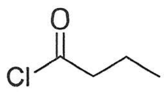
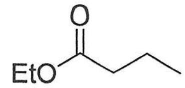
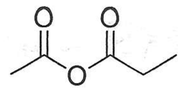
Key - Exam 3 - Summer 2010
CHEM 3331

Select the single best answer to each multiple choice question (1-12). (4 pts each)

1. Which of the following is the least reactive compound towards nucleophilic acyl substitution?


A


B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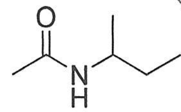
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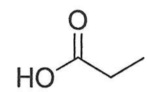
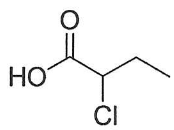
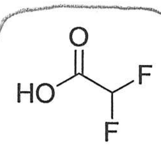

E

2. Which of the following is the most acidic species?


A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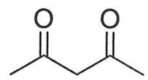
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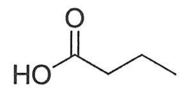
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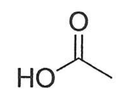
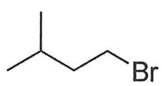
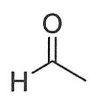
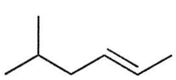
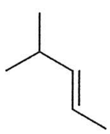

E

3. An ylide was generated from the alkyl halide shown and then reacted with acetaldehyde (structures are given below). What is the major organic product of the reaction of the ylide with acetaldehyde?


alkyl halide


acetaldehyde


A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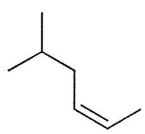
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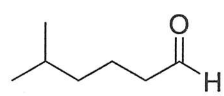
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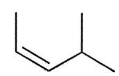
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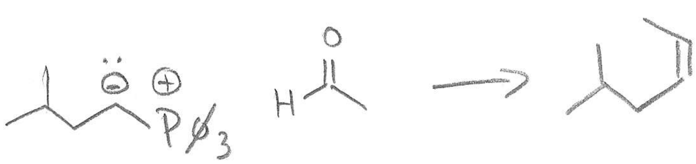
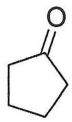
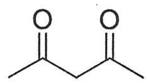


4. Which of the following compounds, when placed in water, do you expect to have the highest concentration of enol at equilibrium?


A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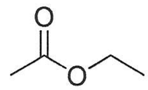
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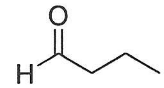
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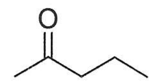
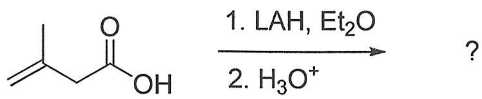
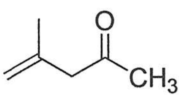
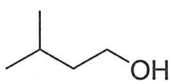

E

5. What is the major organic product of the following reaction?




A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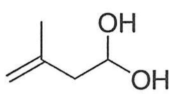
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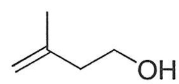
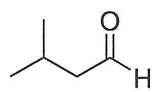
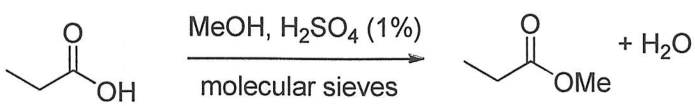
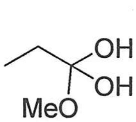
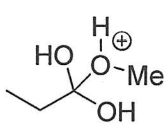

D


E

6. Which of these structures is not a mechanistic intermediate in an acid-catalyzed esterification of a carboxylic acid (Fischer esterification)?




A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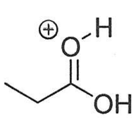
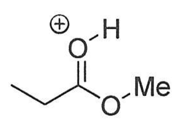
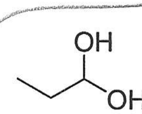
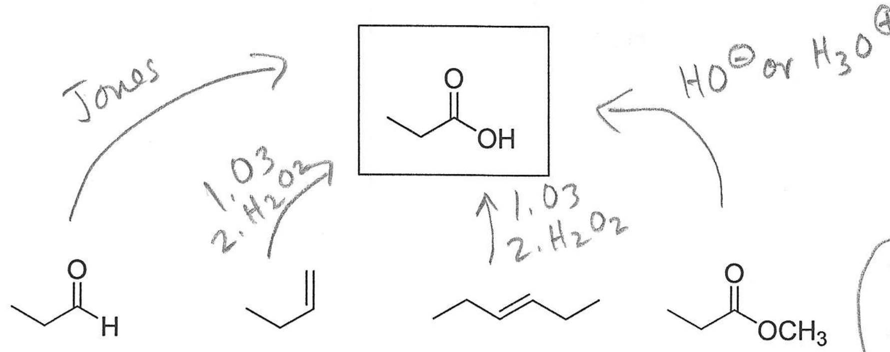

C


D


E

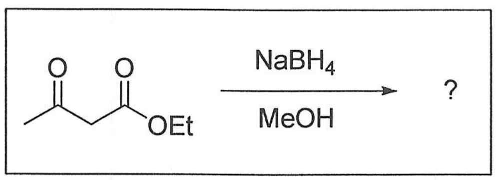
7. From which of the following compounds could the acid shown *not* be made in one synthetic step (plus appropriate workup)?

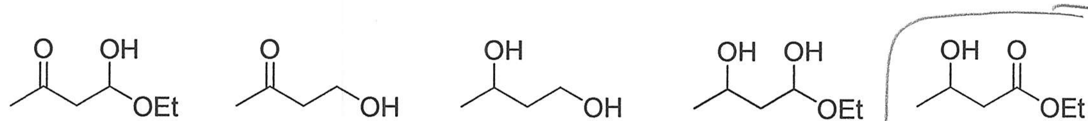


The acid could be made from all these compounds.

A B C D E

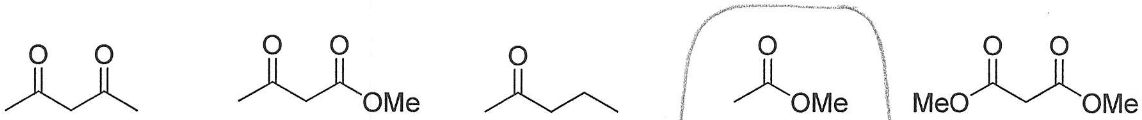
8. What is the major organic product of the reaction conditions shown?





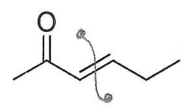
A B C D E

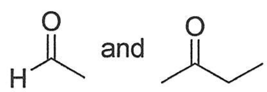
9. Which of the following is the least acidic species?



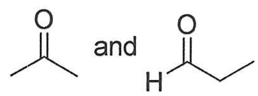
A B C D E

10. What are the starting materials needed to make this molecule using an aldol condensation?

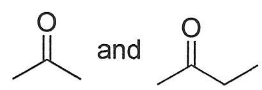




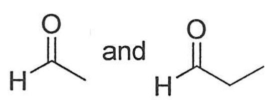
A



B



C



D

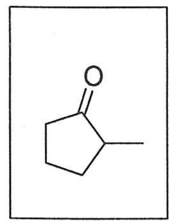
E

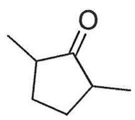
11. Which of the following conditions would successfully form a cyanohydrin? Potentially helpful information: pK_a of HCN: 9.2; pK_a of HCl: < 0; pK_a of ROH: 16

I. HCl (1.0 equiv) and NaCN (1.0 equiv)
II. HCl (1.0 equiv) and NaCN (1.2 equiv)
III. HCN (1.0 equiv) and NaCN (1.0 equiv)

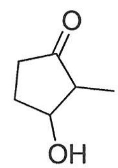
a. I
b. II
c. III
d. I and III
e. II and III

12. The ketone shown is treated with 0.95 equiv of NaH, then with 1.0 equiv methyl iodide, CH_3I. What is the major organic product that will result?





A



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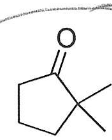
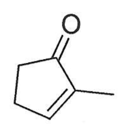
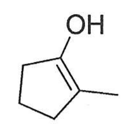


C

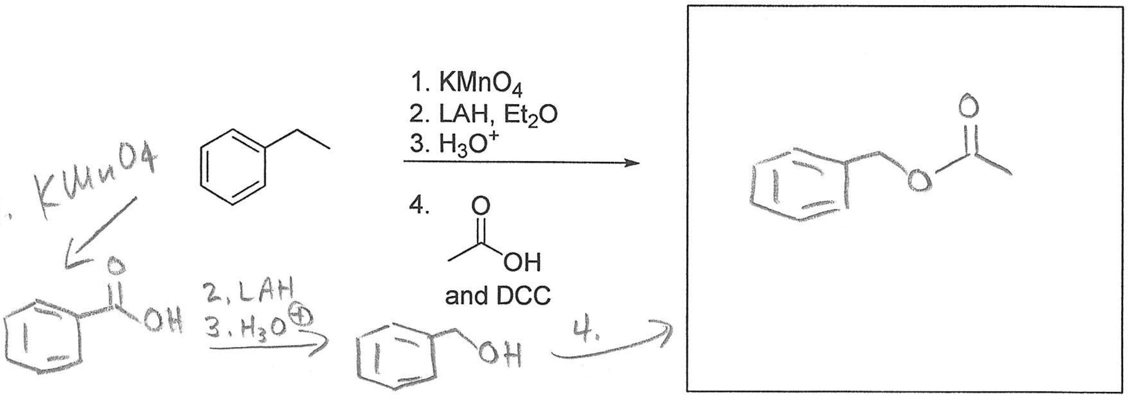


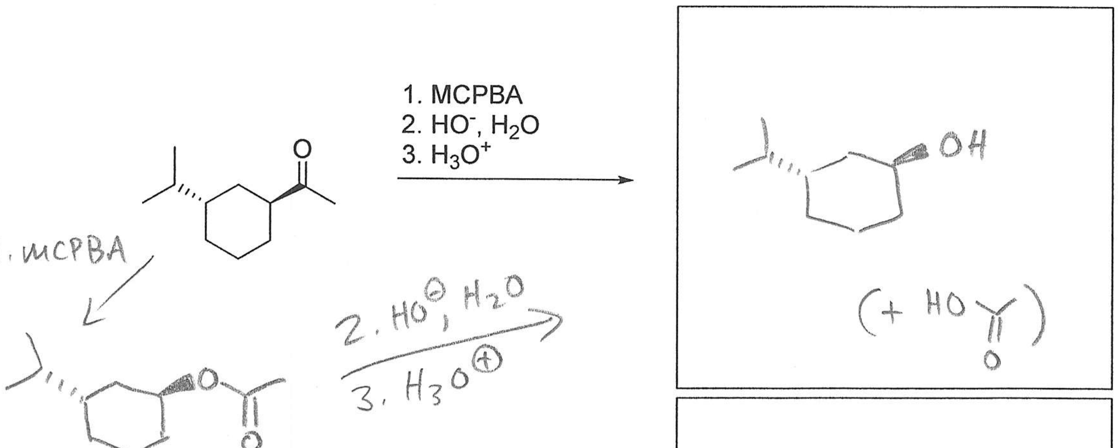
D

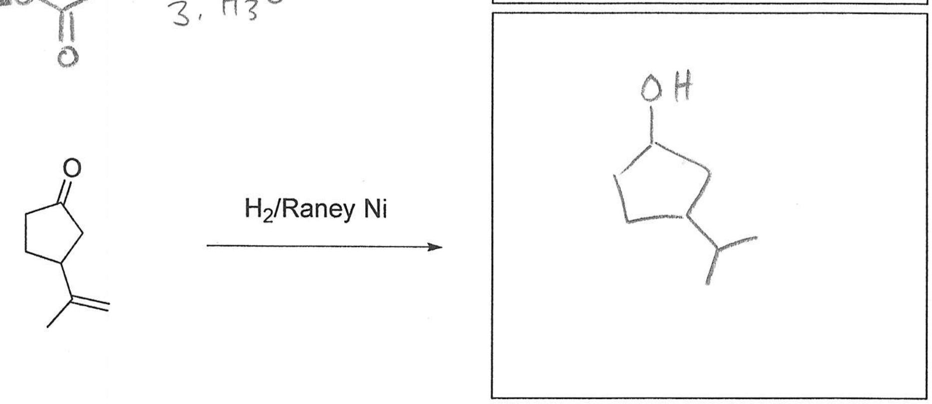


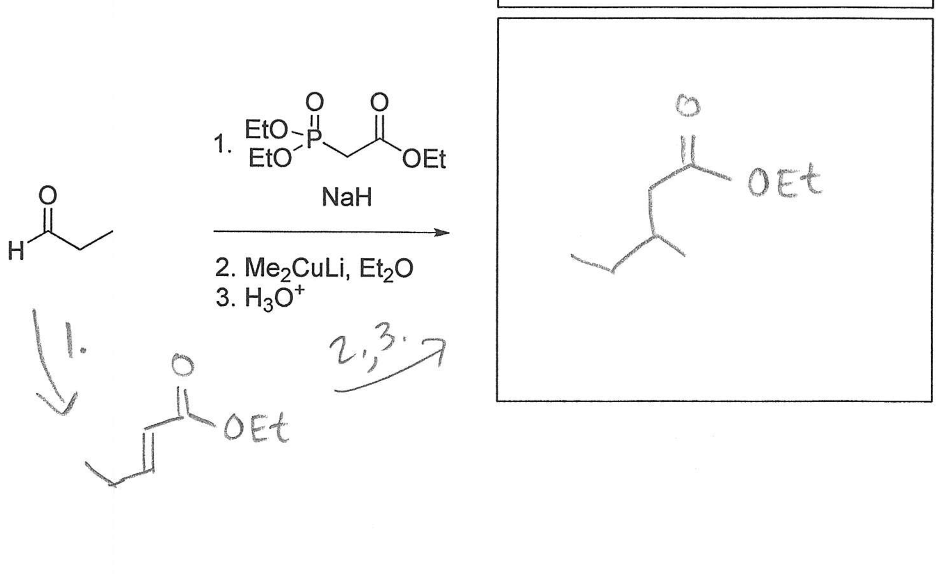
E

13. Predict the major organic product, *including stereochemistry where appropriate*, of each of the following reactions or reaction sequences. (16 pts)

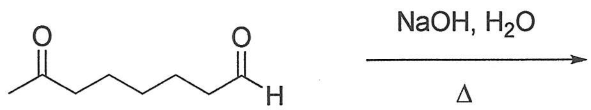


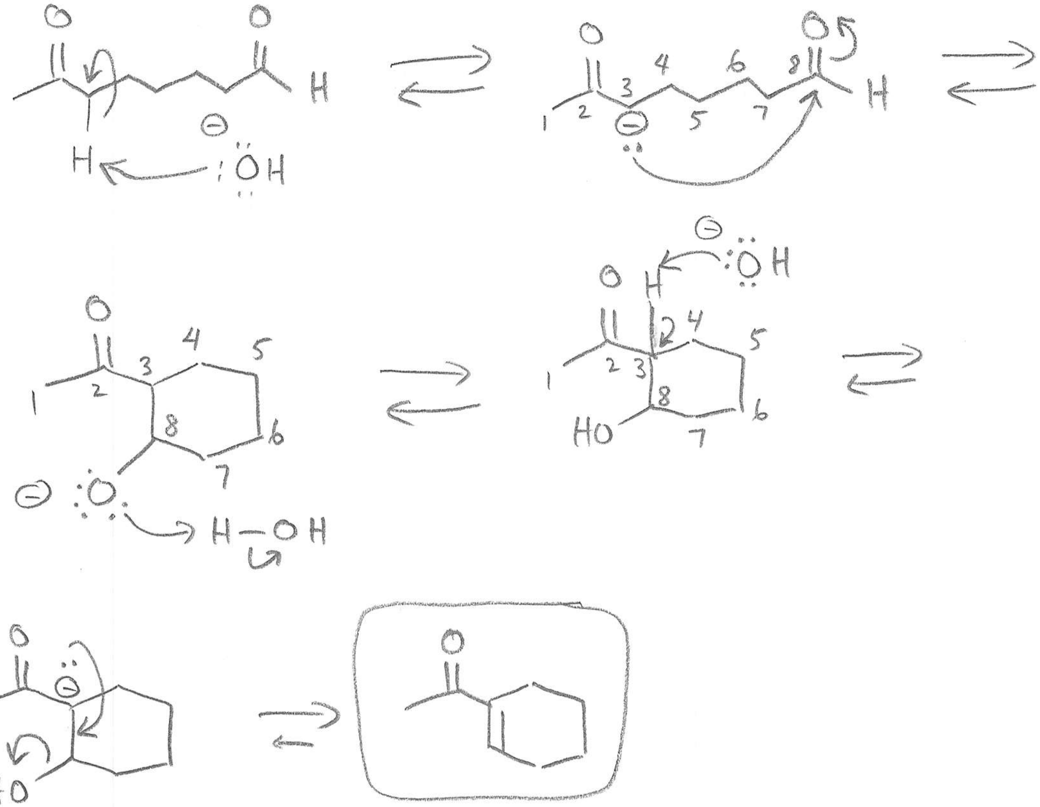






14. Predict the major organic product of the conditions shown and draw a mechanism to rationalize its formation. Include all curved arrows, intermediates, lone pairs of electrons, and non-zero formal charges for full credit. (16 pts)





15. Design a multi-step synthesis for each of the following transformations. Show the reagents needed for each step and the product of each step. Do not draw any mechanisms. Do not provide a list of reagents without showing the product of each step. Write your answer in exactly this format (note that your syntheses may or may not be three steps):

starting material $\xrightarrow{\text{reagent}}$ A $\xrightarrow{\text{reagent}}$ B $\xrightarrow{\text{reagent}}$ target

(20 pts)