

First Three Letters of Last Name

TA Name

Exam 4
5.12 Spring 2005

K

E

Y

Name _____

Signature _____

ID# _____

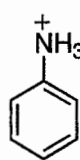
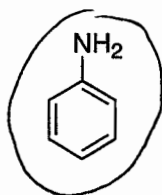
Prerequisite (circle one): 5.112 5.111 3.091

1. Make sure your exam has 11 numbered pages plus a periodic table.
2. Write your initials on each page.
3. Look over entire exam before starting and carefully read all instructions.
4. Show work for partial credit.

Page	Possible Points	Total
1	10	
2	12	
3	15	
4	12	
5	9	
6	12	
7	10	
8	10	
9	10	
Total	100	
10	2	
XC	102	

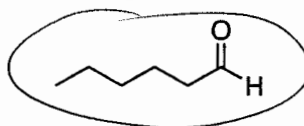
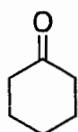
1. (10 points)

a. Which compound is more susceptible to electrophilic aromatic substitution?



← e withdrawing (positive charge) so deactivating

b. Which carbonyl compound is more susceptible to nucleophilic attack?



aldehydes more reactive - sterics + polarity.

c. What is the purpose of the FeBr_3 catalyst in an electrophilic aromatic substitution halogenation?

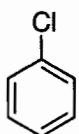
- i. It serves as a radical initiator
- ii. It destabilizes the carbocation intermediate.

iii. It acts as a Lewis acid to activate Br_2 .

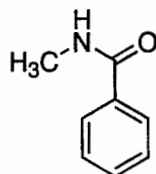
d. Rank in order of reactivity for electrophilic aromatic substitution (1= most reactive)



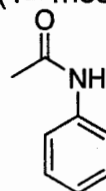
2



3



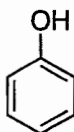
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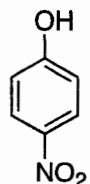
1

← this was marked differently on the practice exam, so ~~marked~~ very generous scoring w/ this one

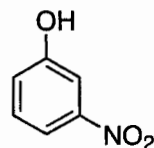
e. Rank in order of acidity (1= most acidic).



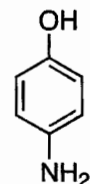
3



1



2



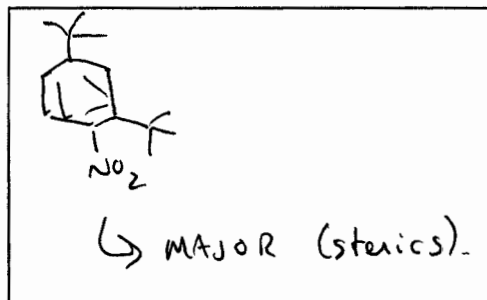
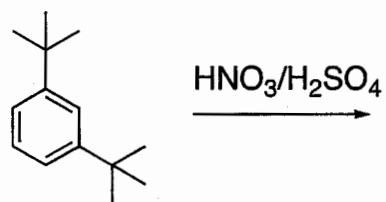
4

Initials

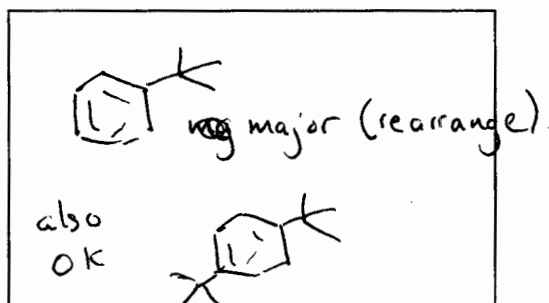
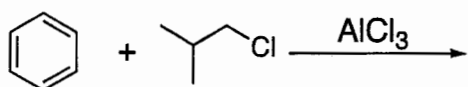
Points

2. (12 points) Draw the structure of the MAJOR product of the following reactions. If there is no reaction, write "NR".

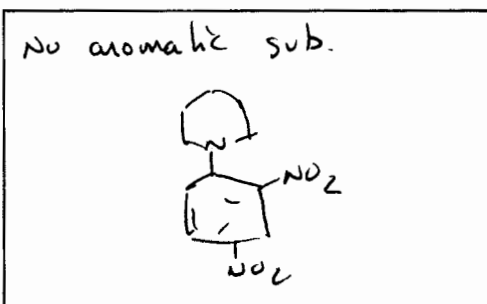
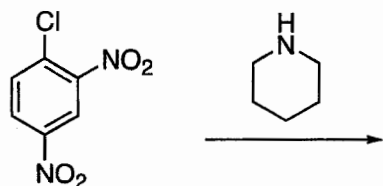
a.



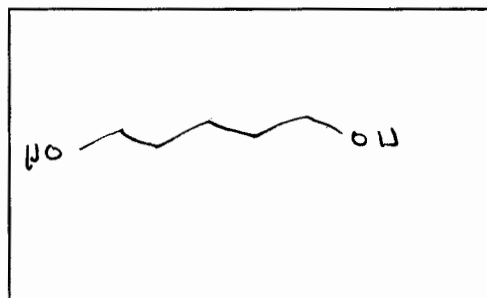
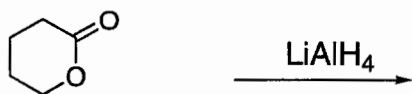
b.



c.



d.

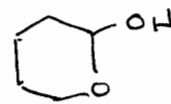
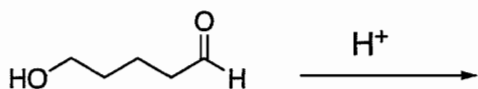


Initials

Points

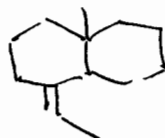
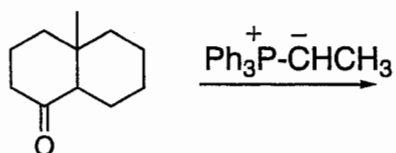
3. (15 points) Draw the structure of the MAJOR product of the following reactions. If there is no reaction, write "NR".

a.

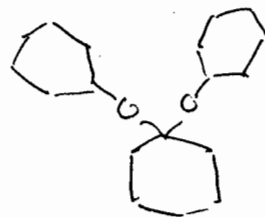
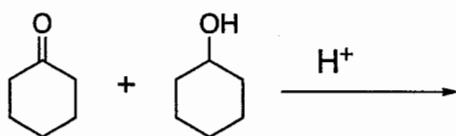


(hint: a hemiacetal)

b.

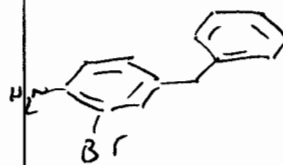
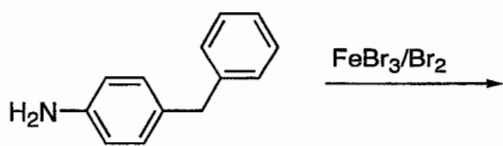


c.

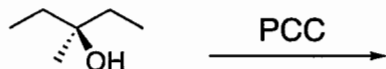


partial credit for hemiacetal

d.



e.



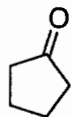
NR

Initials

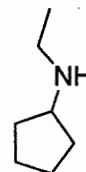
Points

4. (12 points) Provide the necessary reagents for the following transformations. More than one step may be required.

a.



① $\text{NH}_2\text{CN}_2\text{CH}_3$
② NaBH_4 or LiAlH_4

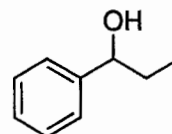


b.

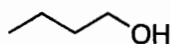


① CH_3COCl , AlCl_3

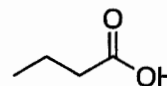
② NaBH_4 or LiAlH_4



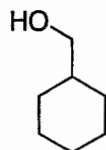
c.



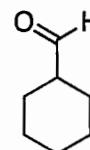
$\text{Na}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$



d.



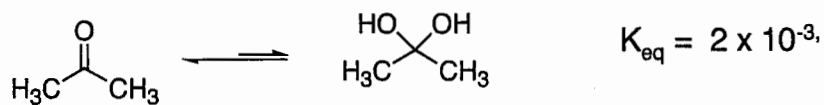
PCC



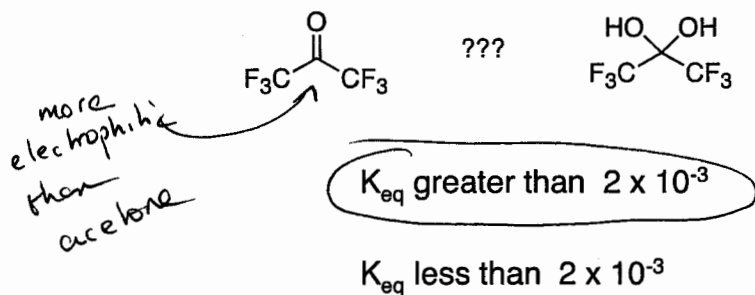
Initials

Points

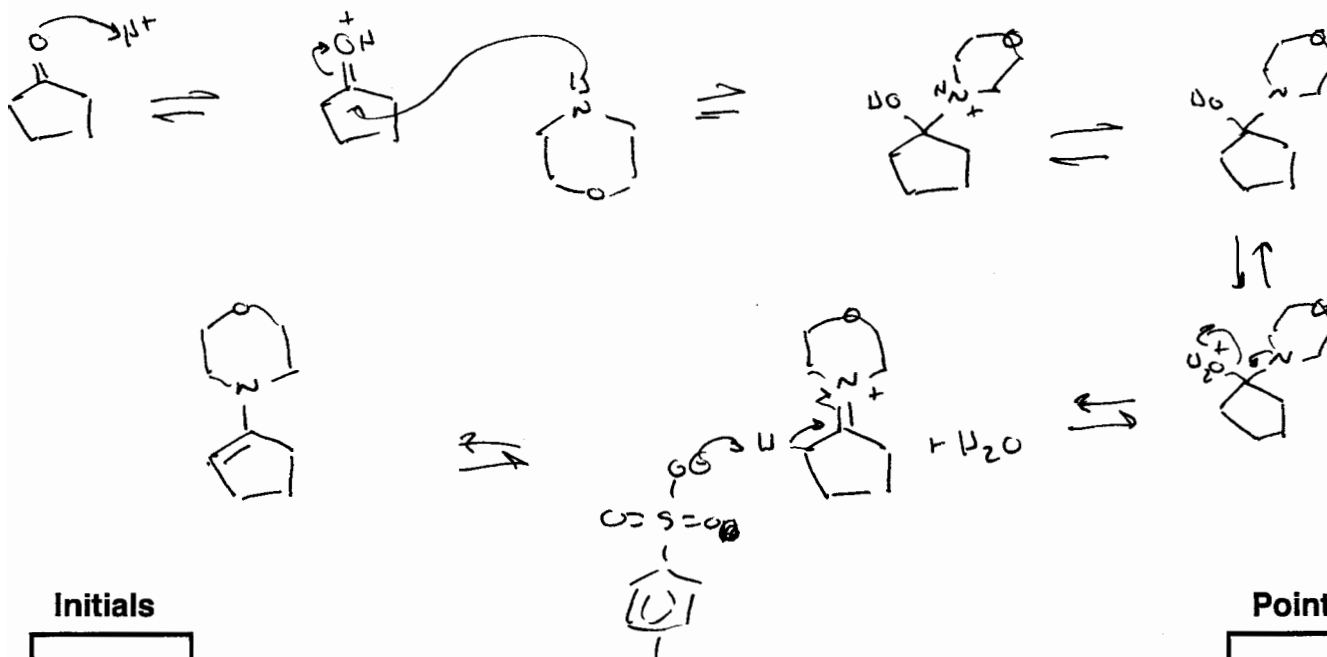
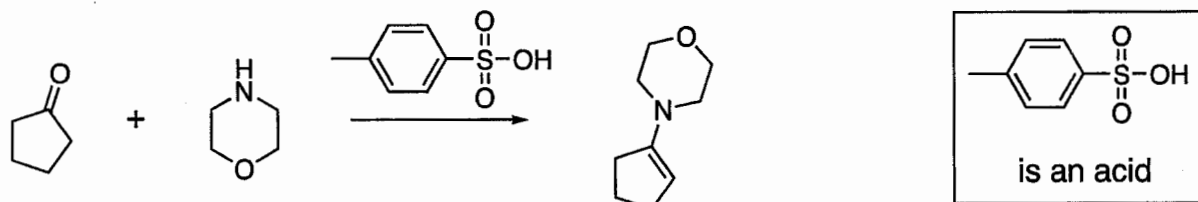
5. (4 points) The equilibrium constant for hydration of acetone is 2×10^{-3} , which translates into a small percent conversion to the following hydrate.



Would you expect the equilibrium constant for hexafluoroacetone to be smaller or larger than that for acetone?



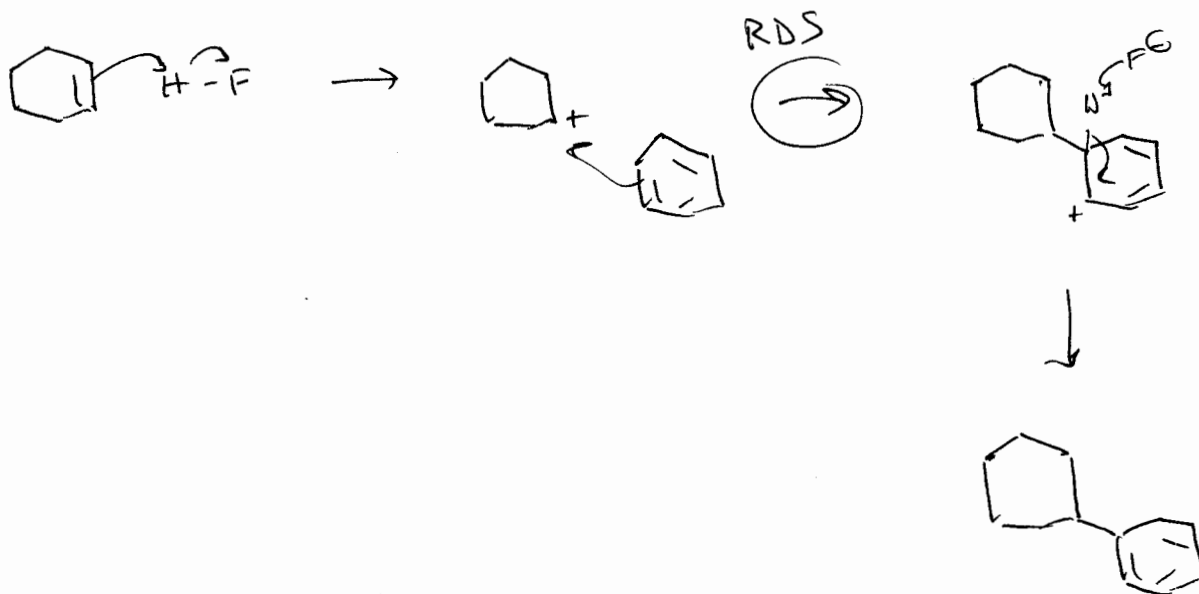
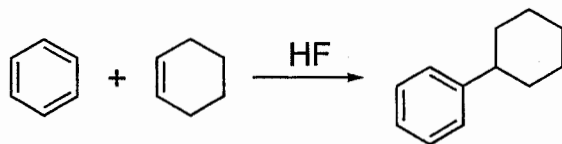
6. (5 points) Draw a mechanism for the following transformation.



Initials

Points

7. A. (10 points) Draw a detailed mechanism for the reaction below.

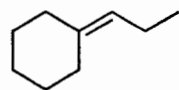


B. (2 points) In your mechanism clearly indicate the rate determining step of the reaction.

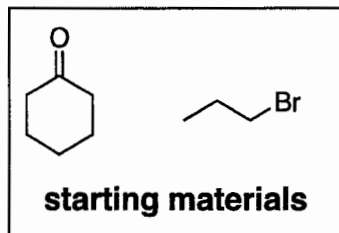
Initials

Points

8. (10 points) Draw a synthesis of the following product from the given starting materials (additional reagents will be necessary). Each step in your synthesis must be clearly shown, but no mechanism is required.

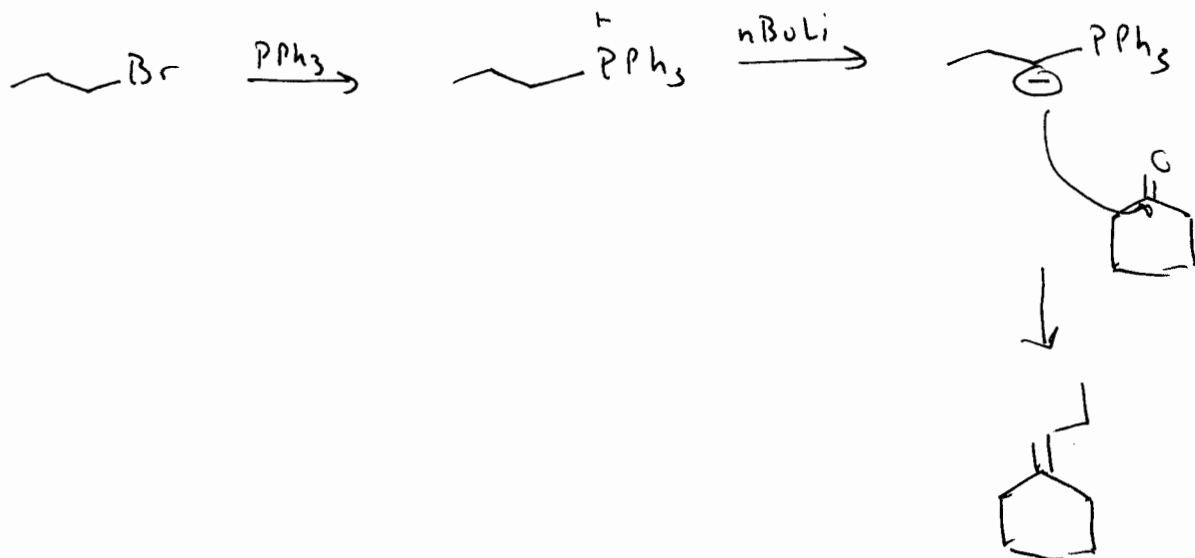


product



starting materials

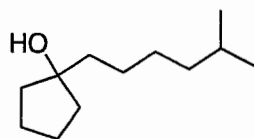
Grignard followed by elimination got 8/10 points (if it was all correct). But the "best" (most regioselective) synthesis is a Wittig.



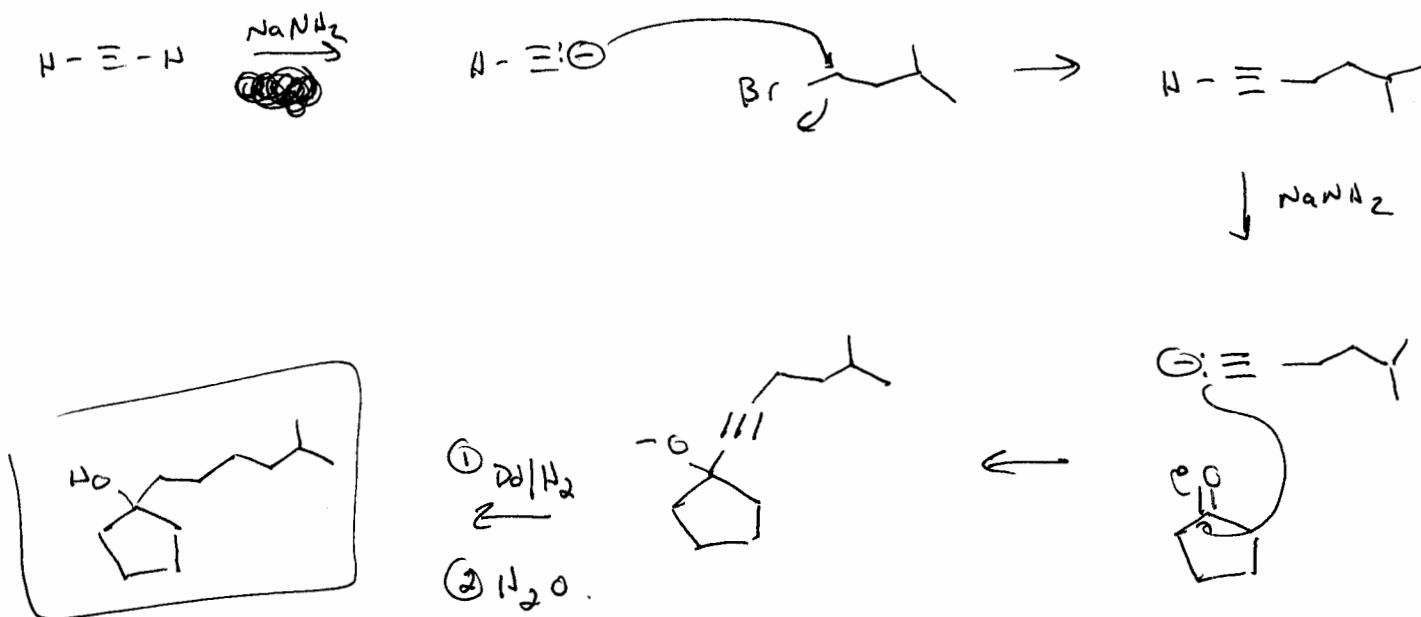
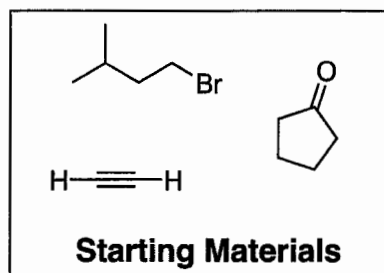
Initials

Points

9. (10 points) Draw a synthesis of the following product from the given starting materials (additional reagents will be necessary). Each step in your synthesis must be clearly shown, but no mechanism is required.



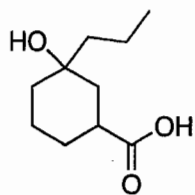
Product



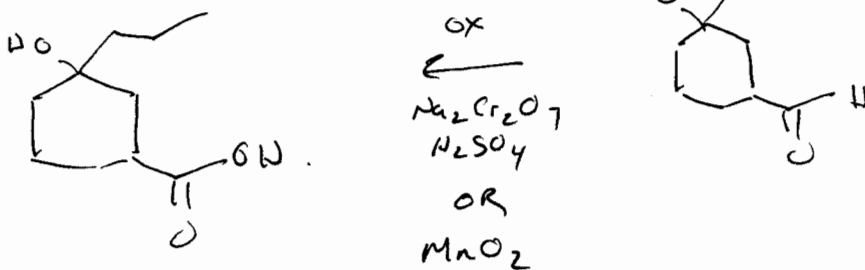
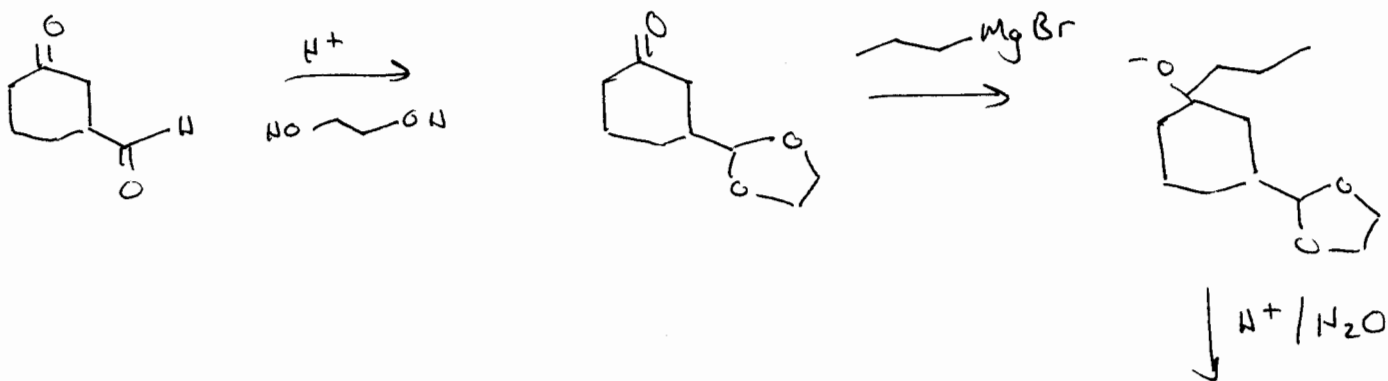
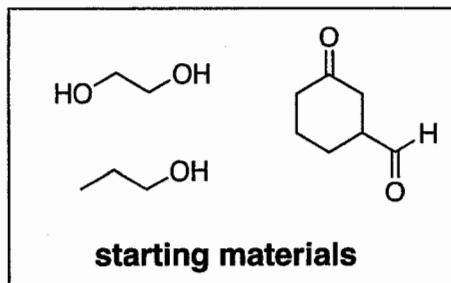
Initials

Points

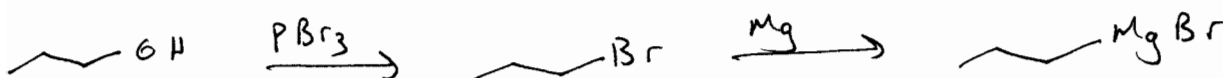
10. (10 points) Draw a synthesis of the following product from the given starting materials (additional reagents will be necessary). Each step in your synthesis must be clearly shown, but no mechanism is required.



product



\xleftarrow{Ox}
 $Na_2Cr_2O_7$
 H_2SO_4
 OR
 MnO_2

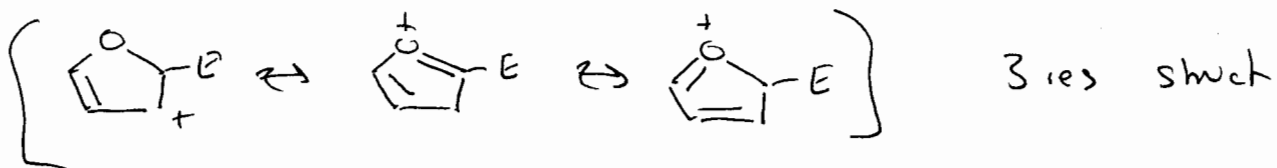
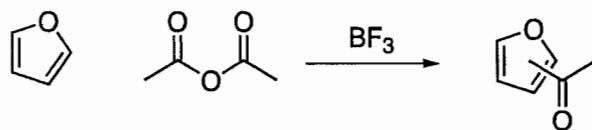


Initials

Points

Extra Credit:(2 points)

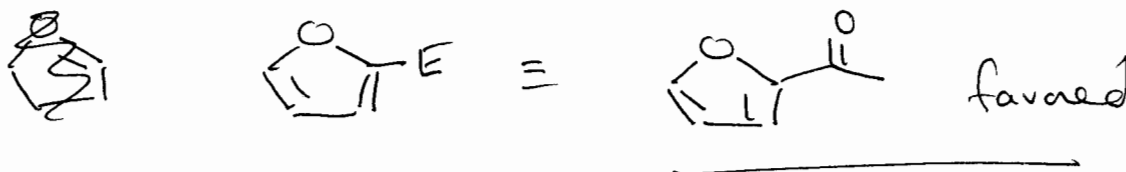
Furan is readily acetylated with acetic anhydride and a Lewis acid such as BF_3 . Predict the major regioisomer produced in this reaction and justify your reasoning with resonance structures.



3 res struct



2 res struct.



Initials

Points