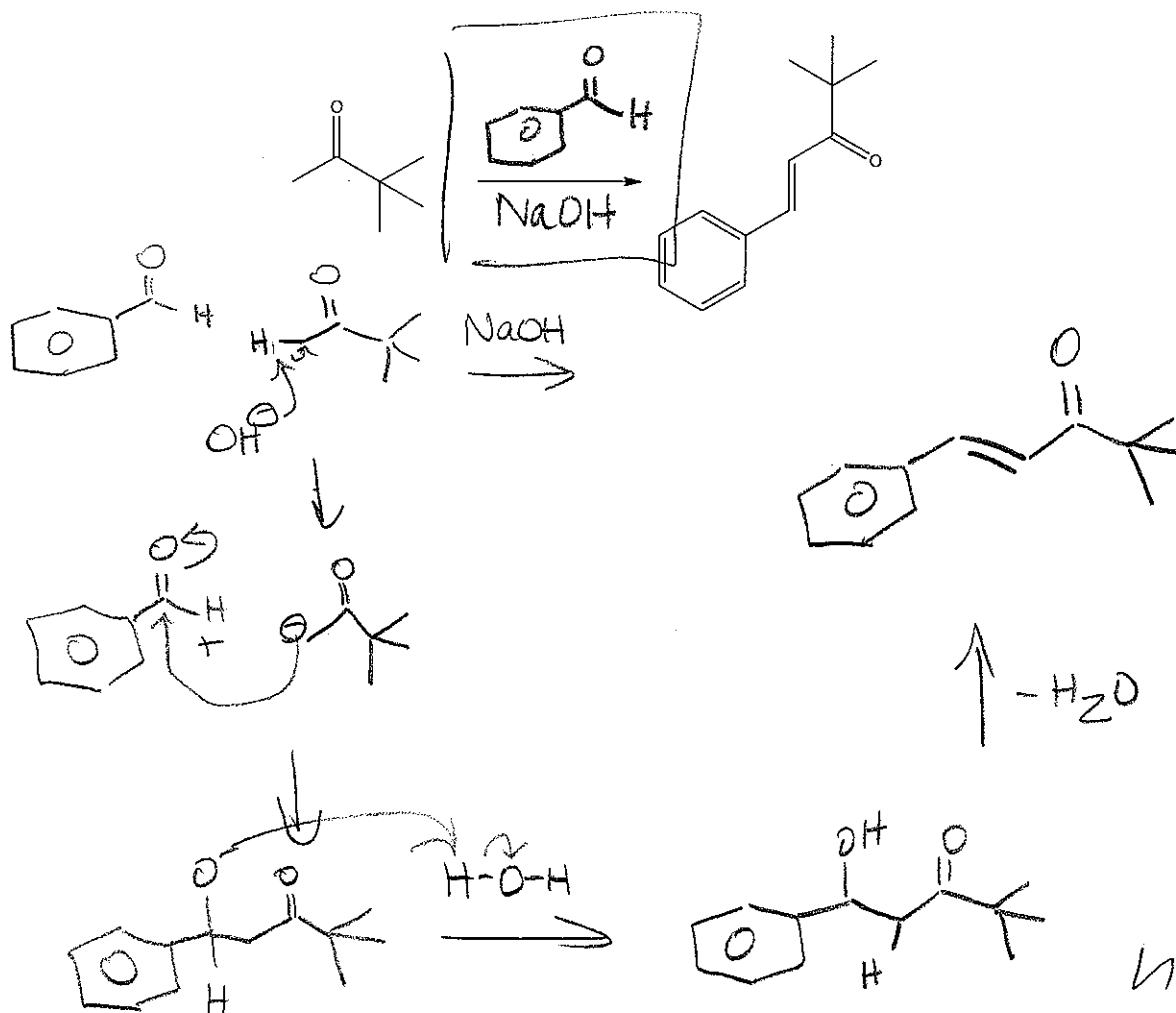


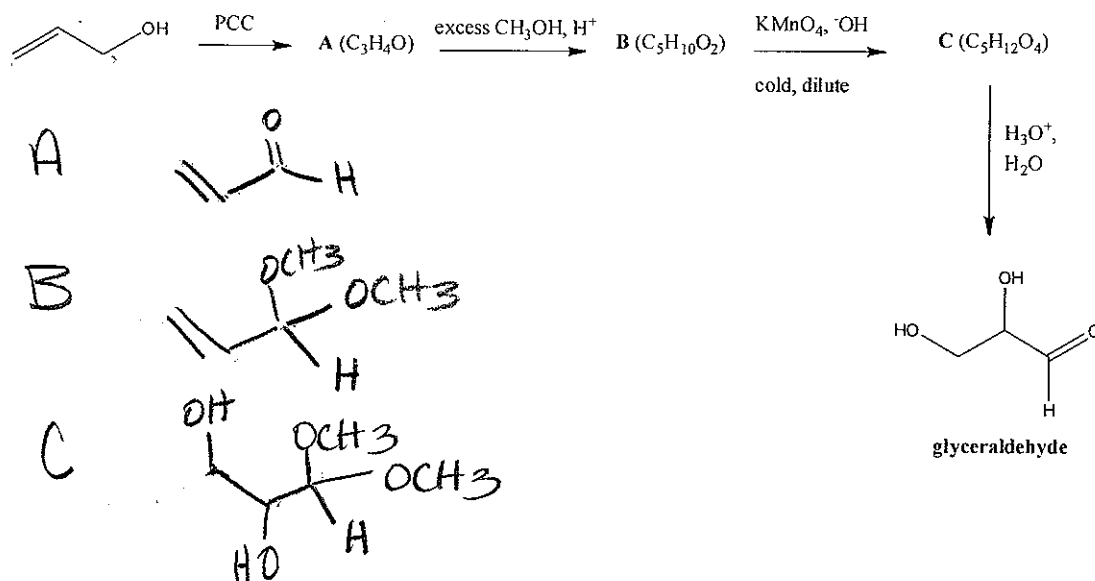
1. **Question 18.20 from homework (5 points):** Give an IUPAC or common name for each of the following compounds.

- a. $C_6H_5CO_2H$ Benzoic Acid
- b. C_6H_5COCl Benzoyl chloride
- c. $C_6H_5CONH_2$ Benzamide
- d. $(C_6H_5CO)_2O$ Benzoic anhydride
- e. $C_6H_5CO_2CH_2C_6H_5$ Benzyl benzoate

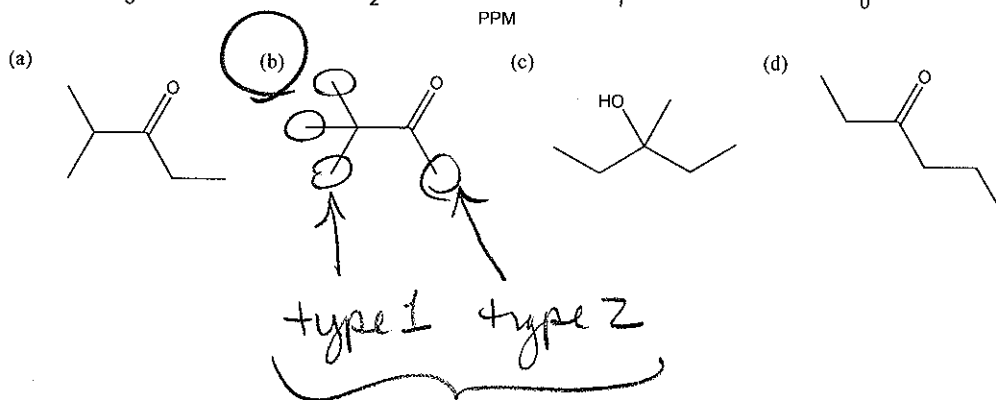
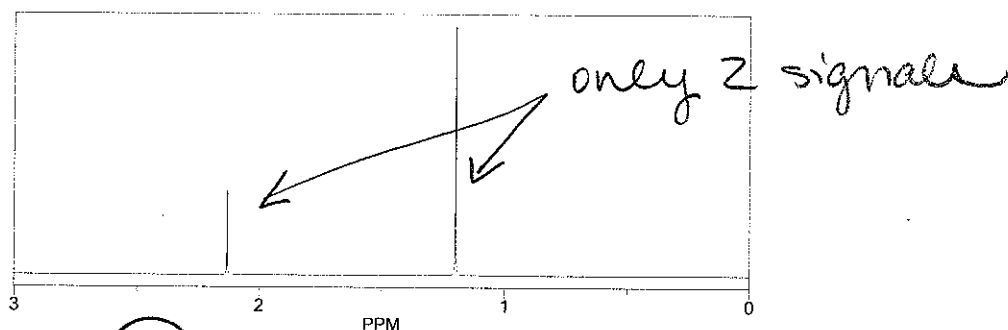
2. **Question 17.31 from homework (10 points):** Show how the following transformation could be accomplished. You may use any other required reagents.



3. **Question 16.32 from homework (10 points):** Outlined here is a synthesis of glyceraldehyde (shown below). Provide chemical structures for A – C in the free space?

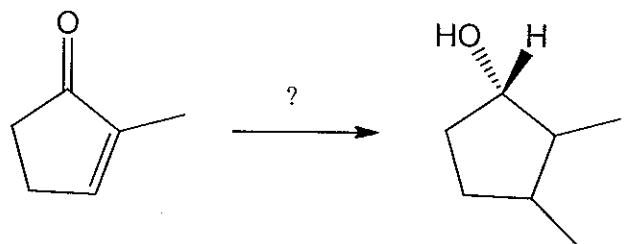


4. **Bonus question (10 points):** the following NMR is most consistent with which of the following structures? Justify your choice in the free space provided.

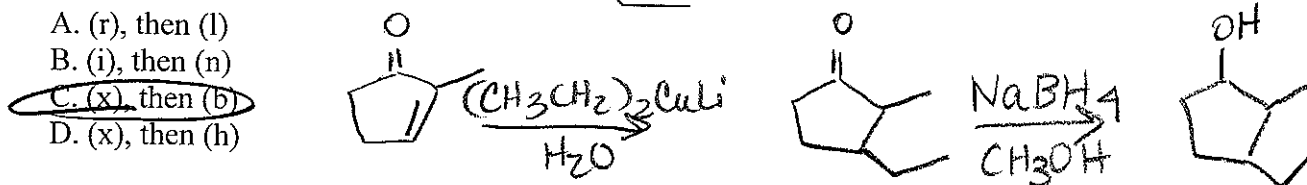


only compound
 which would generate an
 NMR spectra having only
 2 signals. Chemical shift
 values also consistent.

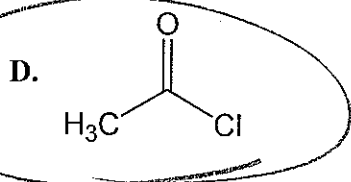
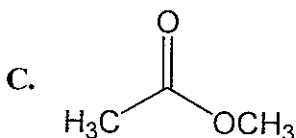
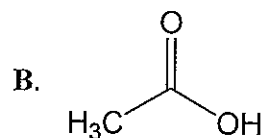
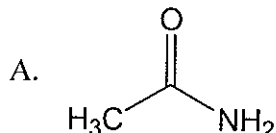
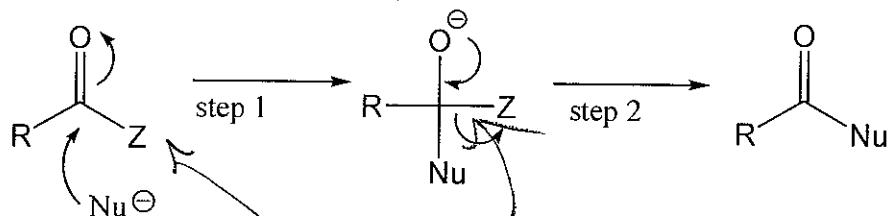
5. Synthesis question (10 points): Choose the best combination of reagents from the list provided to complete the following organic transformation
- (a) SOCl_2 ; (b) $\text{NaBH}_4/\text{CH}_3\text{OH}$; (c) Na_2CO_3 ; (d) $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4, \text{H}_2\text{O}$; (e) NH_3 ; (f) KMnO_4 ; (g) $\text{BH}_3/\text{H}_2\text{O}_2, -\text{OH}$; (h) $\text{H}_2\text{O}/\text{H}_2\text{SO}_4$; (i) $\text{LiAlH}_4/\text{H}_2\text{O}$; (j) NaOH ; (k) NaH ; (l) $\text{H}_2/\text{Pd-C}$; (m) NaNH_2 ; (n) DIBAL-H; (o) pyridine; (p) $\text{LiAlH}[\text{OC}(\text{CH}_3)_3]_3$; (q) $\text{C}_6\text{H}_5\text{-Br}$; (r) $\text{CH}_3\text{CH}_2\text{-MgBr}/\text{H}_2\text{O}$; (s) $(\text{CH}_2=\text{CH})_2\text{CuLi}/\text{H}_2\text{O}$; (t) $\text{CO}_2/\text{H}_3\text{O}^+$; (u) Mg ; (v) PBr_3 ; (w) $(\text{CH}_3)_2\text{CHCl}/\text{AlCl}_3$; (x) $(\text{CH}_3\text{CH}_2)_2\text{CuLi}/\text{H}_2\text{O}$; (y) $\text{C}_6\text{H}_5\text{-Mg-Br}/\text{H}_2\text{O}$



- A. (r), then (l)
 B. (i), then (n)
 C. (x), then (b)
 D. (x), then (h)



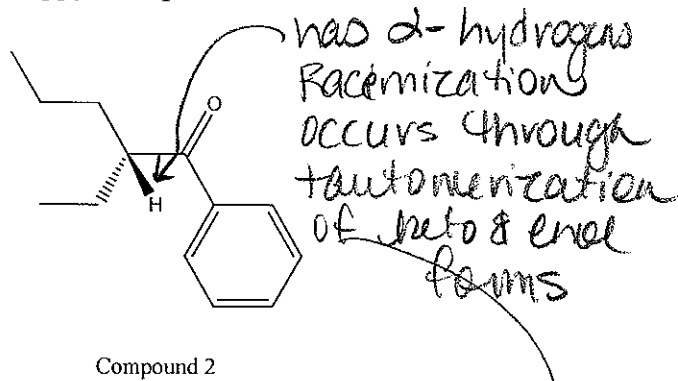
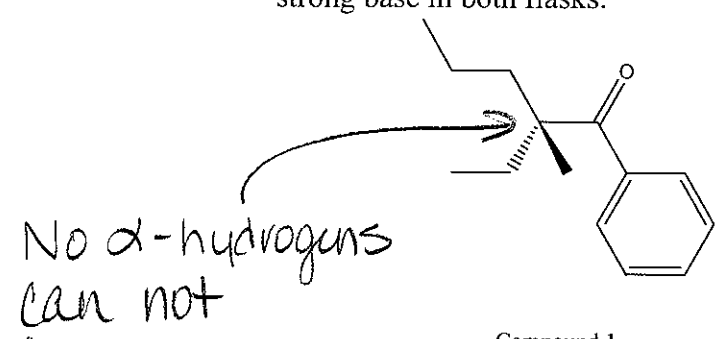
6. (3 points) Which of the following compounds is the most reactive in an addition/elimination reaction (acyl transfer reaction), such as the general 2-step reaction shown? (2 points) Justify your choice in 1 sentence.



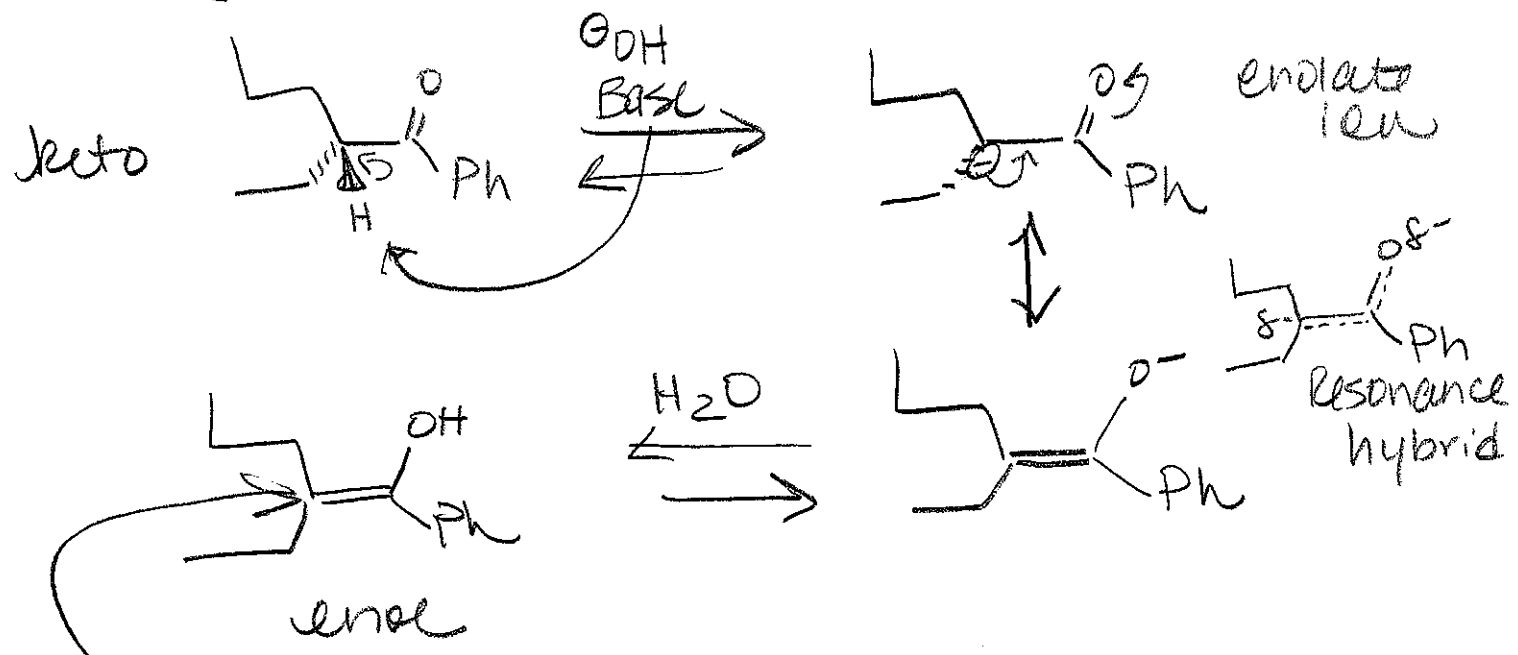
① reactivity increased of addition step because of strongly δ^- -withdrawing Cl atom, accentuates δ^+ charge on carbon.

② decomposition of tetrahedral intermediate and expulsion of L.G. Z is accelerated by the weak base Cl^- which is an excellent L.G., weakest base of the series.

7. Bob was working in the lab late on Sunday evening preparing two pure chiral compounds required for his research, shown below. In his hurry to leave the lab to watch his favorite football game, he became sloppy and spilt a trace amount of strong base in both flasks.

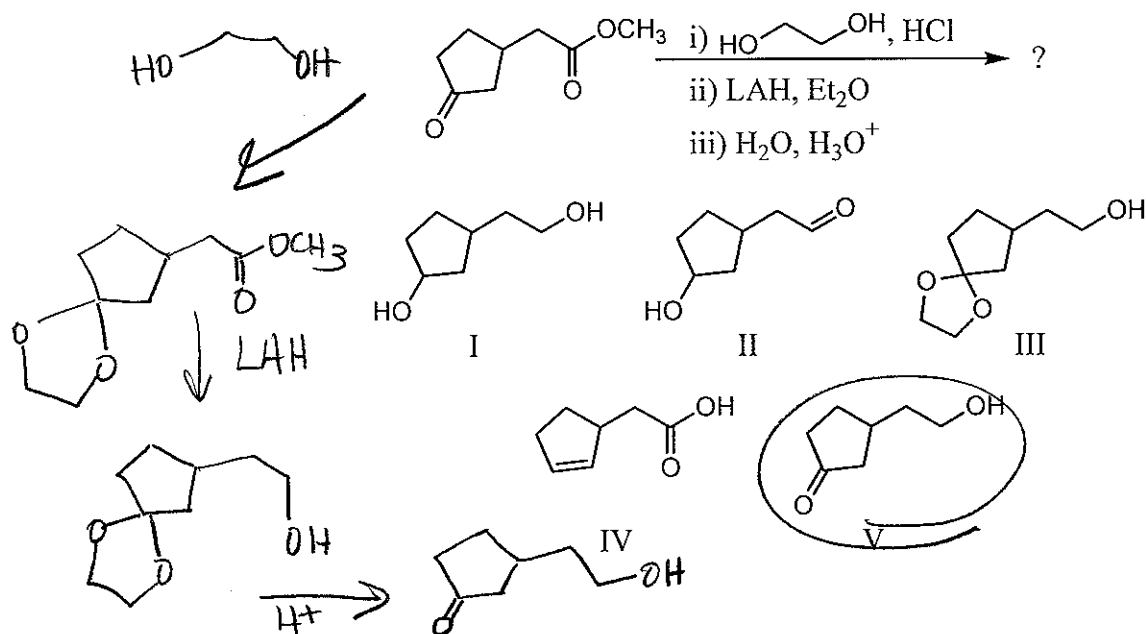


- (5 points) He quickly realized that he had made a horrible mistake, and after analysis discovered that 1 of his compounds had lost all of its optical activity, indicating that it was now a mixture of the two possible enantiomers. Which compound lost its activity and why only one compound?
- (10 points) If one exists, show the keto-enol tautomerization which results from the reaction of each compound with strong base. You must draw the keto and enol forms, enolate ions, any resonance structures, and the resonance hybrid. Show the correct use of arrows indicating electron flow.

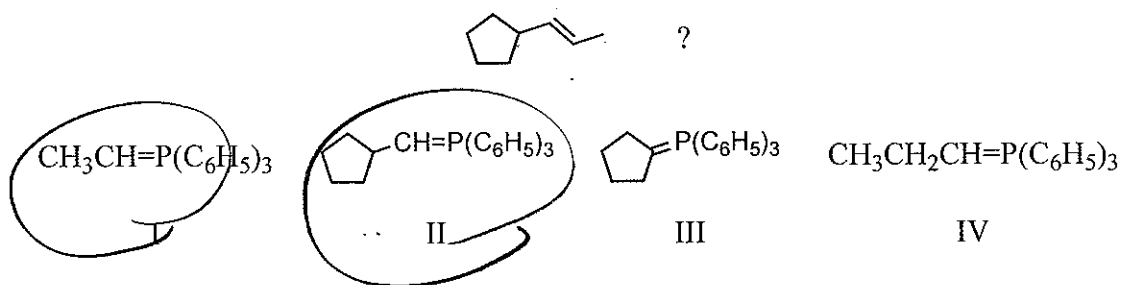


all stereochemistry is lost at this carbon now - and can convert back to either enantiomer

8. (5 points) What would be the product of the following reaction sequence? LAH is short for LiAlH_4 .



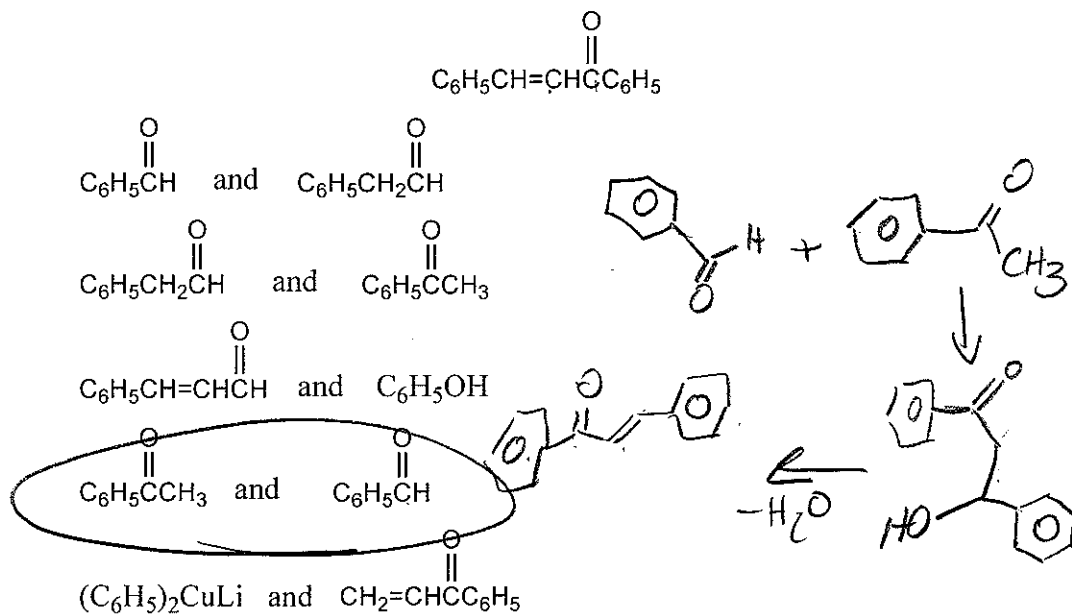
9. (5 points) Which reagents could be used to synthesize the following compound in a Wittig reaction?



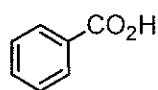
10. (5 points) A compound with an OH and OR group attached to the same carbon is known as a(n) _____.

hemi-acetal

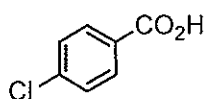
11. (5 points) Which reagents would you utilize to synthesize this compound by an aldol condensation? Circle the correct combination.



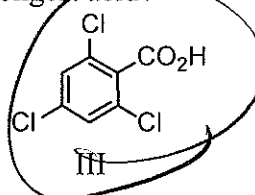
12. (5 points) Which of the following would be the strongest acid?



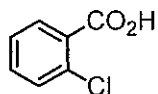
I



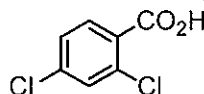
II



III

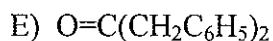
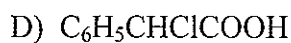
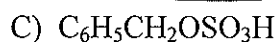
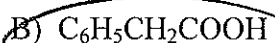
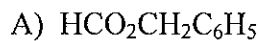
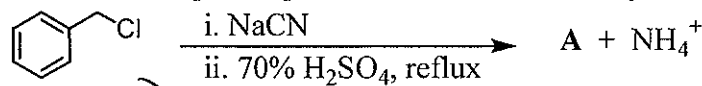


IV



V

13. (5 points) What is the expected product, A, of the following reaction sequence?



14. (5 points) An acid chloride is prepared from the related carboxylic acid by reaction with which of these?

- A) HCl
- B) Cl₂
- C) SOCl₂
- D) HOCl
- E) AlCl₃

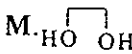

15. (5 points) Base-promoted hydrolysis of esters is sometimes called

saponification

16. (5 points) Question from EC exercise.

How can this transformation be accomplished?



- A. Mg
- B. CH₃CH₂Br
- C. CH₃CH₂OH/TsOH
- D. H₂O/H₂SO₄
- E. Na
- F. NaBH₄/CH₃OH
- G. CrO₃/H₂SO₄
- H. PCC
- I. mCPBA
- J. NaH
- K. CH₃ONH₂
- L. NaOCH₃/CH₃OH
- M. /TsOH
- N. /TsOH
- O. NaOH/H₂O
- P. 