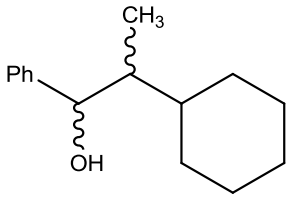
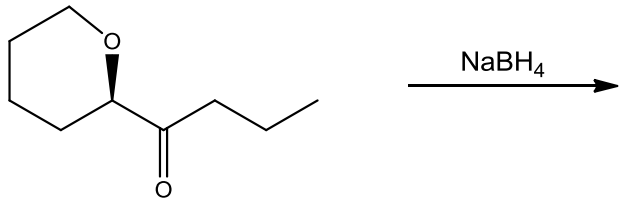
# PART A

1) Synthesize the "syn" and "anti" isomers of the following molecule:

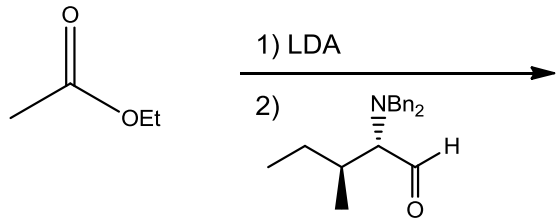



2) Predict the major product in each of the following reactions (include stereochemistry where appropriate):

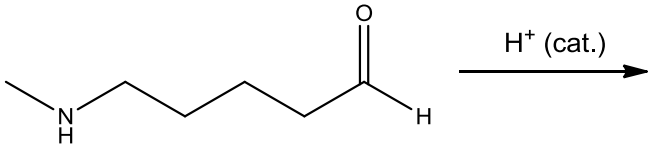
a)



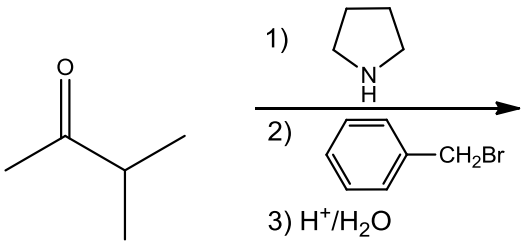

b)



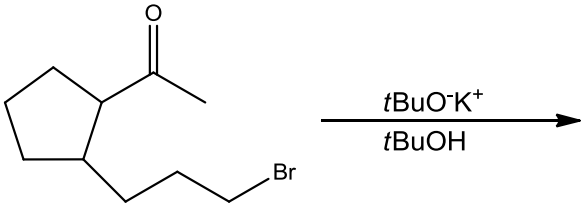

c)



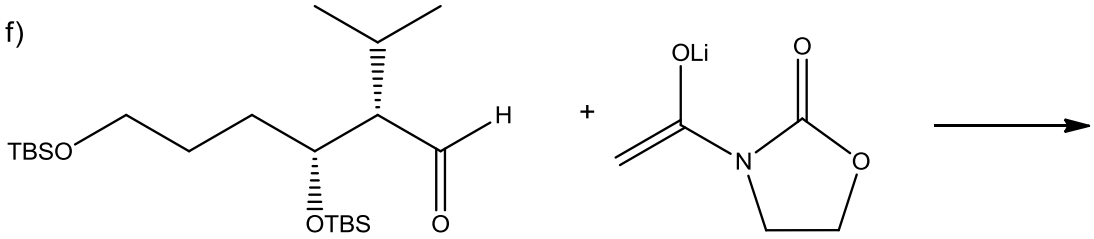

d)



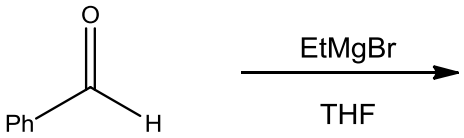

e)



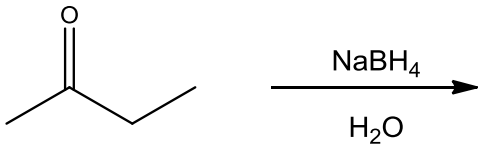
f)


TBSO
H
OTBS
O
+
OLi
O
N
O

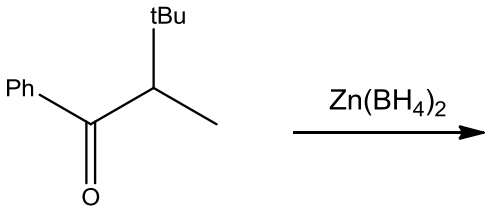
g)


O
Ph
H
EtMgBr
THF

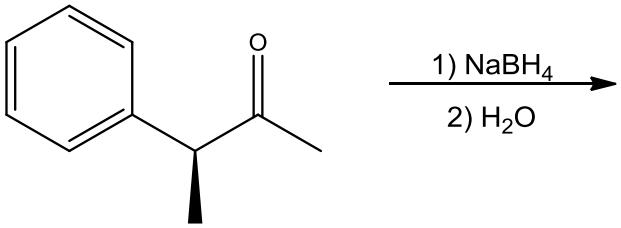
h)


O
NaBH4
H2O

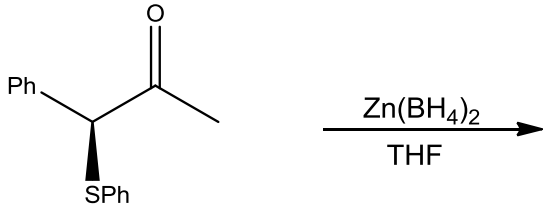
i)


tBu
Ph
O
Zn(BH4)2

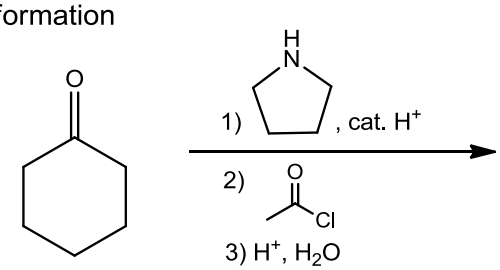
j)


O
1) NaBH4
2) H2O

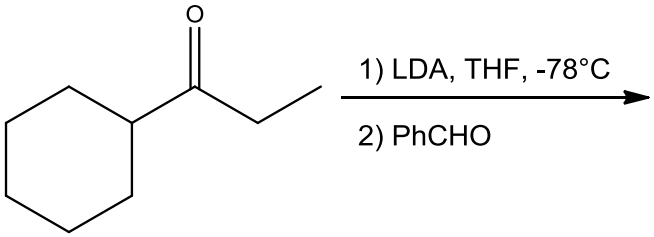
k)


O
Ph
SPh
Zn(BH4)2
THF

3) For the following reaction, predict the product and provide a plausible mechanism for its formation



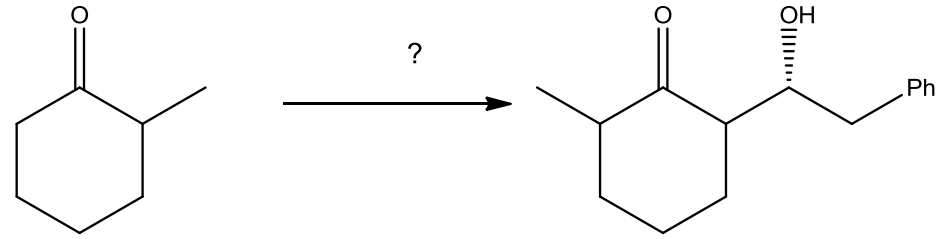

4) Consider the following reaction:



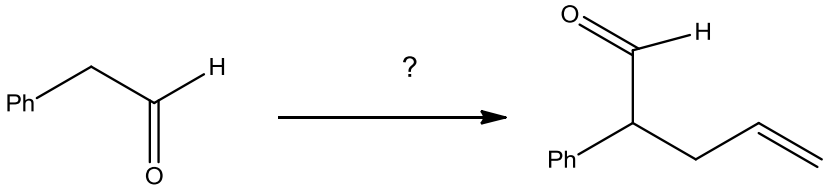

a) Which is the MAJOR enolate? Why?
b) What is the stereochemistry of the major product? Explain.

5) Provide the missing reagents. (Hint: for c) you will need a second S.M.)

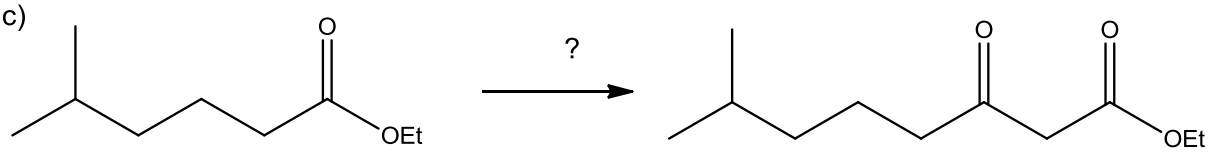
a)



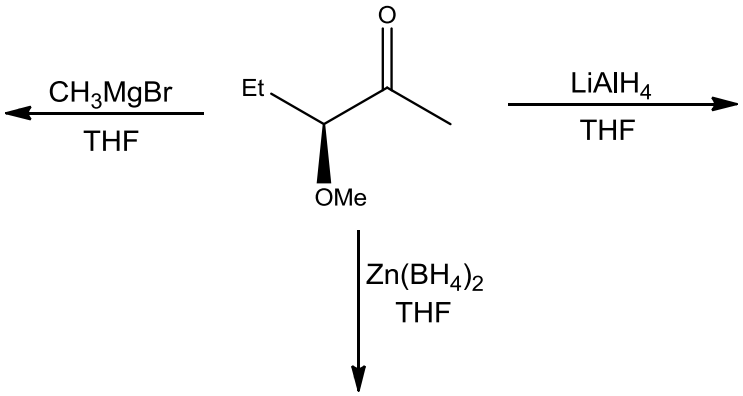

b)




c)

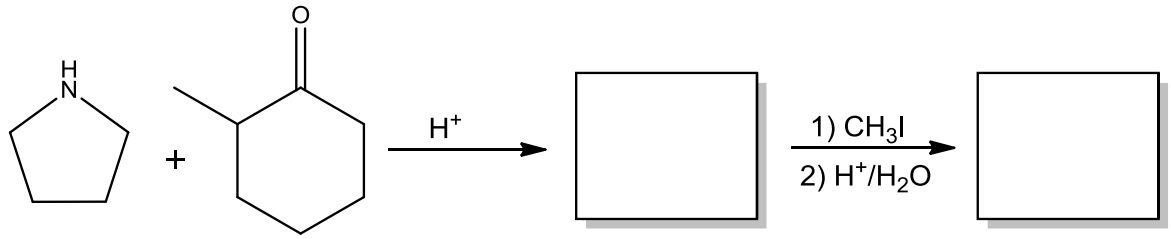


6) Provide the structure of the major product for each of the following sets of reaction conditions (include appropriate stereochemistry).

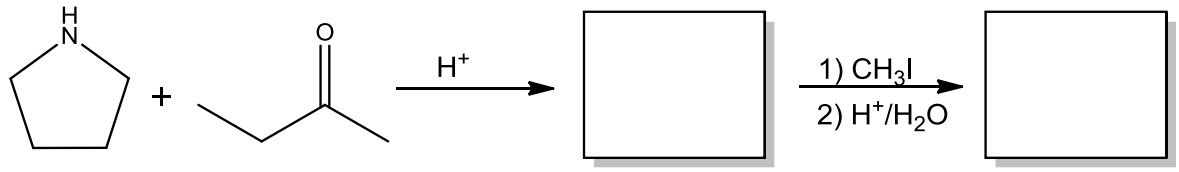



7) Predict the major product from the following reactions. For c) draw the transition state leading to the formation of this product.

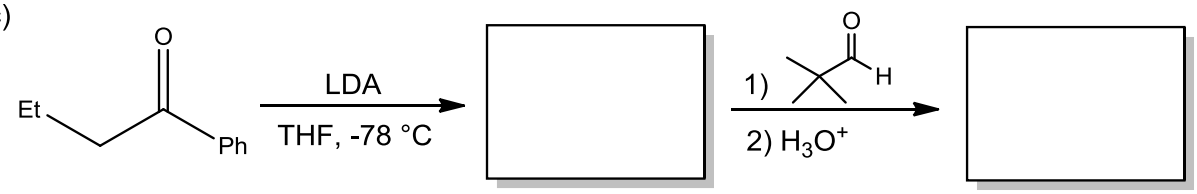
a)



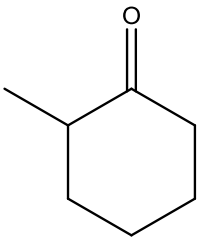

b)



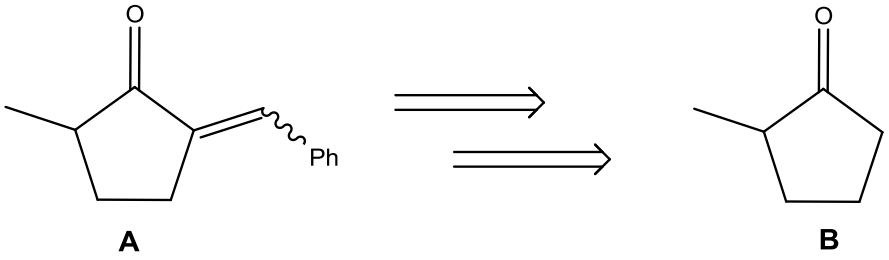

c)



8) Consider the following unsymmetrical ketone. Draw the structures of the thermodynamic and kinetic enolates. What are the reaction conditions and factors that ensure the selective formation of each?



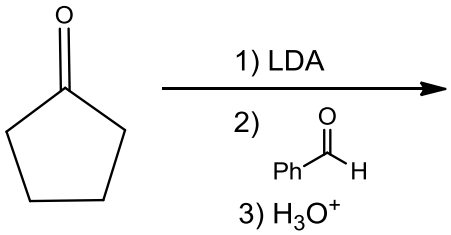

9) How would you prepare **A** starting from **B** using a strategy that **<u>does</u>** **<u>not</u>** involve formation of a kinetic enolate? You may use any reagents and solvents that you require. Show a detailed retrosynthesis.



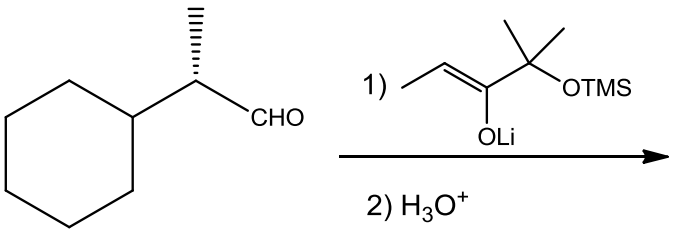

**A** **B**

10) For the following reactions, draw the structures of the major and minor products and explain why one product is favoured:

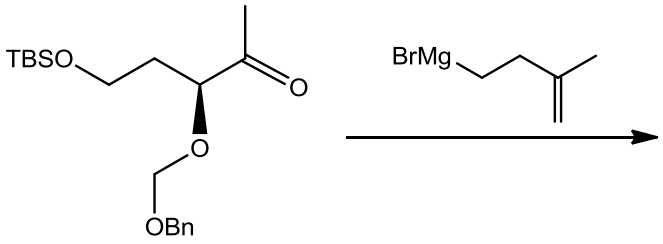
a)

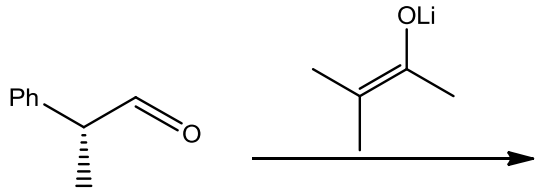


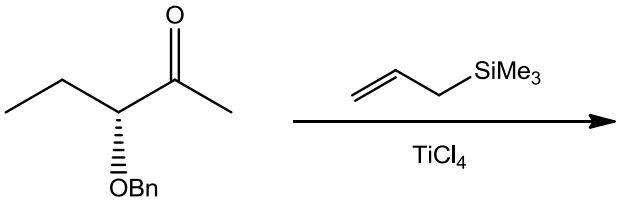

b)

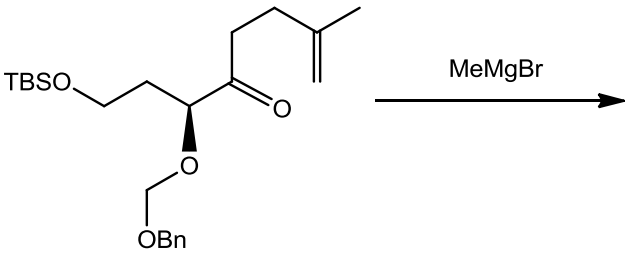


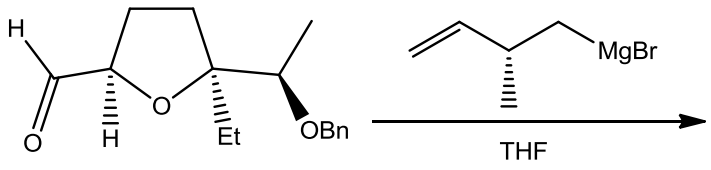
11) Predict the major product in each of the following reactions and draw the transition state explaining its formation:

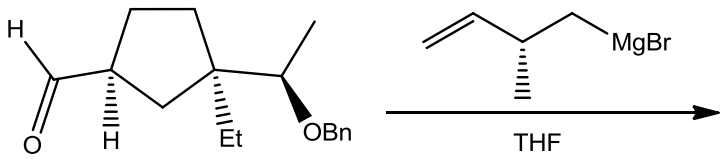


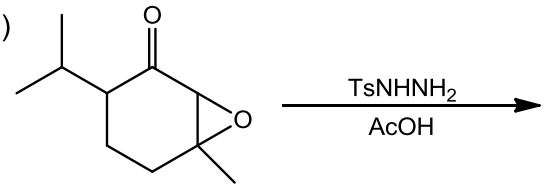



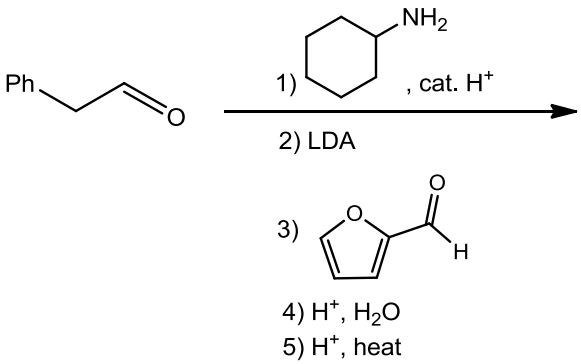



12) For the following reaction, predict the product and provide a plausible mechanism for its formation

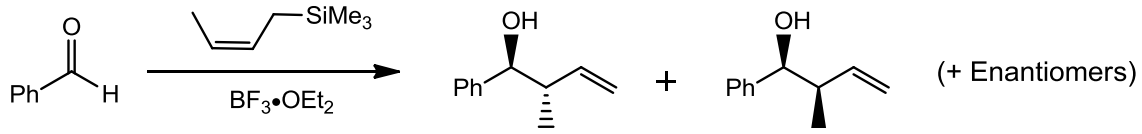
a)




b)

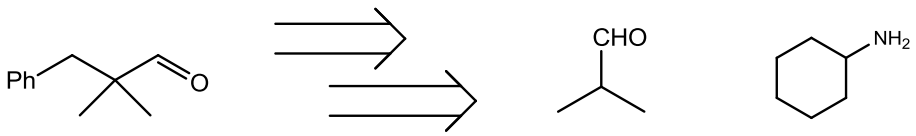



13) Consider the following reaction:




Which is the major product? Explain.

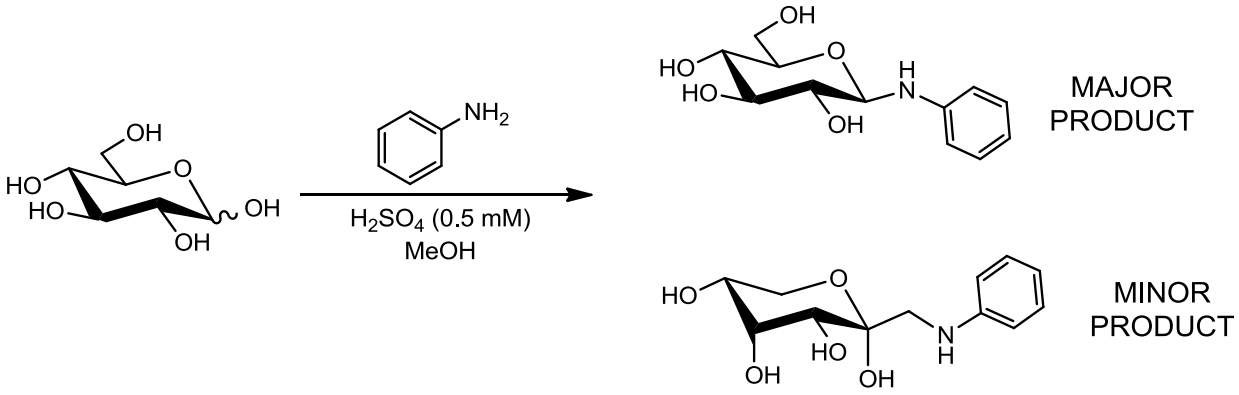
14) Suggest a synthesis of the following molecule from the given starting materials. Include all necessary reagents. Show a detailed retrosynthesis.



15) Consider the following reaction with glucose:

a) Provide a plausible mechanism for the formation of the **MAJOR** product (Hint: Glucose can undergo mutarotation).

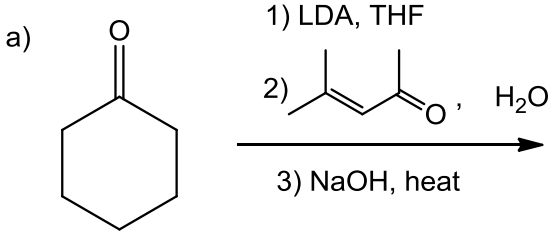
b) The minor product is formed from an intermediate in the mechanism of the major product. Provide a plausible mechanism for the formation of the **MINOR** product.



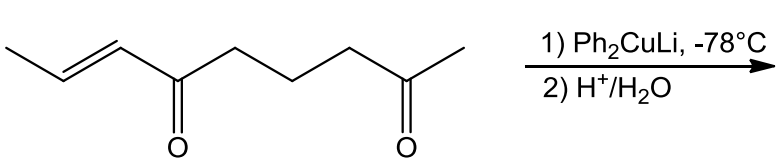

# PART B

16) Predict the major product in each of the following reactions:

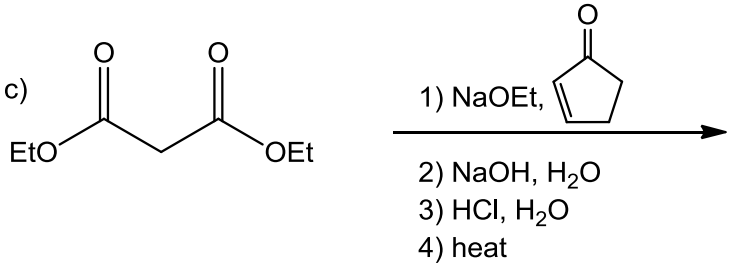
a)



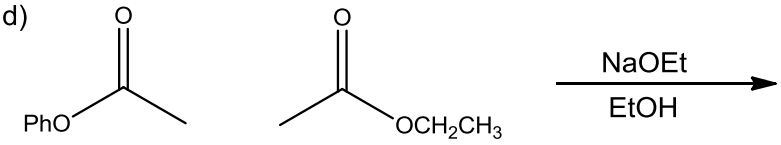

b)



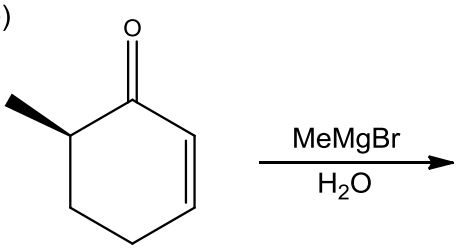

c)



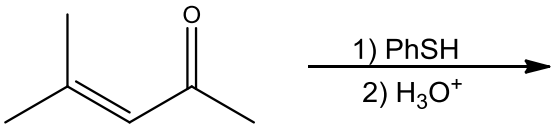
d)



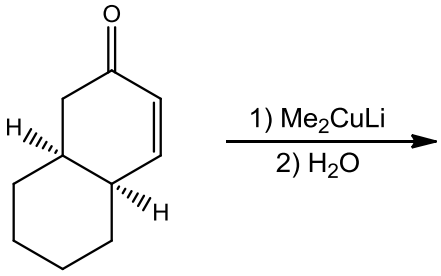

e)



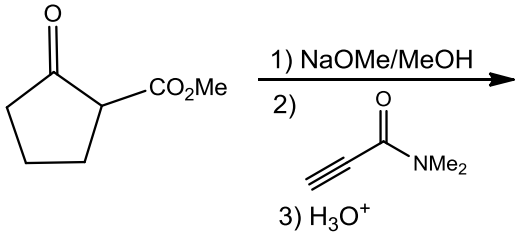

f)




g)

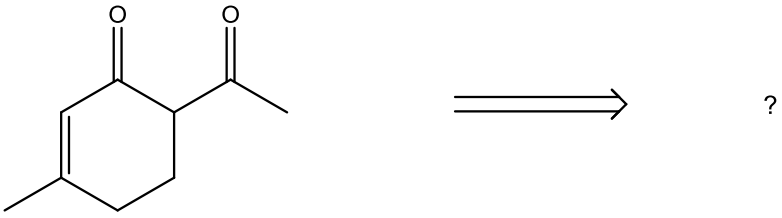



h)




17) Provide the most logical starting materials for the products below. You do not need to include reagents.

a)



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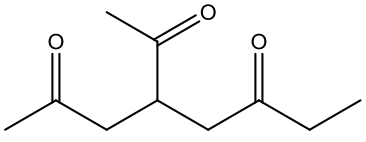
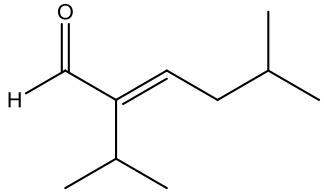


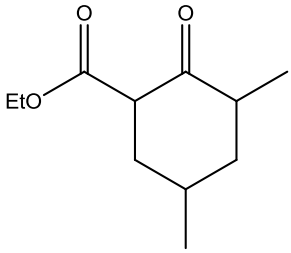

⟹ ?

c)




⟹ ?

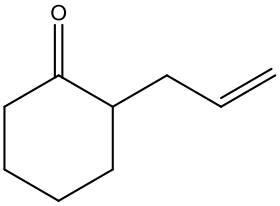
d)



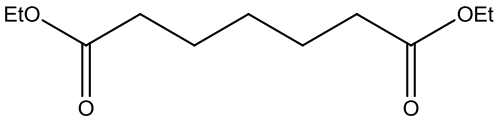

⟹ ?

18) Suggest a synthesis of the following molecules from the given starting material. Include all necessary reagents.

a)




⟹

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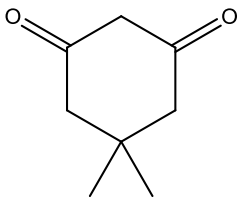
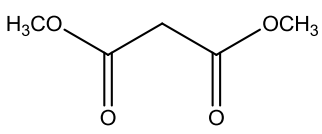
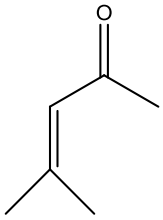


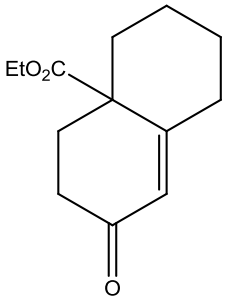

⟹



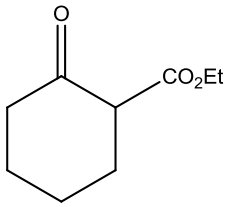

+



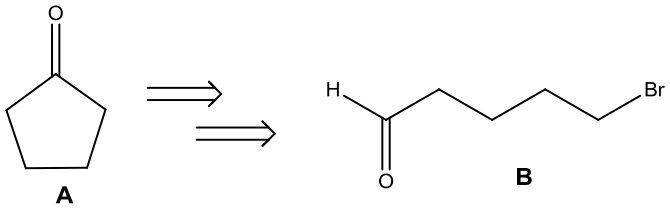

c)




⟹

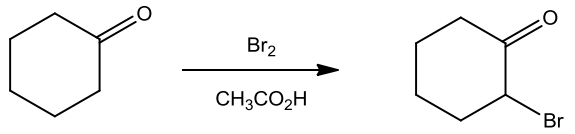


19) How would you prepare **A** from **B**?

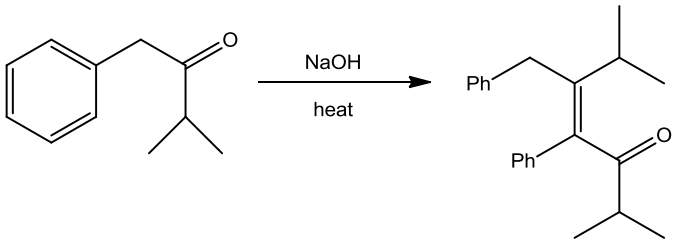



20) Provide a plausible mechanism for each of the following reactions:

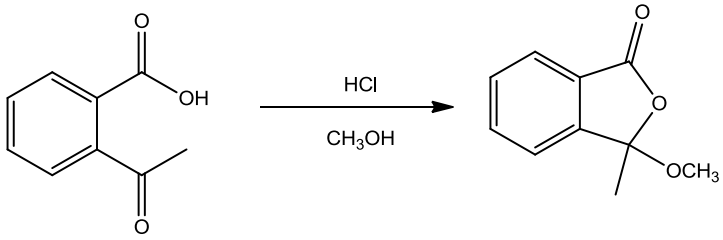
a)




b)

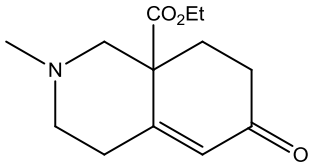



c)

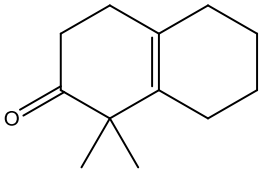



21) How would you use a Robinson Annulation to make the following compounds?

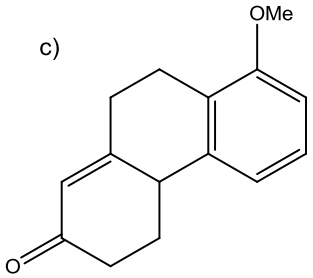
a)



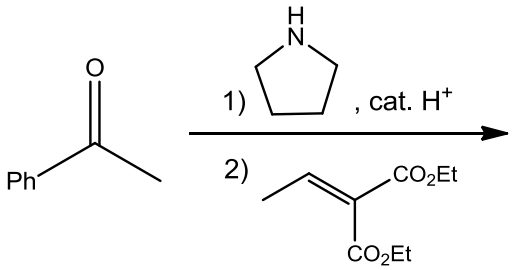

b)




c)

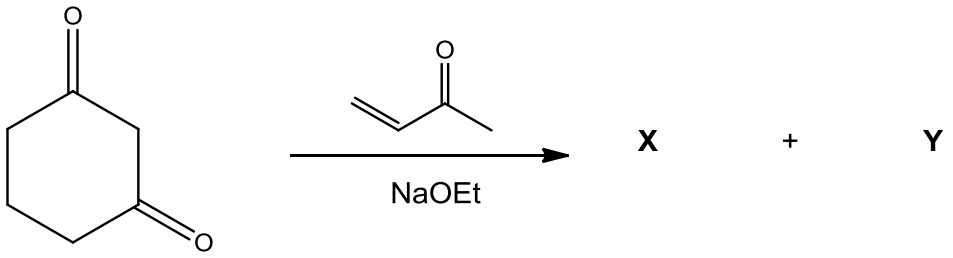


22) For the following reaction, predict the product and provide a plausible mechanism for its formation

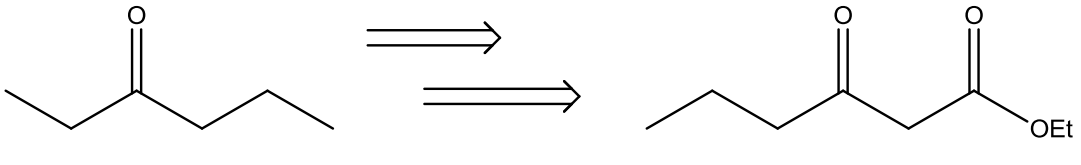



3) $H^+/H_2O$
4) $NaOH/H_2O$
5) $H^+$/heat

23) When 1,3-cyclohexanedione reacts with methyl vinyl ketone in the presence of sodium ethoxide, a mixture of two isomeric products having the formula $C_{10}H_{12}O_2$ are formed. Propose structures for the two products and write mechanisms for their formation.

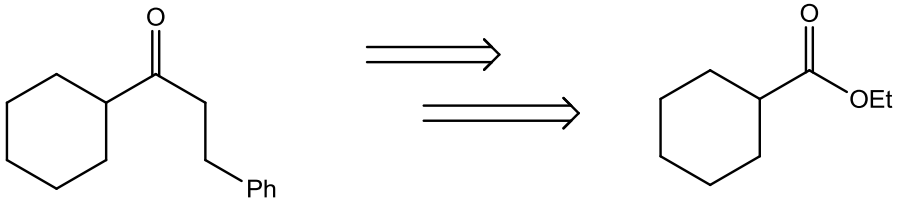



24) Provide a multi-step retrosynthesis and forward synthesis for **C** starting from **D** and any other starting material(s) you require.




**C** **D**

25) Provide a multi-step retrosynthesis and forward synthesis for **E** starting from **F** and any other starting material(s) you require.




**E** **F**