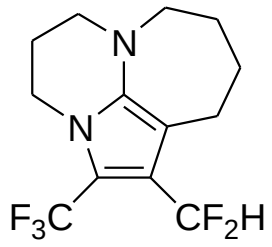
2012 Mechanisms Midterm 100 points NAME:_____

1) (8pts) For the following compound, determine the number of:



a) carbon atoms

b) hydrogen atoms

c) π bonds

d) halogen atoms

e) sp^2 hybridized carbons

f) Nitrogen atoms

g) sp^3 hybridized carbons

h) lone pairs (non bonding pairs) of electrons

2) Is the above structure *AROMATIC*, or *ANTI-AROMATIC*, or *NON-AROMATIC* ? (2pts)

3) Which is the most *basic* atom in the above molecule? (2pts)

4) (2pts) a) What are *resonance structures* ?

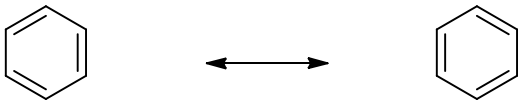
b) (2pts)What are *tautomers* ?

c) (2pts) What is a *Nucleophile* ?

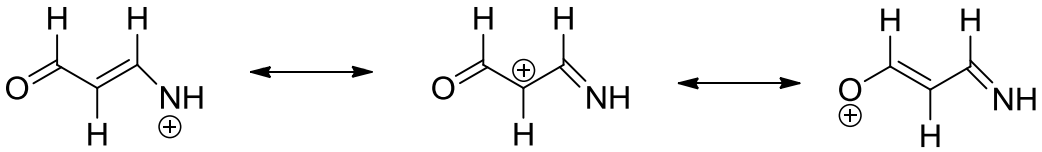
d) (2pts) What is *Occam's Razor* ?

5) (10pts) Draw in the arrows for these resonance structures (as they convert from left to right).

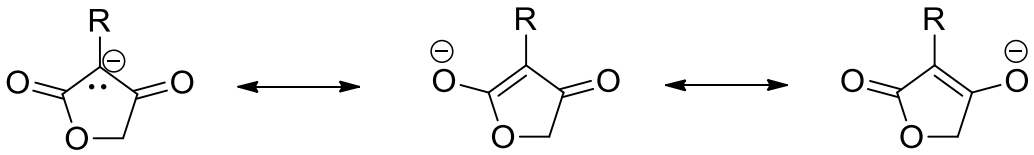
(a)



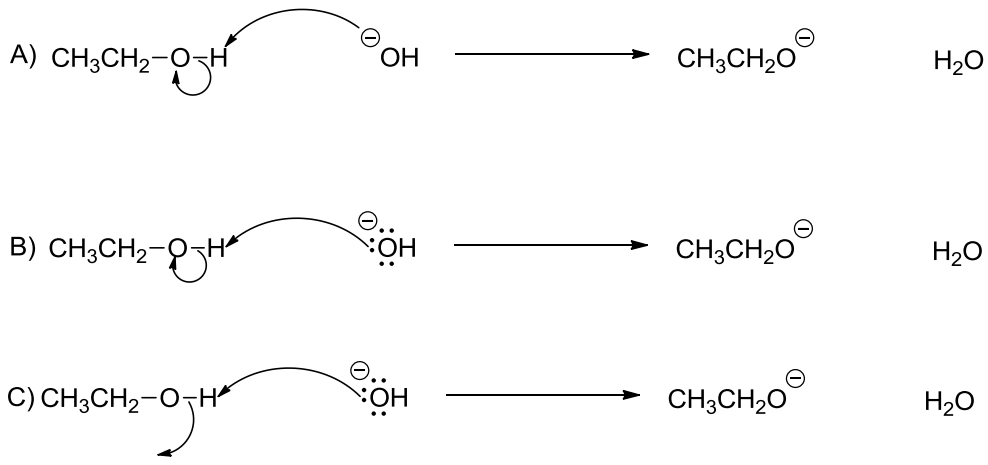
(b)



(c)

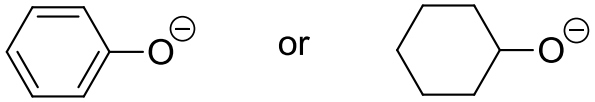


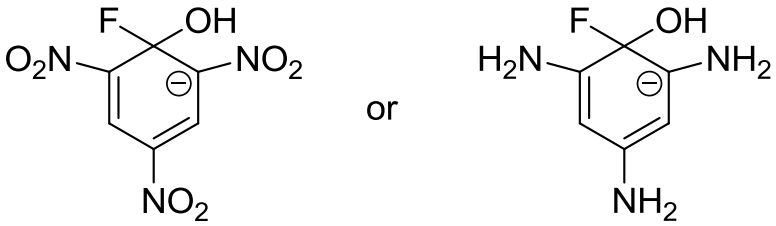
6) (3pts) Indicate whether **A**, **B** or **C** is the correct way to mechanistically illustrate the deprotonation of Ethanol:

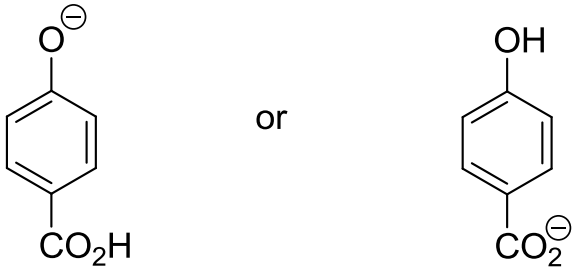


7) (8pts) Circle the **<u>more stable species</u>** in each pair.

(a) 

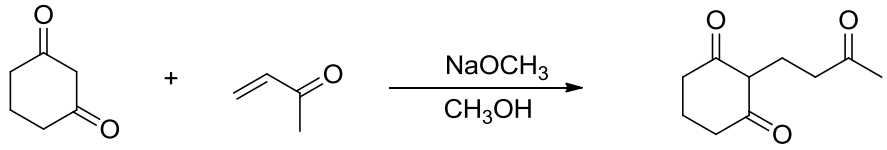
(b) 

(c) 

(d) 

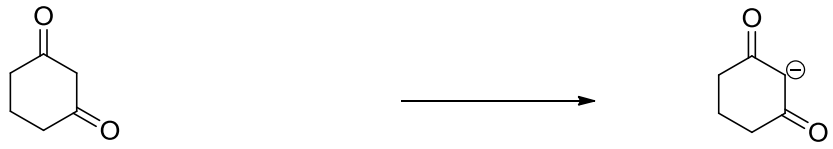
8) (2pts) Describe briefly how can you experimentally *prove* a mechanism is correct ?

9) (17pts) For the following transformation which involves a resonance stabilized anion doing a Michael Addition to an α, β-unsaturated ketone:



i) (4pts) Label the **α** and **β** carbons in the α, β-unsaturated ketone, and also indicate where they end up in the product.

ii) (2pts) Using the *ionic* form of the Sodium Methoxide, write a mechanism showing the formation of the resonance stabilized anion below.



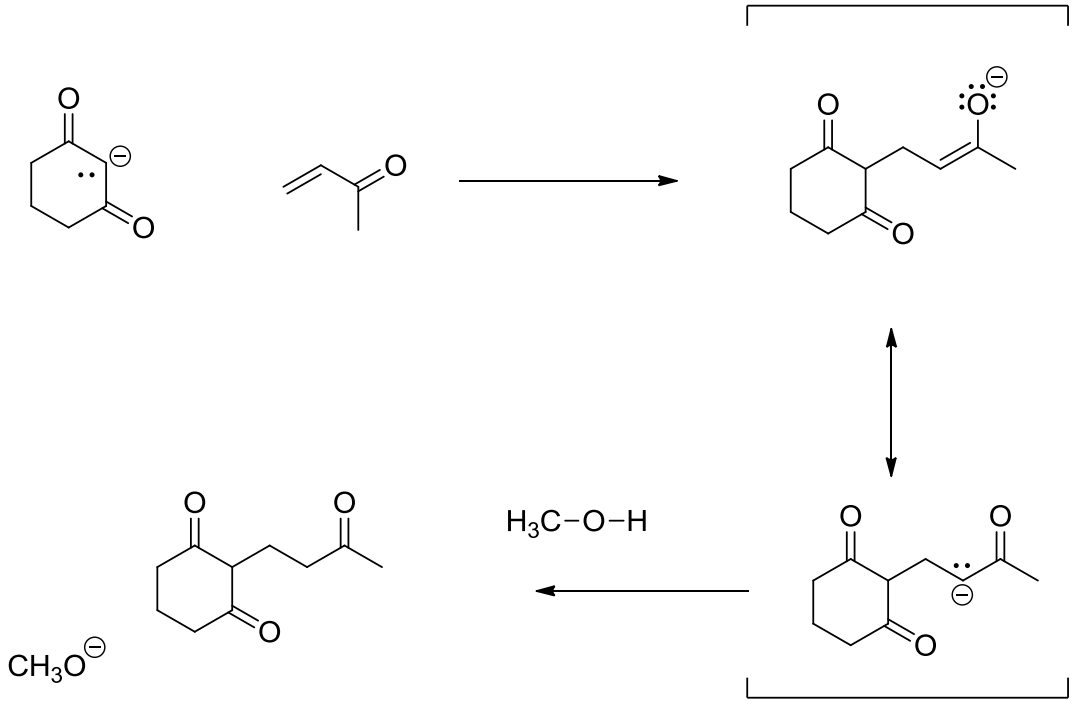
iii) (2pts) Methanol is the solvent for this reaction, is it:

Polar or *Non-Polar* ?

Protic or *Aprotic* ?

iv) (2pts) is this reaction performed under *acidic*, *basic*, or *neutral* reaction conditions ?

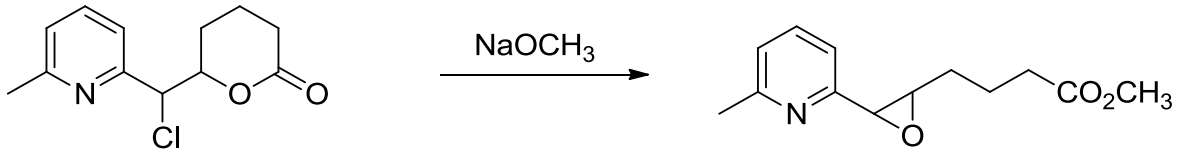
v) (7pts) Draw in the curly arrows which describe the mechanism of this reaction:



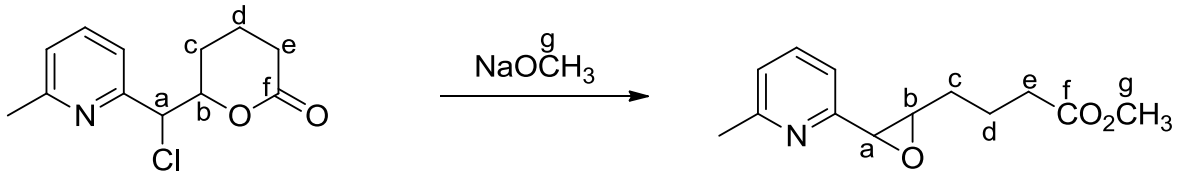
In this section there are THREE questions, (A) – (C), you must answer only 2.

Each is worth 20 points.

A) (20pts) Write the mechanism for the following transformation.



(HINTS
i) Note the Carbon labeling scheme.

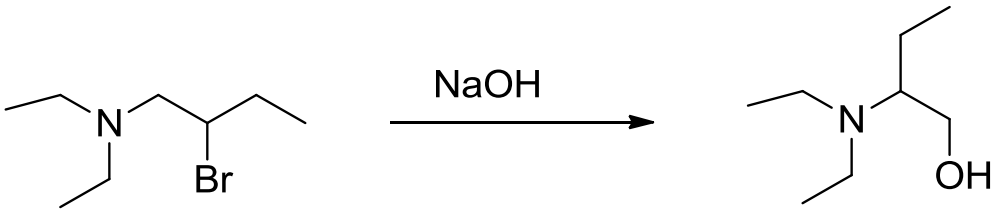


ii) Pay attention to the reaction conditions.

iii) The reaction starts with the Methoxide performing nucleophilic acyl substitution on the cyclic ester.

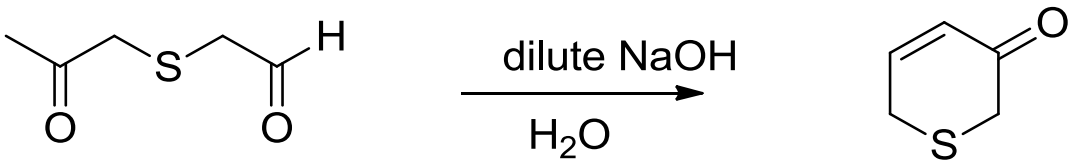
iv) The last step is the displacement of the chlorine).

B) (20pts) Write the mechanism for this reaction.



(HINT: It involves a rearrangement).

C) (20pts) The following is a base promoted cyclization. Write the mechanism for this reaction.



(HINTS:
i) The reaction starts with deprotonation of the ketone, generating a resonance stabilized anion.

ii) That anion reacts with the aldehyde.

iii) The final step is base catalyzed dehydration).

2012 Mechanisms Midterm 100 points NAME:_____

1) (8pts) For the following compound, determine the number of:

a) carbon atoms 13

b) hydrogen atoms 15

c) π bonds 2

d) halogen atoms 5

e) sp^2 hybridized carbons 4

f) Nitrogen atoms 2

g) sp^3 hybridized carbons 9

h) lone pairs (non bonding pairs) of electrons 17

2) Is the above structure *AROMATIC*, or *ANTI-AROMATIC*, or *NON-AROMATIC* ? (2pts) AROMATIC

3) Which is the most *basic* atom in the above molecule? (2pts)

Top N

4) (2pts) a) What are *resonance structures* ?

Species that only differ in their placement of electron density.

b) (2pts)What are *tautomers* ?

Species that are isomers, that are in equilibrium with each other. (Usually through the relocation of readily exchangable atoms, e.g. acidic hydrogens.)

c) (2pts) What is a *Nucleophile* ?

A two electron donor.

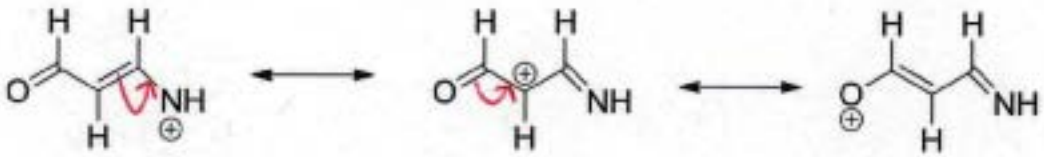
d) (2pts) What is *Occam's Razor* ?

The simplest answer is usually the correct answer.

5) (10pts) Draw in the arrows for these resonance structures (as they convert from left to right).

(a)

(b)



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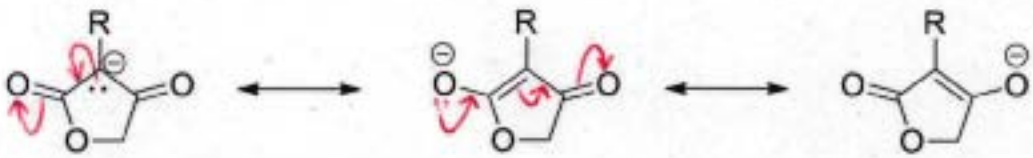

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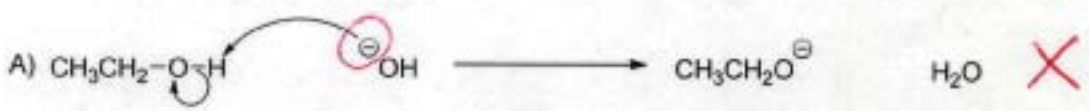
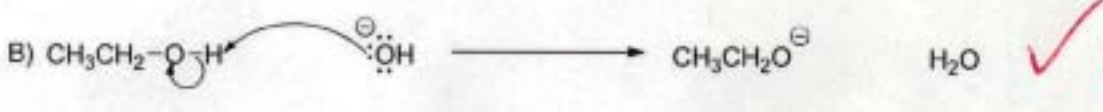
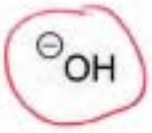
A) 

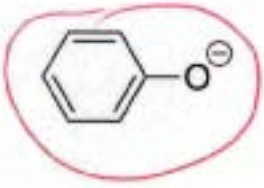
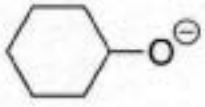
B) 

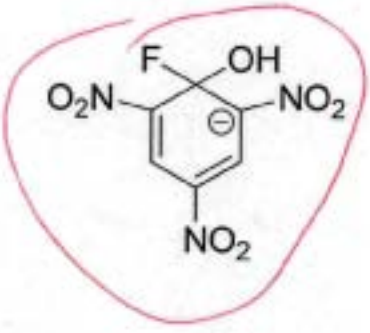
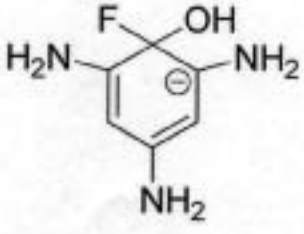
✓ CORRECT

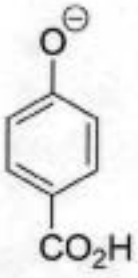
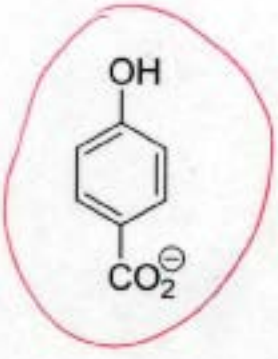
C) 

7) (8pts) Circle the **more stable species** in each pair.

(a)  or 

(b)  or 

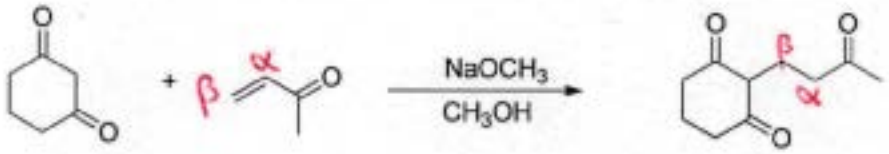
(c)  or 

(d)  or 

8) (2pts) Describe briefly how can you experimentally *prove* a mechanism is correct ?

You CANNOT prove a mechanism, only disprove an incorrect mechanism.

9) (17pts) For the following transformation which involves a resonance stabilized anion doing a Michael Addition to an α, β-unsaturated ketone:



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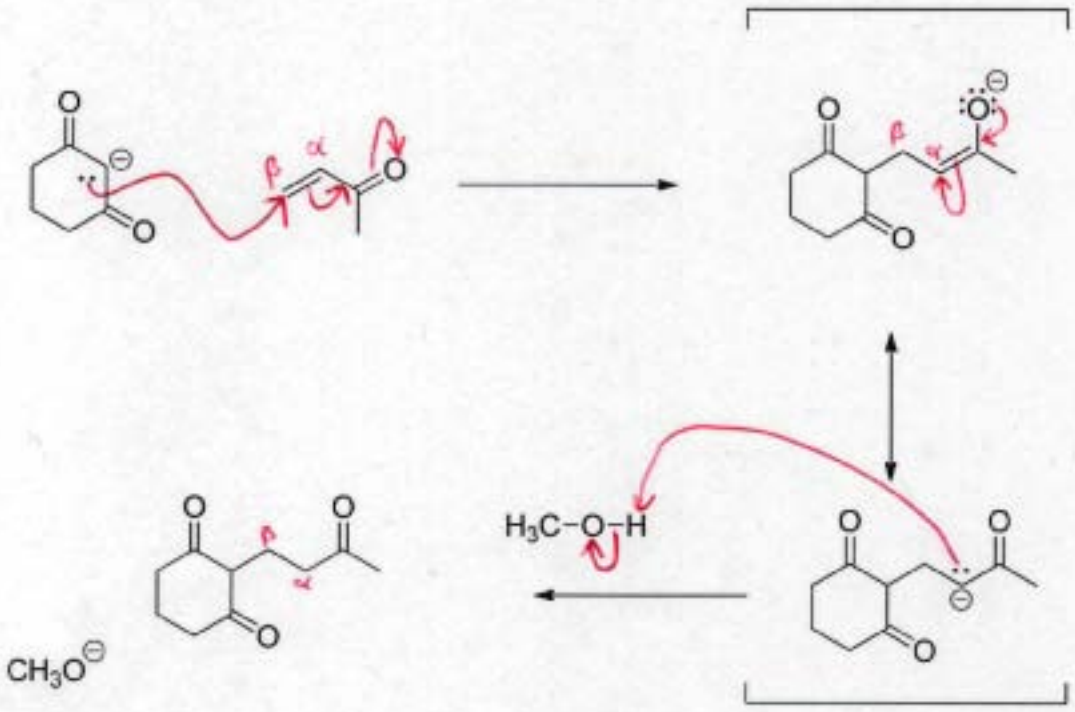
BASIC

v) (7pts) Draw in the curly arrows which describe the mechanism of this reaction:



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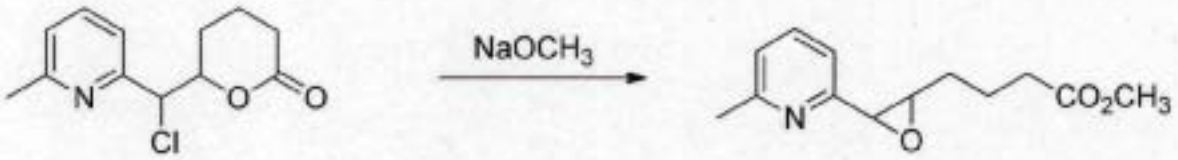

(HINTS

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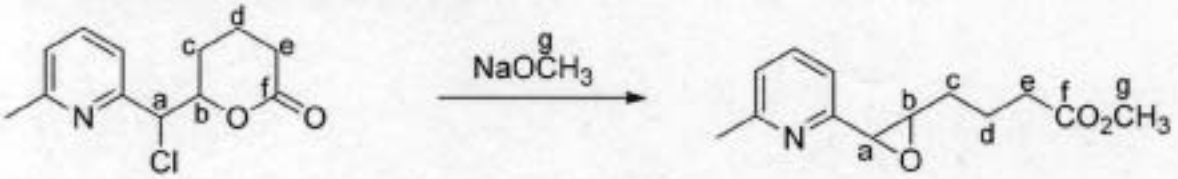

ii) Pay attention to the reaction conditions.

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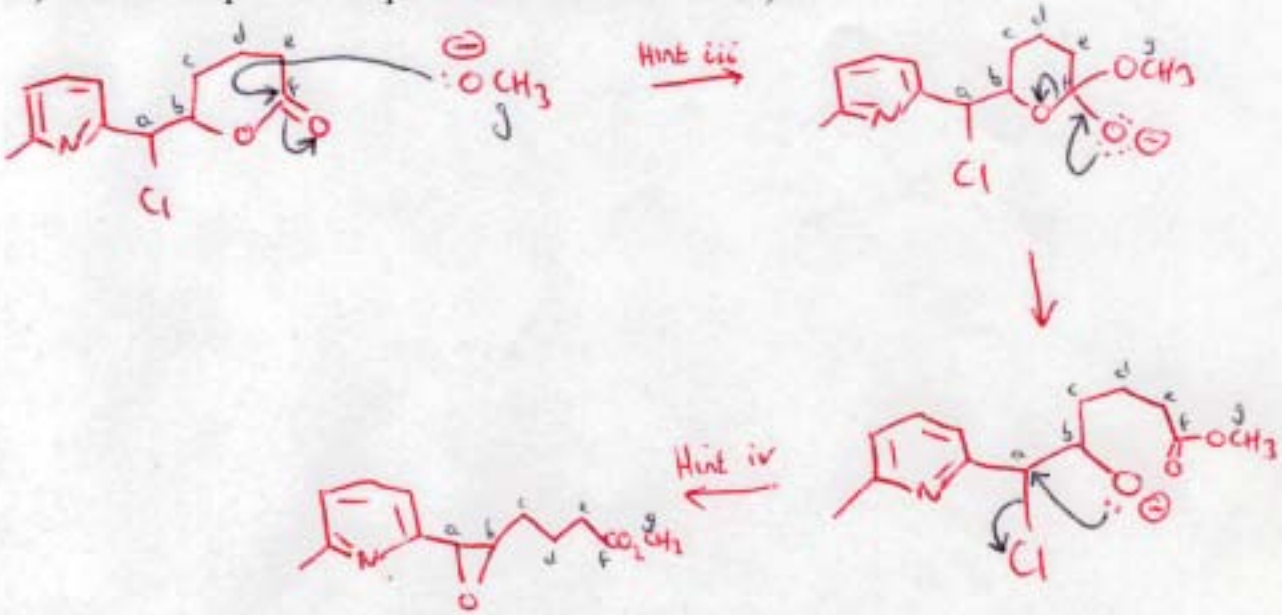

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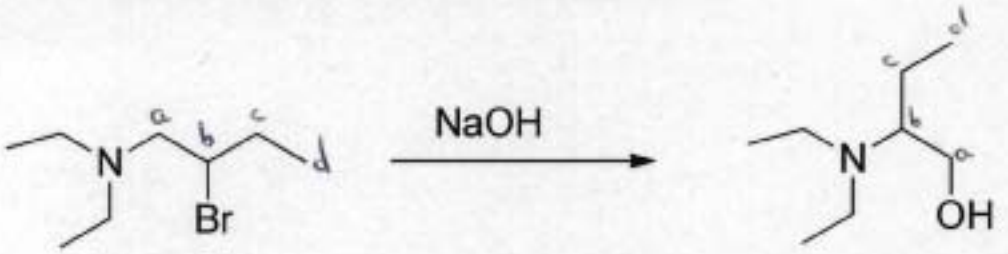
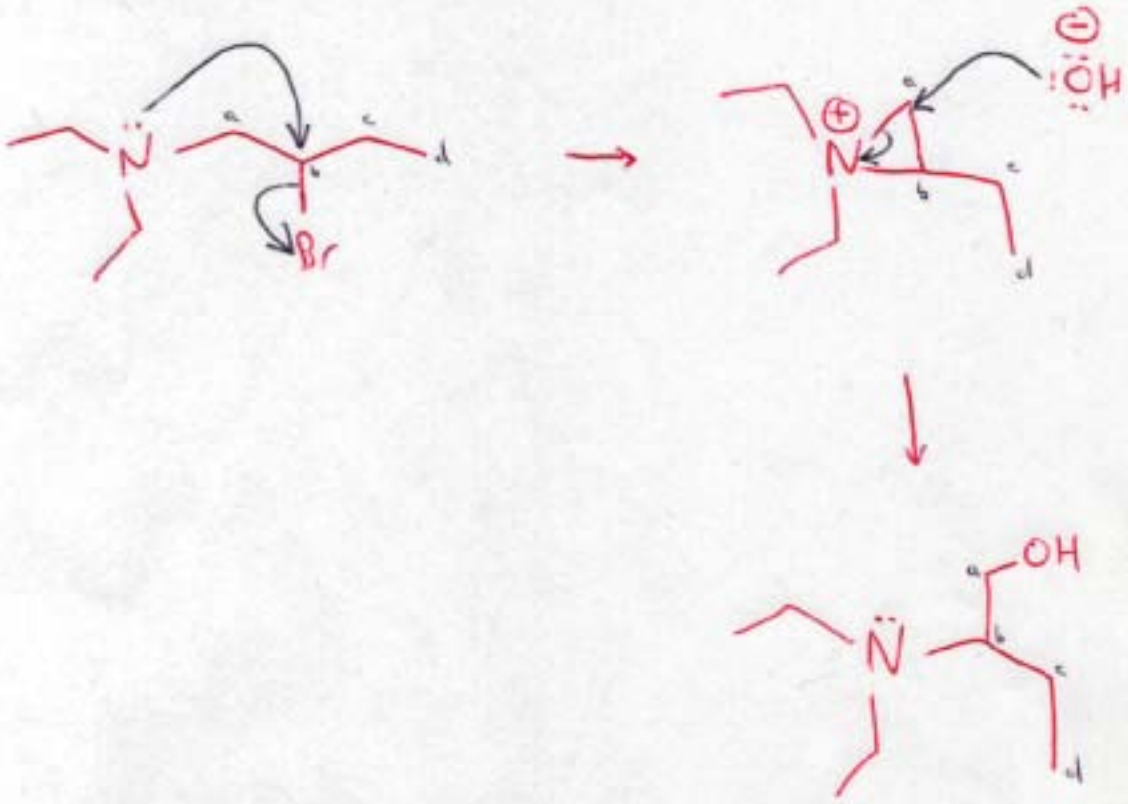


(HINT: It involves a rearrangement).



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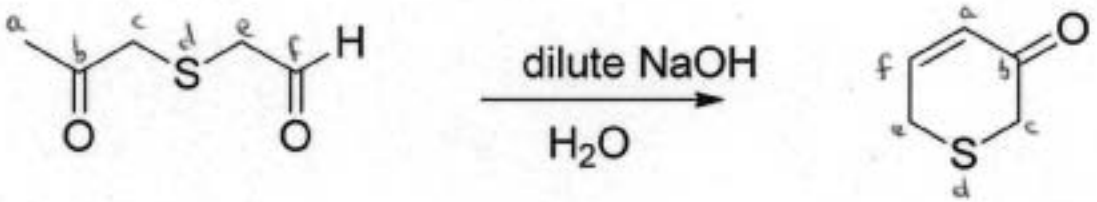

(HINTS:
i) The reaction starts with deprotonation of the ketone, generating a resonance stabilized anion.

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