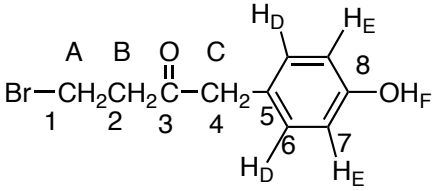
ANSWER KEY

Long Island University, Department of Chemistry

Chem. 122, Sect 009, Exam 2, 150 pts, Spring, 2012

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 corresponds to. (15 pts)



There are 6 proton signals and 8 carbon signals.

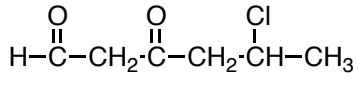
H_A = triplet, 2H H_D = doublet, 2H

H_B = triplet, 2H H_E = doublet, 2H

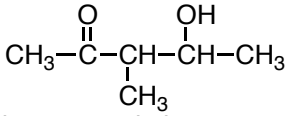
H_C = singlet, 2H H_F = singlet, 1H

IR absorptions: C_{sp3}-H at 2850-3000 cm^{-1}; C_{sp2}-H at 3100-3000 cm^{-1}; O-H at 3300-3500 cm^{-1}; C=O at ~1750 cm^{-1}, etc

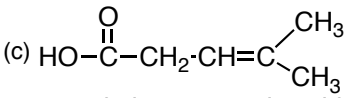
2. Name the following molecules. (15 pts)

(a) 

5-chloro-3-oxo-hexanal

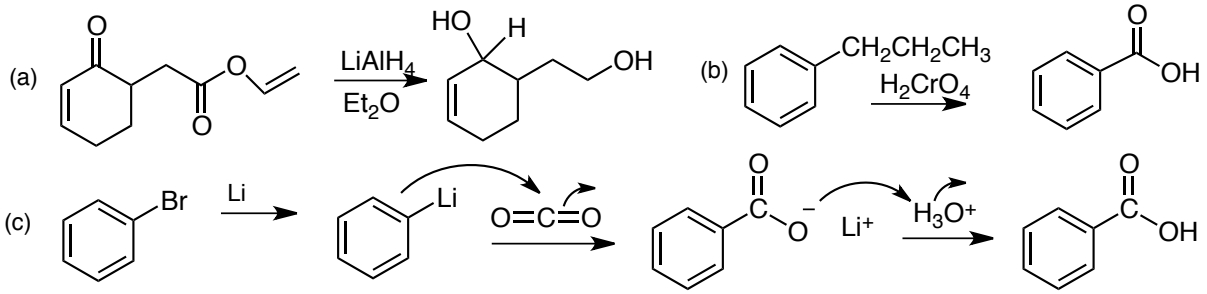
(b) 

4-hydroxy-3-methyl-2-pentanone

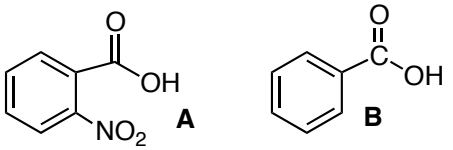
(c) 

4-methyl-3-pentenoic acid

3. Give the product of the following reactions. It is not necessary to show the reaction mechanism but do show all intermediates formed. (15 pts,)



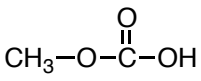
4. Look at the following pairs of molecules and in each case choose which is the stronger acid of that pair and briefly explain your reasoning. (10 pts)

(a) 

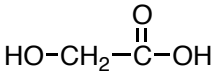
A

B

A is stronger due to the strong inductive effect of the nitro group that helps to withdraw electrons from the benzene ring and subsequently from the O-H bond.

(b) 

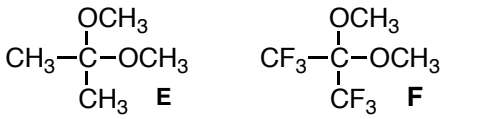
C



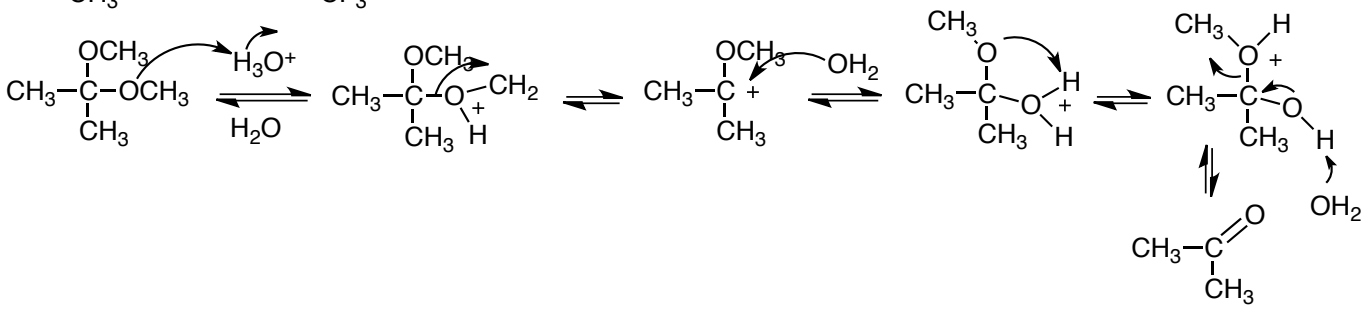
D

D is a stronger acid than **C** because the oxygen in **C** is donating electrons to the carbonyl carbon through resonance, making it less electron deficient and less of an electron withdrawing group.

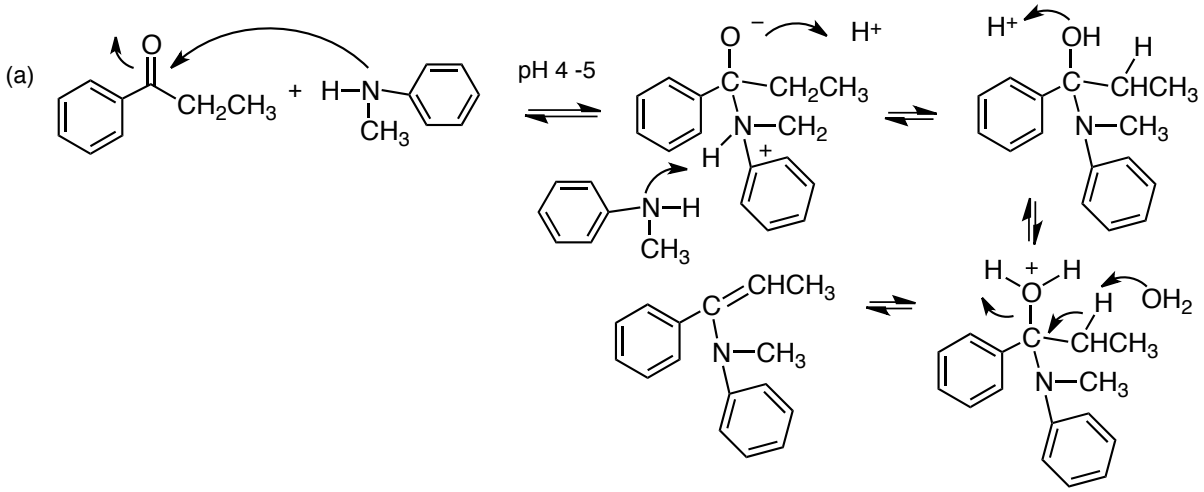
5. Which acetal would cleave faster? Explain your reasoning and show the complete cleavage reaction and mechanism for the molecule that you choose in H_3O^+/H_2O. (15 pts)

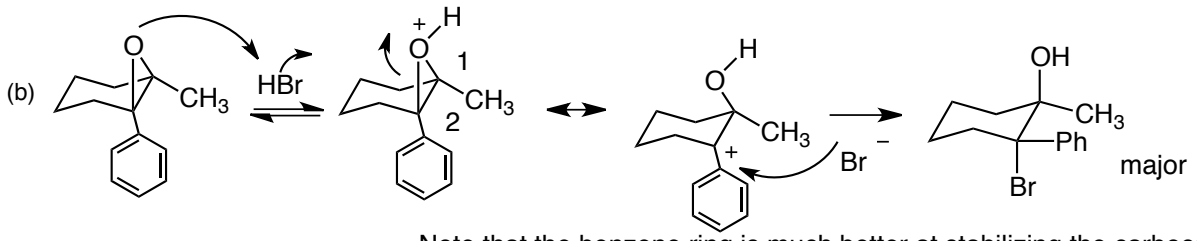


E cleaves faster since it forms a more stable carbocation. The CF_3 groups are strong electron withdrawing groups and destabllize the carbocation intermediate.

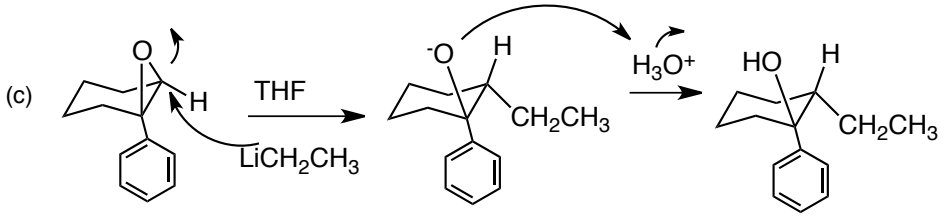


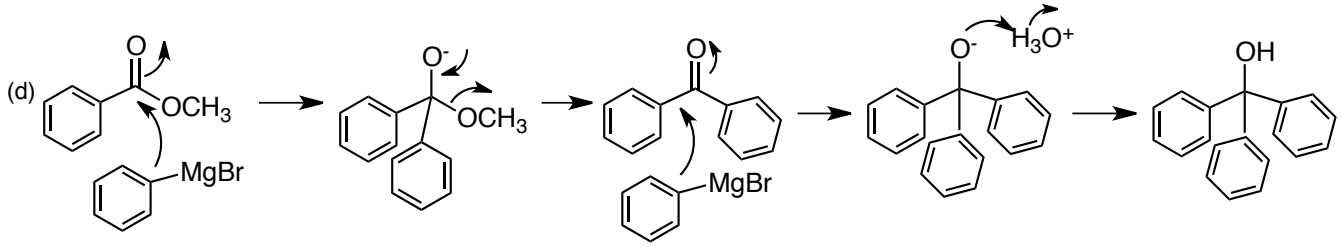
6. Give the product of the following reactions, showing all of the steps of the reaction mechanism. (60 pts)



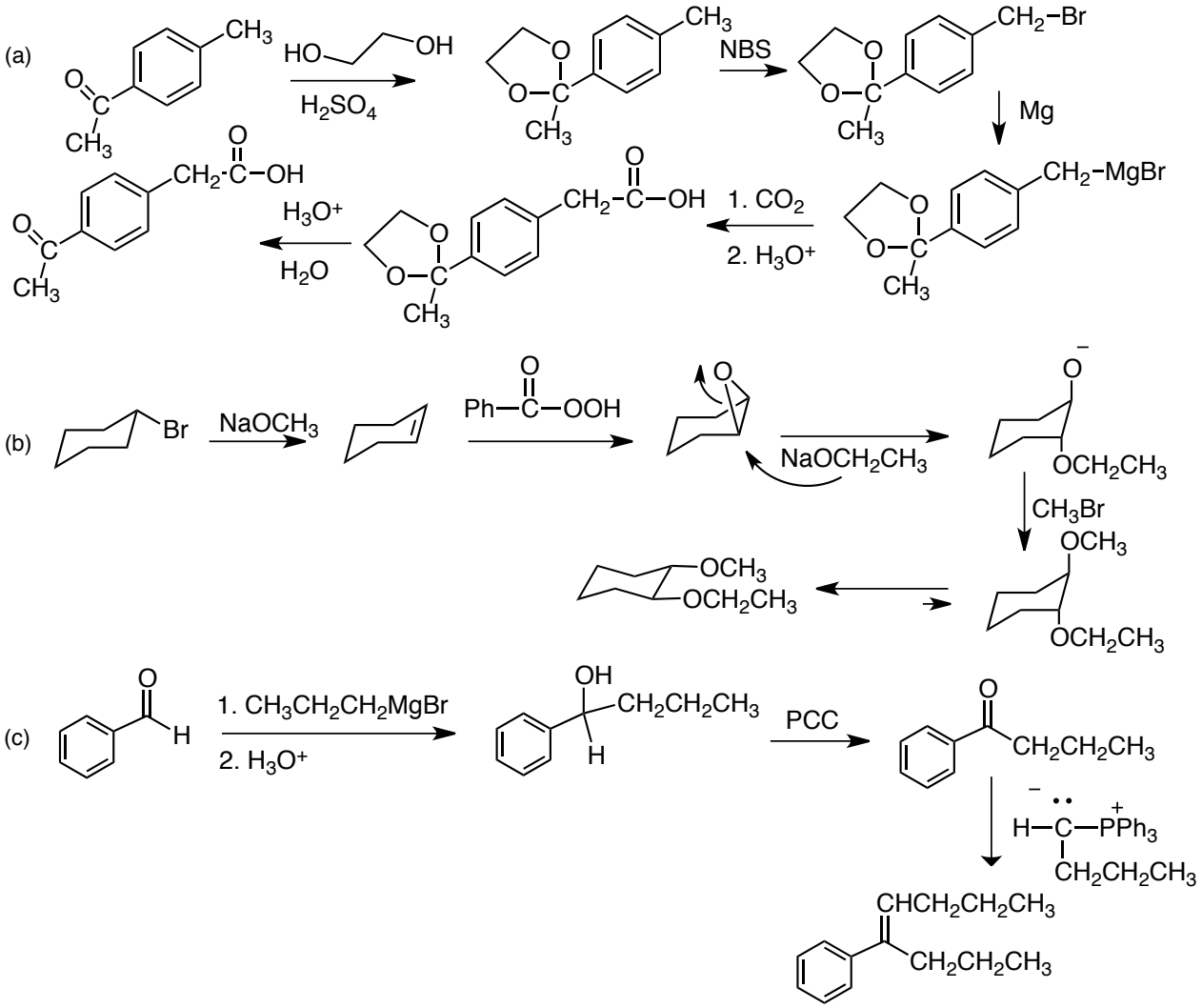


Note that the benzene ring is much better at stabilizing the carbocation than the methyl group so the one major product is the one where the Br^- attacks at C2





7. Synthesize **two** of the following **three** molecules from the starting materials given on the left as shown. Do all **three** for extra credit. (20 pts)


(a)
CH3
HO
OH
H2SO4
NBS
CH2–Br
Mg
CH2–MgBr
1. CO2
2. H3O+
CH2-C–OH
H3O+
H2O
(b)
Br
NaOCH3
Ph–C–OOH
NaOCH2CH3
OCH2CH3
CH3Br
OCH3
(c)
1. CH3CH2CH2MgBr
2. H3O+
OH
CH2CH2CH3
PCC
H
PPh3
CHCH2CH2CH3