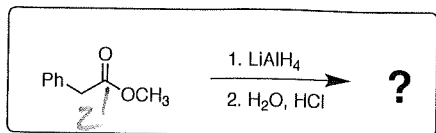


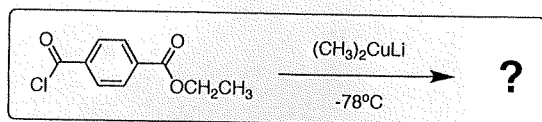
Questions 1-10: Multiple choice (2 pts) each.
Please use the front of the Scantron form

1. What is a major product of the reaction in the box? – Please assume that an excess of LiAlH_4 is used.



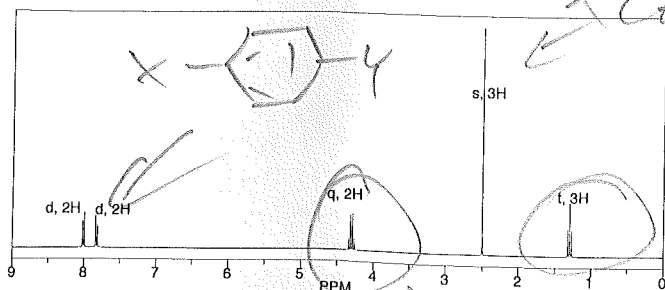
- A) Ph-CH2-COOH
B) Ph-CHO
C) Ph-CH2-OCH3
D) Ph-CH2-CH2-OH (circled)

2. What is a major product of the reaction shown in the box?

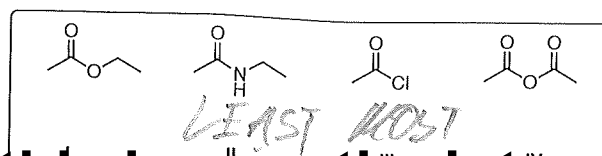


- A) Ph-C(=O)-CH2-CH2-COOEt (circled)
B) Ph-C(OH)(CH3)-CH2-CH2-COOEt
C) Ph-C(=O)-CH2-CH2-COOEt (crossed out)
D) Ph-C(=O)-CH2-CH2-COOEt (crossed out)

^1H NMR of the major product:



3. Consider the carboxylic acid derivatives labeled I to IV shown in the box. Sort these carboxylic acid derivatives according to increasing reactivity towards the nucleophilic acyl substitution. List the least reactive species first.



A) II (least reactive) < IV < I < III (most reactive)

B) II (least reactive) < I < IV < III (most reactive) (circled)

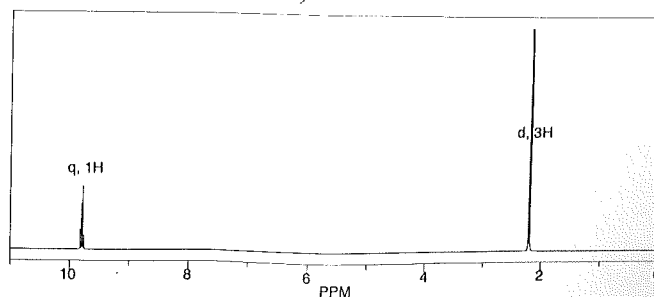
C) III (least reactive) < I < IV < II (most reactive)

D) I (least reactive) < IV < II < III (most reactive)

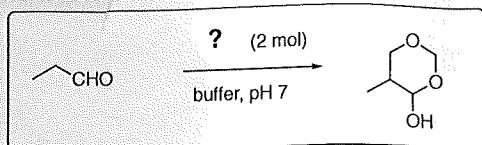
4. Which of the following compounds is able to undergo self-condensation by aldol reaction?

- A) HCHO
B) CH3CHO (circled)
C) c1ccccc1C=O
D) CC(C)(C)C=O

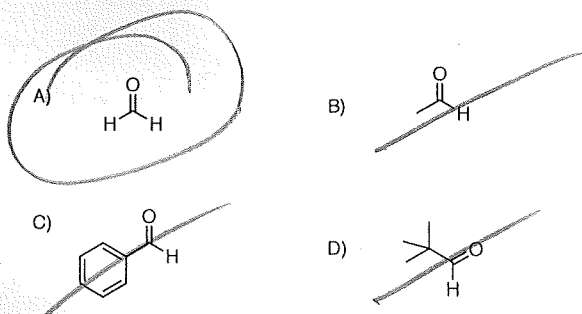
^1H NMR of the compound that is able to undergo self-condensation by aldol reaction:



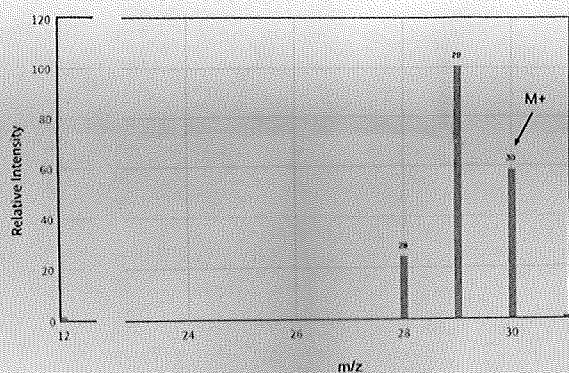
Consider the reaction in the box:



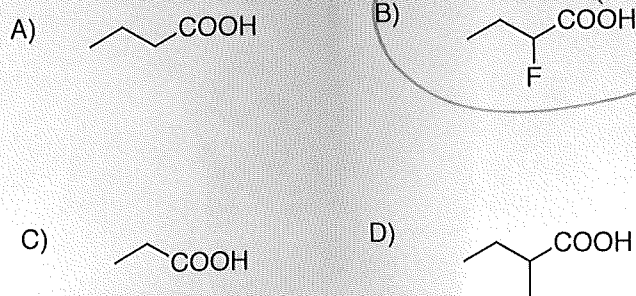
What is the structure of the missing reagent?



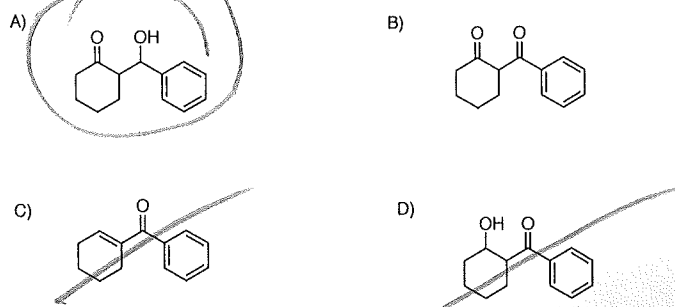
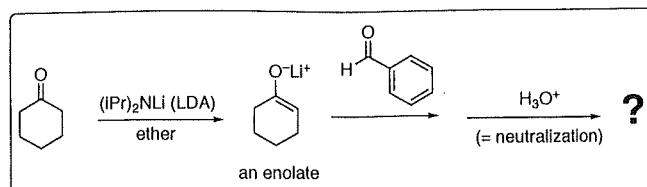
Mass spectrum of the missing reagent:



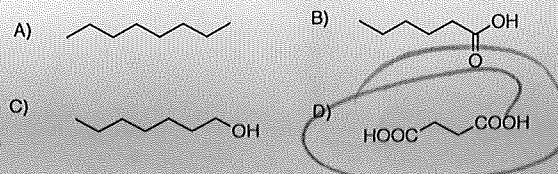
6. Which of the following is most acidic?



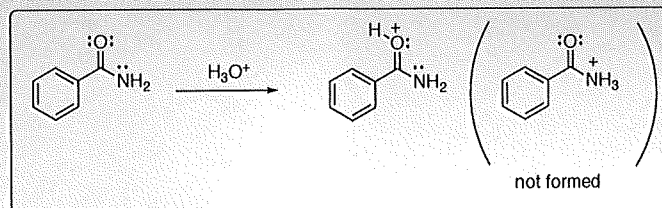
7. What is the major product of the reaction sequence shown in the box?



8. Which of the following is expected to have the highest boiling point?



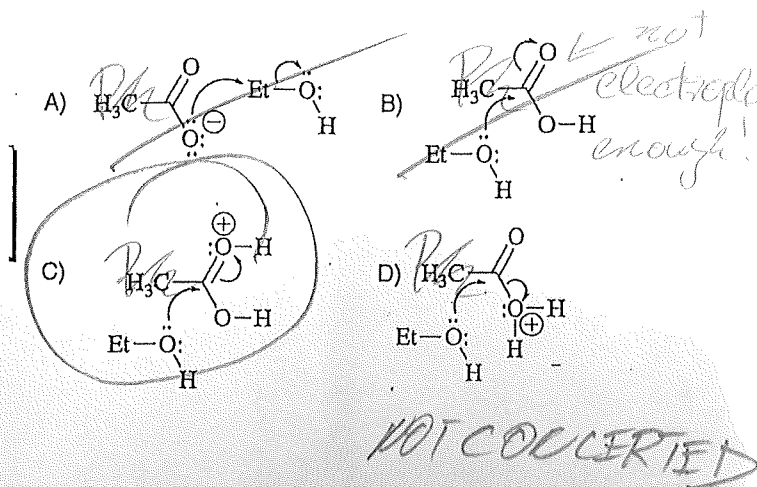
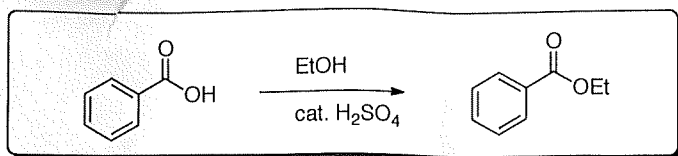
9. Consider the protonation of benzamide shown in the box:



What is the primary reason for this observation?

- A) Relative electronegativity of nitrogen versus oxygen.
 B) Oxygen is a better nucleophile than nitrogen.
 C) Stabilization of the positive charge via resonance. (circled)
 D) Steric effects, there is more room for the proton to attach to oxygen.

Which of the following represent a key step for the reaction in the box?



11. (4 pts) For the following please use the back of the Scantron form:

Line 66: N,N'-Dimethylformamide (DMF) is an important solvent. Draw the structure of this compound.

Line 68: Ethyl acetate is an important solvent. Draw the structure of this compound.

Line 71 and Line 73: Provide the necessary reagents that give the indicated products in high yield:

