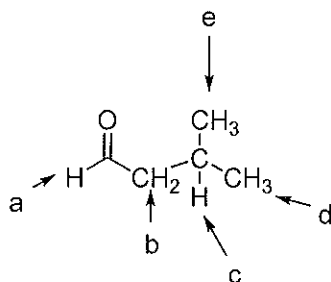


Part I: Multiple Choice (14 points)

For the following compound:



1. How many signals do you expect to see in the proton NMR?

- a) 3
- b) 4
- c) 5
- d) 9
- e) 10

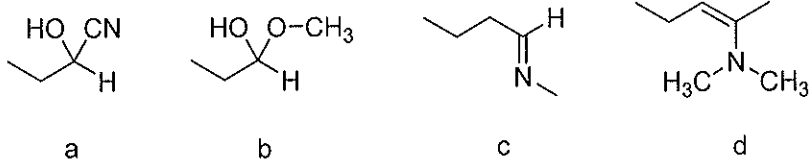
2. Which of the indicated protons should appear the furthest **downfield** in the proton NMR?

- a) a
- b) b
- c) c
- d) d
- e) e

3. What should be the splitting pattern of the **d** protons?

- a) singlet
- b) doublet
- c) triplet
- d) quartet
- e) pentet

4-7: Consider the following compounds and answer questions 4-7.



4. Which is a **hemiacetal**?

a b c d

5. Which is an **imine**?

a b c d

6. Which is a **cyanohydrin**?

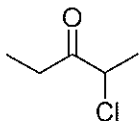
a b c d

7. Which would be converted to a **ketone** upon acid hydrolysis?

a b c d

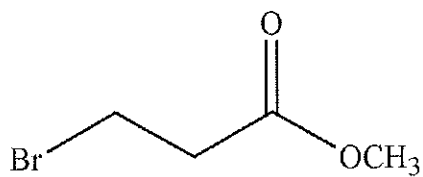
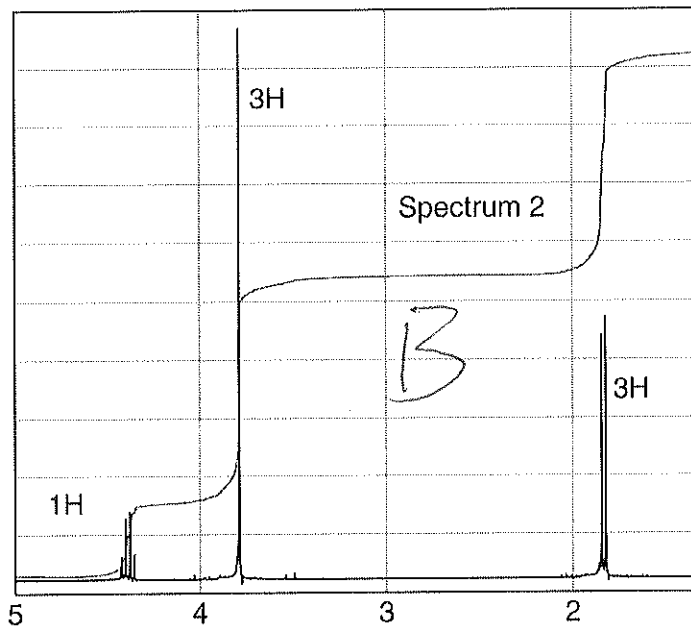
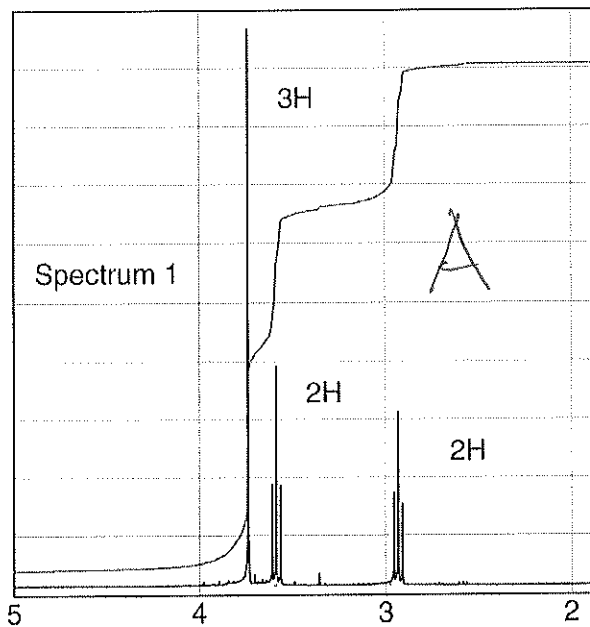
Part II: Short Answer

8. (3 points) Give a IUPAC name for the following compound:

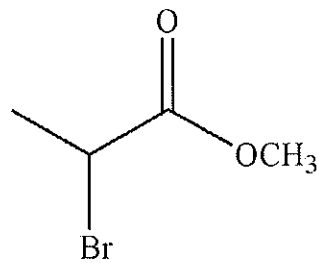


2-chloro-3-pentanone

9. (8 points) Match each of these ^1H NMR spectra to the correct compound. Explain how you determined which was which. No credit for just guessing!



Compound A



Compound B

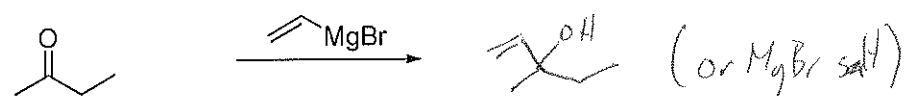
Only need enough analysis to decide.

e.g. $2 \times 2\text{H t} = \sim\text{CH}_2\text{CH}_2\sim \therefore 1 = \text{A}$

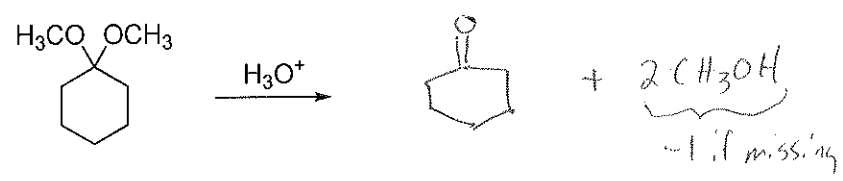
$3\text{H d} = \text{CH}_3\text{-CH} \therefore 2 = \text{B}$

10. (28 points) Give the major product(s) for the following reactions:

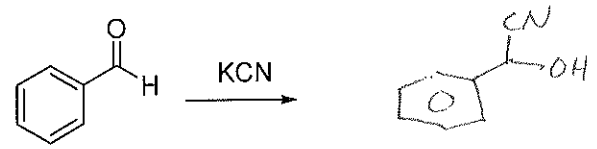
a)



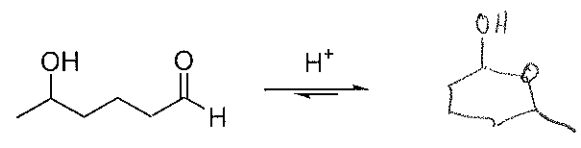
b)



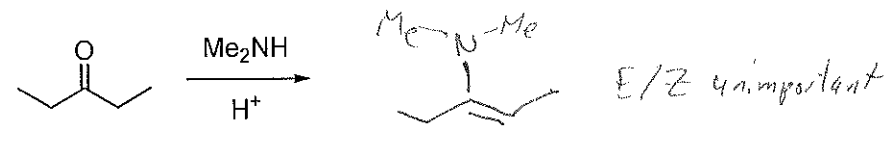
c)



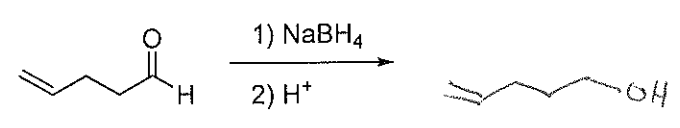
d)



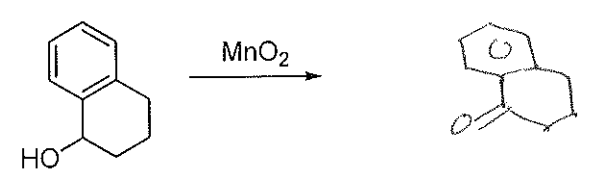
e)



f)

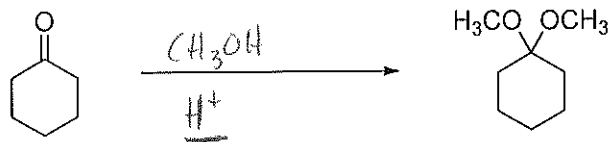


g)

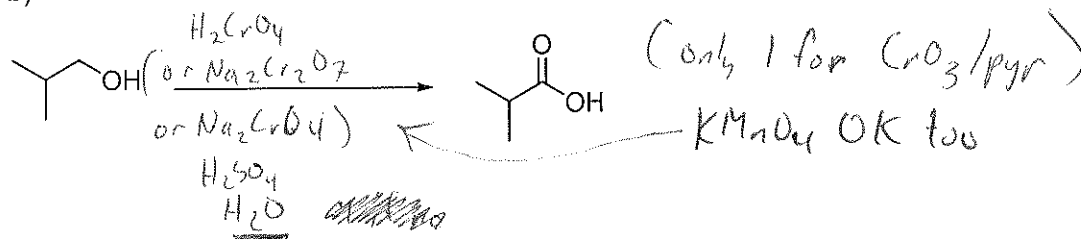


11. (15 points) Provide reagents for the following transformations:

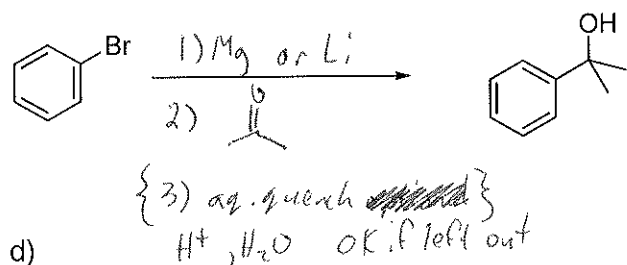
a)



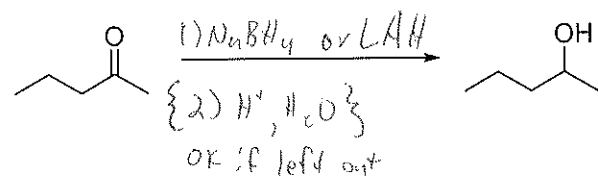
b)



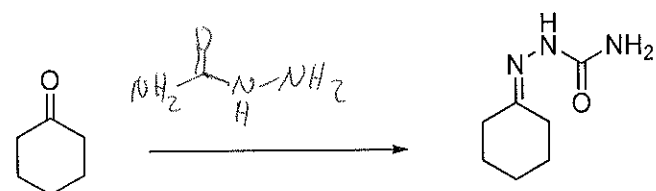
c)



d)



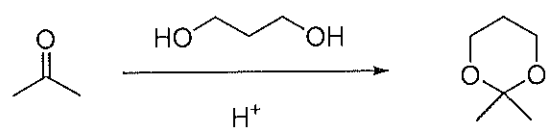
e)



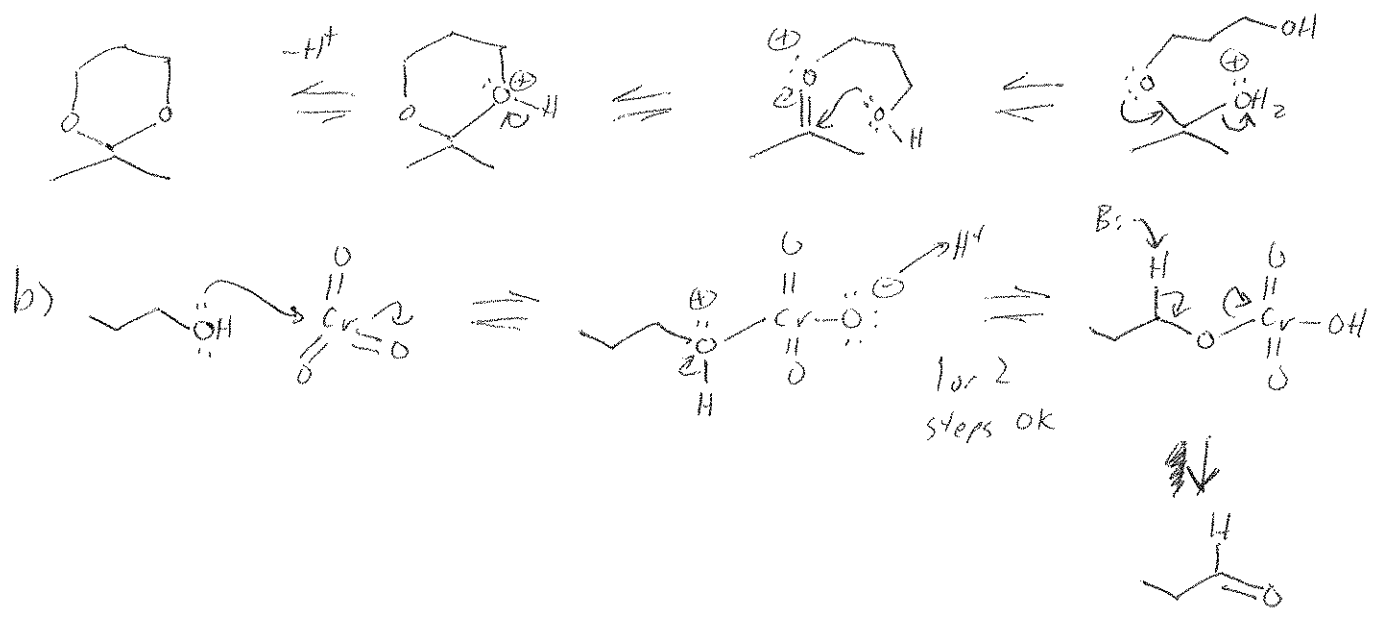
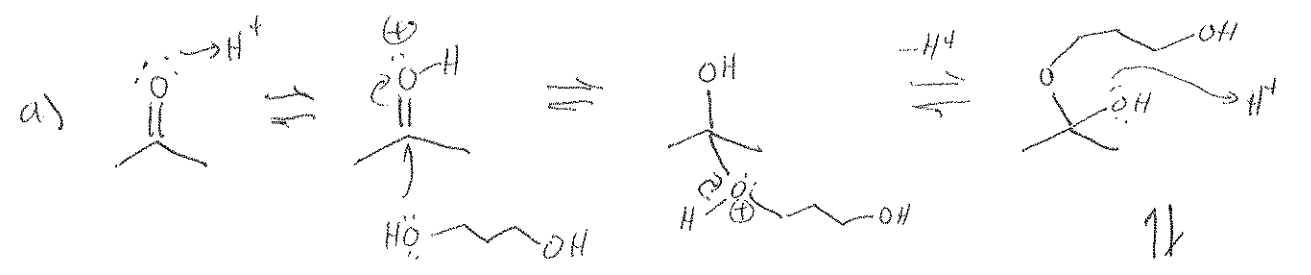
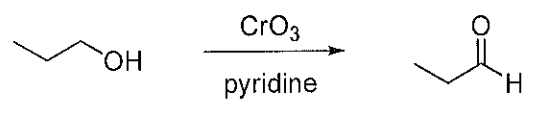
Part IV: Mechanisms

12 (10 points) Give the mechanism for **ONE** of the two following transformations. **Clearly indicate which one of the two mechanisms you wish to be graded.**

a)



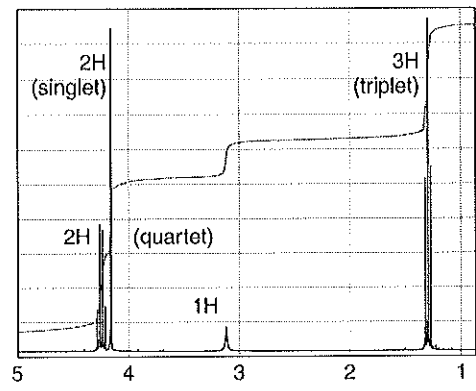
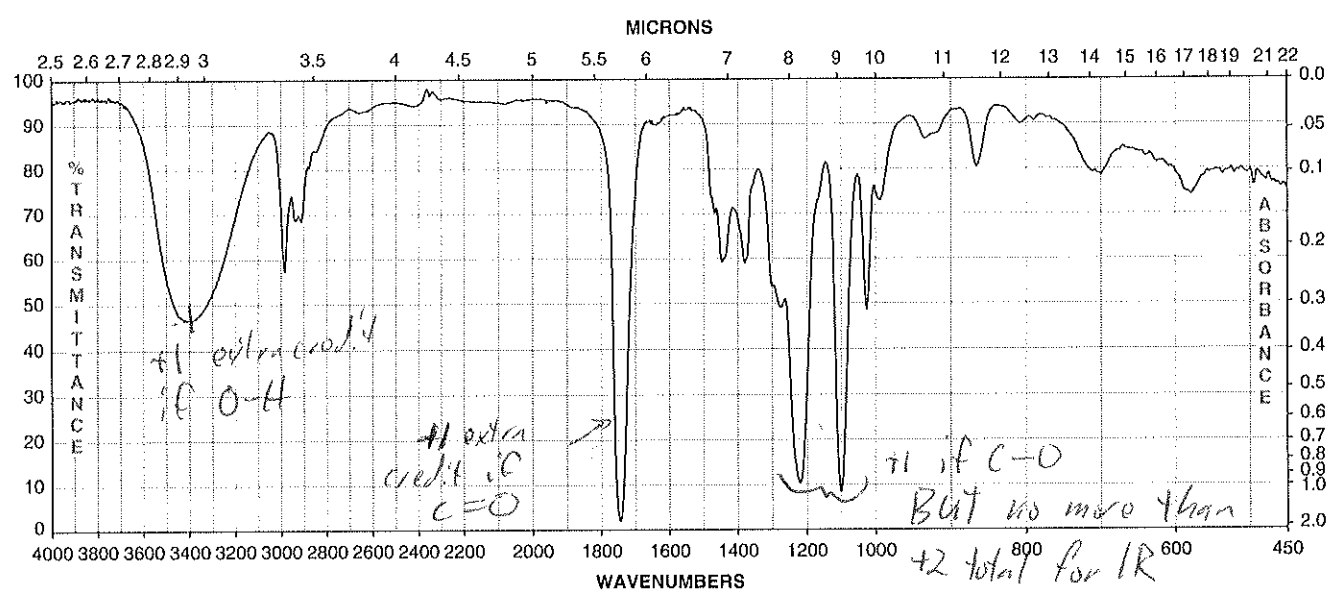
b)



DBE (+1) extra cred. 4

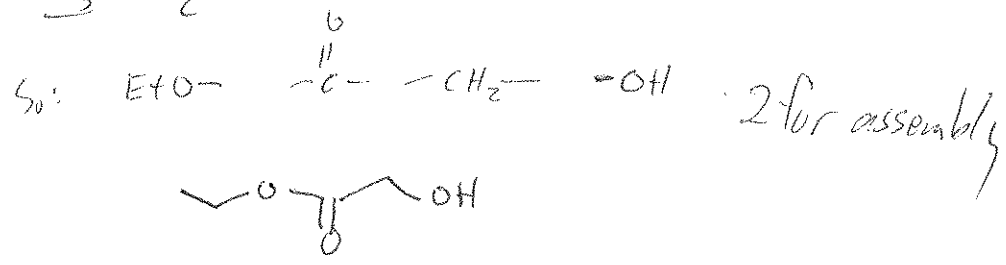
Spectroscopic Analysis of an Unknown Compound (10 points)

14. The IR and ¹H NMR spectra for a compound with the formula C₄H₈O₃ are shown below. Identify the structure of the compound. Use the ¹H NMR data to construct a table (chemical shift, integration, multiplicity, assignment) to identify structural fragments, then arrive at the structure. **You are being graded on your analysis.** Any use of the degrees of unsaturation, or IR, will be considered for extra credit



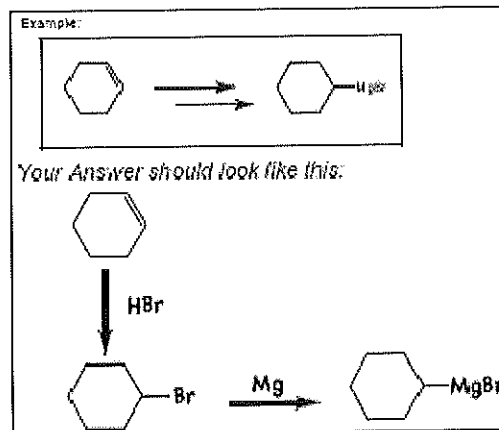
δ	int	mult	asst	
4.3	2H	q	X-CH ₂ -CH ₃	(O-CH ₂ -CH ₃) 2
4.2	2H	s	X-CH ₂ -Y	(O-CH ₂ -Y) 2
3.2	1H	brs	O-H	2
1.3	3H	t	CH ₃ -CH ₂	2

CH₃CH₂-O
 -CH₂-
 C=O
 C₄H₇O₂ missing OH.

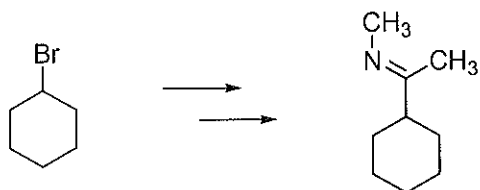


Part III Multistep Synthesis (9 points)

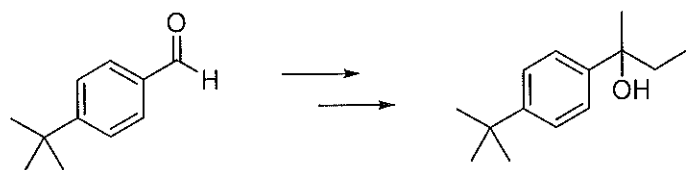
13. Choose one of the two following synthesis problems. Show how you can synthesize the product on the right from the indicated starting material on the left. You can show a retrosynthesis for partial credit, but full credit requires writing out a sequence of forward reactions (see box at right for an example).



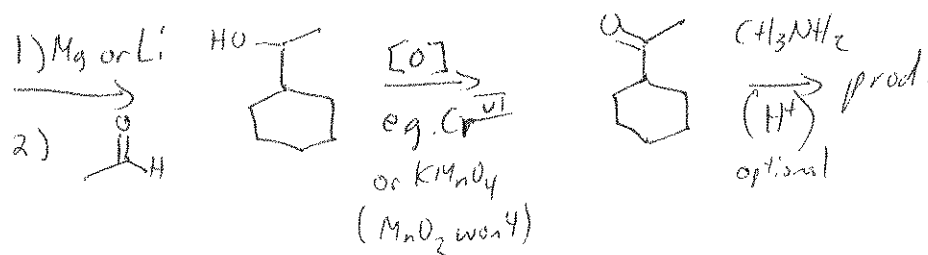
a)



b)



a)



b)

