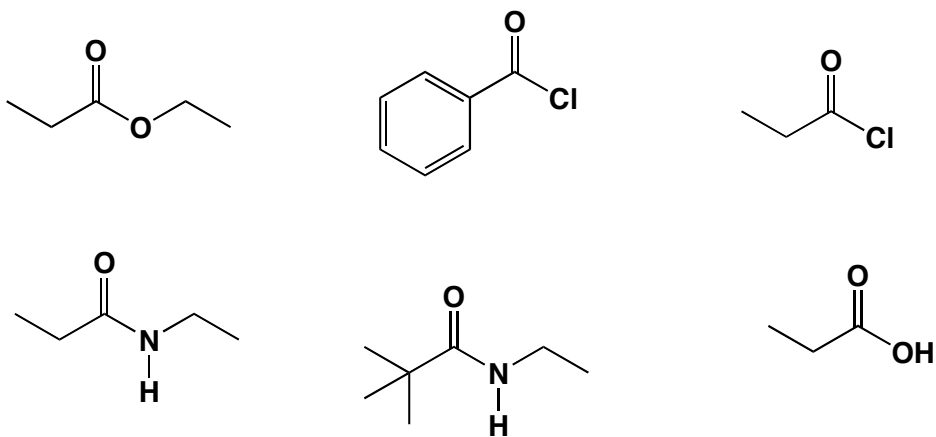
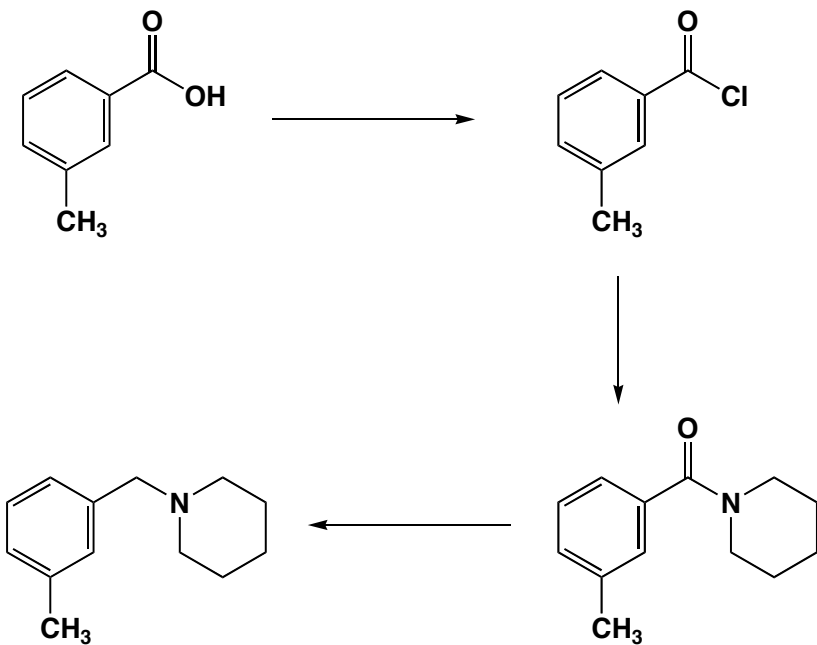


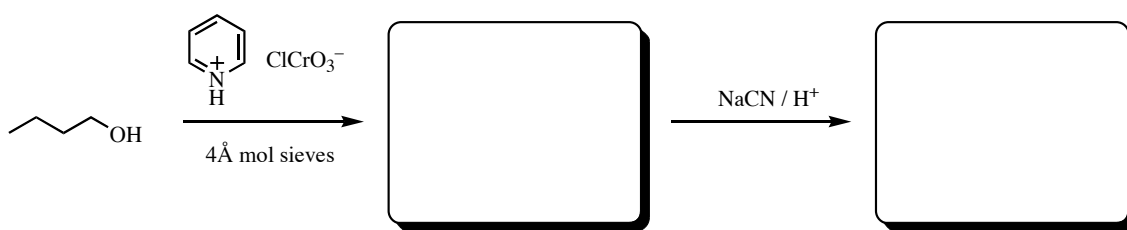
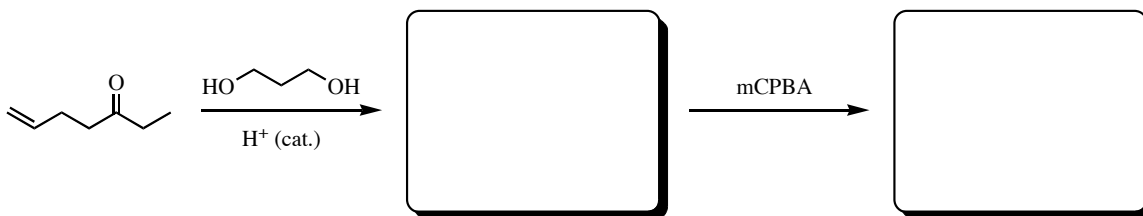
1. Rank the following carboxylic acid derivatives in order of their reactivity toward acyl transfer reactions (i.e. their reactivity toward nucleophiles). Number them in order 1 to 6, where 1=most reactive and 6=least reactive.



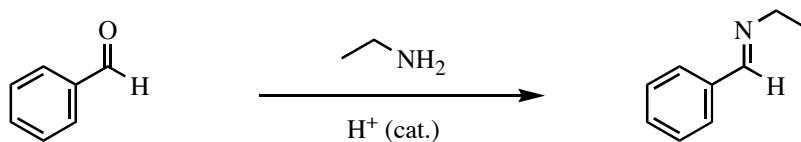
2. Suggest reagents to complete the following sequence of reactions.



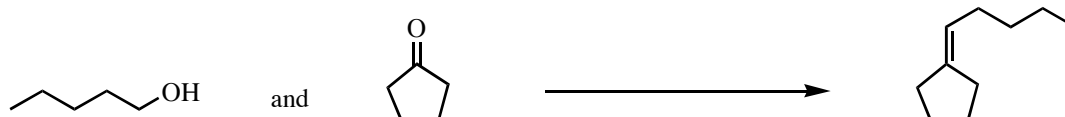
3. What are the products of the following transformations?



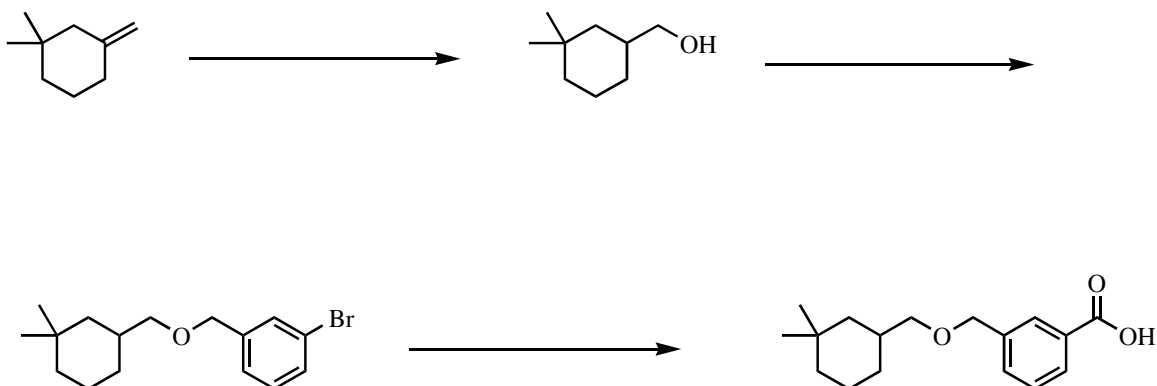
4. Write a mechanism for the following transformation.



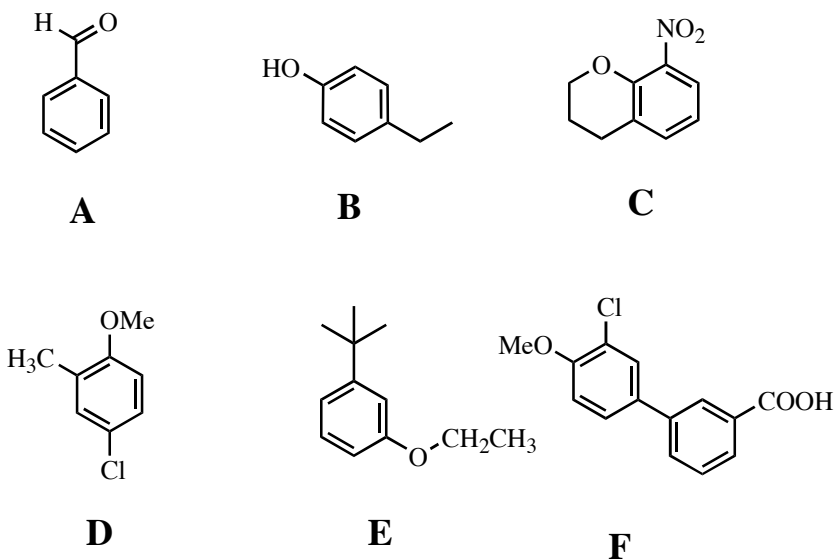
5. Suggest a synthesis of the following compound from the indicated starting materials. Clearly show the reagents used and the products after each step of your synthesis.



6. Suggest reagents to achieve each of the transformations in the following reaction sequence. One or more reactions may be necessary to achieve each step.

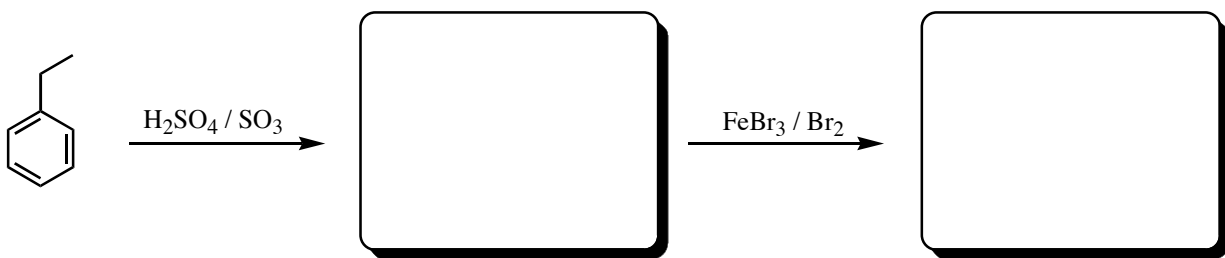


7. Electrophilic aromatic substitution is a powerful method for the formation of substituted aromatic rings. The following molecules A-F could potentially react with electrophiles at different positions on the aromatic rings. On the structures given on the answer sheet, circle ONE position which you predict will be the most reactive site toward electrophilic aromatic substitution. Credit will not be given for answers where more than one position has been circled.

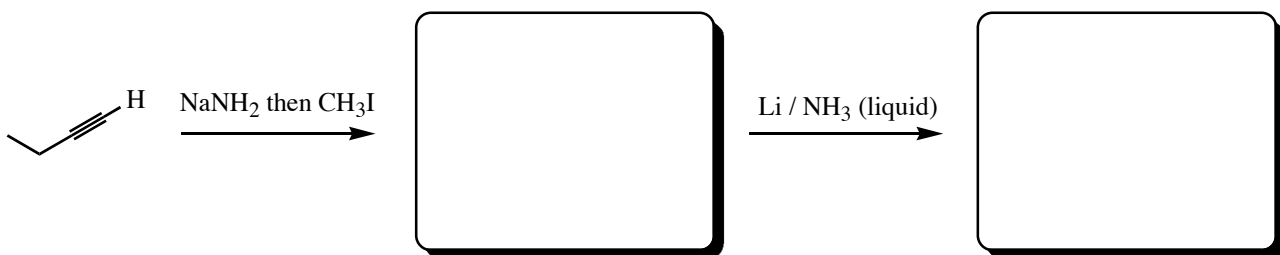


8. What are the major products of the following reactions.

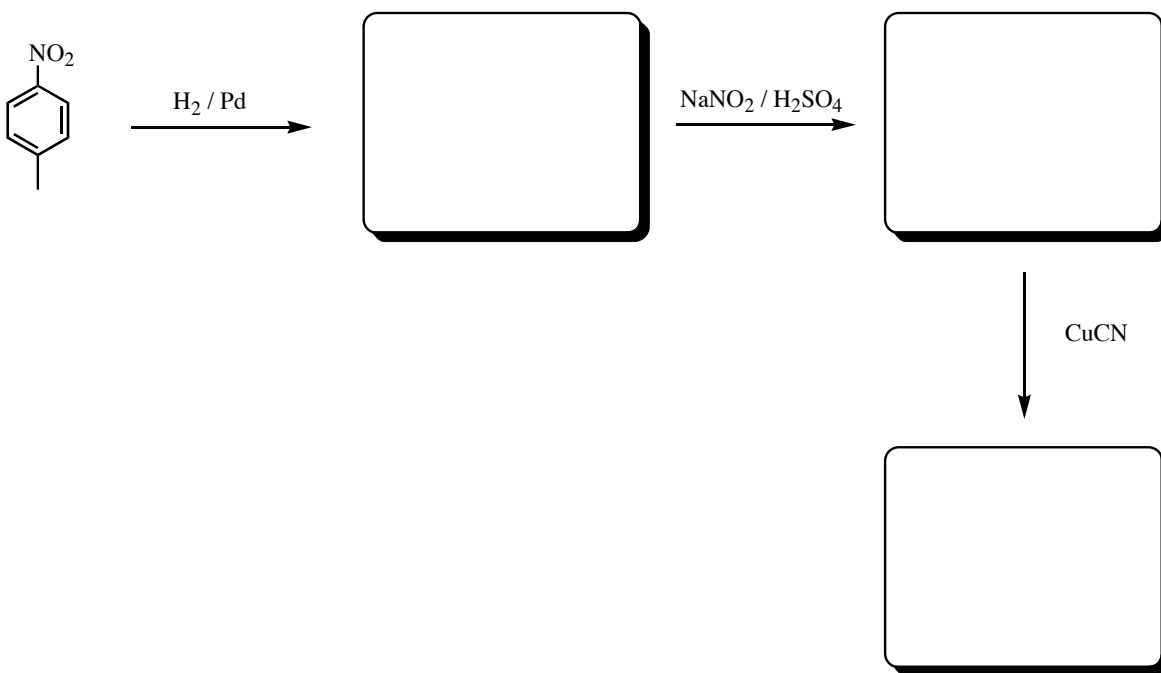
(a)



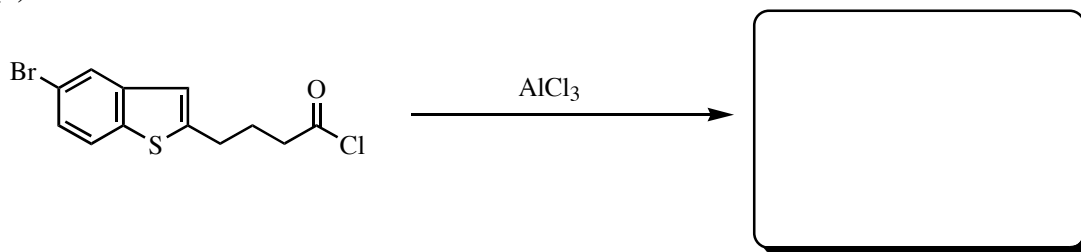
(b)



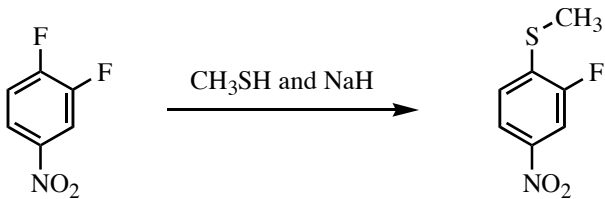
(c)



(d)



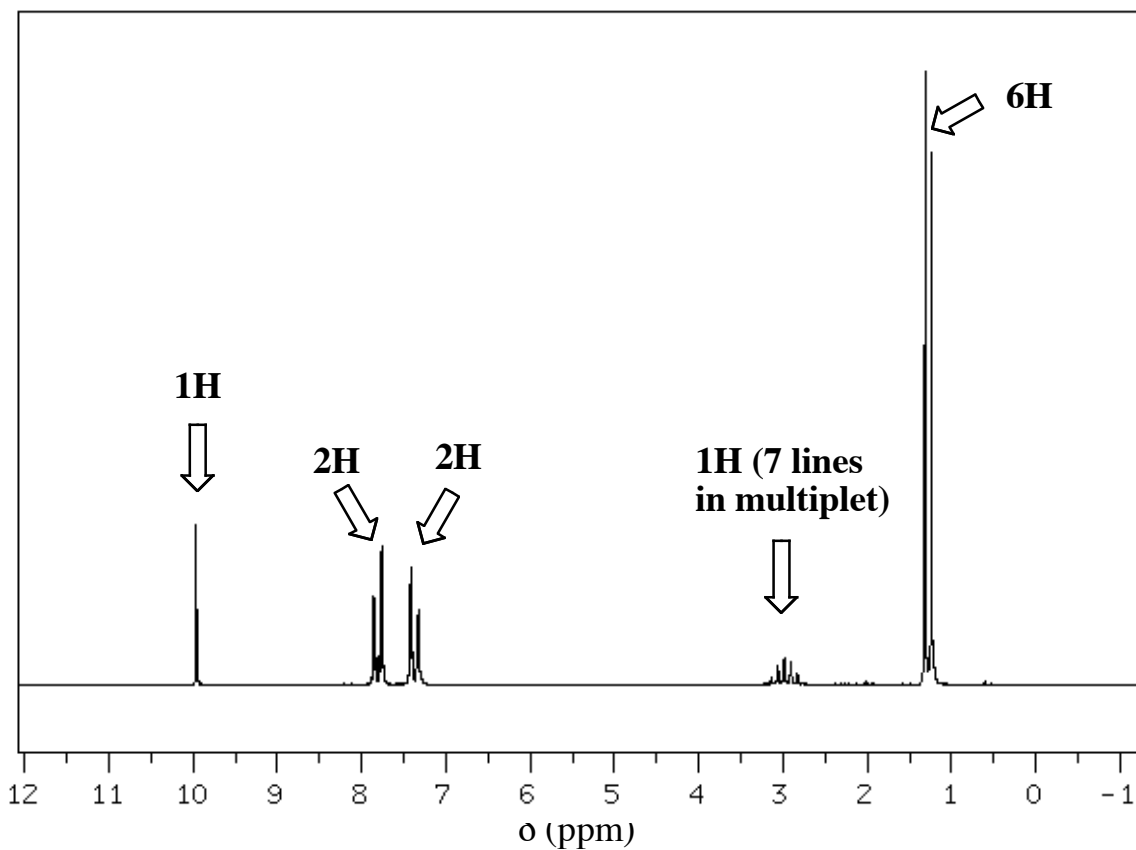
9. The following reaction was used in a synthetic sequence.



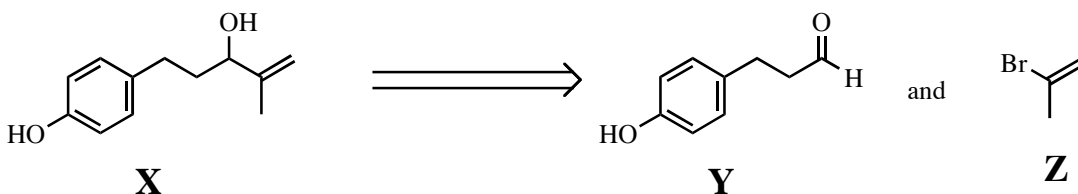
(a) Provide a detailed mechanism for this transformation.

(b) Explain the regioselectivity obtained in the reaction (i.e. for which fluorine atom in the starting compound is replaced).

10. An unknown compound X has molecular formula $\text{C}_{10}\text{H}_{12}\text{O}$, displays a strong IR peak at 1705cm^{-1} , and has the following ^1H NMR spectra (the numerical proton integral is indicated beside each set of peaks. What is the structure of the unknown compound X?



11. A proposed retrosynthesis of the diol **X** is shown below. Using this strategy show how you would synthesize compound **X** from **Y** and **Z**. Show clearly the reagents you would use to achieve each step of the synthesis and the products after each step (more than 2 steps are needed).



12. Suggest syntheses of the following target molecules using the suggested retrosynthetic strategy. Show clearly the reagents you would use to achieve each step of the synthesis and the products after each step (more than 2 steps are needed). In some cases it will be necessary to use other starting materials to complete your syntheses. You may assume that you have access to any organic compound containing 3 or fewer carbons.

