



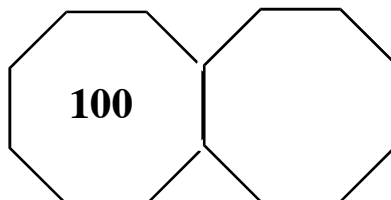
Name: _____ Student Number _____

Marking Scheme For The Exam

QUESTION

1	2	3	4	5	6	7	8
6	14	15	15	15	15	8	12

TOTAL



%

Question 1. (6 Marks) A. Provide the structures of the following compounds:

o-chlorophenyl 3-methyl-4-oxopentanoate

N-ethyl, N-methyl m-(1-cyanopropyl)benzamide

B. Which compound would be the best solvent to use for a Friedel-Crafts acylation process?

toluene

nitrobenzene

aniline

C. Which compound would react with benzaldehyde to form an imine (after loss of water)?

propylamine

diethylamine

trimethylamine

D. Which compound would not react with ethanoyl chloride to form an amide?

propylamine

diethylamine

trimethylamine

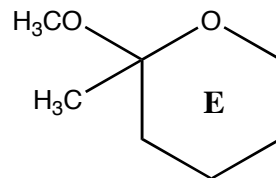
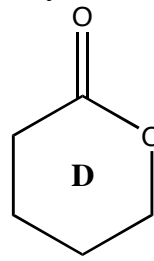
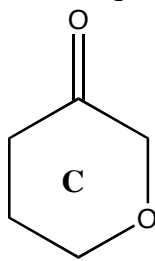
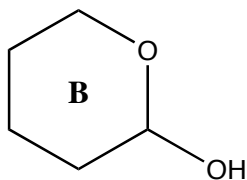
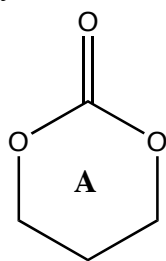
E. Which compound would react with cyclohexanone to form an enamine (after loss of water)?

propylamine

diethylamine

trimethylamine

Question 2. (14 Marks) A. This question is based upon the following cyclic structures. Each letter may be used once, more than once, or not at all. **Each question has only one correct answer. (10)**



Would give a positive Tollen's and a positive 2,4-DNP test

A B C D E

Would give a negative Tollen's and a positive 2,4-DNP test

A B C D E

Would give a positive Iodoform test after reaction with H_3O^+

A B C D E

Would produce CO_2 upon heating with H_3O^+

A B C D E

Would require 2 equivalents of MeMgBr

A B C D E

Would require 3 equivalents of MeMgBr

A B C D E

Would not react with MeMgBr

A B C D E

Would undergo saponification with NaOH(aq)

A B C D E

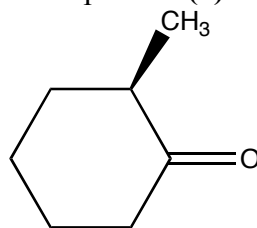
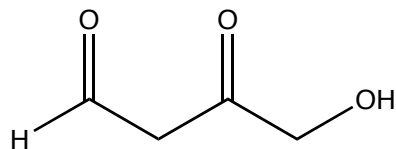
Would undergo mutarotation

A B C D E

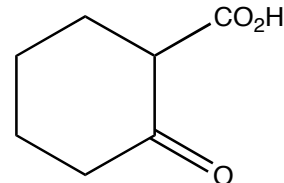
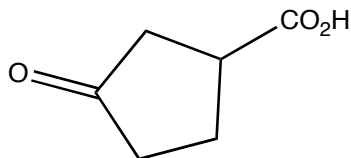
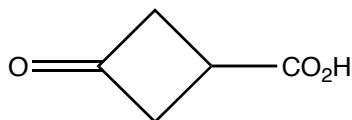
Would be classified as a deoxy ketose

A B C D E

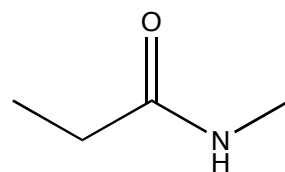
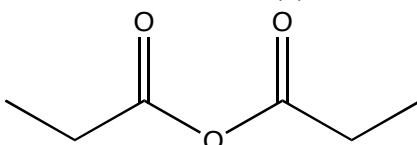
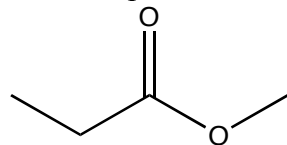
B. Indicate the number of D atoms (in the box to the right) that each of the following compounds would incorporate after stirring with NaOD in D_2O until no further changes took place. **(2)**



C. Which compound would lose CO_2 at the lowest temperature? **(1)**



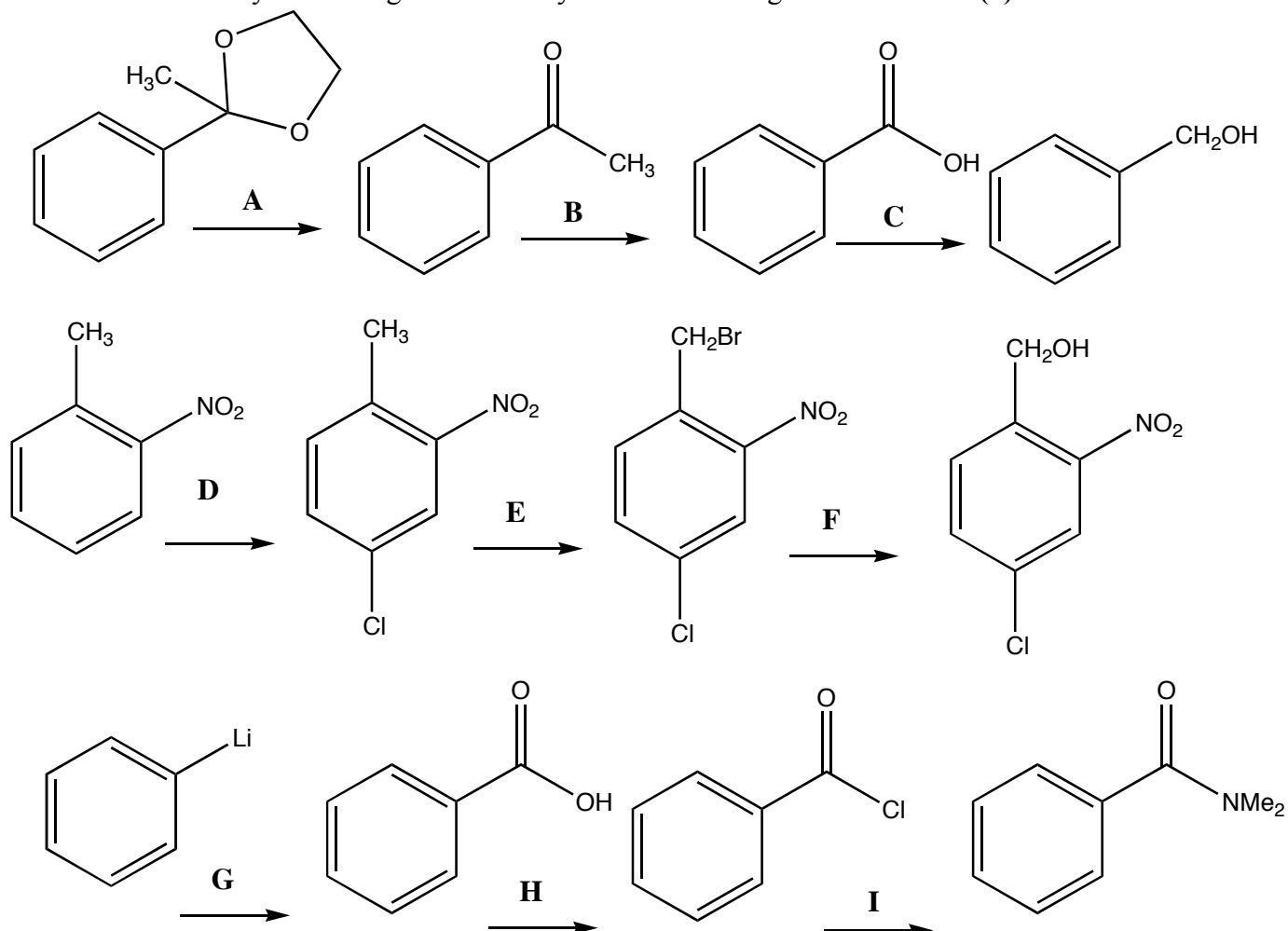
D. Which compound is the least likely to exist in Nature? **(1)**



Question 3. (15 Marks)

A. Provide the identity of the reagents necessary for the following reactions.

(9)



A: _____ B: _____ C: _____ D: _____ E: _____

F: _____ G: _____ H: _____ I: _____

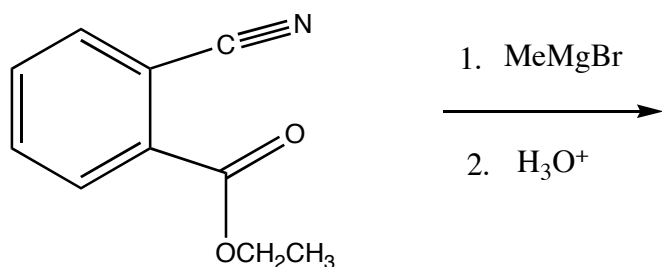
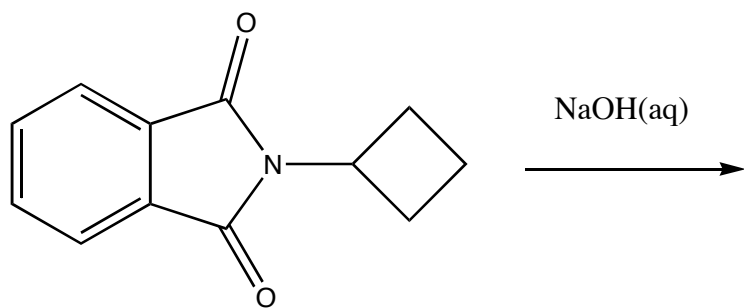
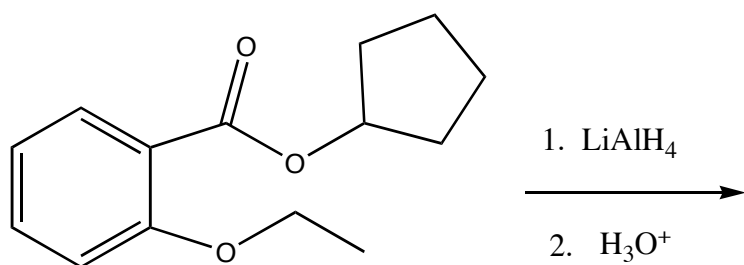
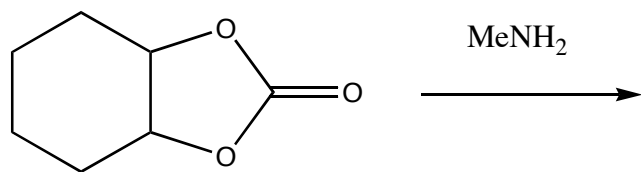
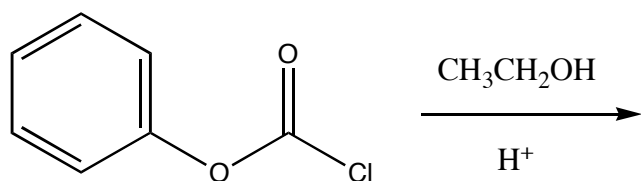
B. Identify (**by a single letter** – there may be more than one example) which of the above reactions would be classified as a(an): (6)

electrophilic aromatic substitution _____ free radical substitution _____

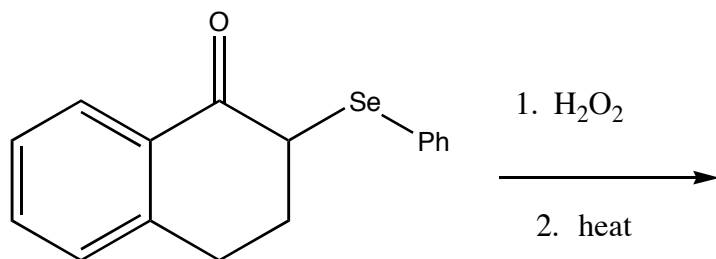
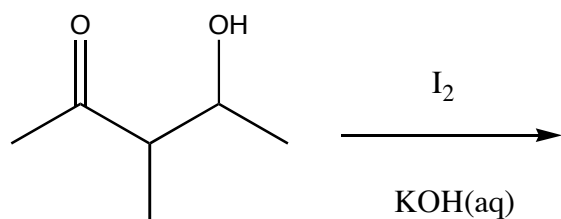
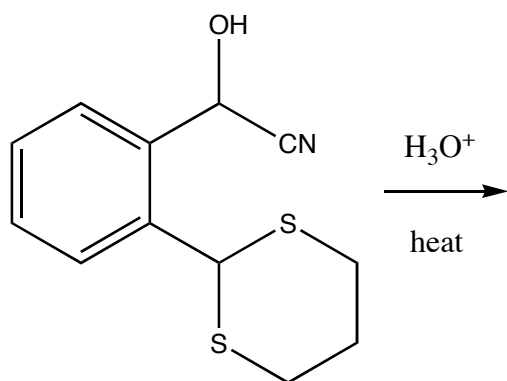
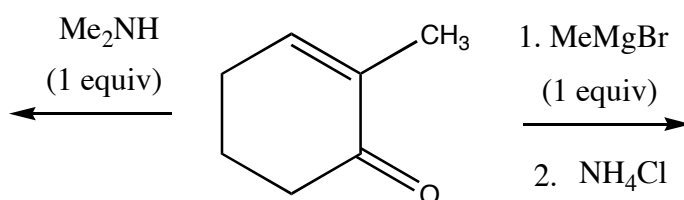
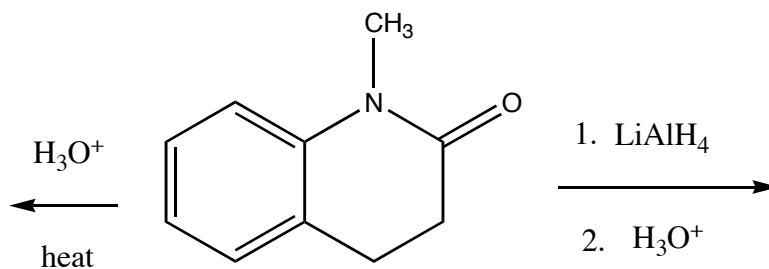
nucleophilic acyl substitution _____ oxidation _____

nucleophilic aliphatic substitution _____ nucleophilic addition _____

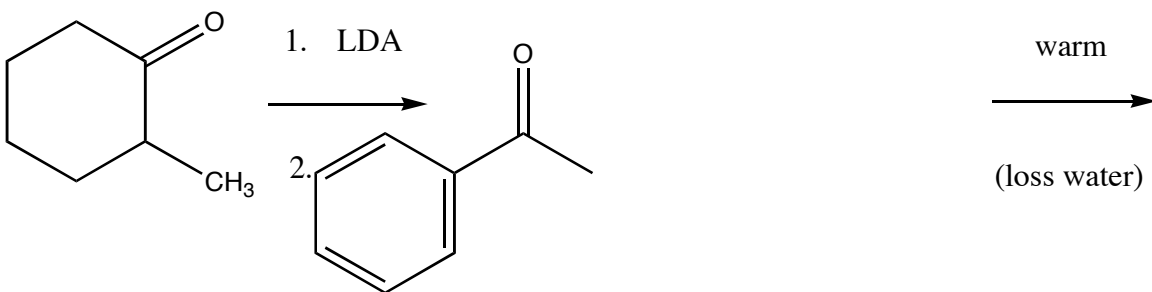
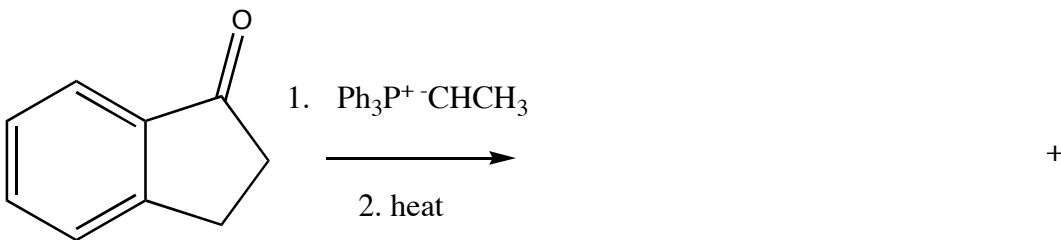
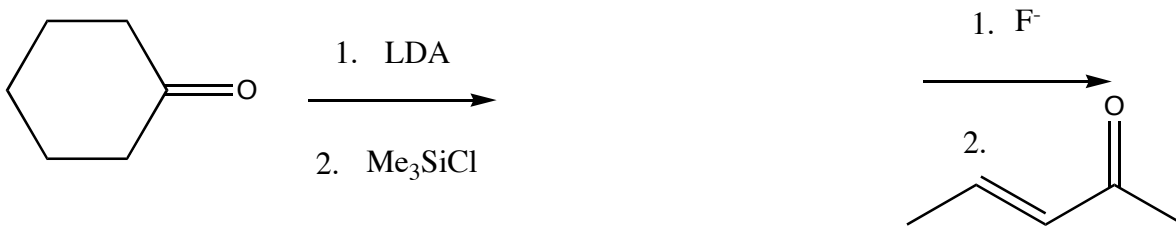
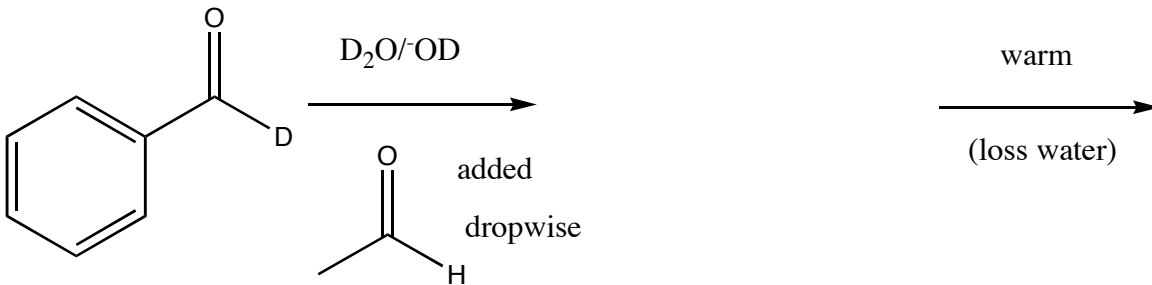
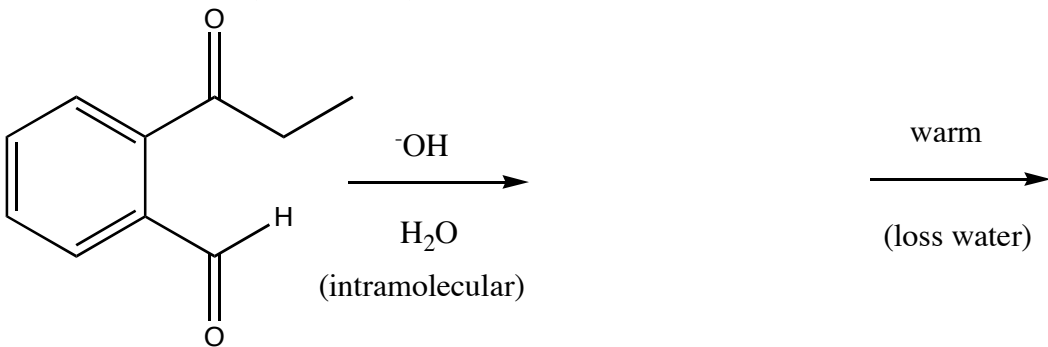
Question 4. (15 Marks) Provide the structures of **all carbon-containing products** formed in each of the following reactions. You may assume that each reaction goes to completion and you have excess reagent (if necessary) unless otherwise specified. Be careful with the possibility of acid/base transfer in the products.



Question 5. (15 Marks) Provide the structures of **all carbon-containing products** formed in each of the following reactions. You may assume that each reaction goes to completion and you have excess reagent (if necessary) unless otherwise specified. Be careful with the possibility of acid/base transfer in the products.

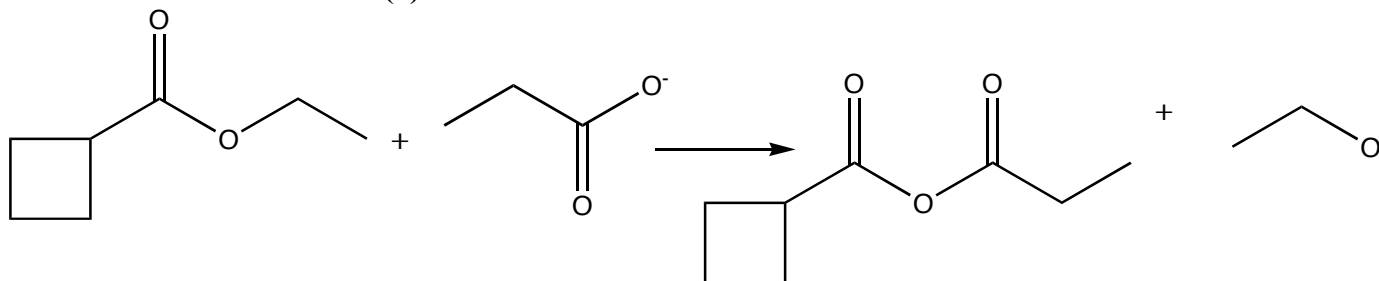


Question 6. (15 Marks) Provide the structures of the products formed in the following reactions.

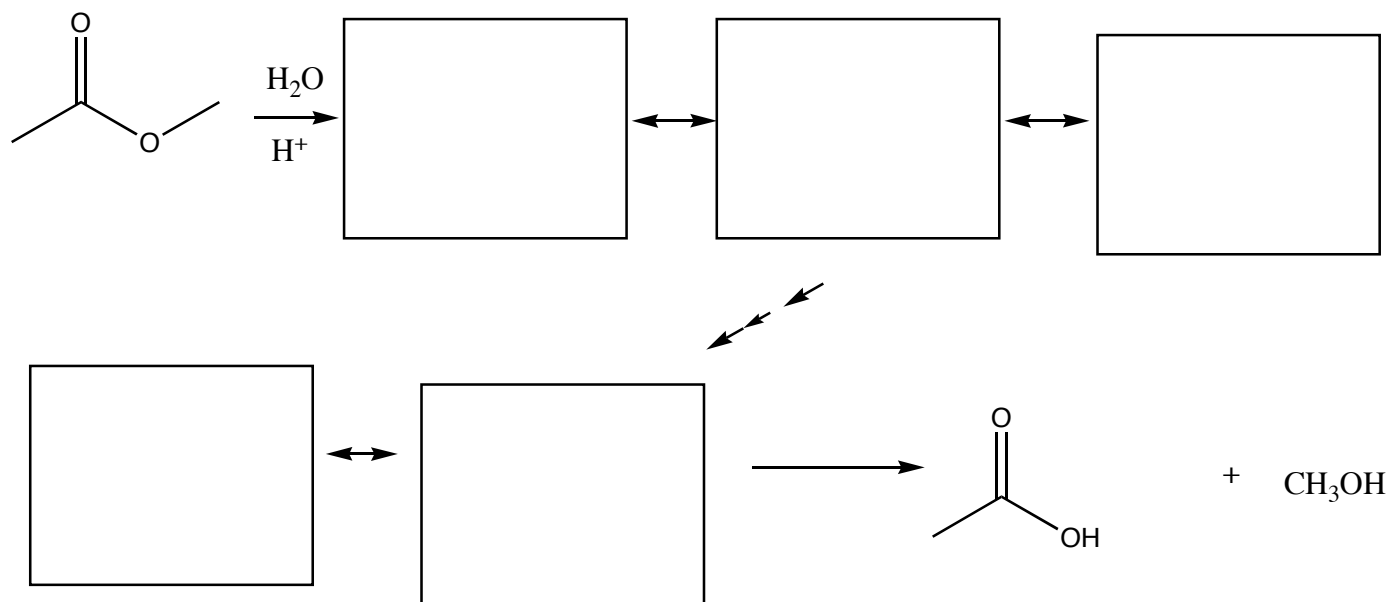


Question 7. (8 Marks)

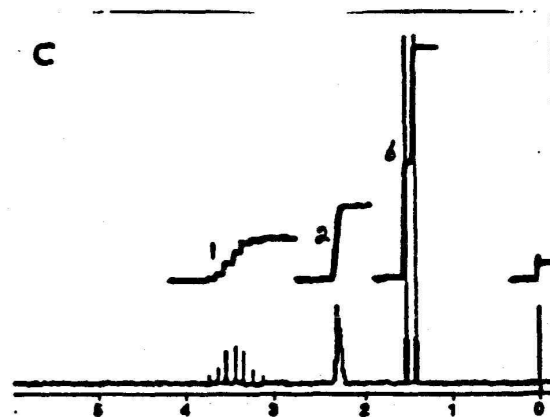
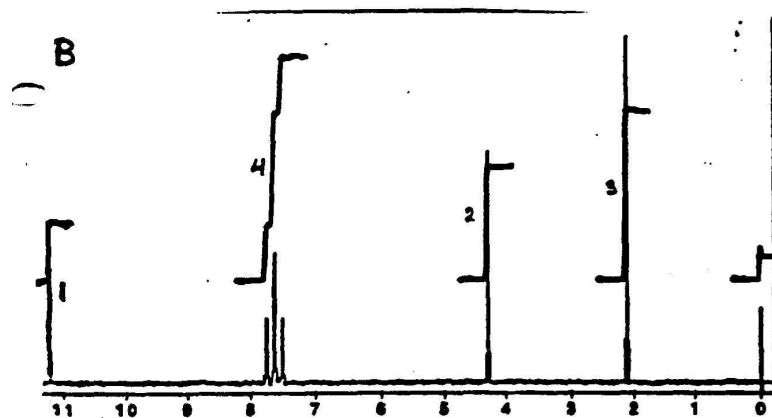
A. Briefly explain why (using words and a mechanistic arrow-pushing approach) why the following reaction will not work as written. (4)



B. In the following process, the initially formed intermediate has 3 different resonance structures while the last intermediate in the process has 2 resonance structures. Provide their structures in the boxes below. (4)



Question 8. (12 Marks) Compound A ($C_{12}H_{17}NO$) has a sharp band near 1700 cm^{-1} and a strong band near 3400 cm^{-1} in the IR. Compound A can be hydrolyzed by heating with aqueous acid to produce compound B ($C_9H_{10}O_2$) which has one sharp band in the IR near 1700 cm^{-1} plus a broad band in the 2500 to 3200 cm^{-1} region. Treatment of the aqueous filtrate with base gives compound C (C_3H_9N) that has a strong odour and a strong IR band around 3400 cm^{-1} . Reaction of compound B with hot acidic $KMnO_4$ gave compound D ($C_8H_4O_3$) that has a sharp band in the IR near 1700 cm^{-1} . The 1H NMR spectra of compounds B and C are shown. Provide the structures of compounds A, B, C and D.



A: _____ B: _____ C: _____ D: _____