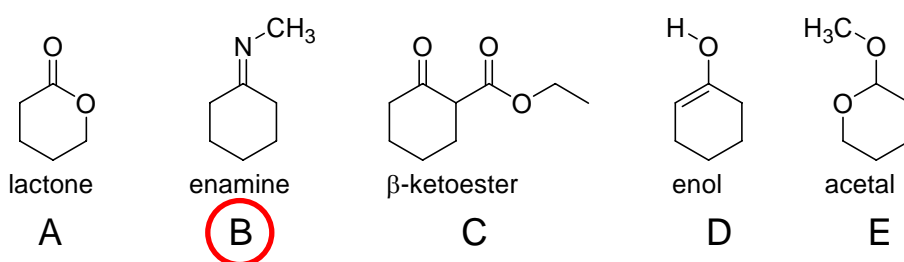
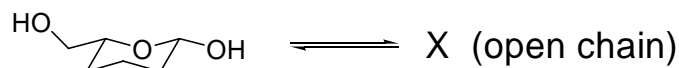


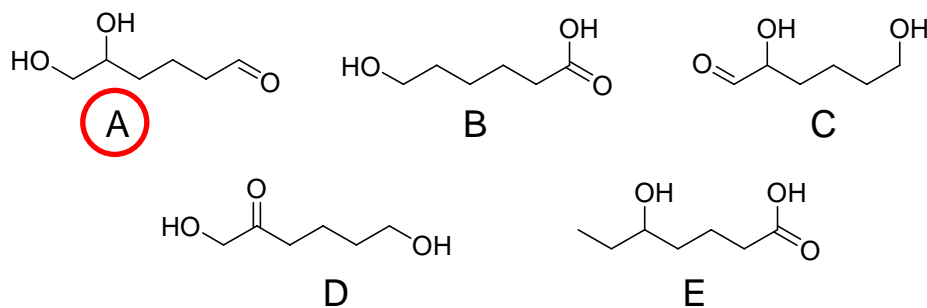
1. Which of the following functional groups is named incorrectly?



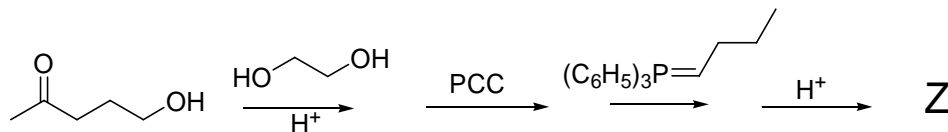
2. The compound shown below is a cyclic hemiacetal. It is in equilibrium with an acyclic open chain compound X.



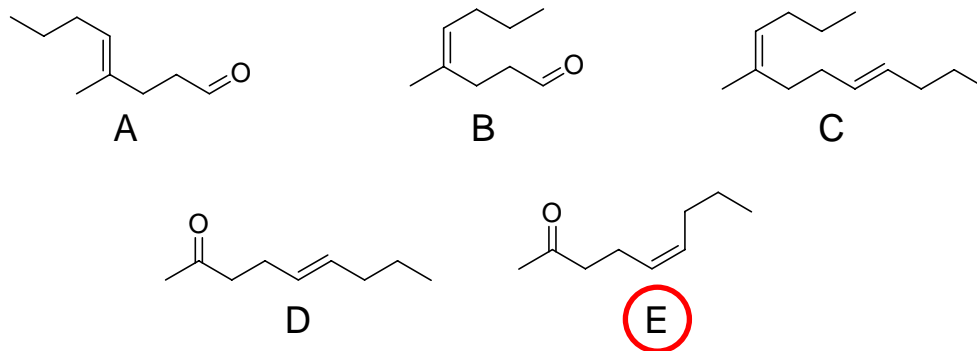
Identify the structure of compound X.



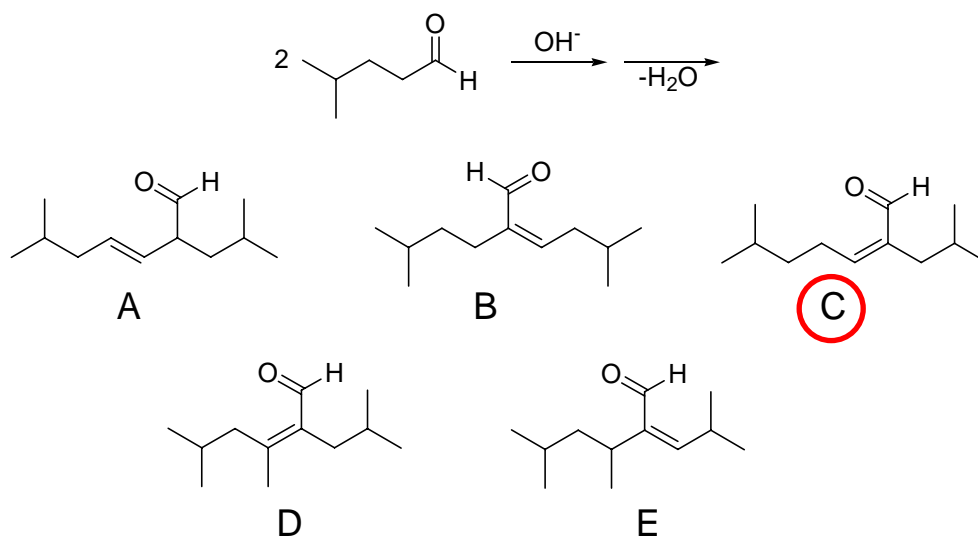
3. The reaction sequence shown below gives compound Z as the main product.



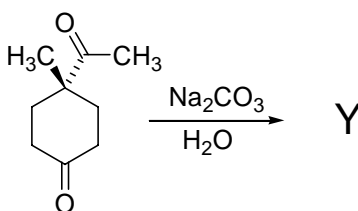
Identify the structure of compound Z.



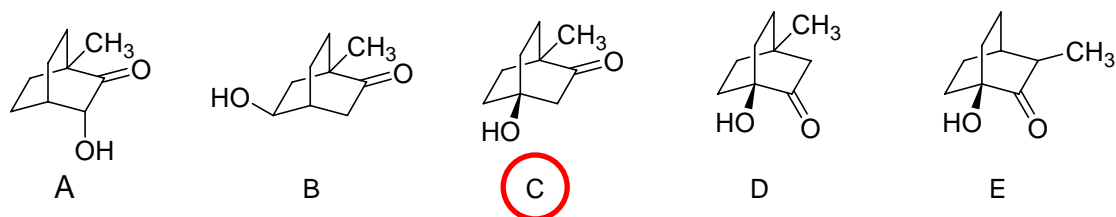
4. Predict the product of the following aldol condensation.



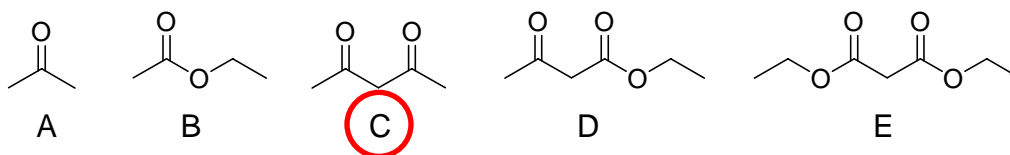
5. In the presence of base the compound below cyclizes to give a compound Y,



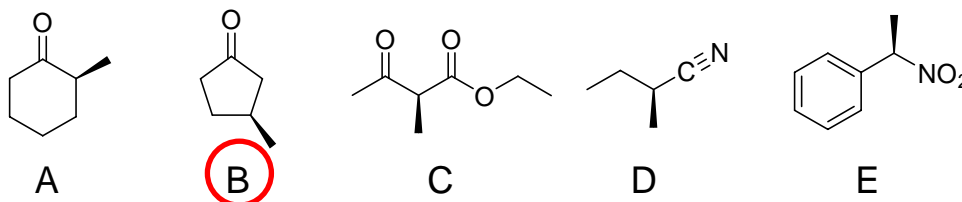
Identify the structure of compound Y.



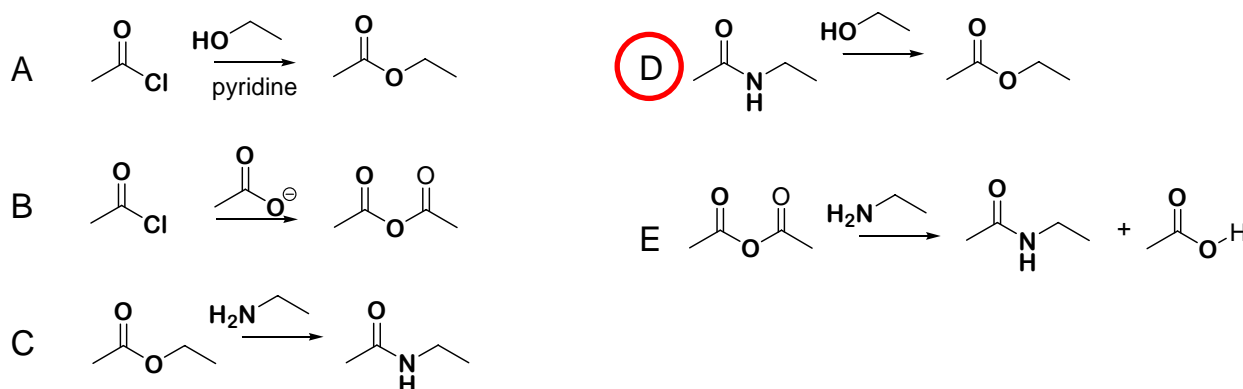
6. Which of the following compounds is the most acidic? (Which has the lowest pK_a ?)



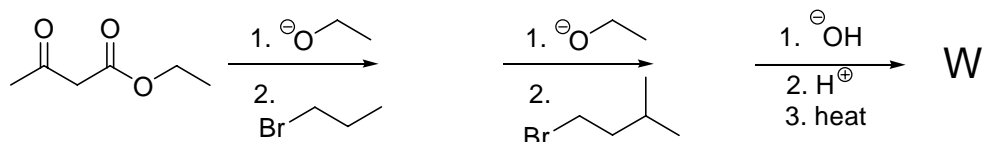
7. Each of the following compounds is chiral. A sample of a single enantiomer of each compound is dissolved in ethanol and exposed to a catalytic amount of sulfuric acid. Four of the compounds are observed to racemize. One does not. Which compound would not racemize in the presence of acid?



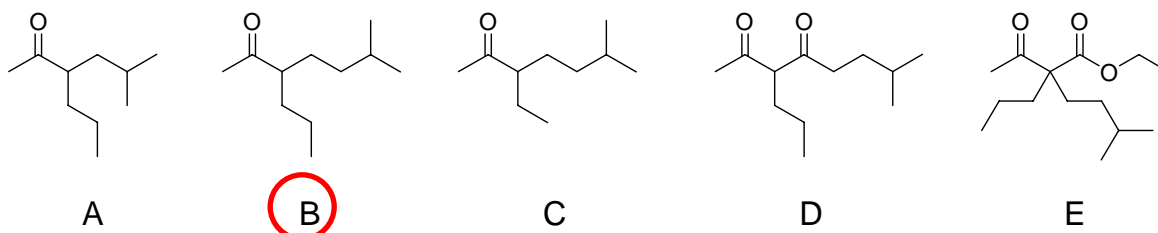
8. Four of the five reactions shown below should proceed as shown to give good yields. One of reaction has problems and will not proceed as indicated. Identify this one reaction which will not proceed as shown.



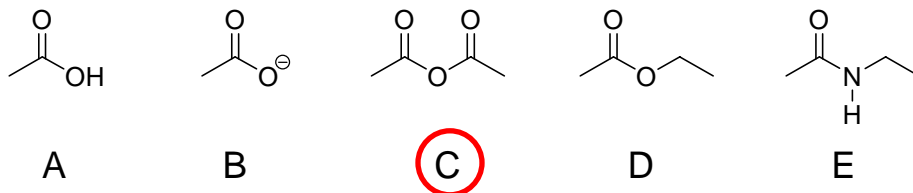
9. The reaction sequence shown below gives compound W as the main product.



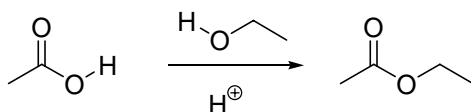
Identify the structure of compound W.



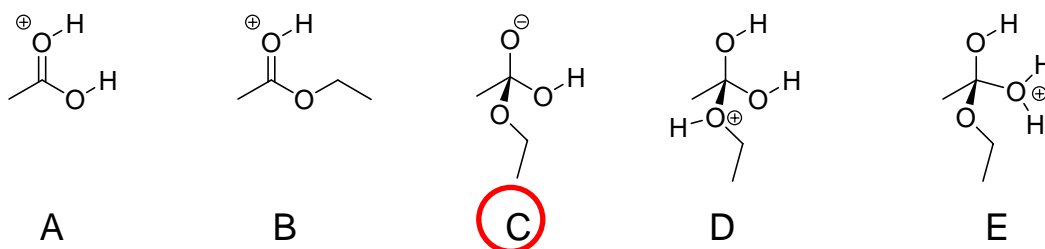
10. Which of the following compounds would have the highest frequency C=O absorption band in its IR, infrared spectrum?



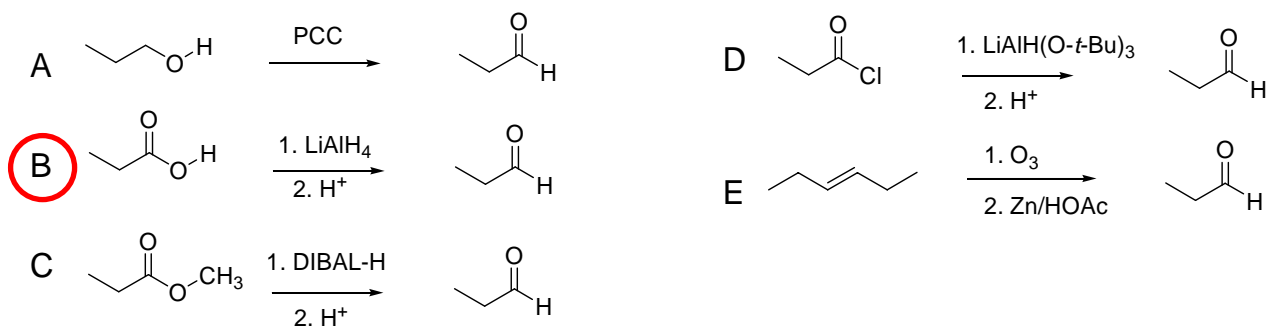
11. A student was asked to write a mechanism for the acid catalyzed synthesis of an ester from a carboxylic acid.



Which of the following intermediates would not be found in a correct mechanism?

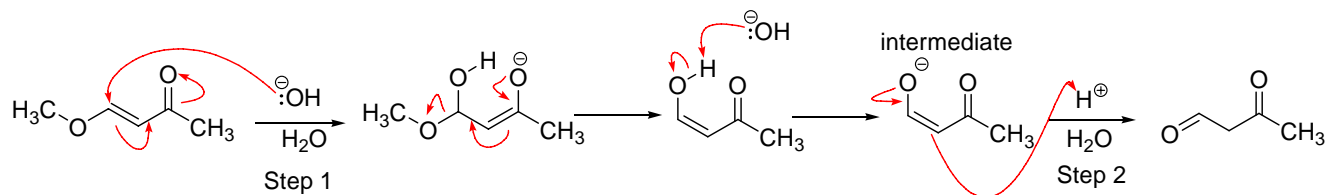


12. Shown below are five possible syntheses of propionaldehyde. Which one would not work?



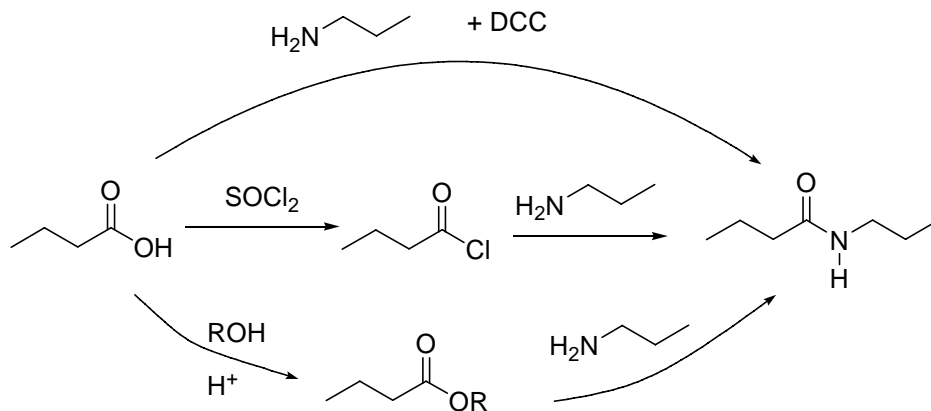
13. Using the curved arrow formalism show the bond breaking and bond making that occurs in each step of the following two step transformation. (10 pts)

This is very similar to the hydrolysis of an ester. The intermediate forms because the beta-carbonyls of the product render the compound very acidic. So acid is needed for the protonation step.

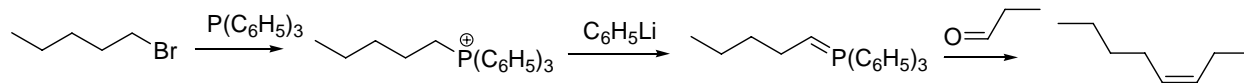


14. Complete the following sequences by proposing the methods for performing such transformations. More than one step may be required. Use any additional reagents you would like. (5 pts each)

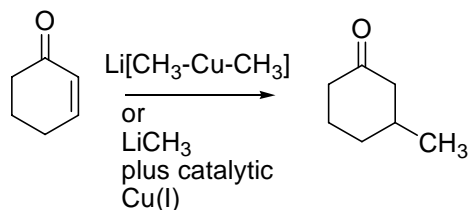
a. There are several different ways to do this.



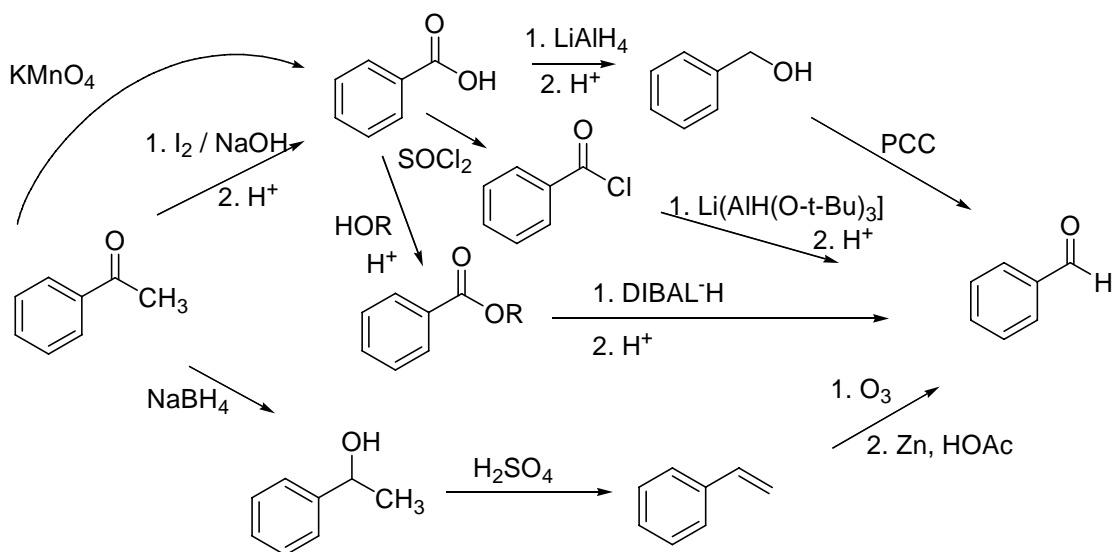
b. This is a Wittig reaction



c. This is 1,4 conjugate addition

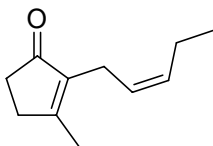


d. Many different ways to do this. Here are some of them



15. The compound jasmone can be isolated from the oil contained in the flowers of the jasmine plant. The compound is widely used in the perfume industry.

Propose a synthesis of jasmone. Your carbon containing starting materials may have no more than four carbon atoms. (10 pts)



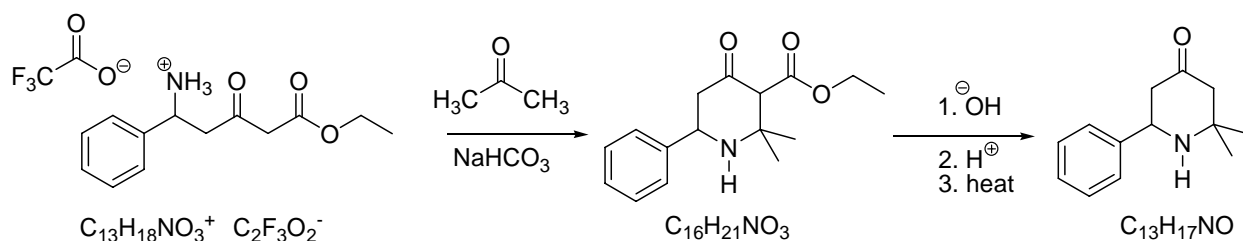
jasmone

There are many possible syntheses. A selection of student answers will be posted later after the grading is complete.

Challenge Problem. Make sure you complete the rest of the exam before working on this problem.

Alkaloids are natural products containing nitrogen. The following reaction was discovered in a study of biologically active cyclic alkaloids.

The starting compound was an ammonium salt of trifluoroacetic acid. It was subjected to the following reaction sequence. An intermediate **A** was formed as a precursor to the final product **B**.



This is a Mannich reaction.