

CH310N
Spring 2010

Anslyn

February 16, 2010

Exam 1

Please **PRINT** the first three letters of your last name in the three boxes.

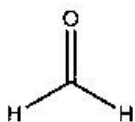
| | | |
|---|---|---|
| K | E | Y |
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PRINT Name _____ UT-EID _____

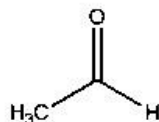
- 1) _____ (7 pts)
- 2) _____ (8 pts)
- 3) _____ (6 pts)
- 4) _____ (4 pts)
- 5) _____ (32 pts)
- 6) _____ (5 pts)
- 7) _____ (8 pts)
- 8) _____ (8 pts)
- 9) _____ (8 pts)
- 10) _____ (8 pts)
- 11) _____ (6 pts)
- Bonus) _____ (4 pts)

Total Score _____ (100 pts)

1. a) (From the notes) Give the common names for the following compounds. (2 points)

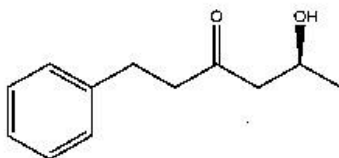


Formaldehyde



Acetaldehyde

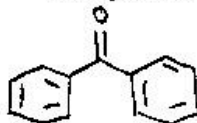
- b) (From homework, problem 16.14) Give the IUPAC name for the following compound. (2 points)



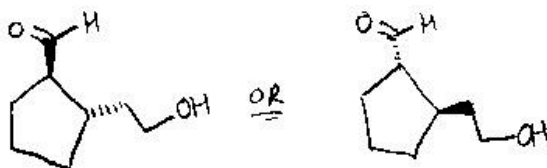
(S)-5-hydroxy-1-phenylhexan-3-one

- c) (Partly from notes). Draw the chemical structures of the following names. (3 points)

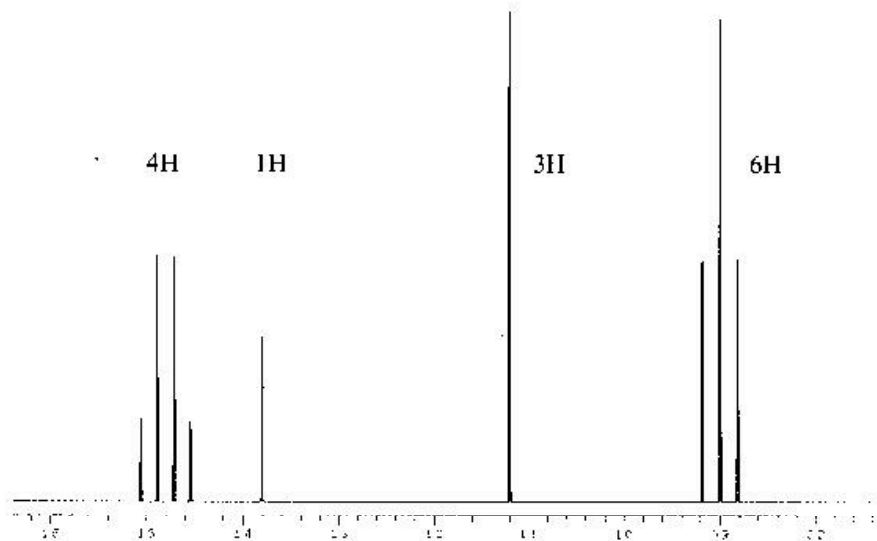
benzophenone



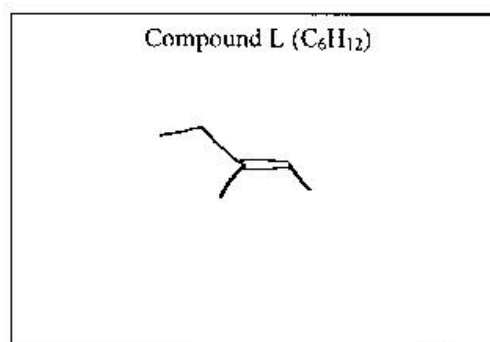
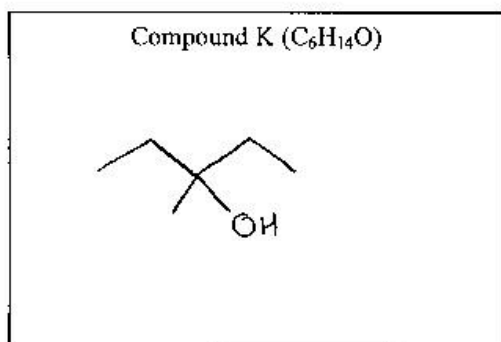
trans-2-(2-hydroxyethyl)cyclopentanecarbaldehyde



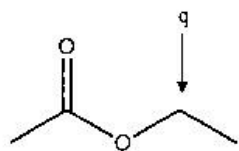
2. (From homework, problem 13.19) Compound K, molecular formula $C_6H_{14}O$, readily undergoes acid-catalyzed dehydration when warmed with phosphoric acid to give Compound L, molecular formula C_6H_{12} , as the major organic product. The 1H -NMR spectrum of Compound K (shown below) shows signals at δ 0.90 (t, 6H), 1.12 (s, 3H), 1.38 (s, 1H), and 1.48 (q, 4H). (8 points)



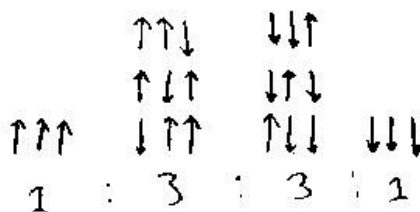
Deduce the structural formulas of Compounds K and L.



3. The indicated CH_2 group in the following molecule gives a quartet signal in the ^1H NMR spectrum. Using arrows to represent nuclear spin, explain the splitting pattern. Then predict the relative sizes of the four peaks in the quartet. (6 points)

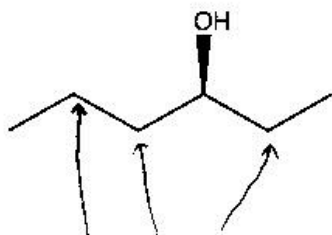


Three H nuclei next door can have spins of $+\frac{1}{2}$ or $-\frac{1}{2}$, represented as \uparrow or \downarrow . All possible combinations are shown below.



The two with all spins \uparrow or all \downarrow are unique, while the combinations with 2 \uparrow and 1 \downarrow or 2 \downarrow and 1 \uparrow each have 3 possibilities, leading to a 1:3:3:1 intensity ratio.

4. How many distinct, inequivalent hydrogens are in the following molecule? (4 points)

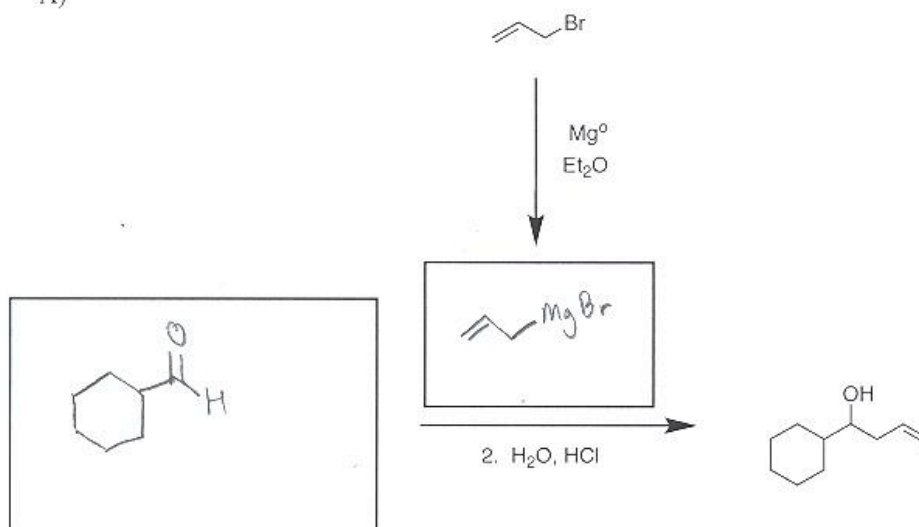


10

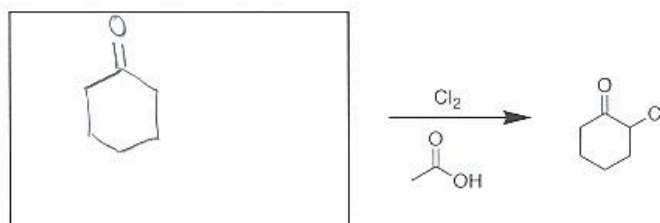
3 sets of diastereotopic protons that are all chemical shift inequivalent

5. Fill in the box with the appropriate reactant, reagent, or product. Some boxes require more than one step. (32 points)

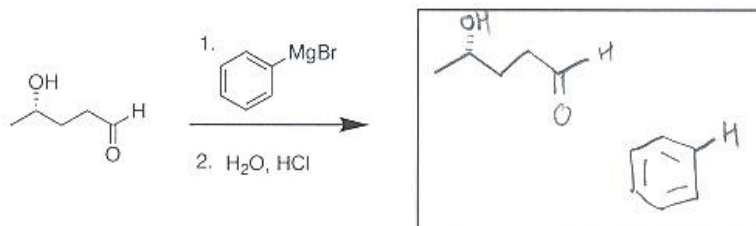
A)



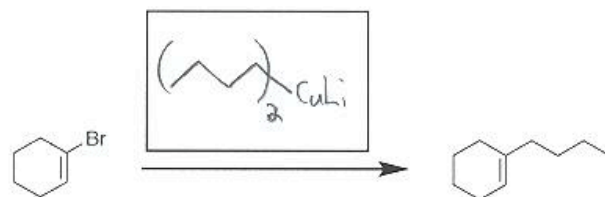
B) From homework, problem 16.46



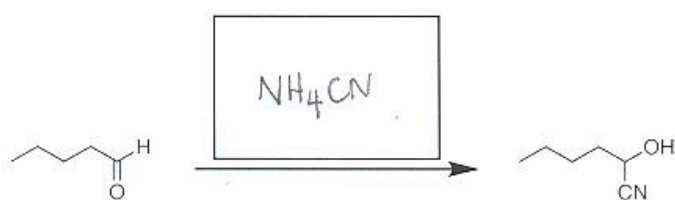
C)



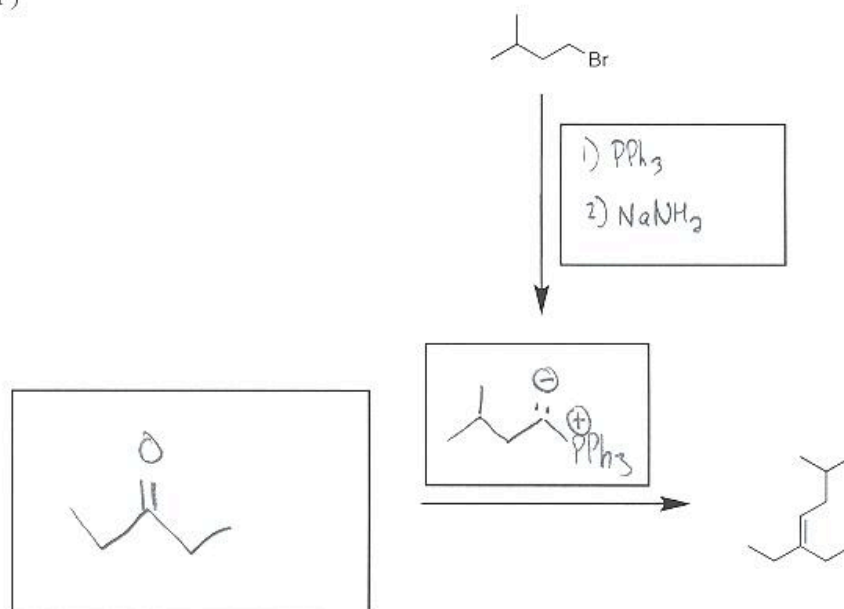
D) From homework, problem 15.7



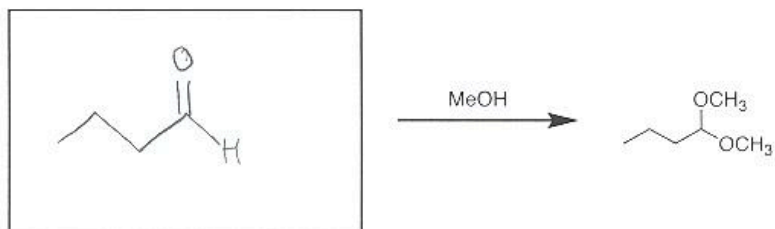
E)



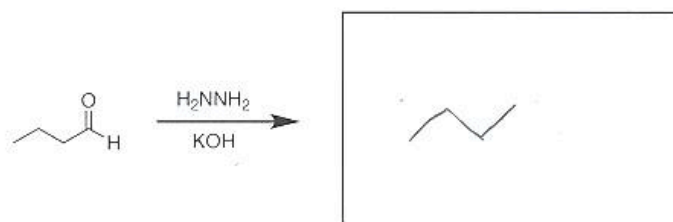
F)



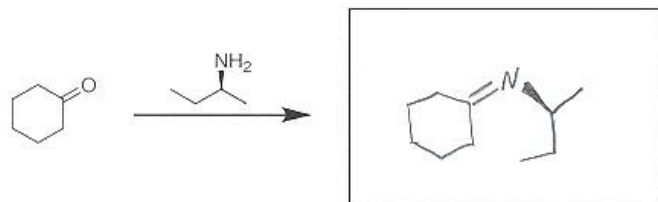
G) From homework, problem 16.30



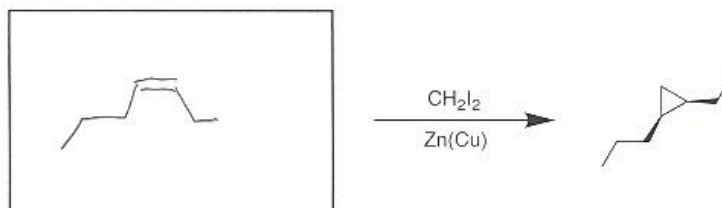
H) From homework, problem 16.43



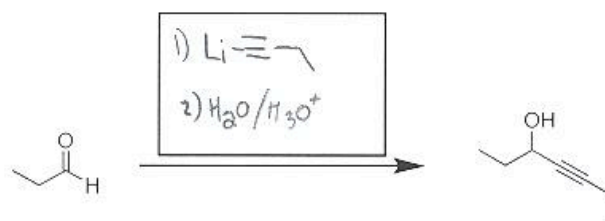
I)



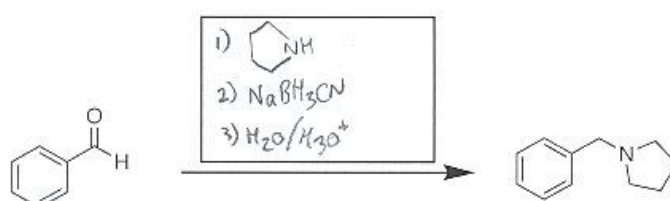
J)



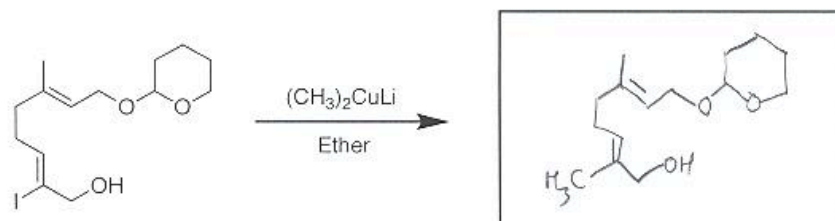
K)



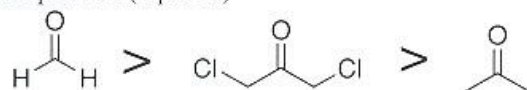
L)



M) From homework, problem 15.24



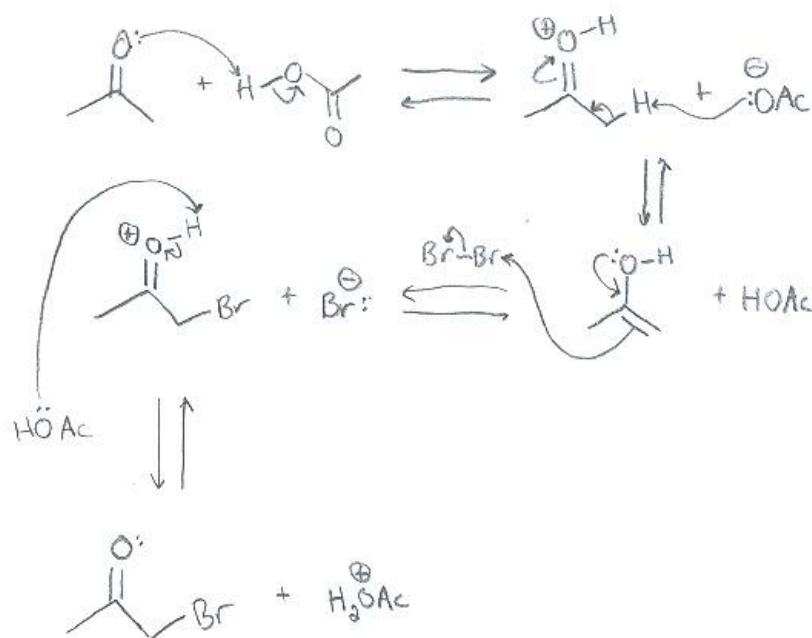
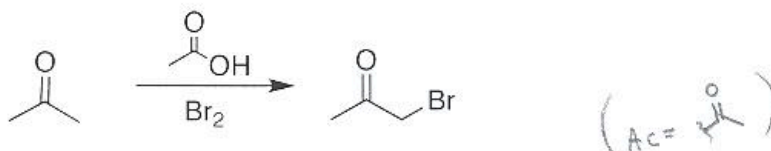
6. In 3 sentences or less, please explain the noted trend in reactivity toward hydration of the three carbonyl compounds. (5 points)



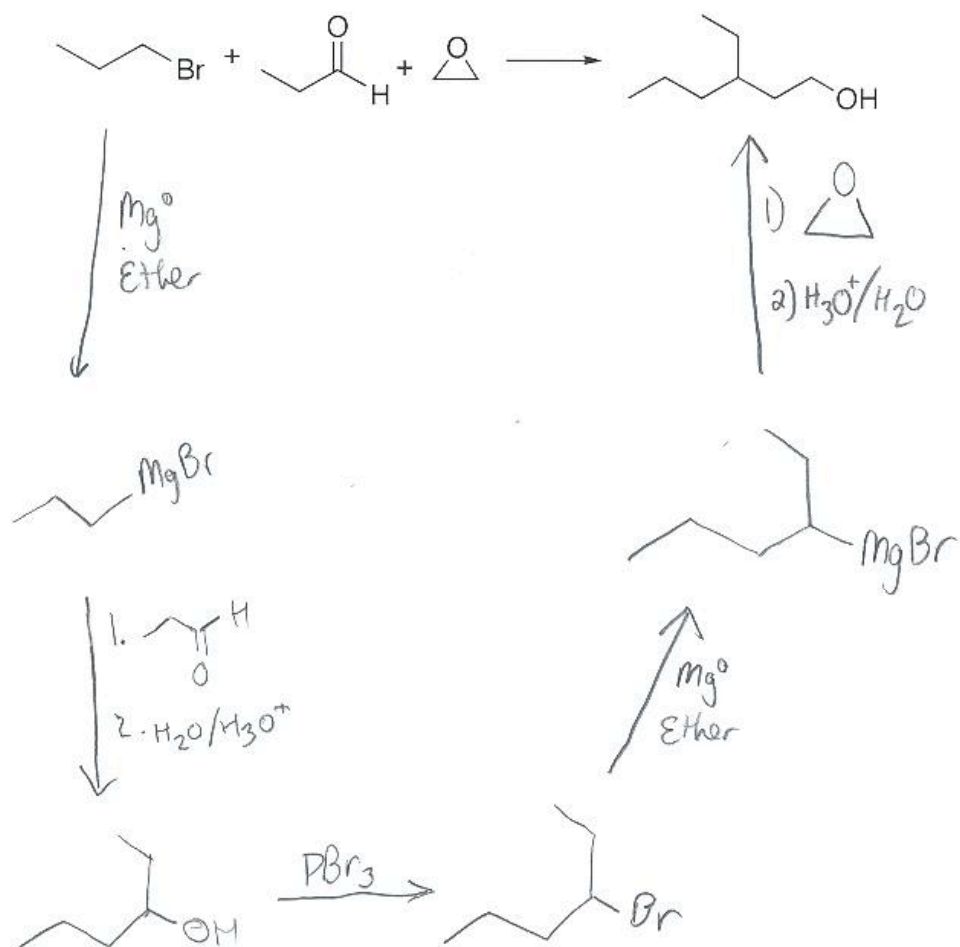
Sterics — less substituted carbonyl (formaldehyde) reacts the most with water to form the hydrate. The other two both have 2 alkyl groups off of the carbonyl.

Electronics — more electron withdrawing substituents makes the carbonyl more electrophilic and react faster with water.

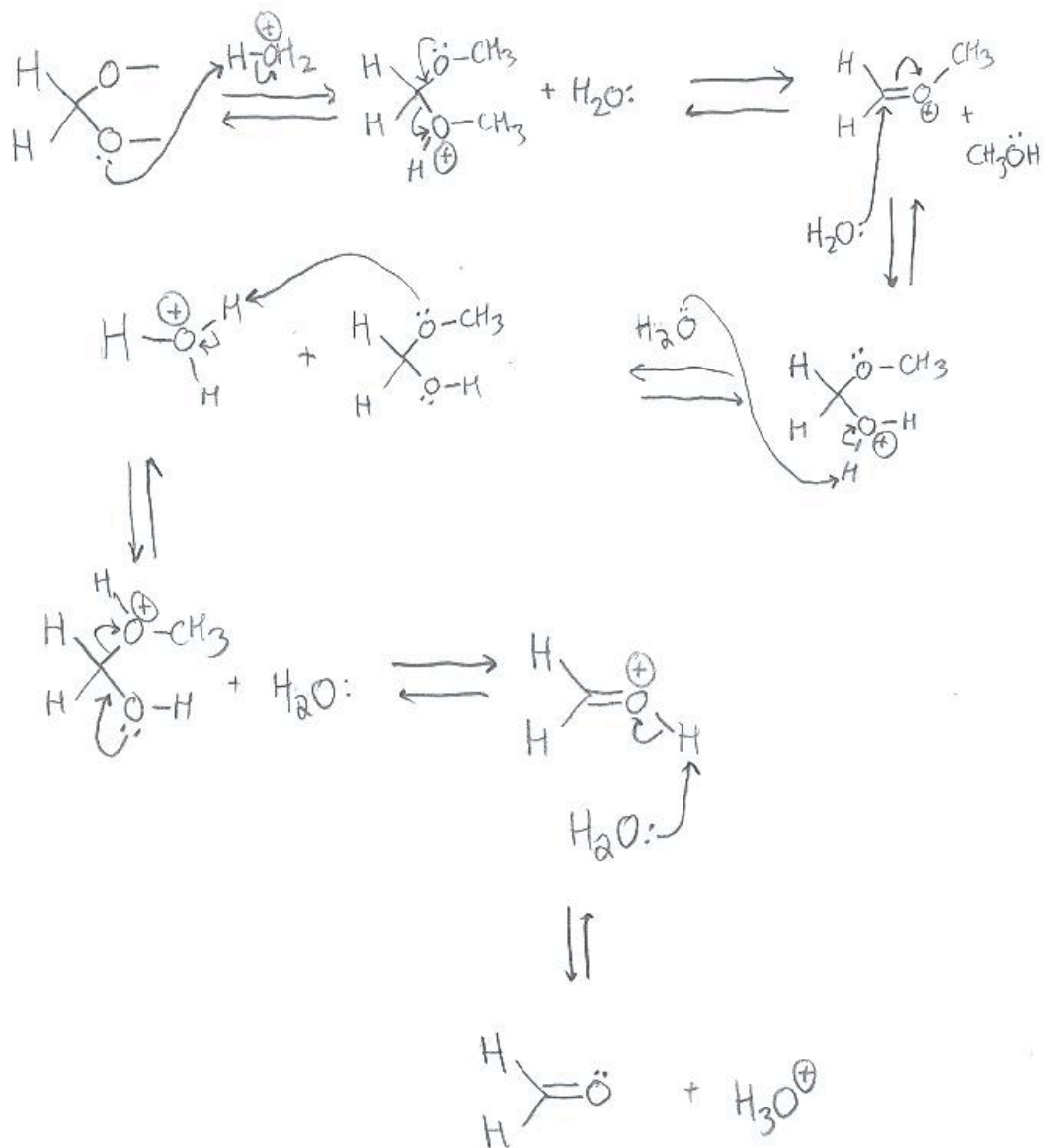
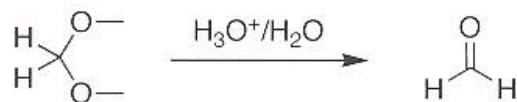
7. One of the mechanisms studied in class was α -halogenation. The following example shows the α -bromination of acetone. Draw a plausible mechanism for this transformation, showing all arrow pushing and lone pairs. (8 points)



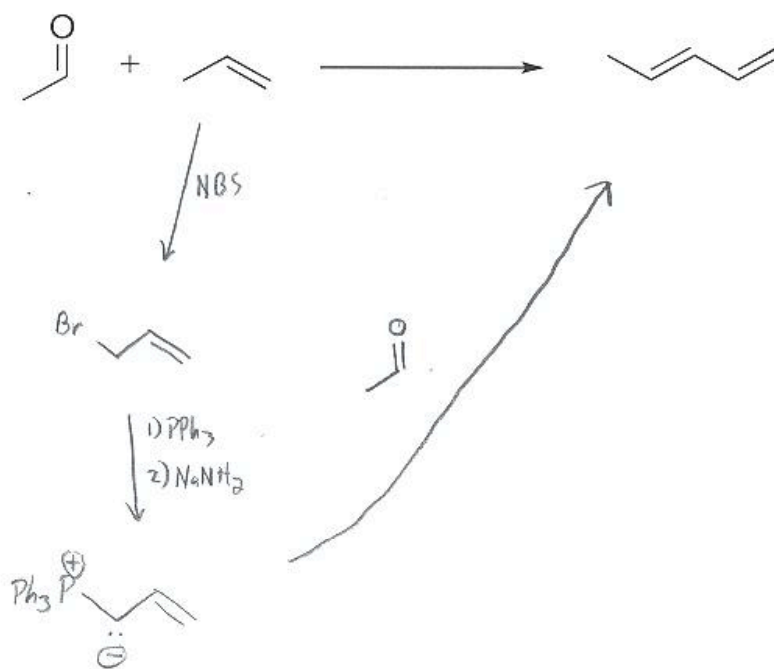
8. (From homework, problem 16.20) Show how to synthesize the following alcohol using 1-bromopropane, propanal, and ethylene oxide as the only sources of carbon. (8 points)



9. The following acetal is formed by reacting an aldehyde with excess methanol. When placed in acidic water, the equilibrium is pushed back toward the starting aldehyde. What is the mechanism of this reaction? Show all arrow pushing and lone pairs. (8 points)

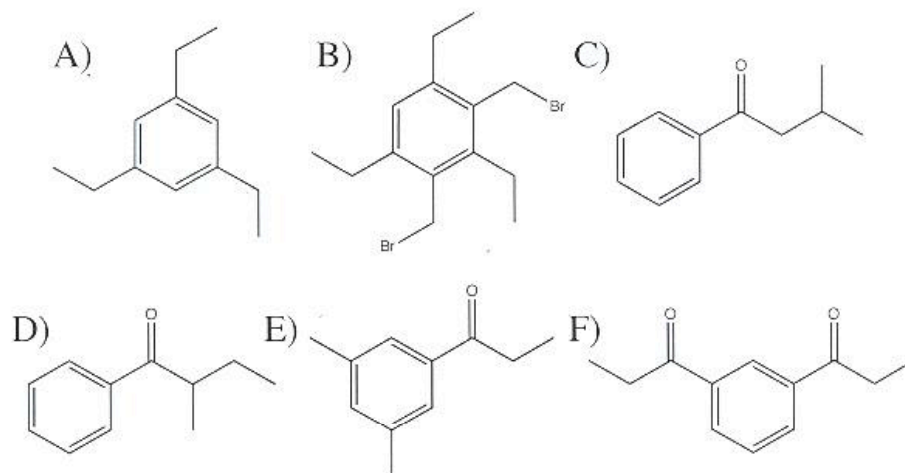


10. Using the following aldehyde and propene, show how you would synthesize the desired product. All carbon atoms in the final product must come from the aldehyde and propene. You may use any reagents you desire EXCEPT organolithium, organomagnesium, or organocopper species. (8 points)

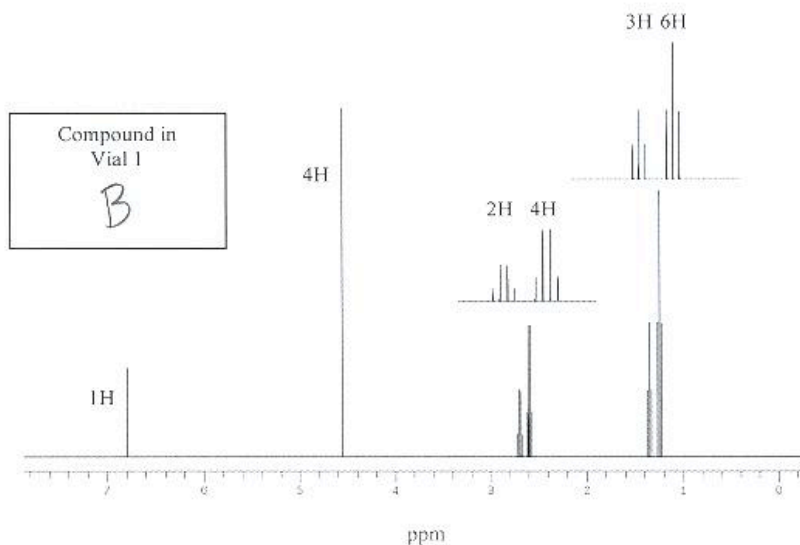


11. Your TA Leo was working in the lab, and found three vials of compounds in a drawer. To his dismay, these vials were poorly labeled and did not have a chemical structure or chemical formula for the compound inside the vial. Leo had a vague idea what the compounds might be and wrote down six possible structures, A-F. Then, he took a ^1H -NMR spectrum of all three compounds. Using the information below, help him figure out which compound belongs to each vial. Label each spectrum below with the letter that corresponds to the correct structure. (6 points)

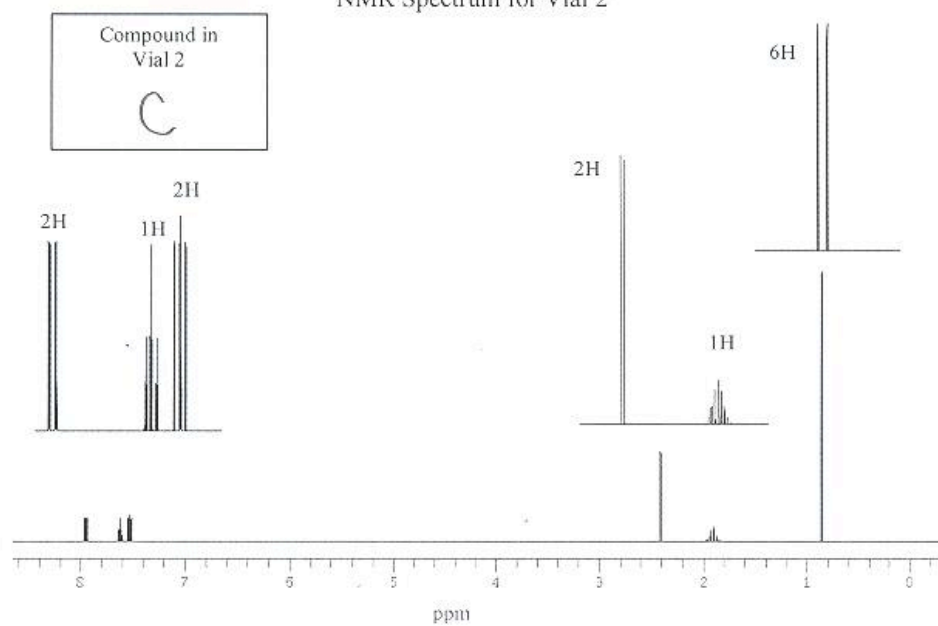
Possible Structures A-F



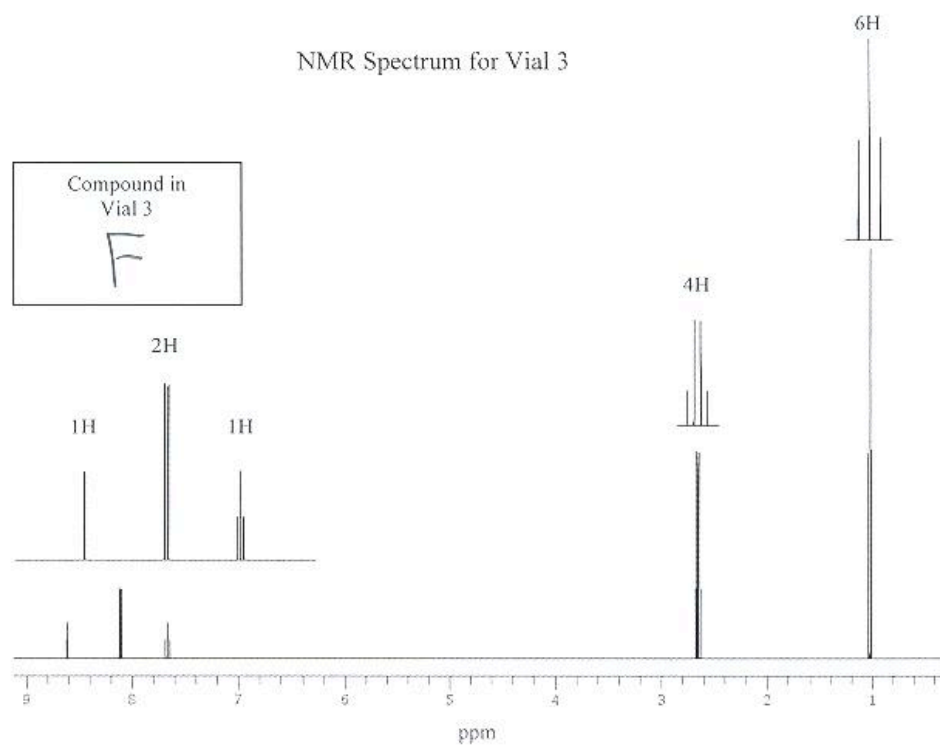
NMR Spectrum for Vial 1



NMR Spectrum for Vial 2



NMR Spectrum for Vial 3



12. BONUS QUESTION: Write each TA's first name on the line below his or her picture.
(4 points)



Leo



Michelle



Jeff



Justin

