

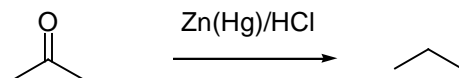
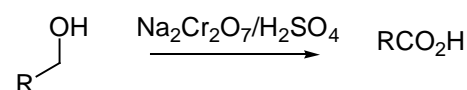
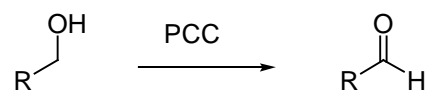
Organic Chemistry 32-335
Exam #3-Spring 2004

Printed Name: _____

Signature: _____

Section #: _____

Useful Reactions:



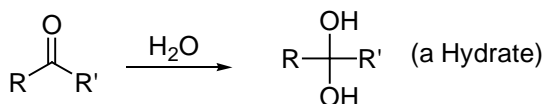
1. Be sure your exam has 6 pages, including this page.
2. Read each problem carefully. Write **clearly**; illegible answers will be considered incorrect.
3. Avoid looking or glancing at other students' exams.
4. Please leave quietly if you finish early.

Part 1. (4 point each, 48 points)---**Circle only one choice!**

1. Which of the following correctly describes the hybridization of the carbon and the bond angle HCO in formaldehyde (CH₂O)? (chapter 18)

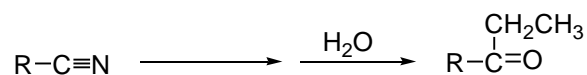
- (A) C, sp²; HCO, ~120°
 (B) C, sp³; HCO, ~109.5°
 (C) C, sp³; O, sp²; HCO, ~109.5°
 (D) C, sp³; O, sp³; HCO, ~109.5°

2. Aldehydes and ketones react with water to give hydrate as shown below. Which of the compounds listed would give the best yield of hydrate? (chapter 18)



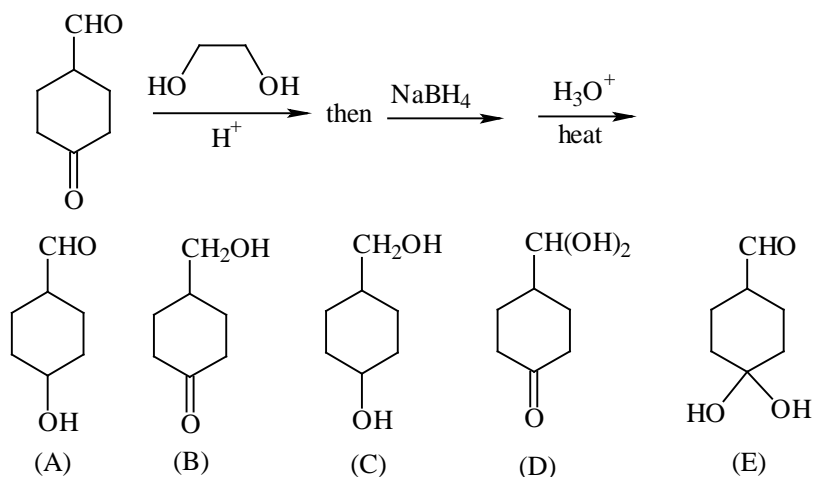
- CH₃COCH₂Cl ClCH₂CHO CH₃COCH₃ CH₃CHO CH₃COCH₂CH₂CH₃
 (A) (B) (C) (D) (E)

3. In the following synthesis, a nitrile is reduced to give a ketone as the final product. Which reagent is needed for the first step of this conversion? (chapter 18)

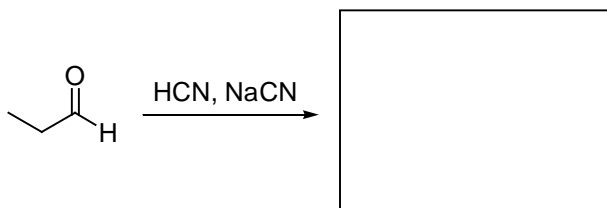


- (A) CH₃CH₂Br (B) CH₃CH₂OH (C) NaOH, then CH₃CH₂I (D) CH₃CH₂MgBr

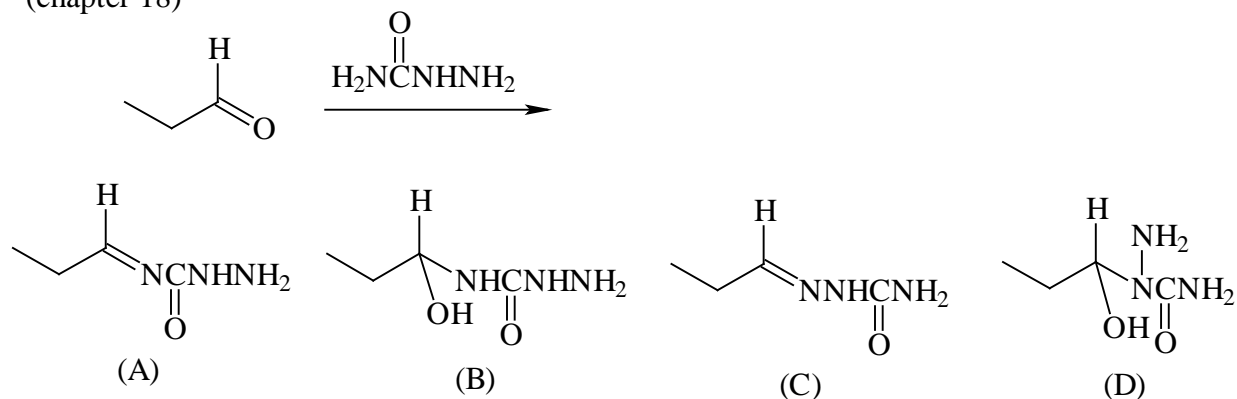
4. What is the major organic product from the following reaction sequence? (chapter 18)



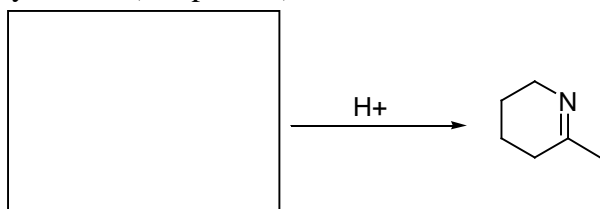
5. Provide the missing structure for the product: (chapter 18)



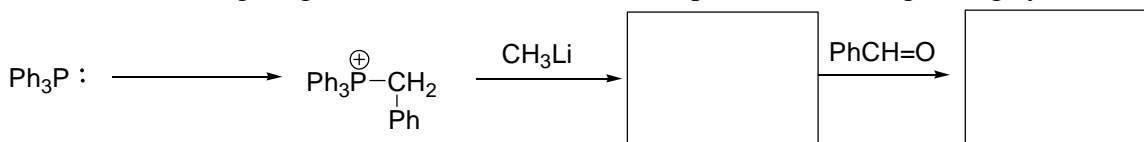
6. Semicarbazone is often used as a derivative in determining an unknown aldehyde or ketone. Which of the following is the expected semicarbazone product (Hint: three N's are of different reactivity!) (chapter 18)



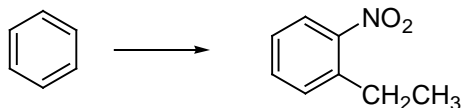
7. In the boxes provided, draw the structure of the reactant needed to complete the following imine synthesis: (Chapter 18)



8. Provide the missing reagents or structures for each step of the following Wittig synthesis: (chapter 18)

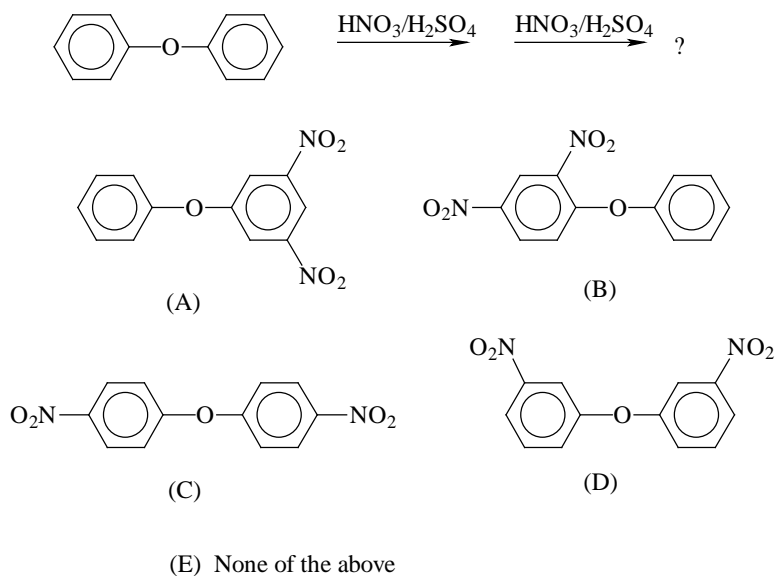


9. Which condition would allow for the completion of this synthesis? (chapter 17)

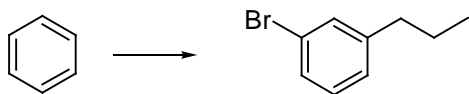


- (A) (i) $\text{CH}_3\text{CH}_2\text{Cl}$, AlCl_3 ; then (ii) $\text{HNO}_3/\text{H}_2\text{SO}_4$
- (B) (i) $\text{CH}_3\text{CH}_2\text{OH}$; then (ii) NaNO_3
- (C) (i) $\text{HNO}_3/\text{H}_2\text{SO}_4$; then (ii) $\text{CH}_3\text{CH}_2\text{Cl}$, AlCl_3
- (D) (i) $\text{CH}_3\text{CH}_2\text{MgBr}$; then (ii) $\text{HNO}_3/\text{H}_2\text{SO}_4$

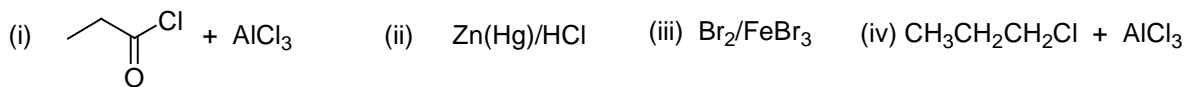
10. What is the major product expected when the following reactant is subject to nitration twice (i.e. after the first nitration, take the product and subject that to a second nitration)? (chapter 17)



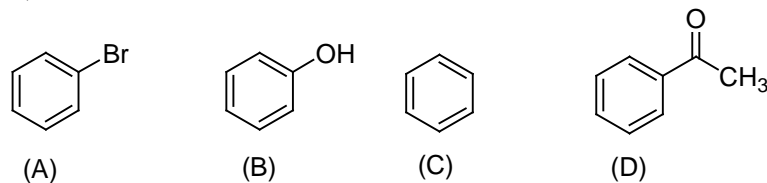
11. Benzene can be converted to the desired product only by the correct combination of the conditions shown below. Choose the correct sequence from choices (A)-(E). (Chapter 17)



Conditions:



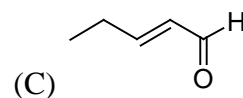
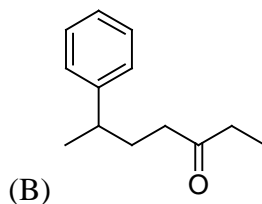
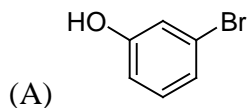
- (A) (i) then (iii) then (ii)
 (B) (i) then (ii) then (iii)
 (C) (iii) then (i) then (ii)
 (D) (iv) then (iii)
 (E) (iii) then (iv)
12. Which of the following reacts most rapidly under the nitration condition to introduce a nitro group onto the ring? (chapter 17)



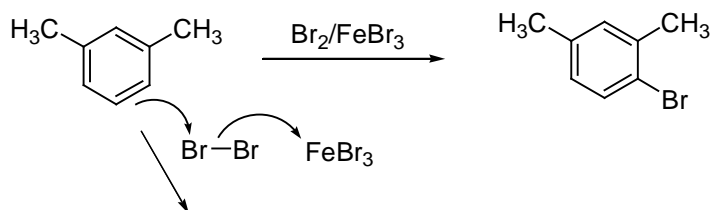
End of Part I

Part II: (52 points)

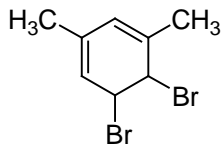
1. (12 points) Give an IUPAC acceptable name for each of the following compounds: (chapter 18 plus chapter 16)



2. (16 points) Shown below is the bromination of m-xylene in a electrophilic substitution reaction. (chapter 17)

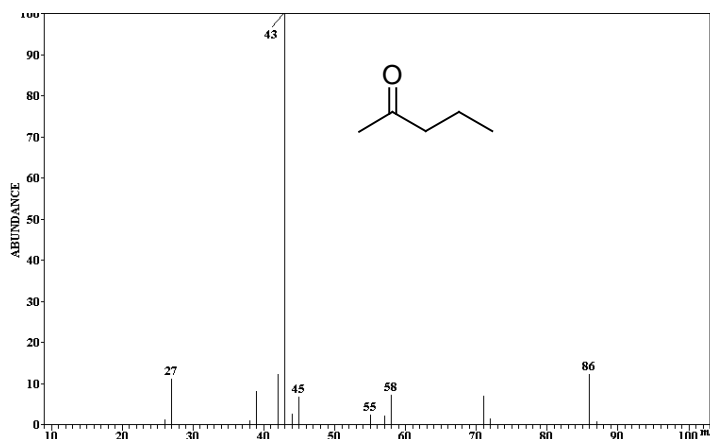


- (A) The mechanism involves two steps, the first step has been started for you. Draw the intermediate sigma complex, showing all its resonance structures.
- (B) Show how the intermediate continues to form the product. Use proper arrow pushing.
- (C) Which step is the rate limiting and why?
- (D) Explain why m-xylene reacts much faster than benzene when treated with $\text{Br}_2/\text{FeBr}_3$ under the same reaction conditions (Hint: the activation energy is affected by the stability of the intermediate)
- (E) Explain why the following possible product is NOT formed in this reaction.



3. (10 points) The M.S. of the following compound shows a base peak at $m/e=43$. (chapter 18)

(A) Propose reasonable structures to account for the peaks at 86 and 58 (Hint: McLafferty Rearrangement)



(B) Propose two possible fragmentation ions that account for the base peak. Which ion is expected to be the major contribution to the 43 peak (more stable)? Briefly explain.

4. (14 points) Show how you would convert the reactant R into the product P in the following desired synthesis (more than one step is necessary). For each step, specify the reagents (use any organic or inorganic ones that you need). (Hint: carefully examine the functional group change and the location of the new C-C bond) (chapter 18)

