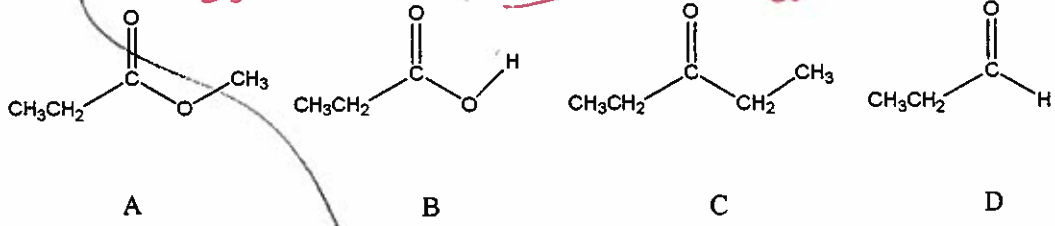
Question 1. (18 Marks)

Sample Exam

Signature _____

a) Which of the following correctly lists theses compounds in order of increasing pKa.
Circle the correct answer.

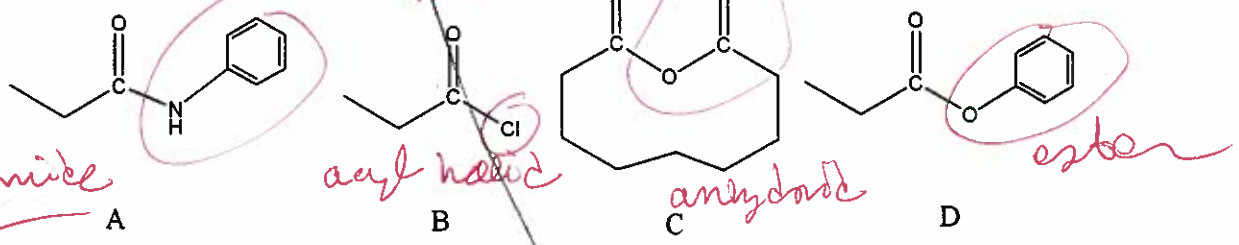


A B C D

low pKa → high pKa

a. A < C < D < B b. D < C < A < B c. B < A < D < C d. B < D < C < A

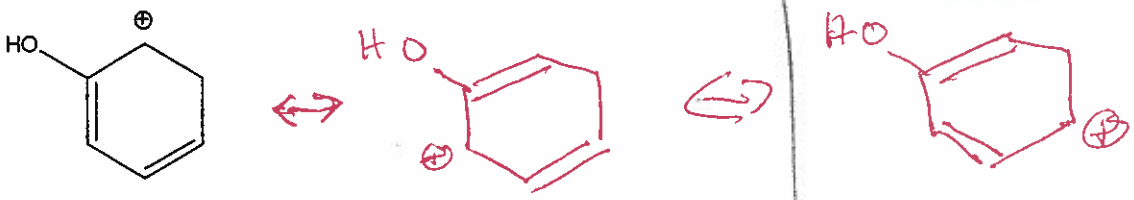
b) Which of the following correctly lists these compounds in order of increasing rate of base hydrolysis.
Circle the correct answer.



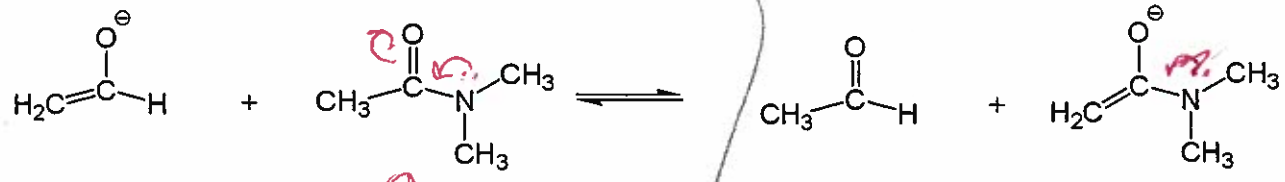
A B C D

a. D < A < B < C b. A < D < C < B c. D < A < C < B d. A < D < B < C

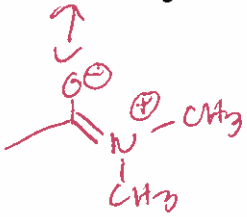
c) Draw all the resonance structures of the cation below.



d) Does the equilibrium of this reaction lie to the left or right?
Circle the appropriate answer and briefly explain your choice.



LEFT RIGHT

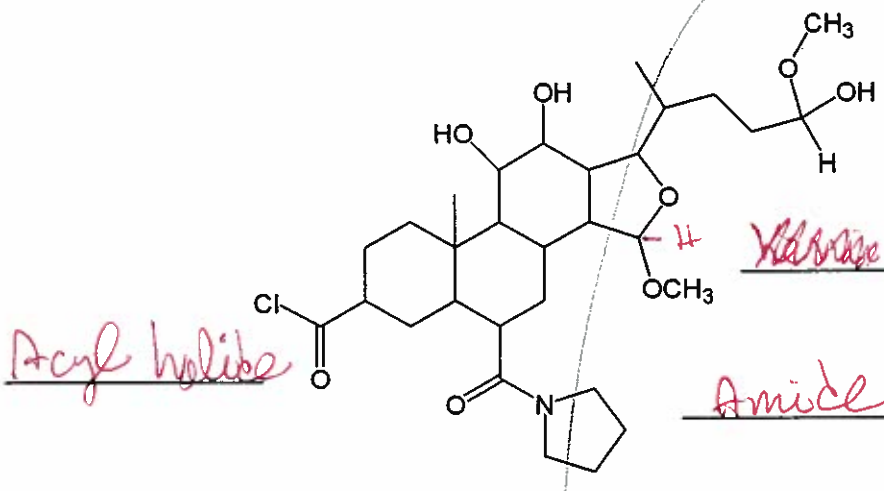


(complete)

Signature _____

Question 2. (2 Marks)

Place the correct name of the functional groups next to the functional groups on the molecule below.



hemi Acetal

Acetal

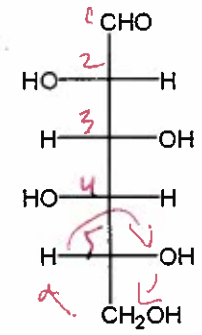
Acyl halide

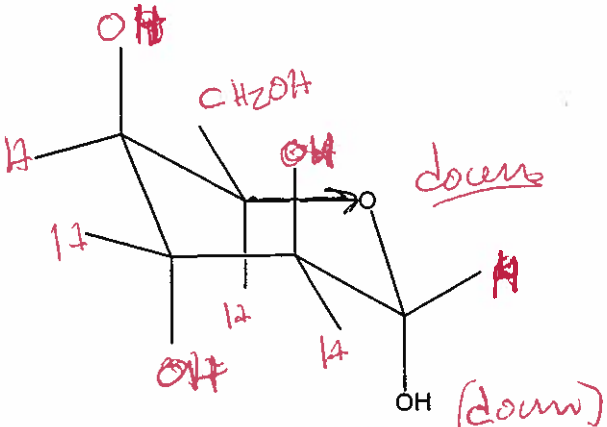
Amide

Question 3. (8 Marks)

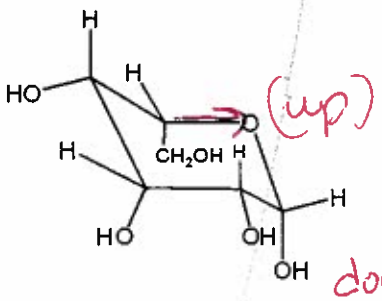
a) Draw a chair conformation for sugar A and the Fischer projection of sugar B on the structures given below.

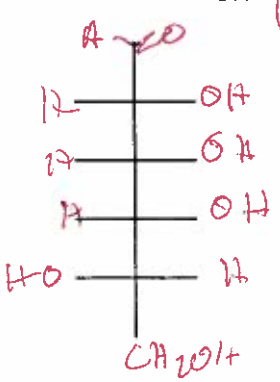
A





B





b) Circle the appropriate answer in each { }.

Sugar A above in question (f) is a { D / L } { alpha \ beta } anomer.

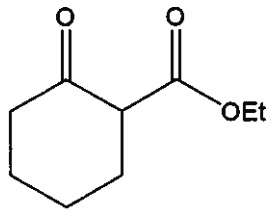
Sugar B above in question (f) is a { D / L } { alpha \ beta } anomer.

Signature _____

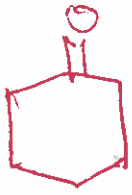
Question 4. (10 Marks)

Provide the structures of the **MAJOR** organic product(s) obtained from each of the following reactions.

a)

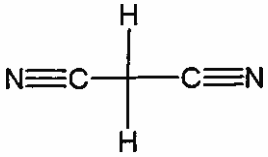


H^+, H_2O , heat

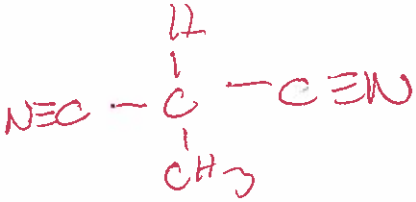


CO_2 HOEt

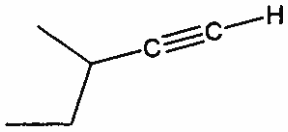
b)



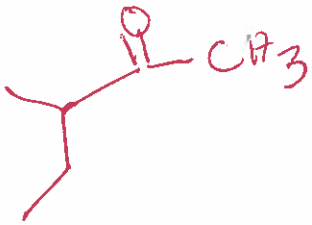
1. LDA (1 equ), THF
2. CH_3Br



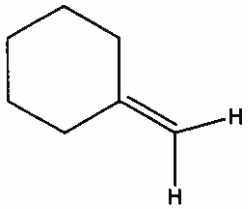
c)



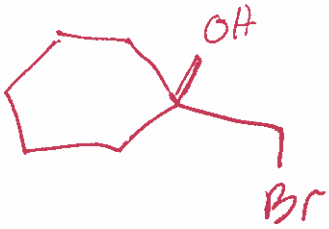
1. H^+, H_2O



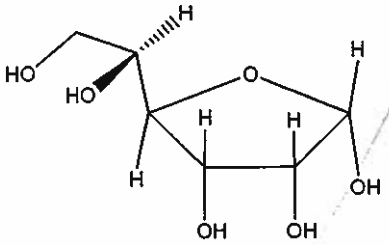
d)



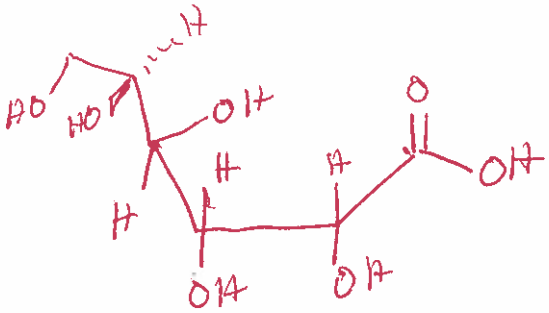
Br_2, H_2O



e)



Ag^+, NH_2OH

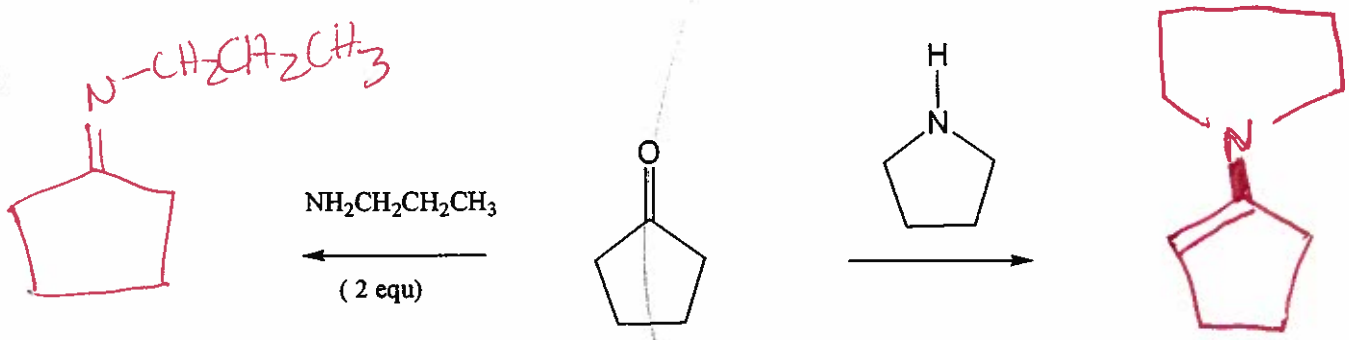


Signature _____

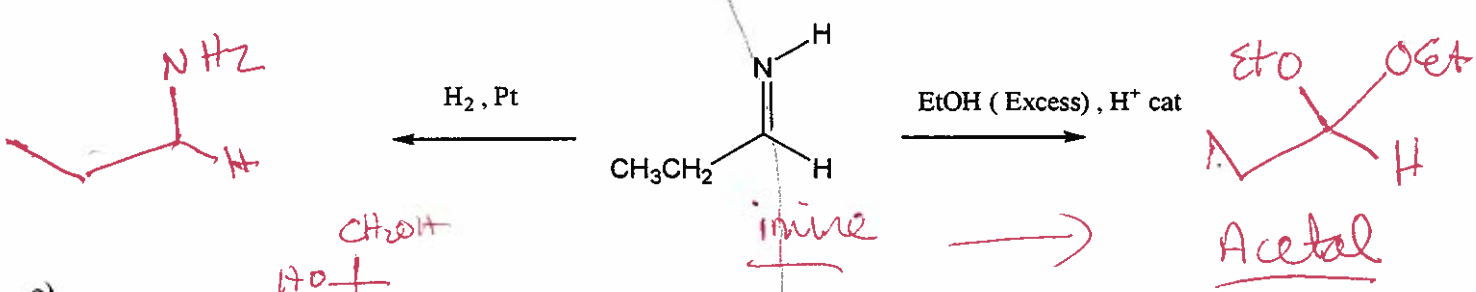
Question 5. (24 Marks)

Different reagents may react with the same starting material to produce very different products. Provide the structures of the major organic product(s) obtained from each of the following reactions.

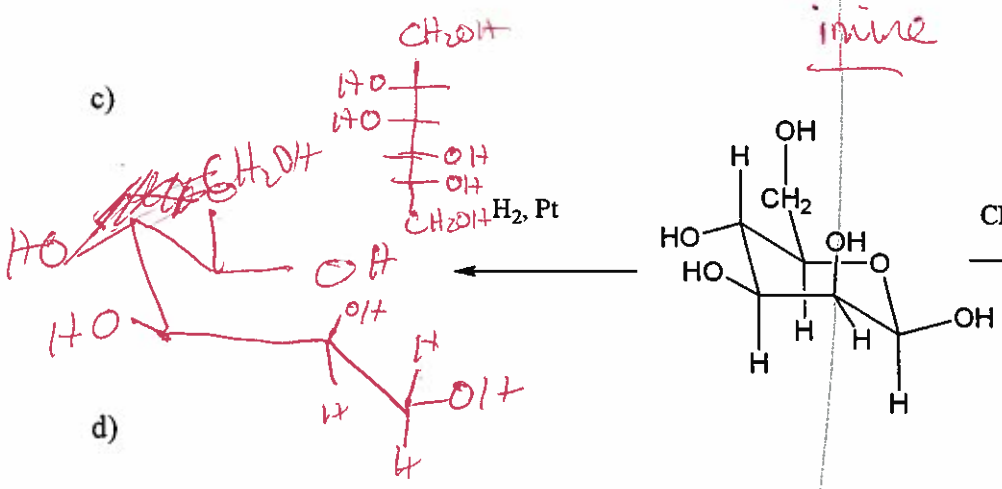
a)



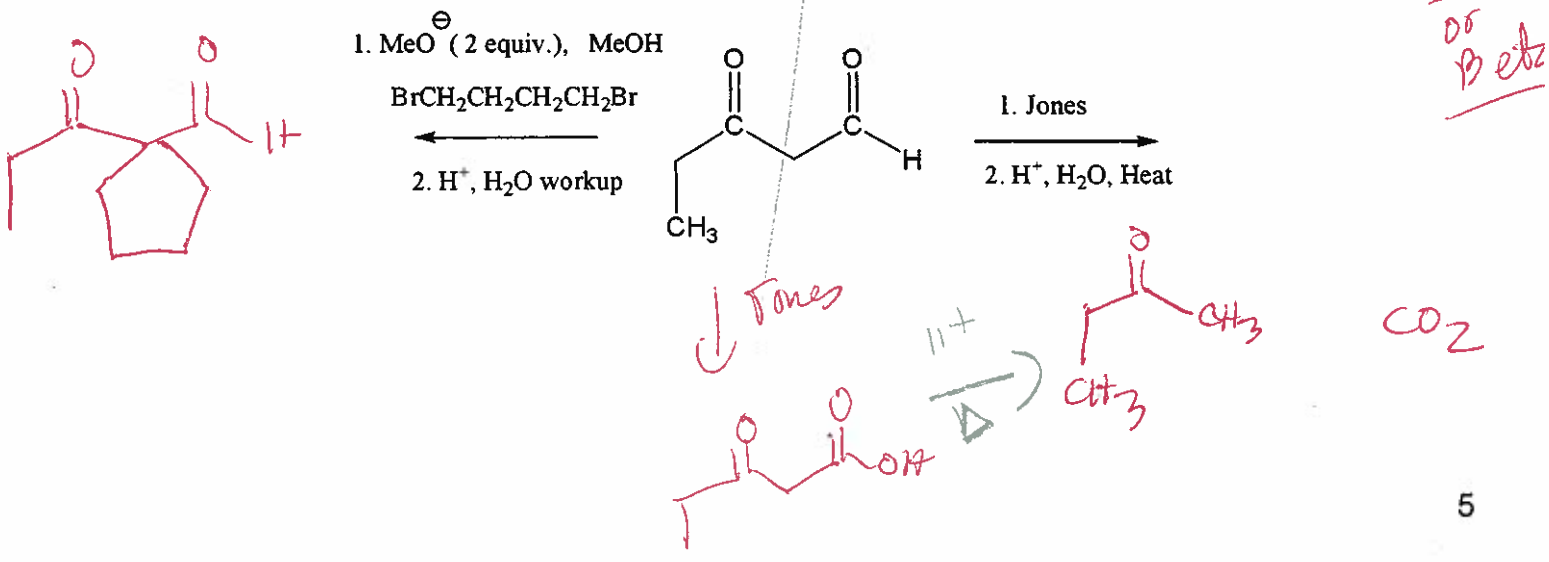
b)



c)

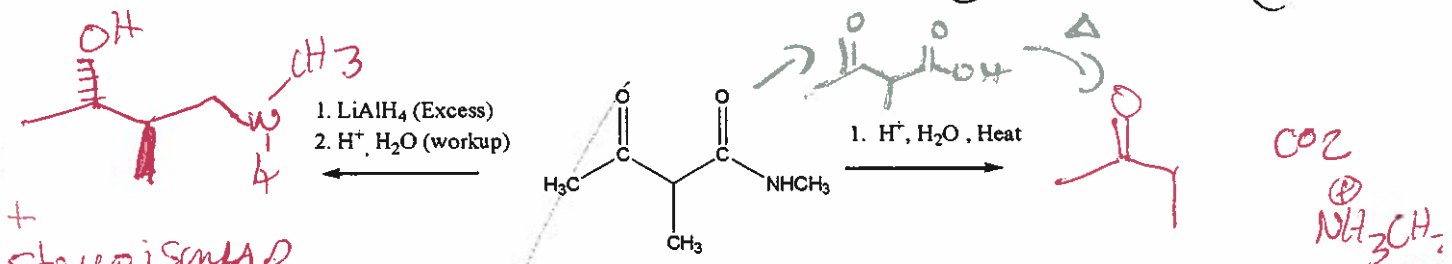


d)

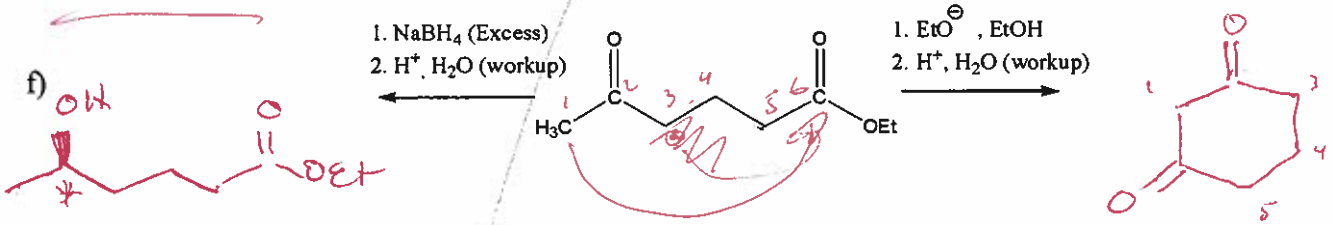


Signature _____

e)



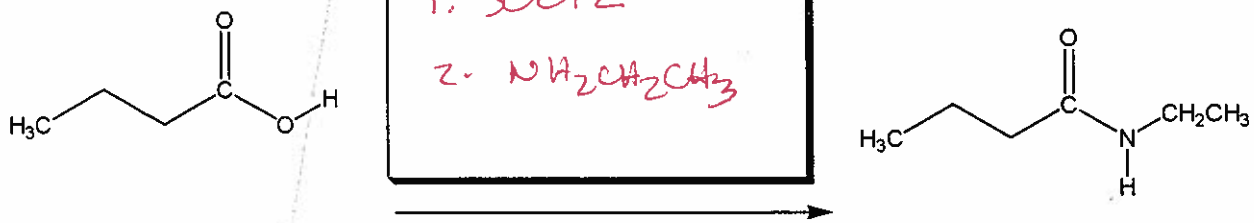
f)



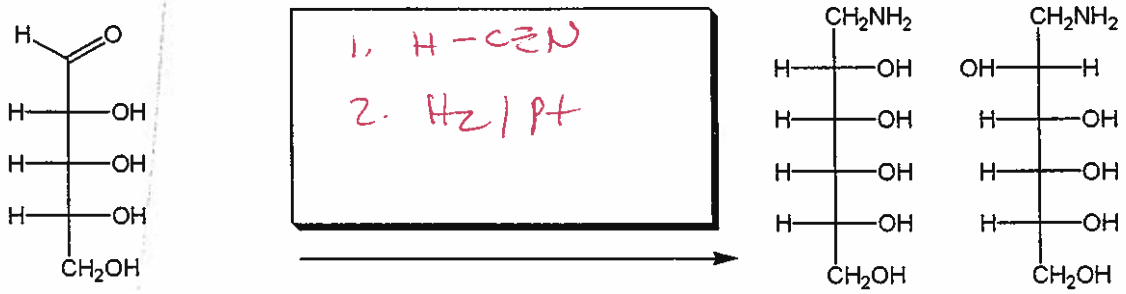
Question 6. (9 Marks)

Add the missing reagents necessary to carry out the steps below.
Each synthesis below requires only **one to three steps.**

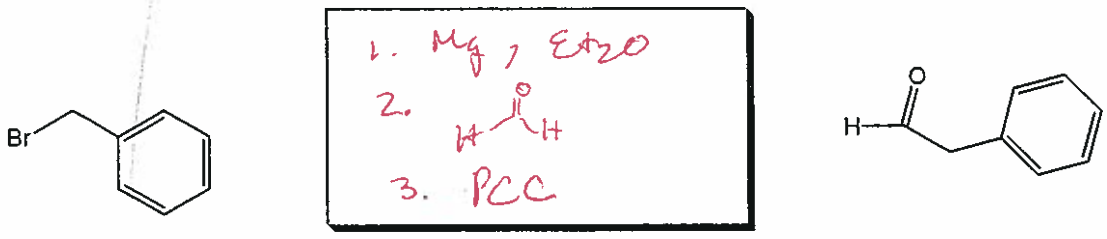
a)



b)



c)



Signature _____

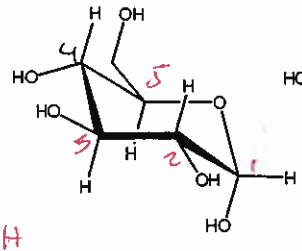
Question 7. (6 Marks)

Compound A is a D-aldopentose that can be oxidized to an optically inactive aldaric acid B. On Kiliani-Fischer chain extension, A is converted into C and D. Upon oxidation, compound C gave an optically active aldaric acid and compound D gave an optically inactive aldaric acid. What are the structures of A-D

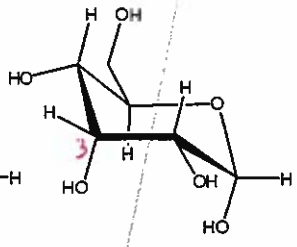
A	B	C	D

Question 8. (5 Marks)

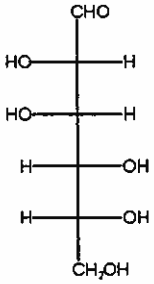
Fill in the blanks below.



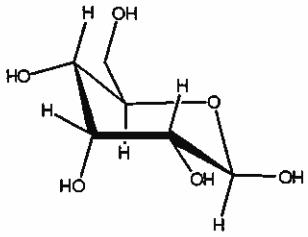
A



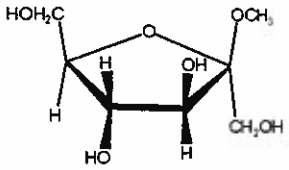
B



C



D



E

a) Which pair of sugars are C3-epimers (A,B)

b) Which pair of sugars are anomers (B,D)

~~c) Which pair(s) of sugars will give the same osazone~~ _____

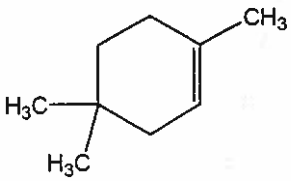
d) Which sugar(s) are reducing sugars A, B, C, D

e) Which sugar(s) give an optically active alditol A, C, (E)

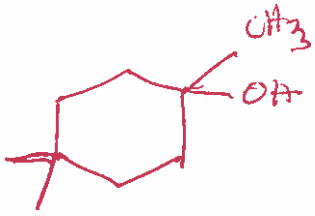
Signature _____

Question 9. (7 Marks)

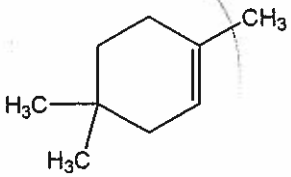
Draw the product(s) obtained from the reactions shown below and describe the stereochemical aspect of product(s) by circling the appropriate term.



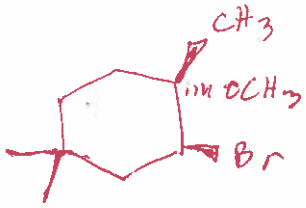
1. H^+, H_2O

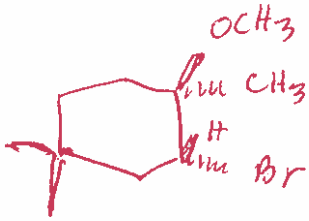


racemic mixture achiral diastereomeric mixture Consitutional isomer



1. Br_2, CH_3OH

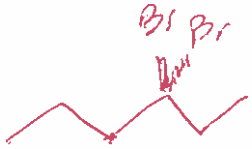




racemic mixture achiral diastereomeric mixture Consitutional isomer

$CH_3CH_2CH_2—C\equiv C—CH_3$

HBr (excess)

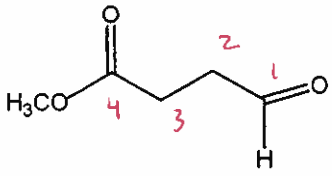


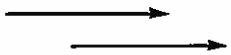
racemic mixture achiral diastereomeric mixture Consitutional isomer

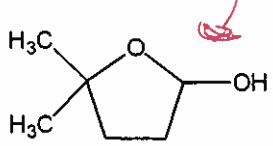
Signature _____

Question 10. (7 Marks)

Give the reagents and write out the steps involved in the following multi-step synthesis. Inorganic and organic reagents of choice may be used. Show the product after each step. It is **not** necessary to show the mechanistic details of any of the proposed reactions.



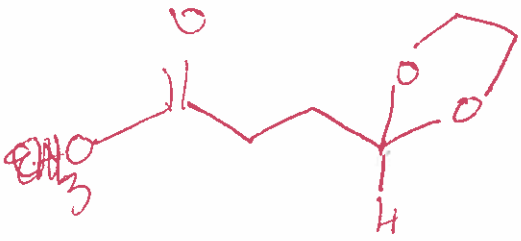




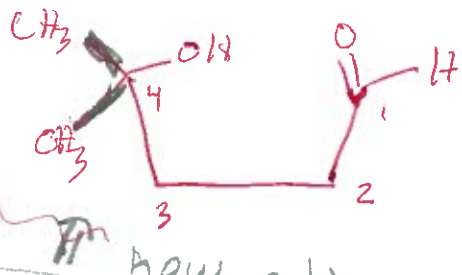
hemi Acetal

backward

protect



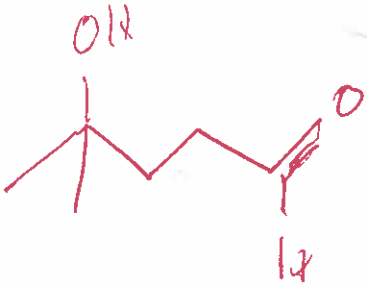
CH_3MgBr



How add 2 CH_3 ?

add 2 CH_3

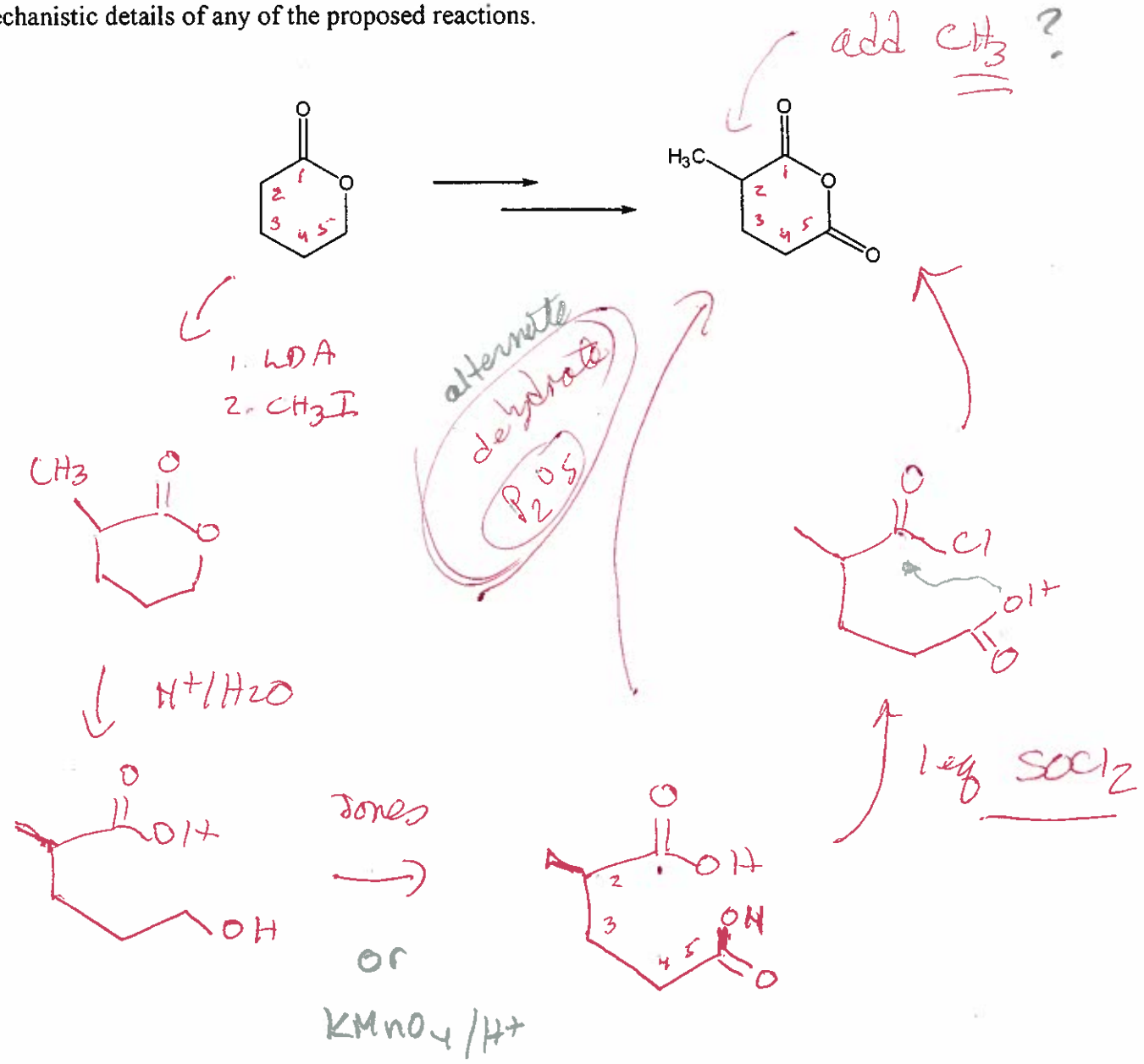
- add grignard to ester!!?



Signature _____

Question 11. (8 Marks)

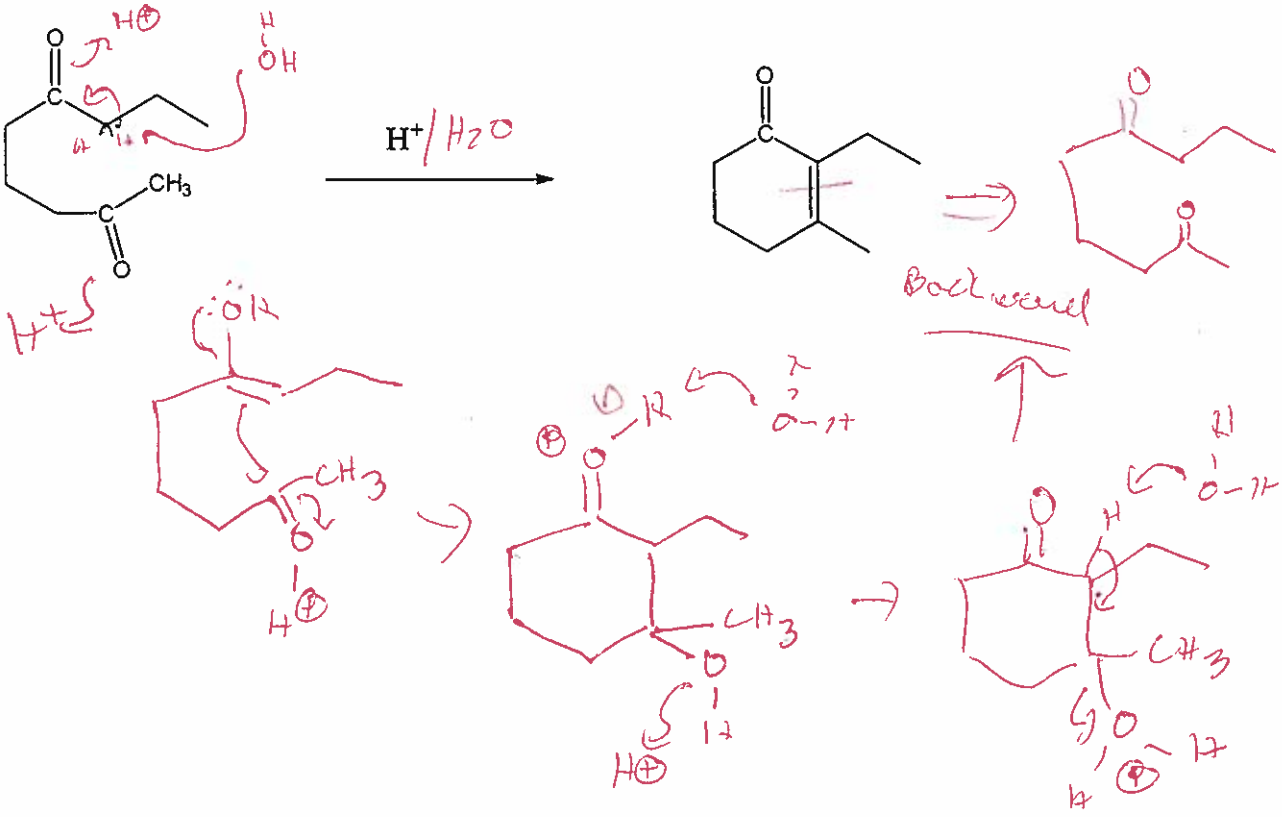
Give the reagents and write out the steps involved in the following multi-step synthesis. Inorganic and organic reagents of choice may be used. Show the product after each step. It is **not** necessary to show the mechanistic details of any of the proposed reactions.

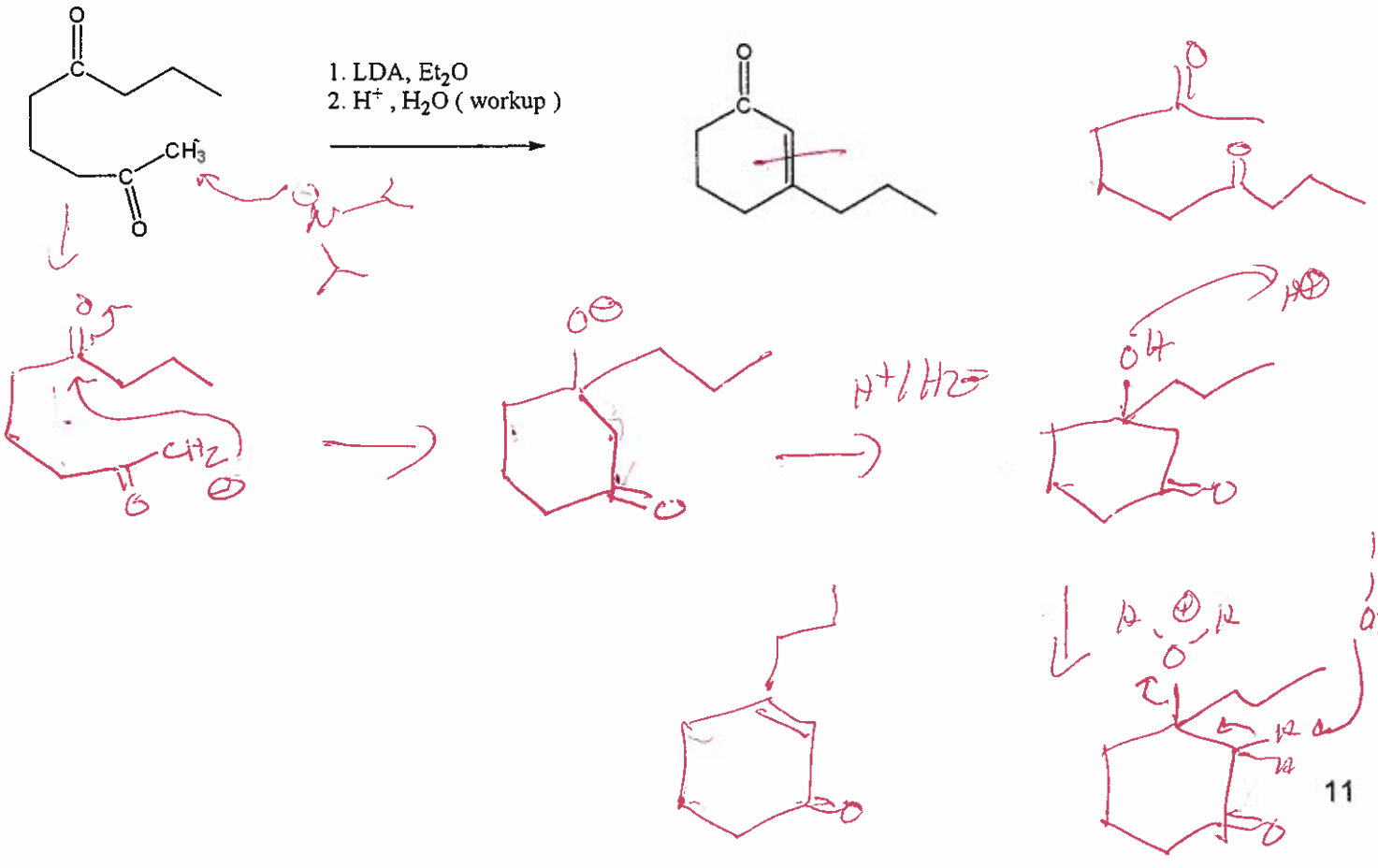


Signature _____

Question 12. (7 Marks)

Write the mechanisms for each of the reactions below to rationalize the following experimental observations.

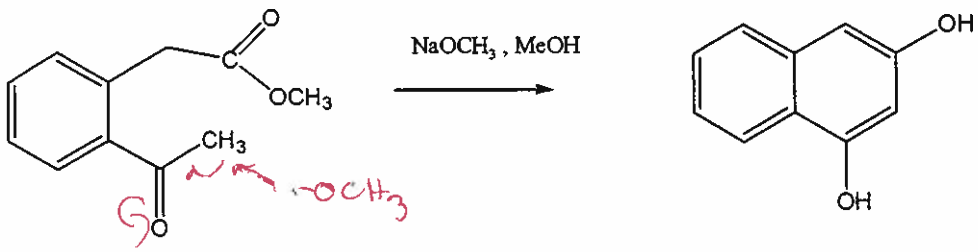


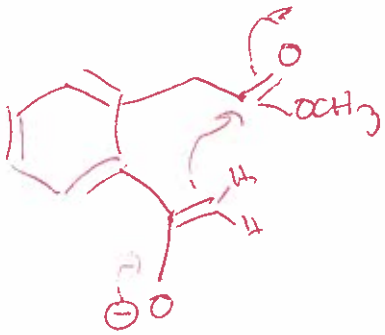


Signature _____

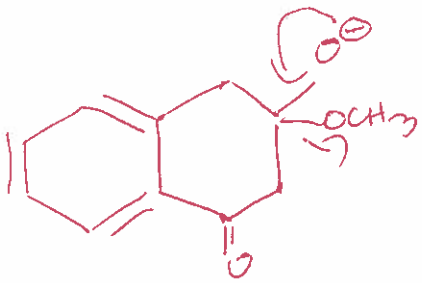
Question 13. (4 Marks)

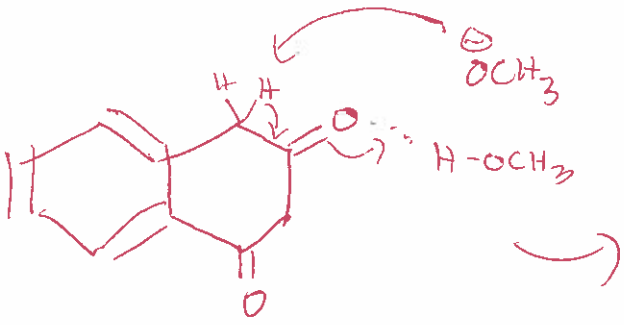
Including the correct use of electron-movement arrows, lone pairs of electrons, and the position of any formal charges, show the detailed step-by-step mechanism involved in the reaction below.



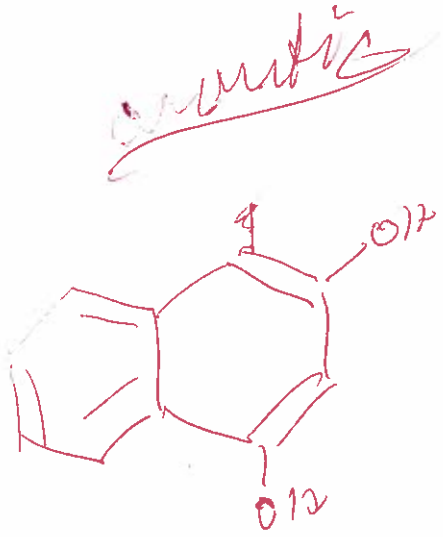


HOCH3

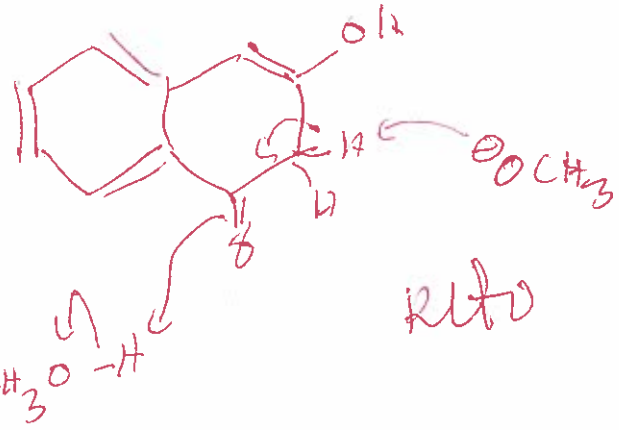




Keto



enol



Keto