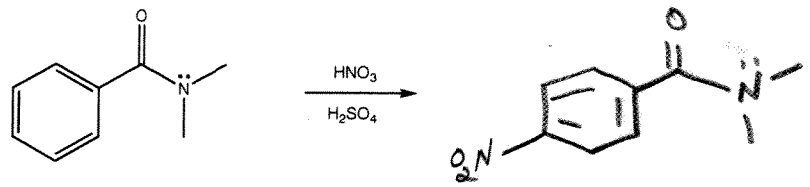
CHEM 235 • Final Exam Spring 2007 Name: Key

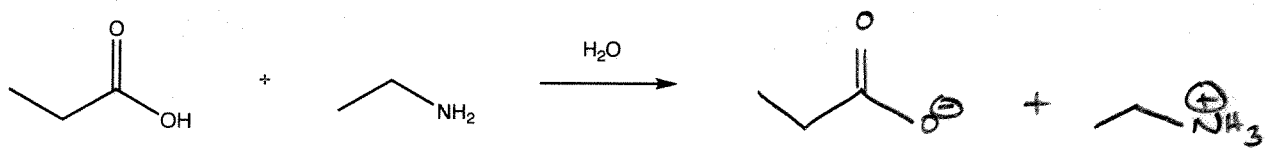
1. (6 points each) Predict the product(s) for the following reactions.

- You need to show only the ***major*** product or products.
- Except when indicated, you may ignore stereochemistry.
- If no reaction is expected, please explain briefly.

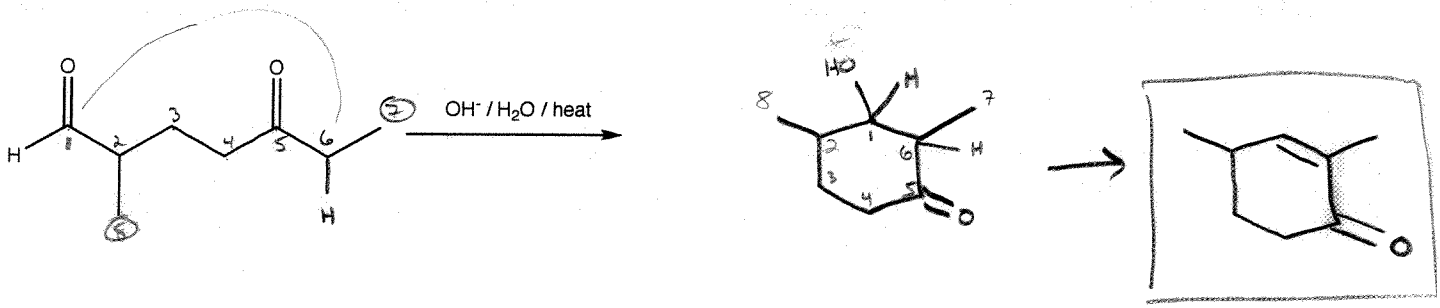
A)



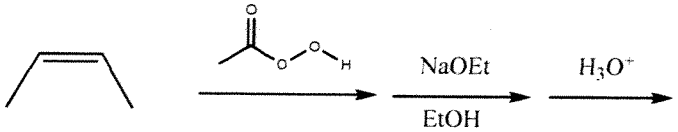
B)

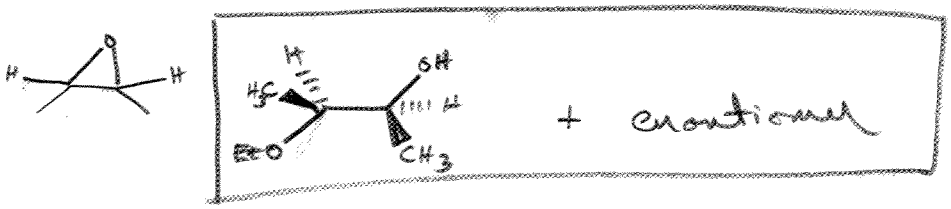


C)

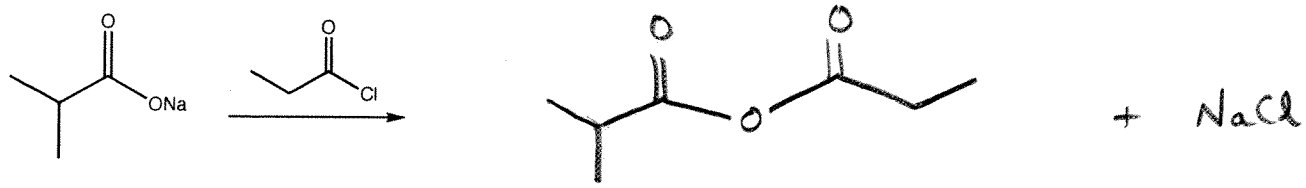


D) Clearly show stereochemistry of the product(s):

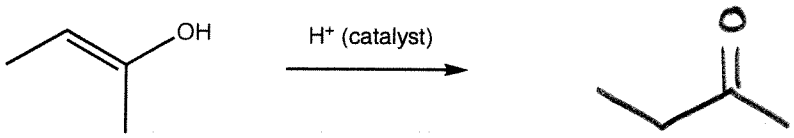




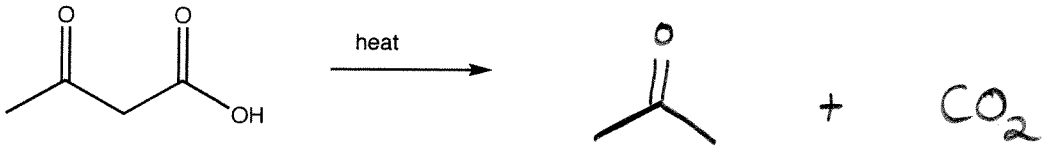
E)



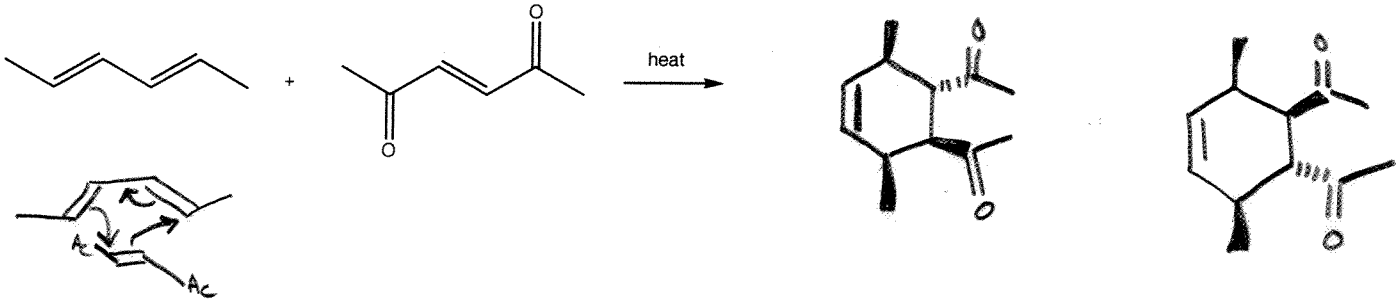
F)



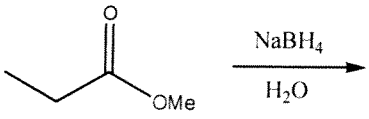
G)



H) Clearly show stereochemistry of the product(s):

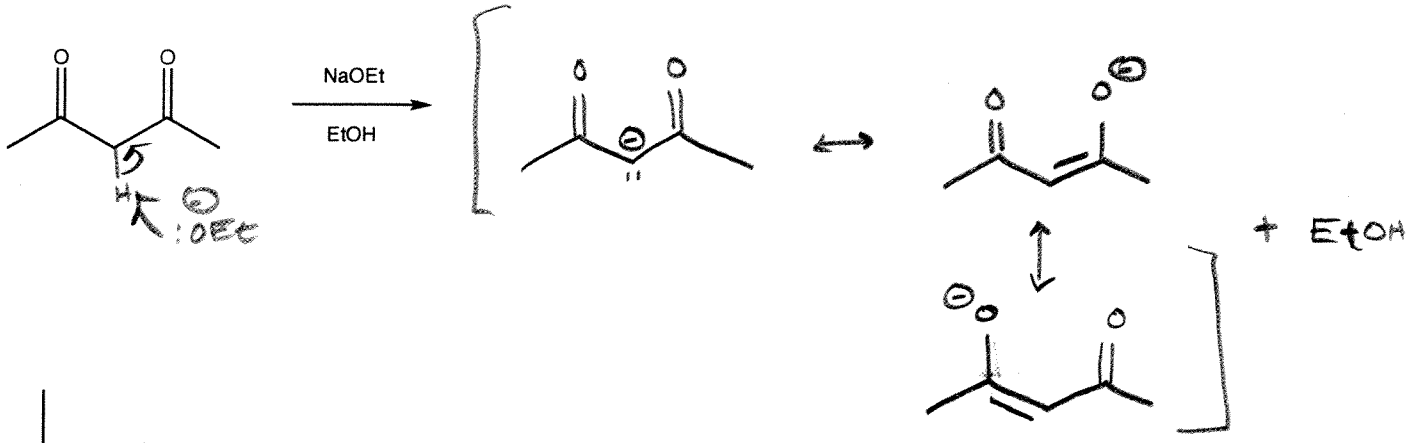


I)

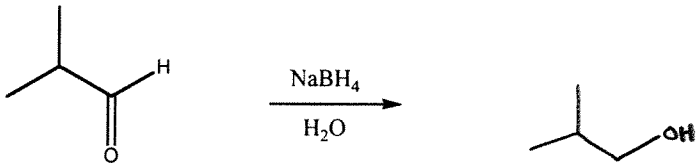


No Reaction
(NaBH4 will not reduce an ester)

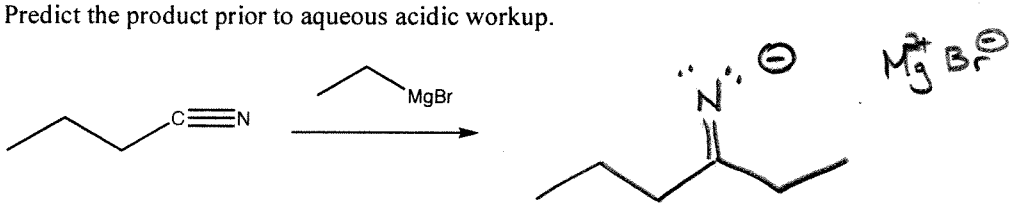
J)



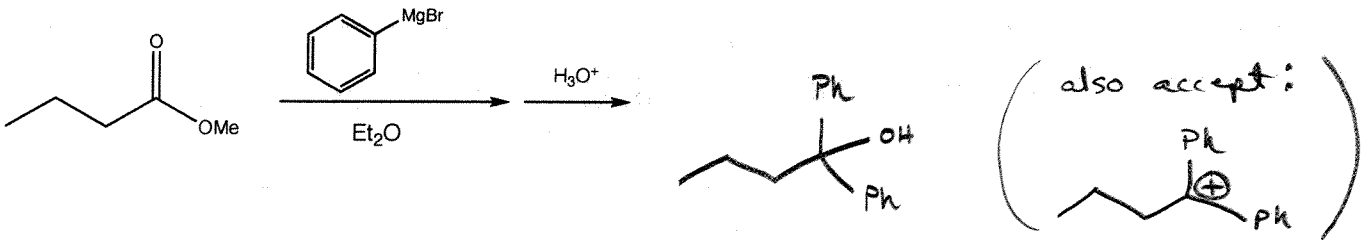
K)



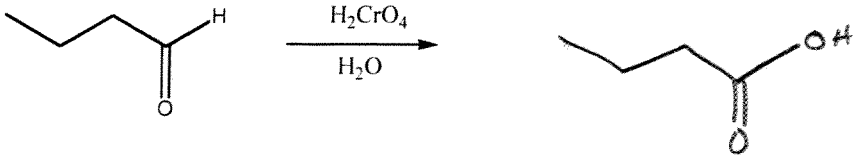
L) Predict the product prior to aqueous acidic workup.



M)



N)

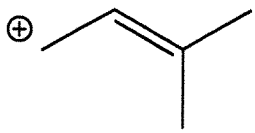


(II) is Major prod at low temp (kinetic control)

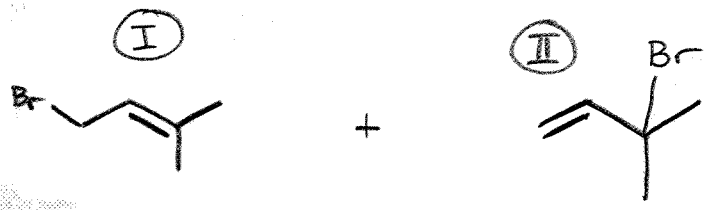
thermodynamic control

(I) is major product at high temp & minor product at low temp (kinetic control)

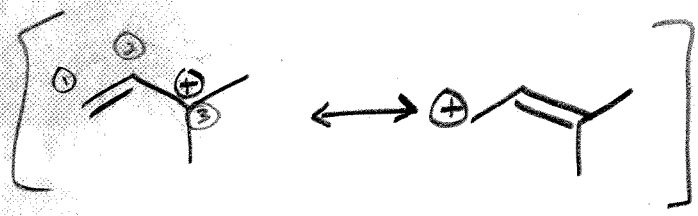
2. (12 points) Consider the allylic cation below.



A) Predict the major and minor product of the reaction with NaBr.

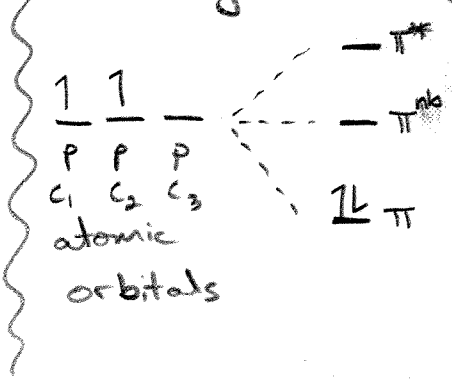


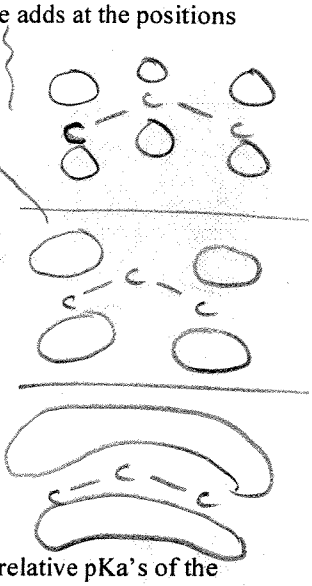
B) In terms of both molecular orbital theory and resonance (valence bond) theory, explain why the bromine adds at the positions you have shown in part A.



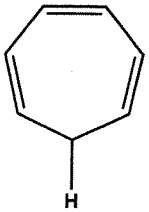
(+) charge on the 2 carbons indicated by resonance

LUMO has e⁻ density on 2 outer carbons of π system.

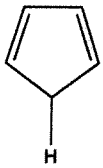




3. (10 points) Consider the compounds below. *Based on molecular orbital theory and aromaticity*, predict the relative pKa's of the indicated protons. Be specific & thorough. Diagrams may be helpful.

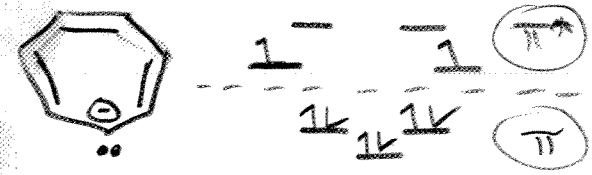


higher pKa (less acidic)

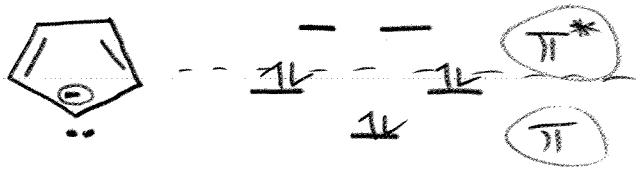


lower pKa (more acidic)

* Consider the resulting conjugate bases: *

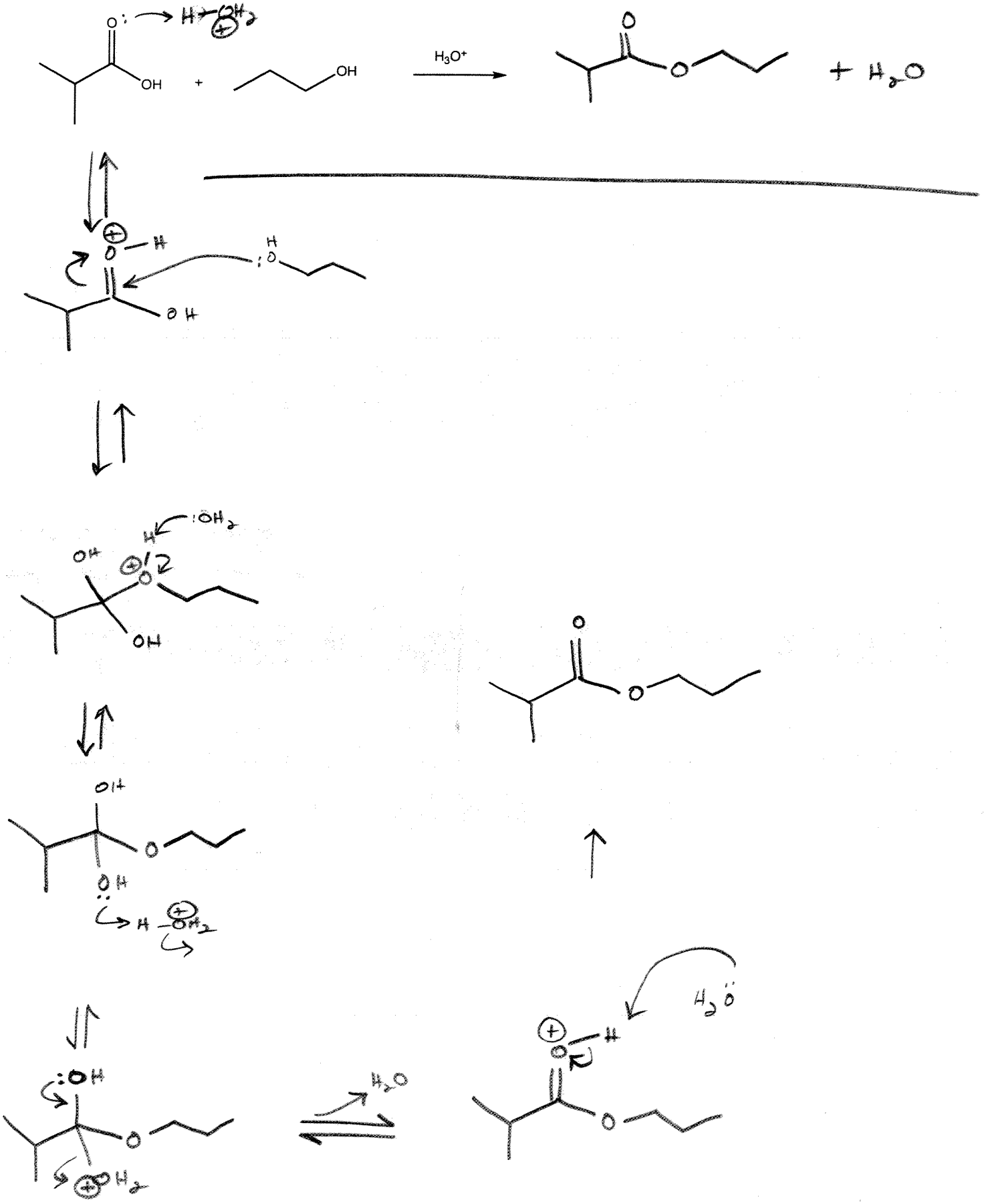


8 π e⁻s leads to filling of π* antibonding orbitals → no aromaticity

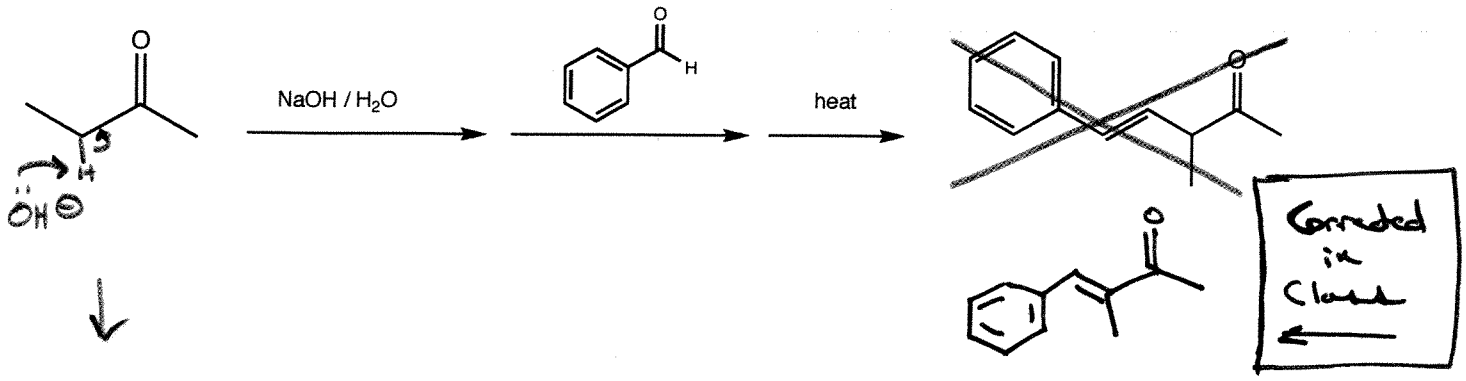


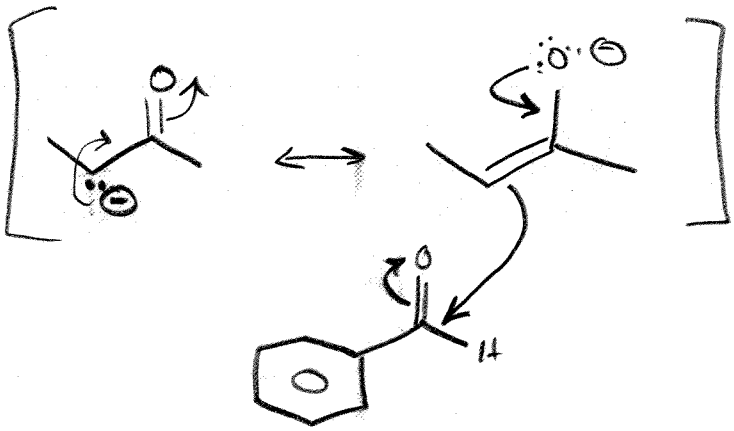
6 π e⁻'s leads to filling of only π orbitals (bonding) & they are filled completely

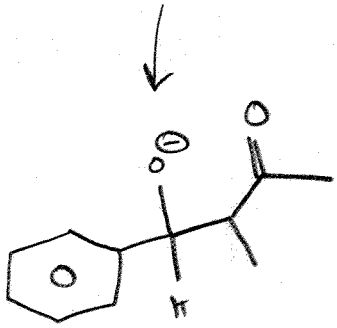
4. (20 points) Predict the products of the following reaction and provide a detailed arrow-pushing mechanism for the reaction. Show all important resonance structures of any intermediates.

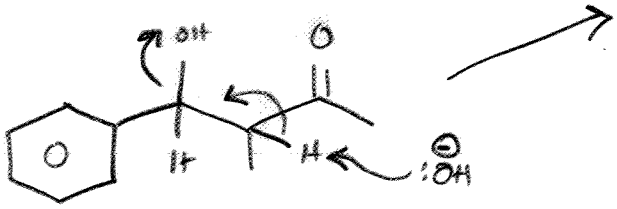


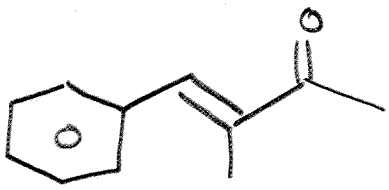
5. (18 points) Predict the major product of the following reaction scheme and provide a detailed arrow-pushing mechanism for the reactions. Show all important resonance structures of any intermediates.



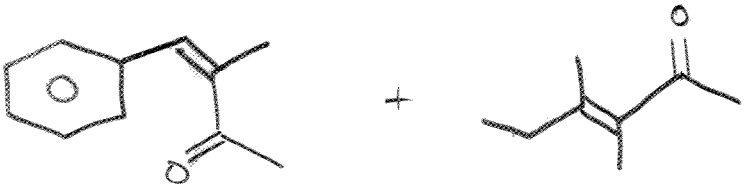








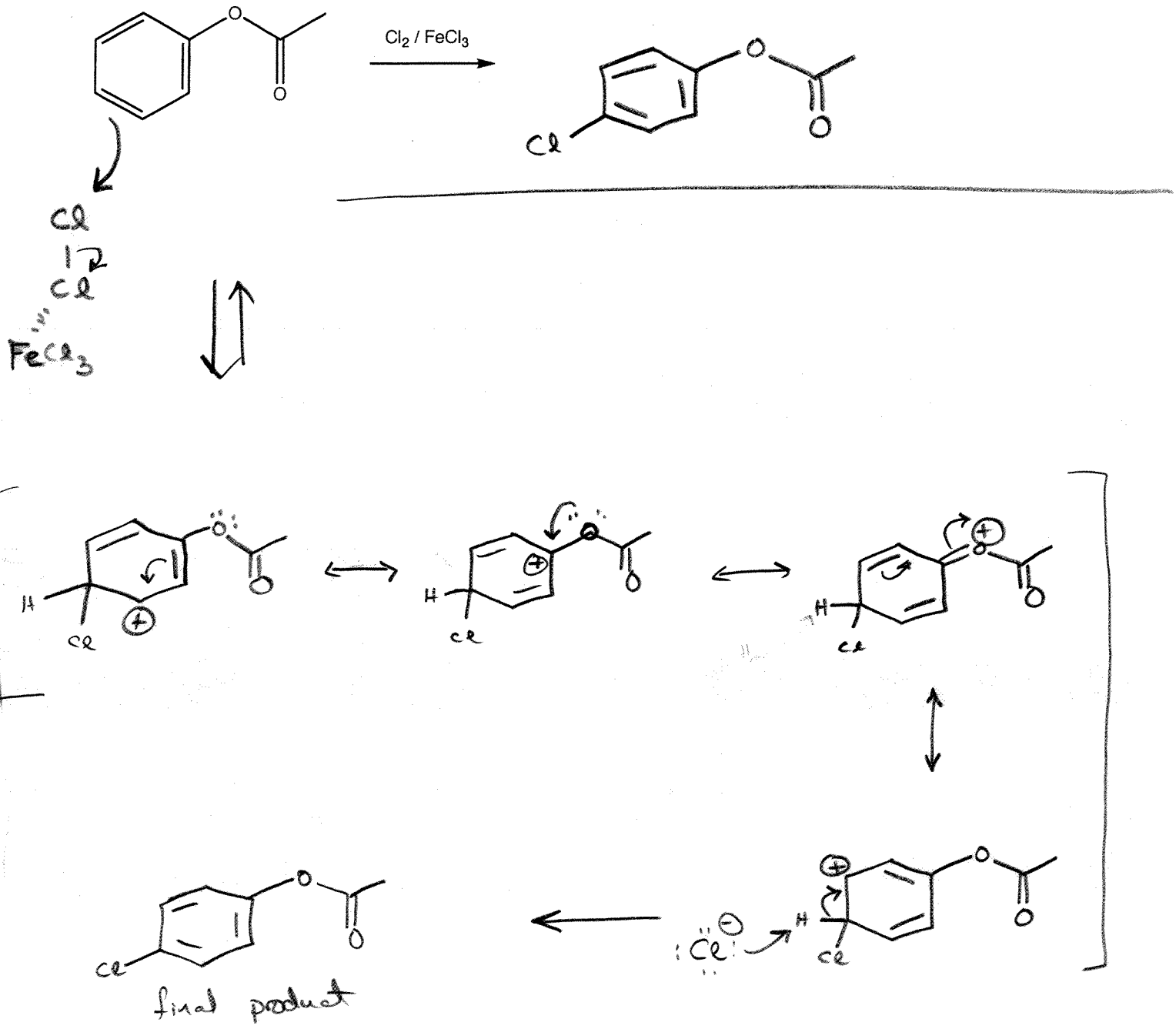
B) What minor side products would be expected?



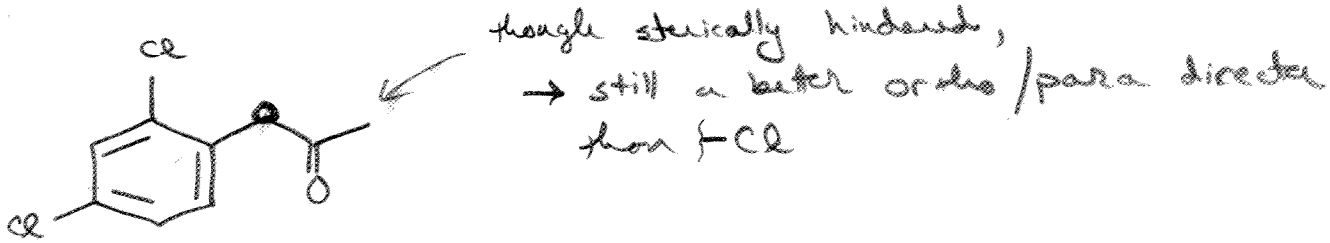
aldol precursors to the 2 α, β unsat carbonyls

6. (20 points) Consider the reaction below and conditions below.

A) Assuming a single monochlorinated product, predict the likely structure of the product, and provide a complete, arrow-pushing mechanism for its formation. Show all important resonance structures of any intermediates.

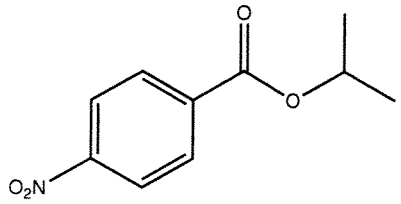


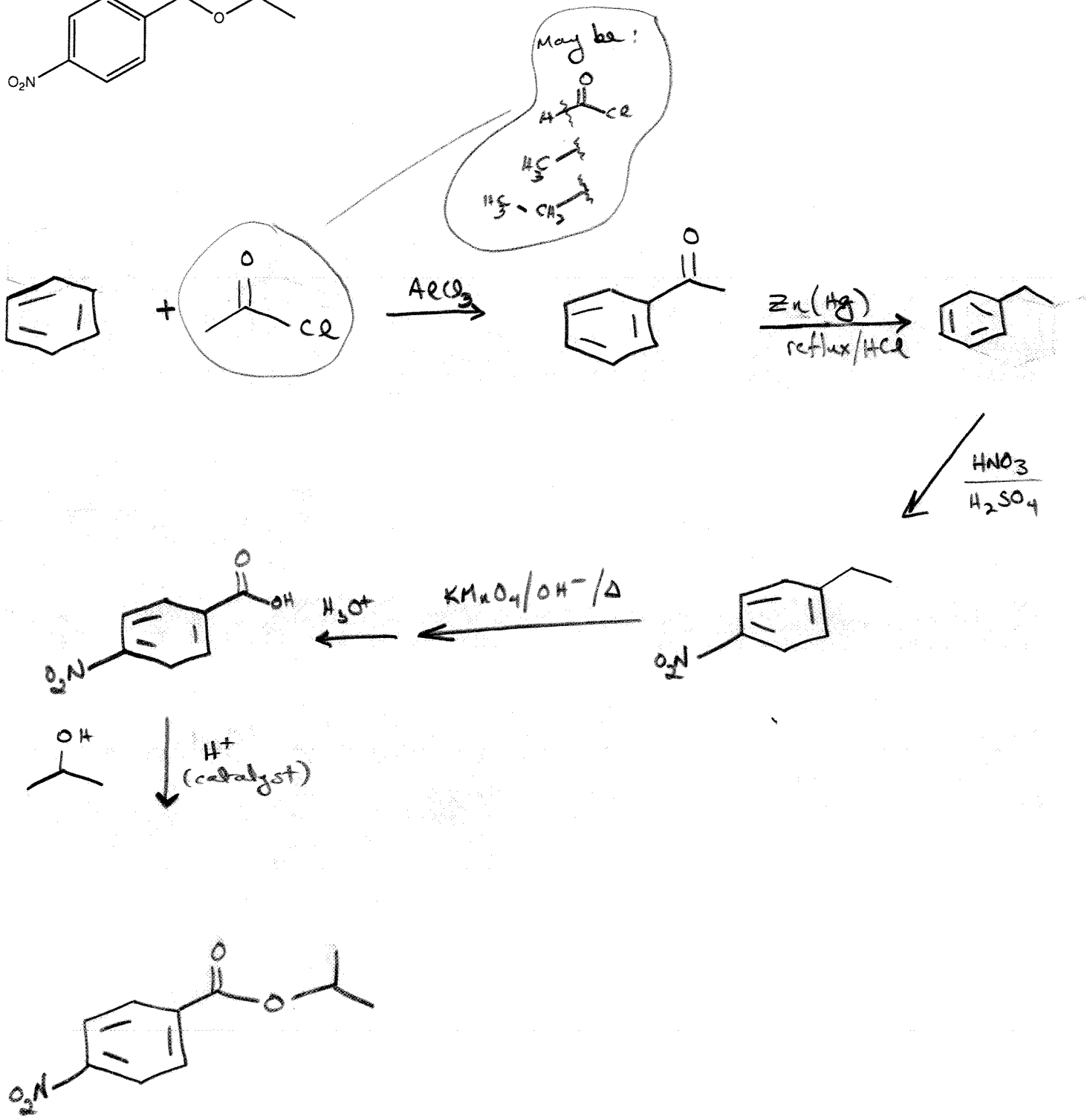
B) If a second chlorination of the ring were to occur, show what that structure would likely be.



NO functional group restrictions (Noted in class)

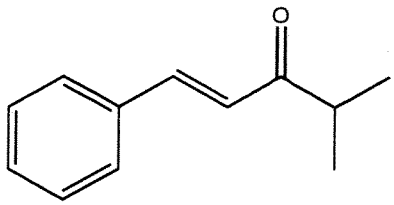
7. (12 points) Consider the compound below. Starting with ***benzene*** and ***compounds with three carbons or less*** as your only sources of carbon atoms, suggest a reasonable scheme for its synthesis in good yield. You may use any other reagents or solvents needed. Show the products of each intermediate step. (Mechanism not required.)

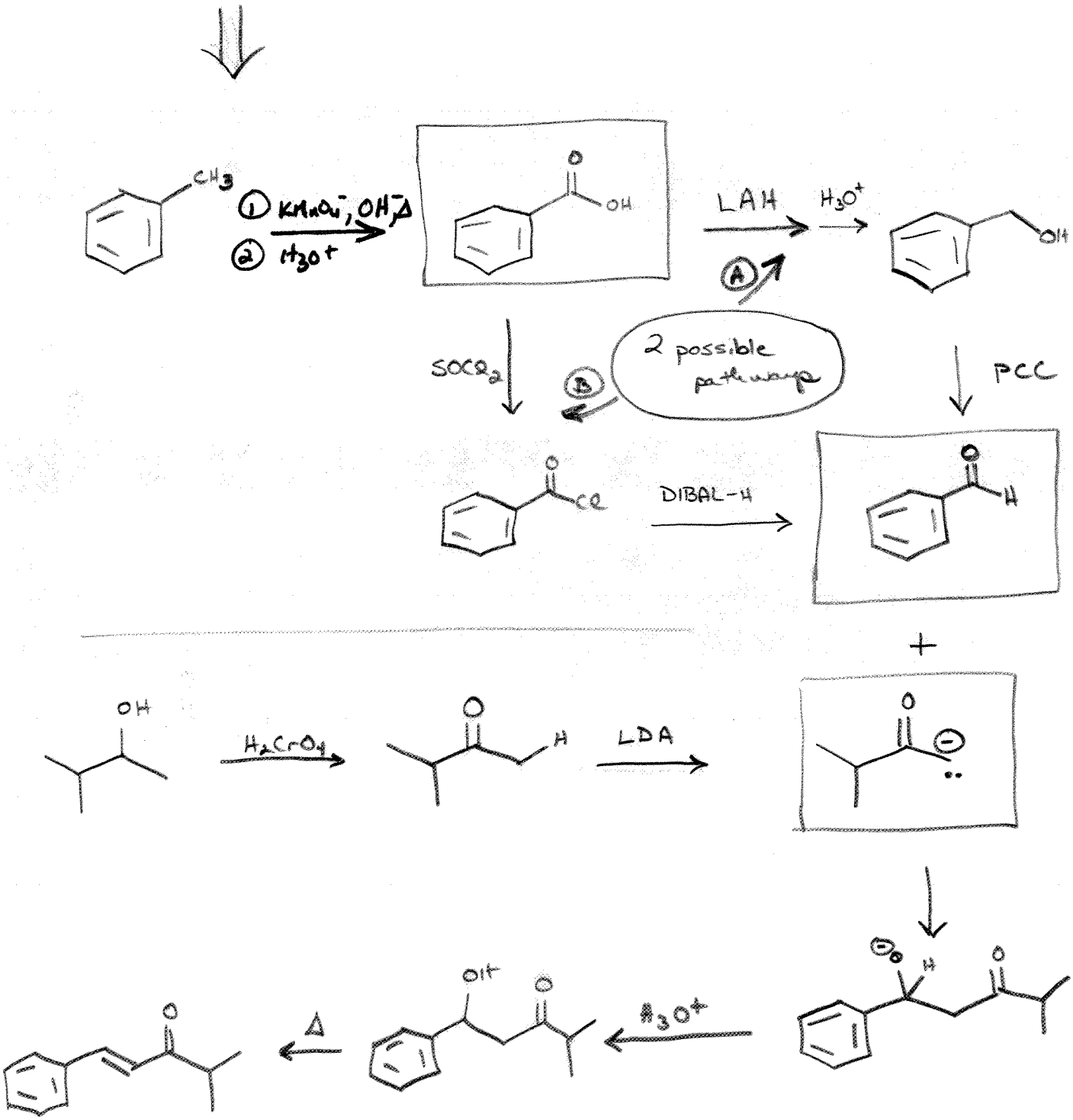




in the final product (noted in class).

8. (12 points) Consider the compound below. Starting with ***toluene*** and ***an alcohol with five carbons*** as your only sources of carbon atoms, suggest a reasonable scheme for its synthesis in good yield. You may use any other reagents or solvents needed. Show the products of each intermediate step. (Mechanism not required.)





9. (12 points) Consider the compound below. Starting with ***compound given*** and ***methyl bromide*** as your only sources of carbon atoms, suggest a reasonable scheme for its synthesis in good yield. You may use any other reagents or solvents needed. Show the products of each intermediate step. (Mechanism not required.)