

Last Name

First Name

Email: \_\_\_\_\_

**The exam must be written in ink. You have 2 hours to complete the exam.**

CHEM 610B

Exam 3

Spring 2000

Instructor: Dr. Pagenkopf

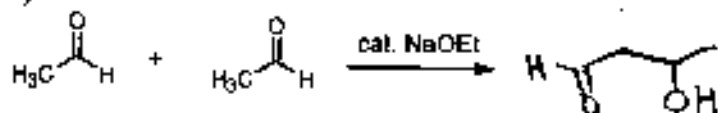
Page	Possible Points	Score
1	35	
2	20	
3	35	
4	20	
5	40	
6	22	
7	30	
8	25	
9	25	
10	15	
Total	267	

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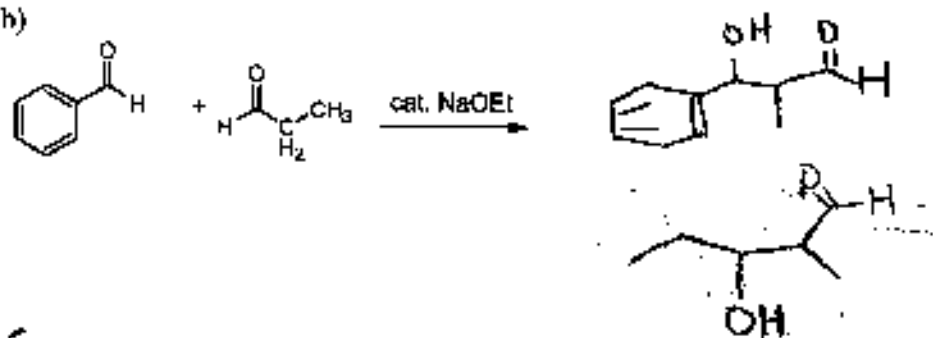
Exam 3/6/11H/PaperkupC

Question 1 (35 points). Aldol Reactions. Show the products of the following aldol condensations. For each question where more than one product is possible, show all possible aldol condensation products even if expected to be minor products. In each question show the  $\beta$ -hydroxy aldehyde(s) or  $\beta$ -hydroxy ketone(s). Do not eliminate or dehydrate to the  $\alpha,\beta$ -unsaturated product.

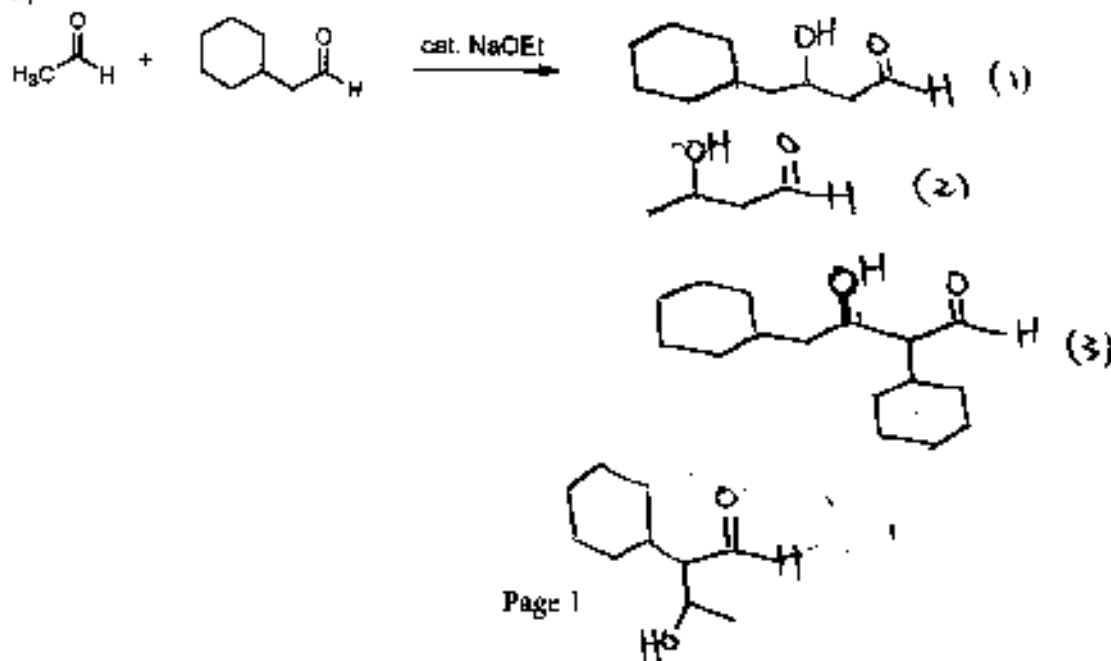
a)



b)



b)

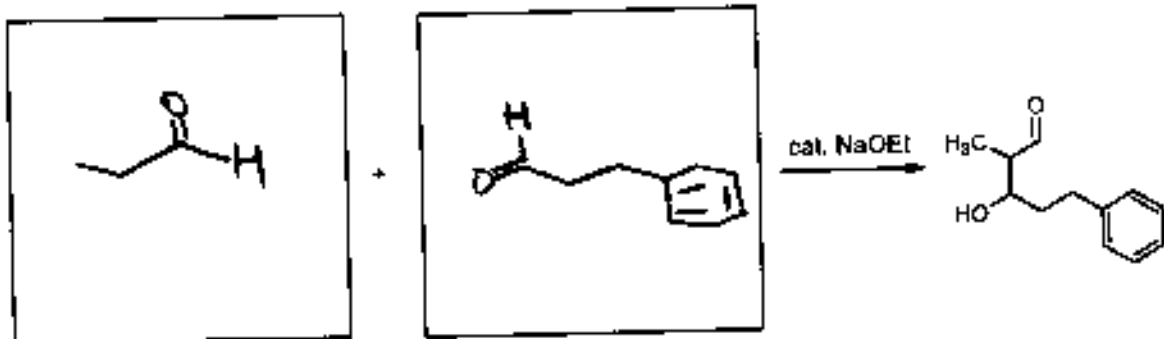


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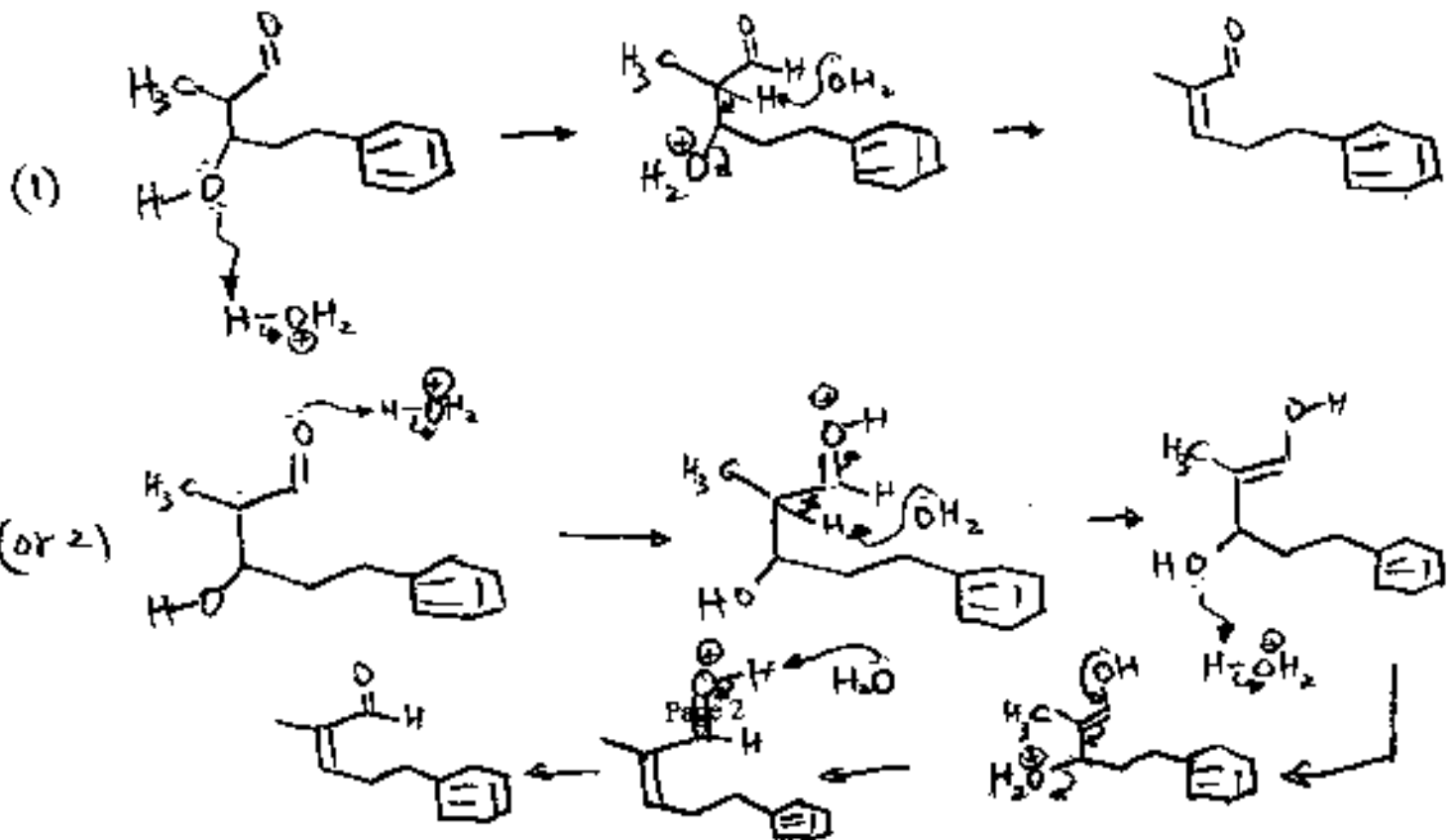
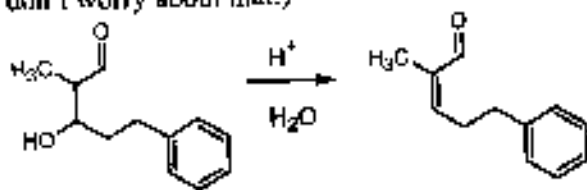
Exam 3:6100/Pagenkopf

Question 2. (20 points). Aldol Reactions.

a) The following molecule was one of several different structures isolated from an aldol condensation reaction. What were the starting materials?

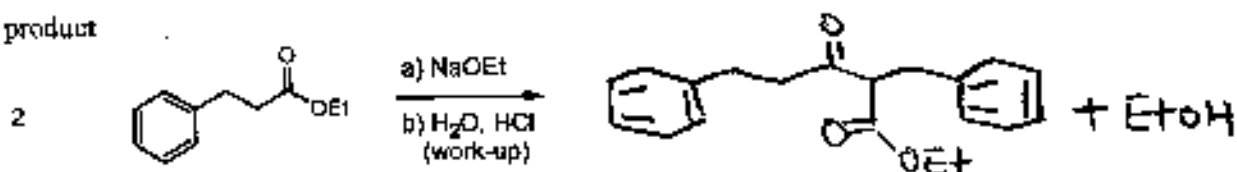


b) The initial products of aldol condensation products readily undergo dehydration. Provide a mechanism for the following dehydration under acidic conditions. (The *E* isomer is also formed but don't worry about that.)

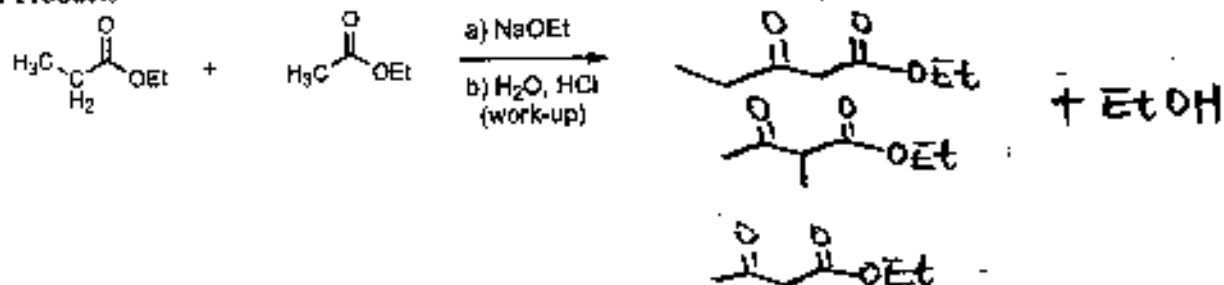


Question 3 (25 points). Claisen Condensations. Draw the major product(s) expected from each of the following reactions. For each question where more than one product is possible, show all possible products. Any product(s) containing a carbon atom should be shown.

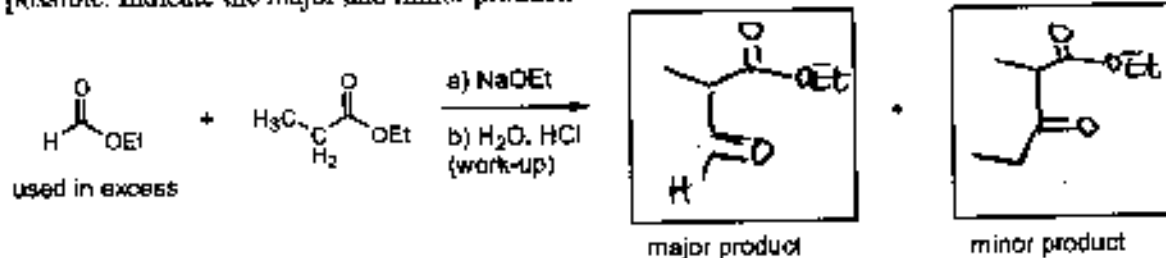
a) One product



b) Four Products



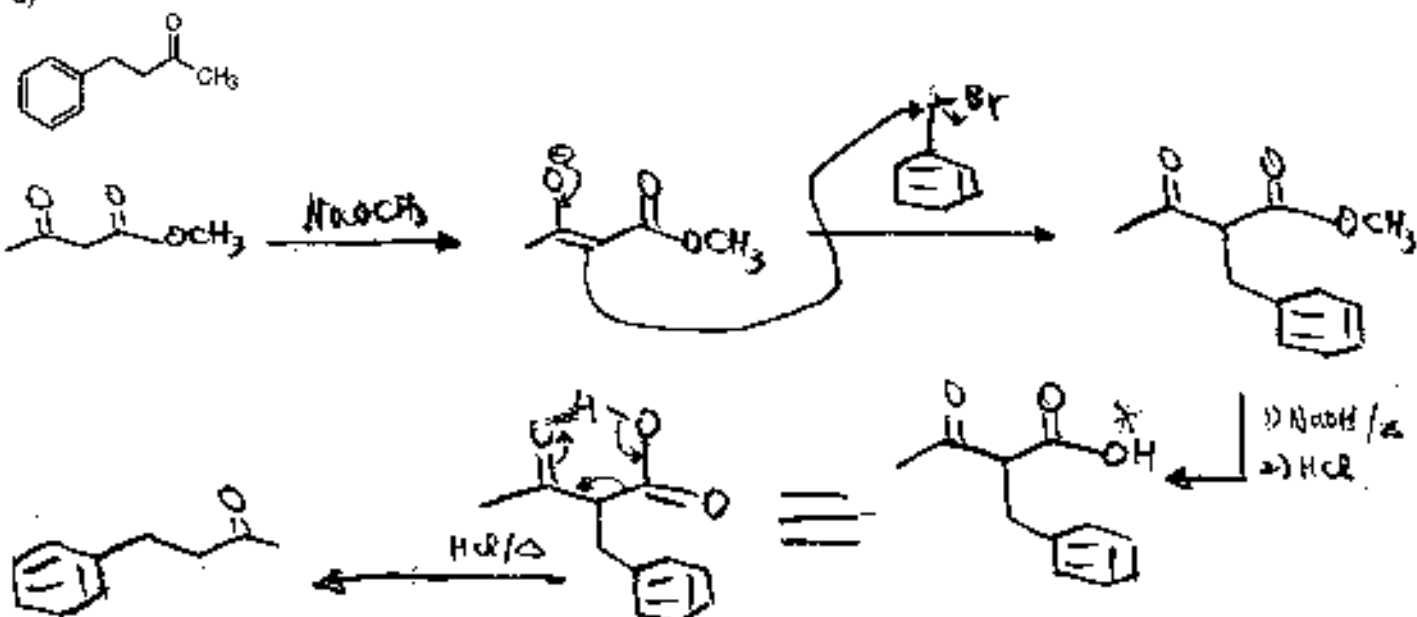
Question 4 (10 points) Claisen and Dieckmann Condensations. In this question only two products are possible. Indicate the major and minor product.



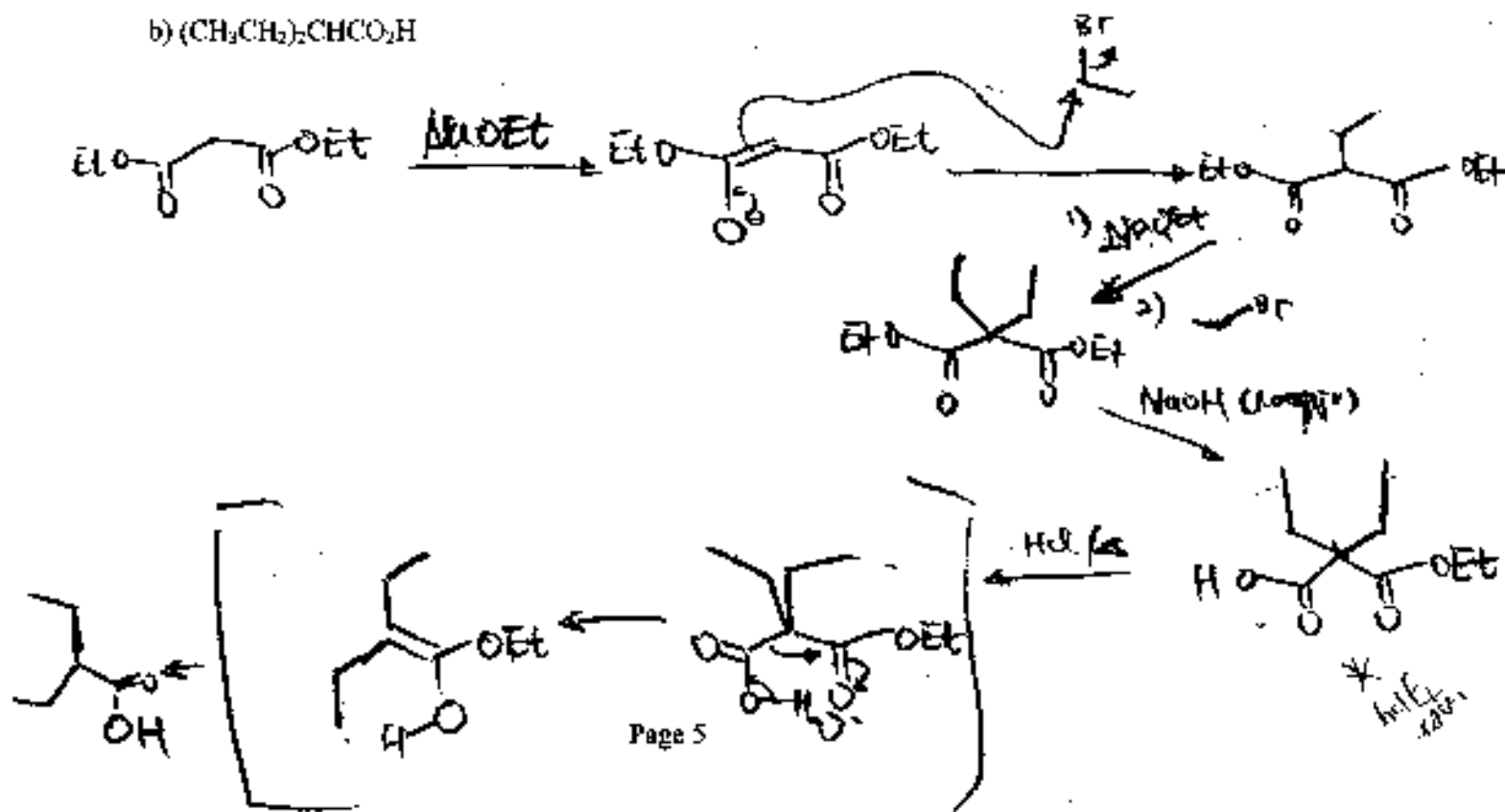


Question 6 (40 points). Show how to synthesize the following compounds using either the malonic ester synthesis or the acetoacetic ester synthesis by providing the necessary reagents and conditions.

a)



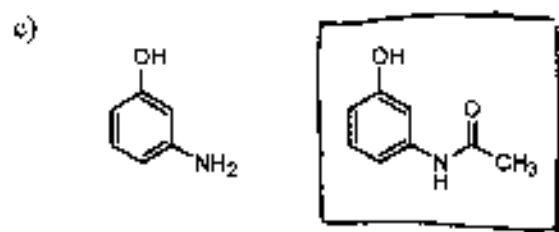
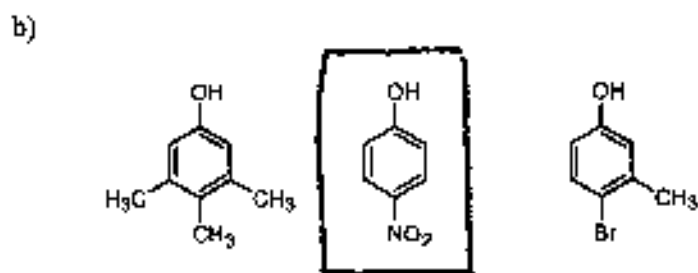
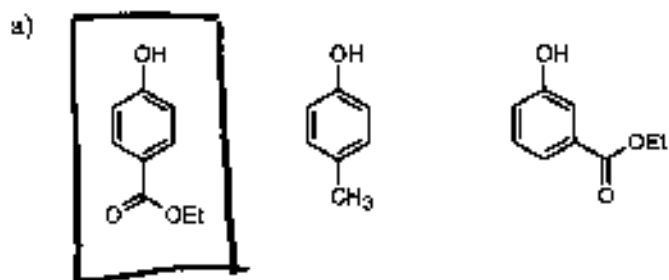
b)  $(\text{CH}_3\text{CH}_2)_2\text{CHCO}_2\text{H}$



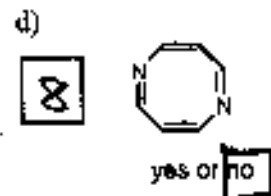
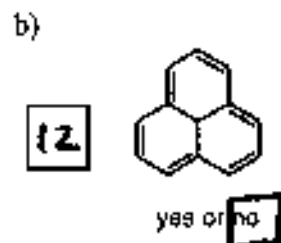
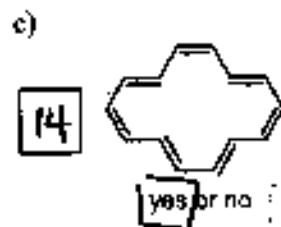
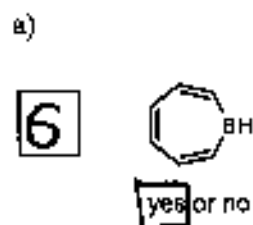
NAME: \_\_\_\_\_

Exam 2/610B/Pagenkopf

Question 7 (6 points). For each series, draw a box around the most acidic phenol.



Question 8 (16 points). In the box next to each structure state the number of pi electrons, then answer the question, is the compound aromatic according to Hückel's criteria?

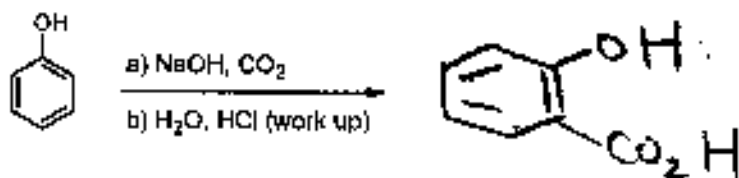


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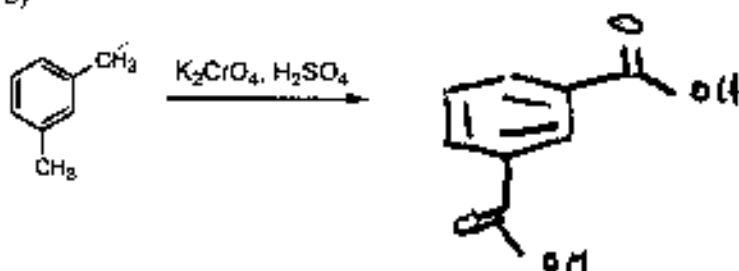
Exam 1610B/Pagenkopf

Question 9 (30 points). Reactions. Draw the major product(s) expected from each of the following reactions.

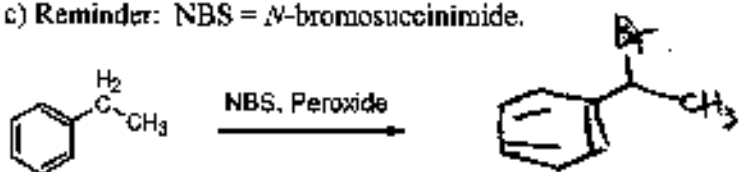
a) **hint:** Kolbe Reaction



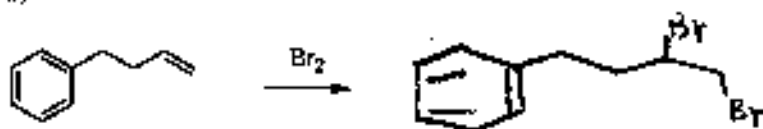
b)



c) **Reminder:** NBS = *N*-bromosuccinimide.



d)

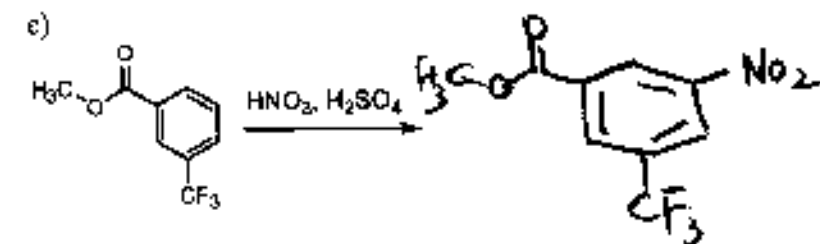
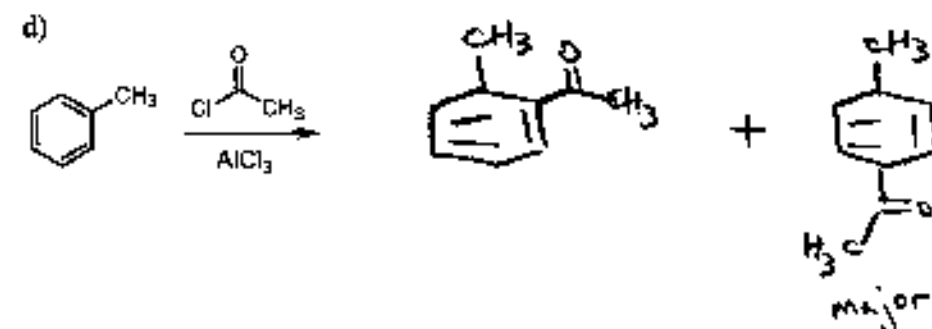
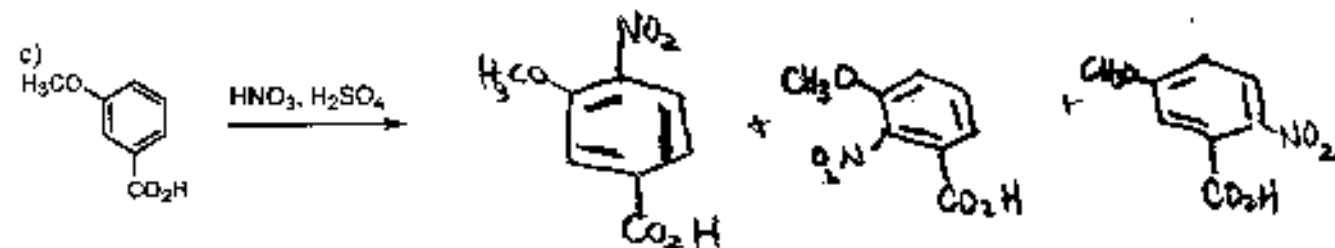
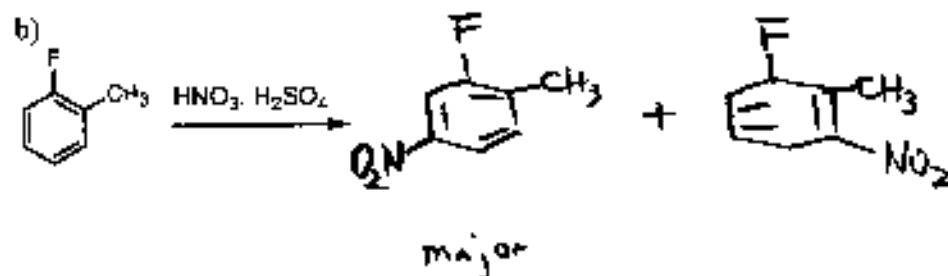
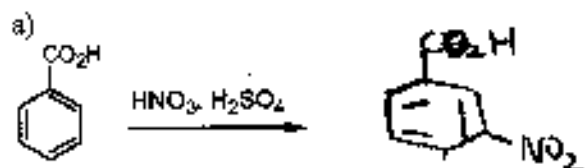


e) Show two products: one with 7 carbons and the other with 6.

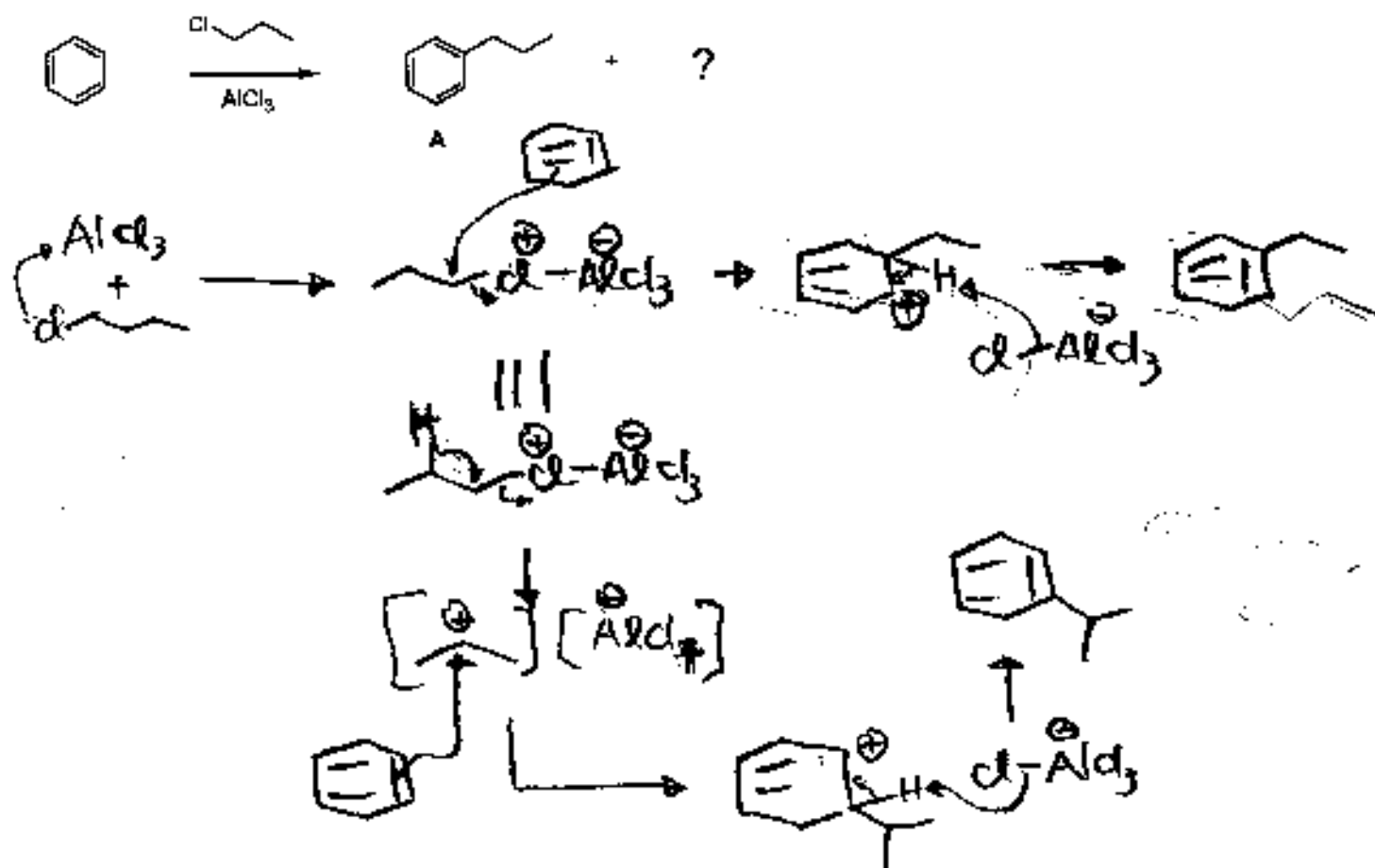




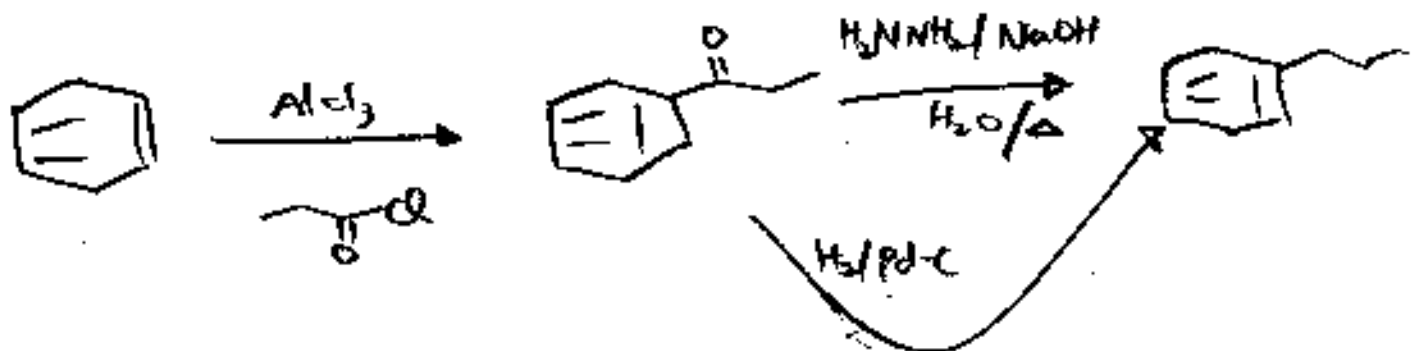
Question 10 (25 points). Electrophilic aromatic substitution reactions. Draw the major product expected from each of the following reactions. For each nitration reaction, add only one nitro group to the aromatic ring.



Question 11 (25 points). The following Friedel-Crafts alkylation reaction gives two products, both of formula  $C_9H_{12}$ . Show the second product, and provide a mechanism to explain how it is formed. (It is not necessary to show *all* of the resonance structures of the benzene ring delocalizing the positive charge but show at least one.)



Propose an alternative way of making molecule A from benzene that avoids the other side product you drew above. Show necessary reagents and conditions.



NAME: \_\_\_\_\_ *C*

Question 12 (15 points). Synthesis. Starting with molecule **B**, show how it might be converted into molecule **C** using any reagents you want. OR Starting with molecule **D**, show how it might be converted into molecule **E** using any reagents you want. Only do one synthesis.

Circle the reaction the TA is to Grade **B** → **C** or **D** → **E**.

