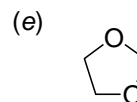
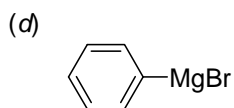
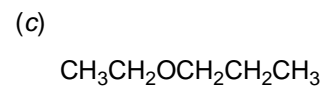
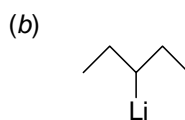
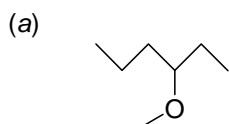


In putting my name on this test and turning it in I am certifying that it **my work alone**.

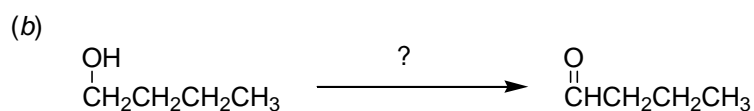
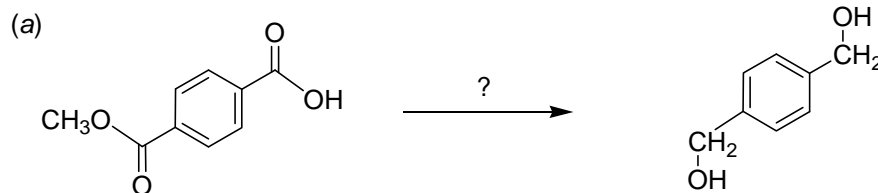
**NOMENCLATURE**

1. Name the following compounds (you may give common names or IUPAC names):  
(10 pts)



**REAGENTS**

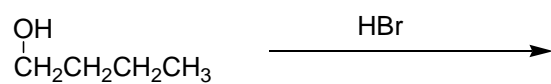
3. Give the reagent(s) necessary to carry out the following reactions: (8 pts)



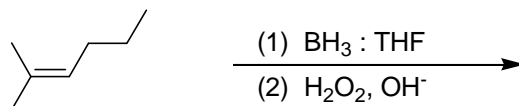
## SYNTHESIS

4. Give the organic product(s) for the following reactions: (60pts total; 4pts each)

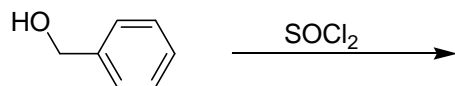
(a)



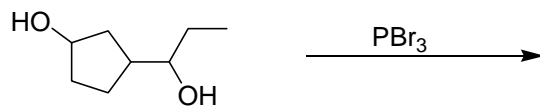
(b)

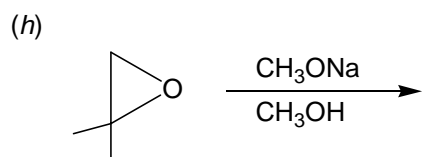
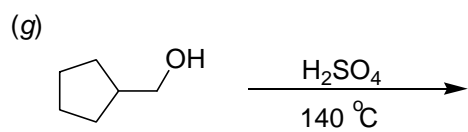
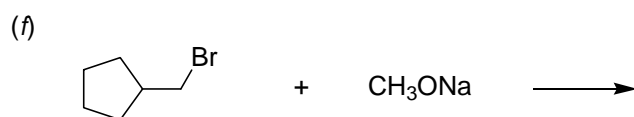
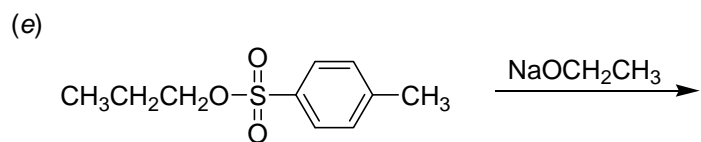


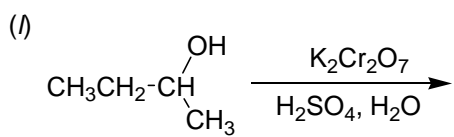
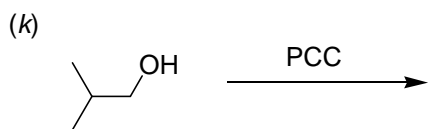
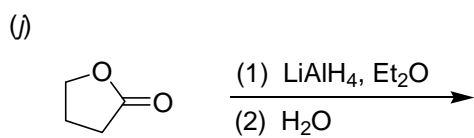
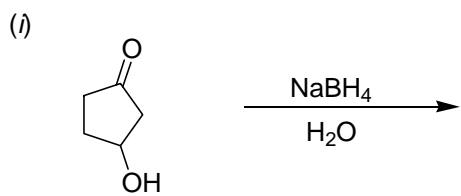
(c)

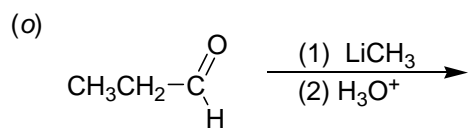
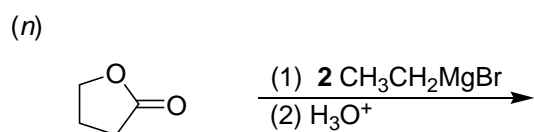
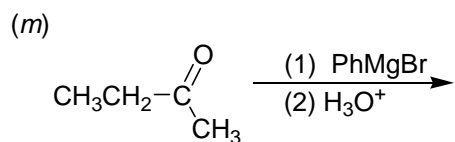


(d)





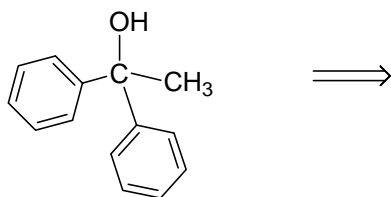




### RETRO SYNTHESIS

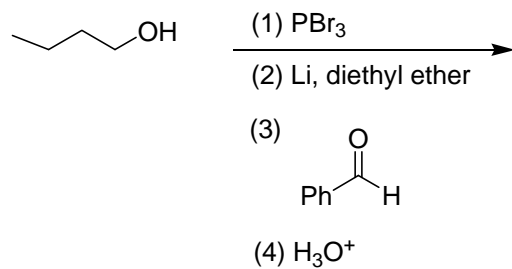
5. Write the two starting materials needed to prepare the following molecule by a Grignard reaction. (6 pts)

(\*note\* there are several correct answers possible, but please only give one method):



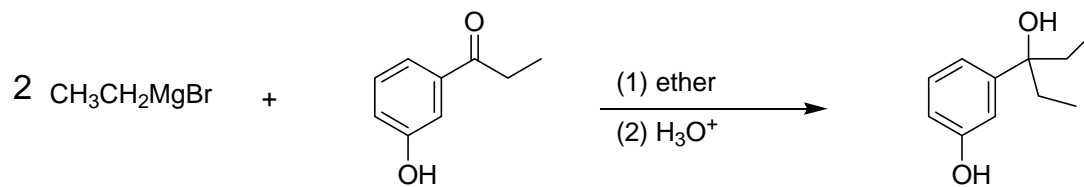
### Multi-step Synthesis

7. Give the major organic product(s) for the following four-step reaction. (7 pts)



### MECHANISM

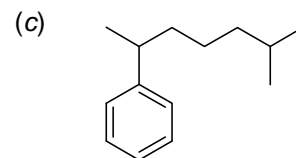
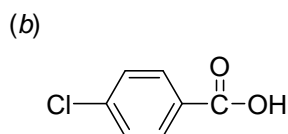
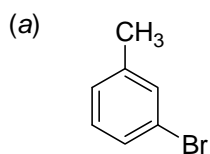
8. Using curved arrows, draw the complete mechanism for the following Grignard reaction (show all steps). (7 pts)



In putting my name on this test and turning it in I am certifying that it **my work alone**.

**NOMENCLATURE**

1. Name the following compounds (you may give common names or IUPAC names):  
(6 pts)



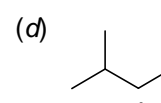
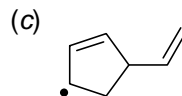
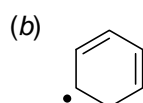
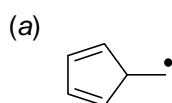
2. Draw structures for the following names: (4 pts)

(a) *p*-nitroaniline

(b) methoxybenzene

**STABILITY**

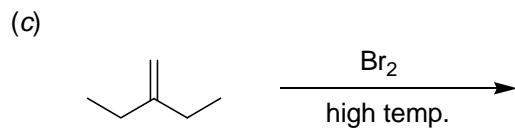
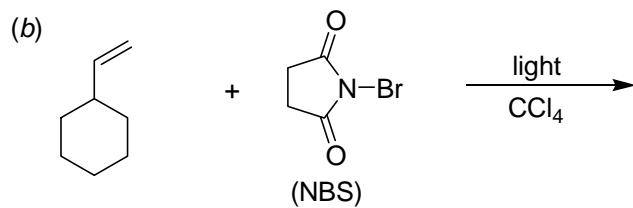
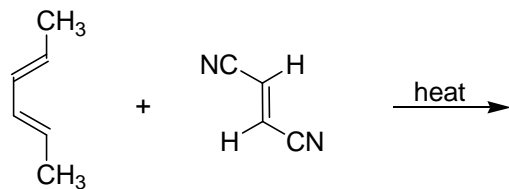
3. Rank the following radical in order of increasing stability (*least stable first*): (4 pts)

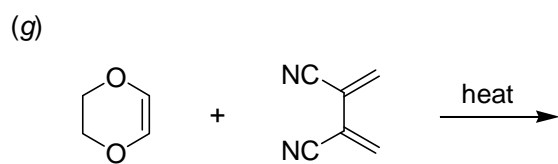
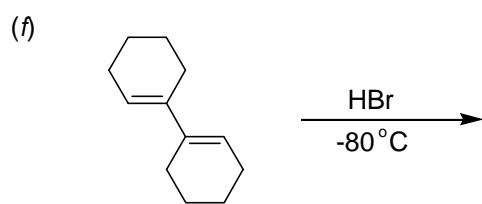
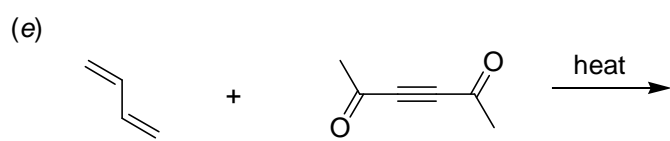
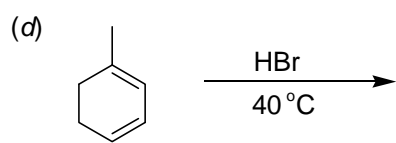


**REACTIONS:**

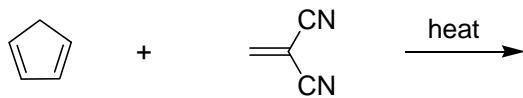
4. Give the major organic product(s) for the following reactions: (50pts total; 5pts each)

(a) show stereochemistry for the product

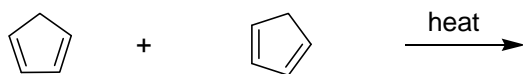




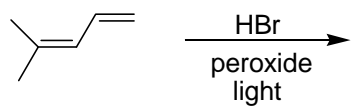
(h)



(i)

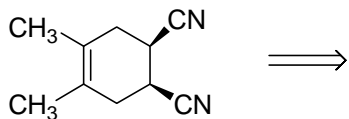


(j)



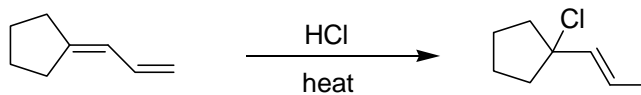
## RETRO SYNTHESIS

5. Write the two starting materials needed to prepare the following molecule by a Diels-Alder reaction. (7 pts)

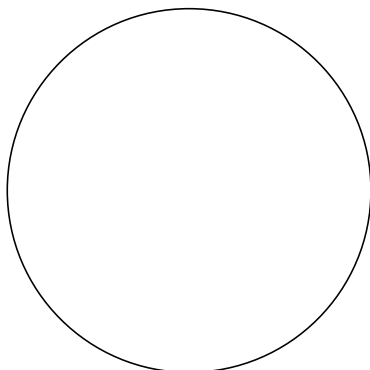
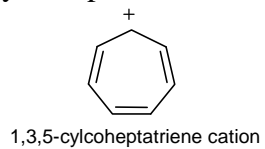


## MECHANISM

6. Using curved arrows, draw the complete mechanism for the following reaction (show all steps). (7 pts)



7. Using the circle method, draw a molecular orbital energy diagram for the 1,3,5-cycloheptatriene cation. (7pts)

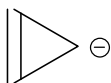


8. Identify the following molecules as aromatic, anti-aromatic, or non-aromatic. (10pts)

(a)



(b)



(c)



(d)



(e)

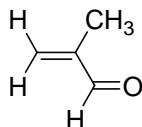


In putting my name on this test and turning it in I am certifying that it **my work alone**.

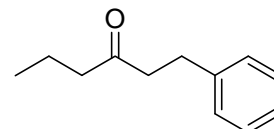
**NOMENCLATURE**

1. Name the following compounds (you may give common names or IUPAC names):  
(4 pts)

(a)



(b)



2. Draw structures for the following names: (4 pts)

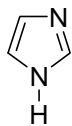
(a) 3-bromo-1-chloro-2-butanone

(b) cyclopentanone

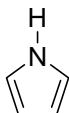
**AROMATICITY OF HETEROCYCLES**

3. Identify the following molecules as aromatic, anti-aromatic, or non-aromatic. (8pts)

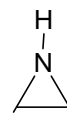
(a)



(b)



(c)

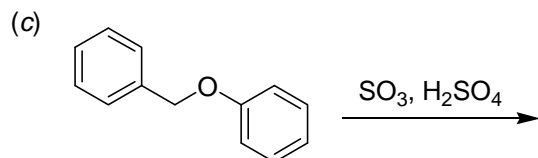
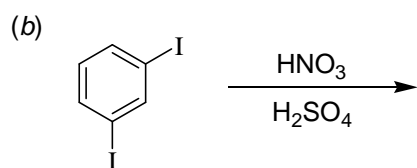
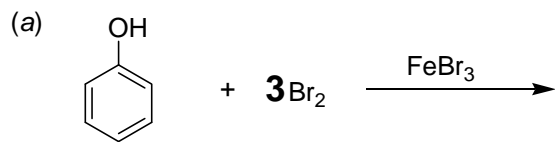


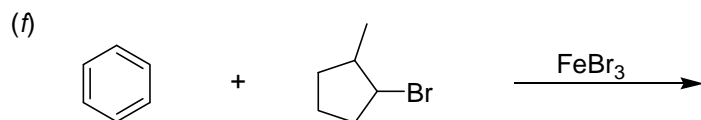
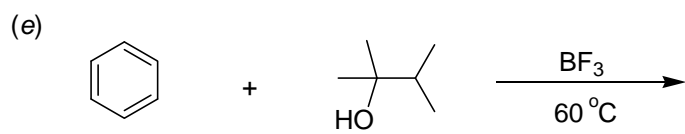
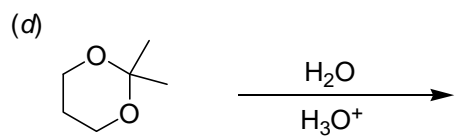
(d)



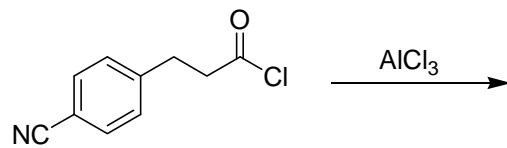
**REACTIONS:**

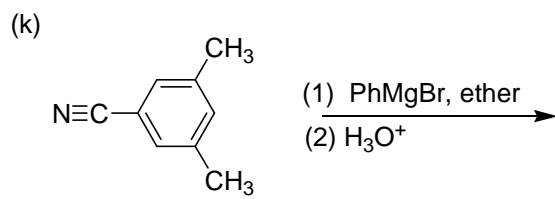
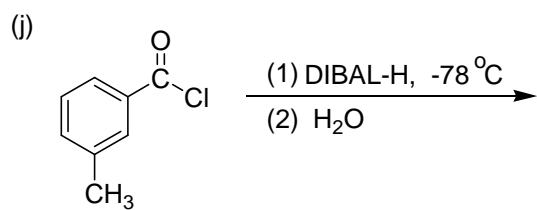
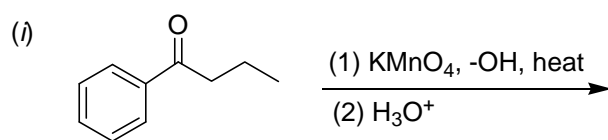
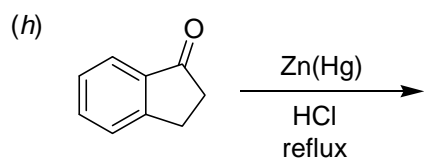
4. Give the major organic product(s) for the following reactions: (55pts total; 5pts each)





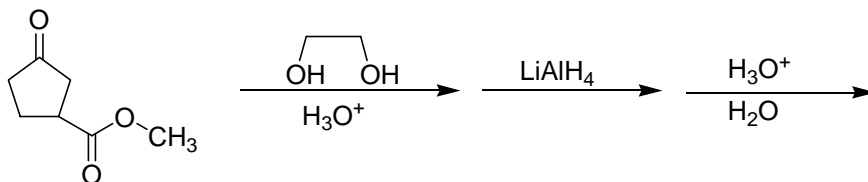
(g) *friedel-crafts acylation*



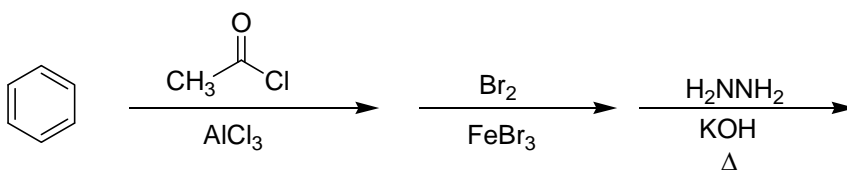


**MULTIPLE-STEP REACTIONS:**

5. Give the major organic product for the following three-step reaction. (6 pts)

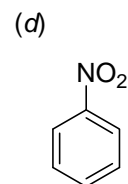
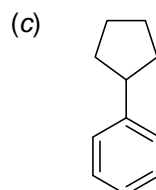
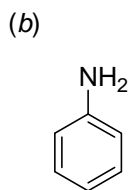
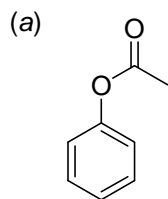


6. Give the major organic product for the following three-step reaction. (6 pts)



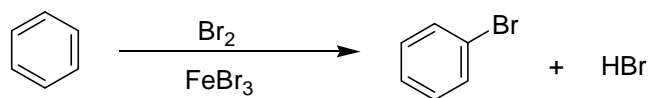
**ORTHO-PARA AND META DIRECTING GROUPS:**

7. For the following molecules, indicate which benzene substituents are **ortho-para directors** and which are **meta directors** towards electrophilic aromatic substitution. (8 pts)



**MECHANISM**

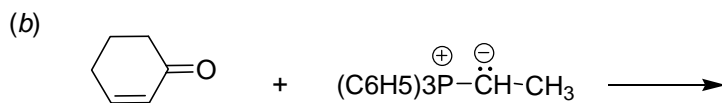
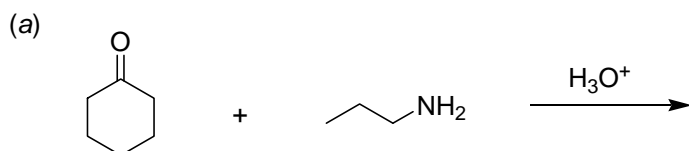
8. Using curved arrows, draw the complete **mechanism** for the following electrophilic aromatic substitution reaction (**show all steps**). (6 pts)

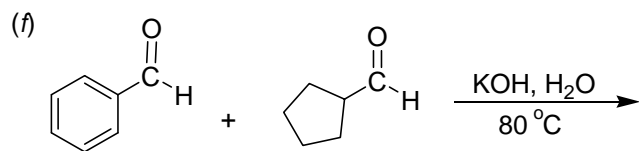
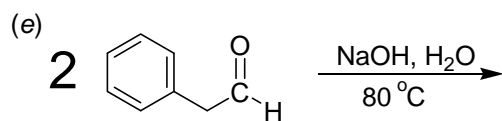
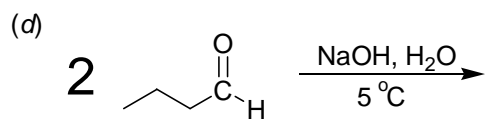


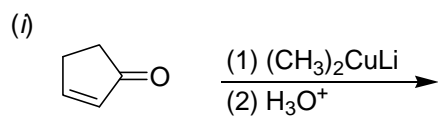
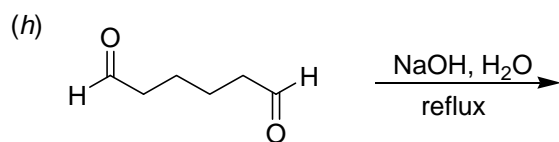
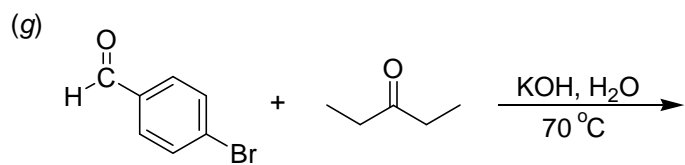
In putting my name on this test and turning it in I am certifying that it **my work alone**.

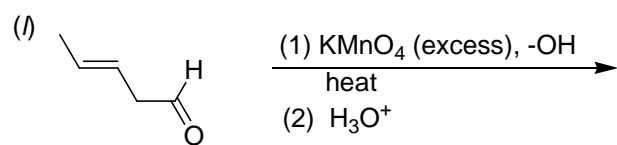
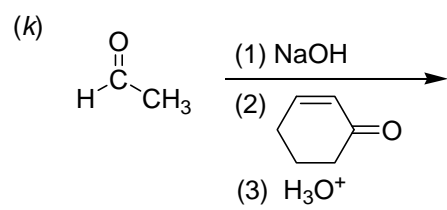
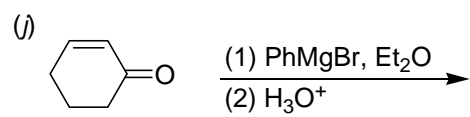
**REACTIONS:**

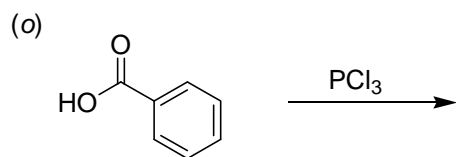
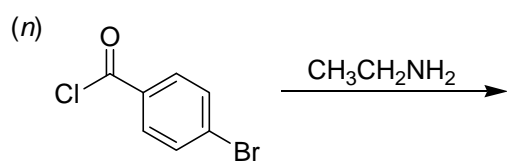
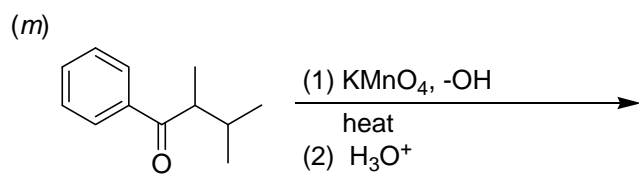
1. Give the major organic product(s) for the following reactions: (90pts total; 5pts each)

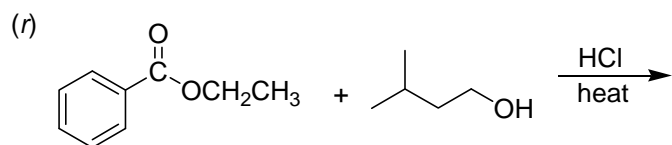
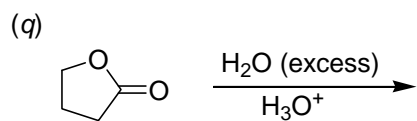
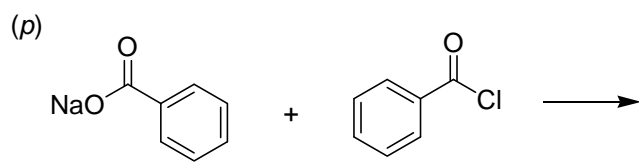






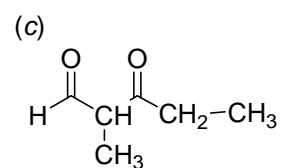
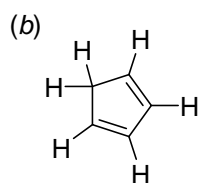
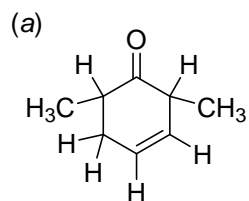






## ACIDIC HYDROGENS

2. Circle the most acidic hydrogen(s) in each of the following molecules: (3 pts)



## MECHANISM

8. Using curved arrows, draw the complete **mechanism** for the following aldol condensation reaction (**show all steps**). (6 pts)

