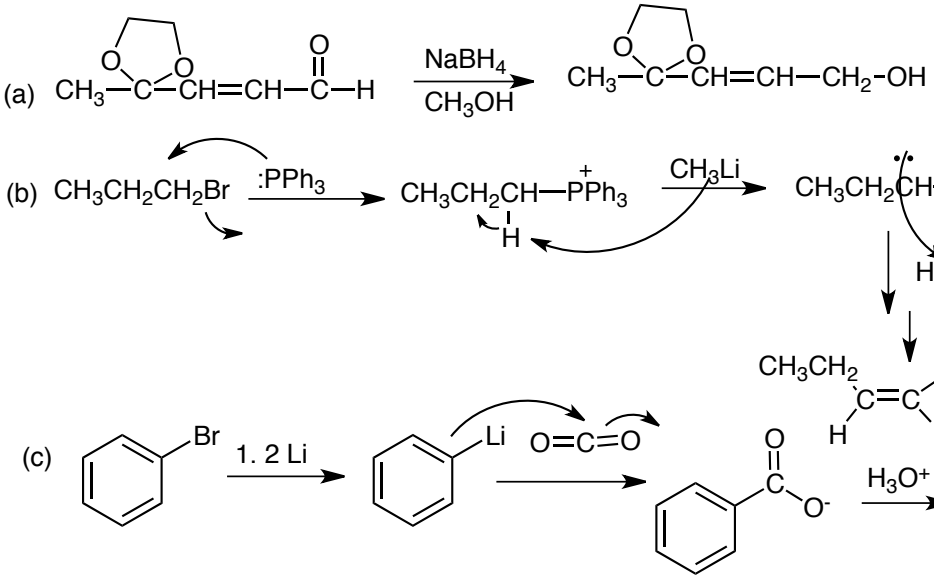


3-bromo-butanal

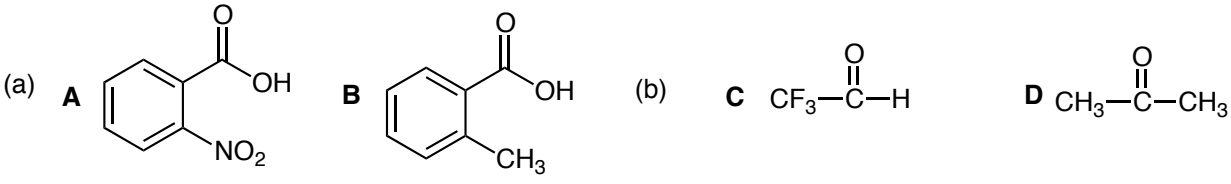


2-choloro-2-cyclohexenone

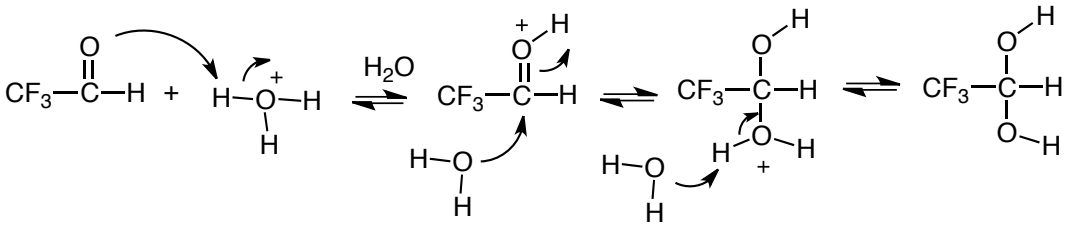
3. Give the product of the following reactions. It is not necessary to show the reaction mechanism but do show all intermediates formed. (30 pts, 10 pts each)



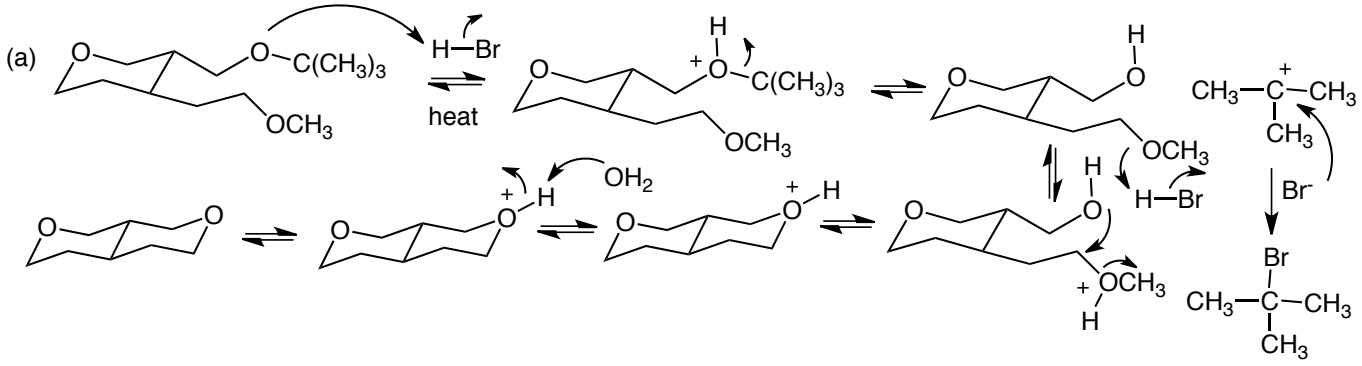
4. (a) Look at **A** and **B** and choose which is the stronger acid and briefly explain your reasoning. (b) Look at **C** and **D** and choose which one would form the greater concentration of hydrate in acidic (H_3O^+/H_2O) conditions and show the reaction that occurs, including all steps of the mechanism. Again, briefly explain the reasoning behind your choice. (15 pts)

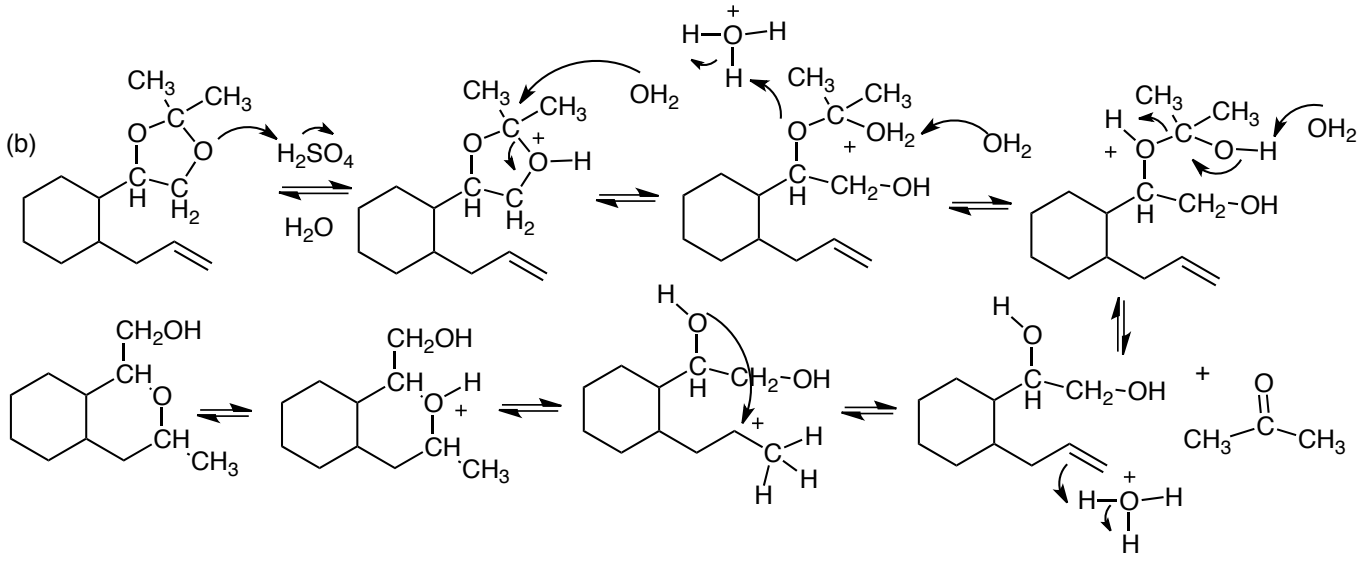


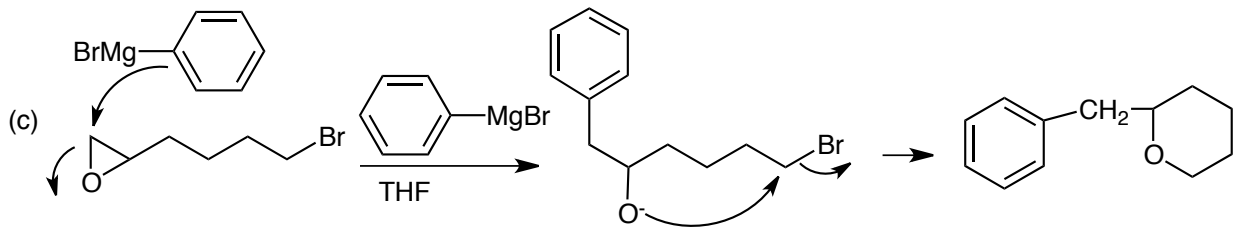
(a) A is a strong acid due to the inductive effect of the very strong electron withdrawing nitro group. (b) **C** will form a much higher concentration of hydrate in acidic conditions due to the strong electron withdrawing inductive effect of the CF_3 group that makes the carbonyl carbon more electron deficient and therefore more reactive to attack by the nucleophilic water and also due to the fact that **C** is an aldehyde and is less hindered than the ketone **D**.



5. Show how the following transformations occur, giving all of the steps of the mechanisms. No other reagents are needed except 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)