KWANTLEN UNIVERSITY COLLEGE

CHEMISTRY 2420 R10 - ORGANIC CHEMISTRY II

Term Exam 2 - March 20, 2002 **NAME: _____**

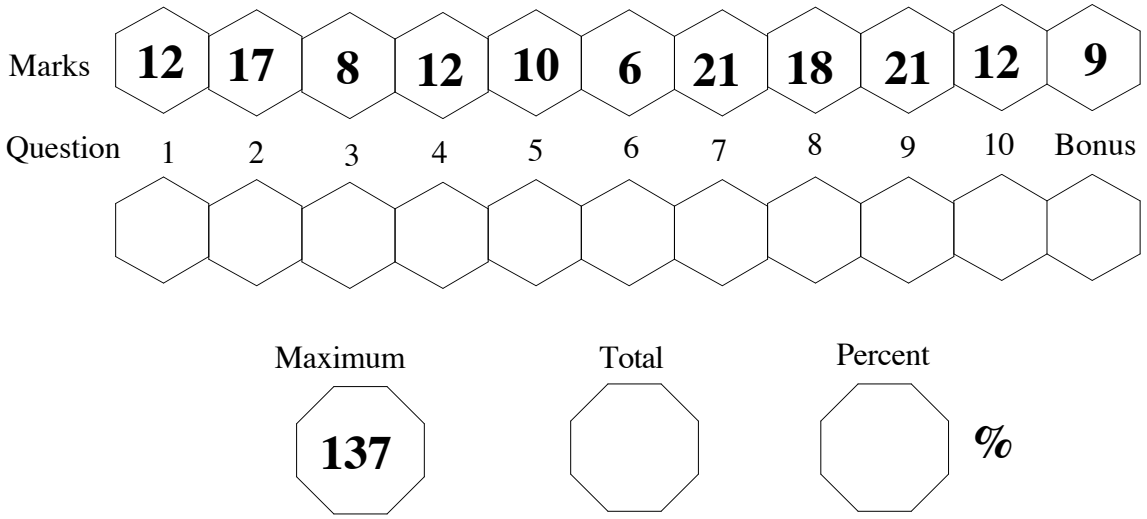
Time: 110 minutes **Budget your time carefully and good luck!!!**

This paper consists of 10 pages (**10 questions plus 1 bonus question**) including this title page.

Molecular models may be used during this examination.

Place all your answers on this examination paper.

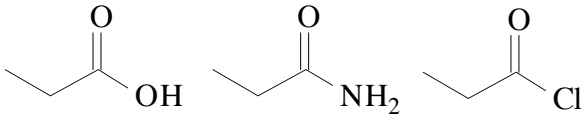
Grading Scheme For The Exam



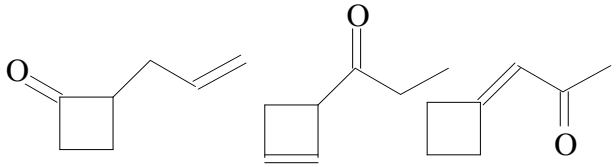
Question 1. (12 Marks) Short Answer Questions

Circle the correct answer for each of the following:

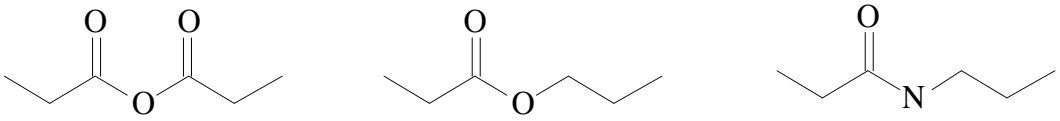
a) least likely to be found in Nature



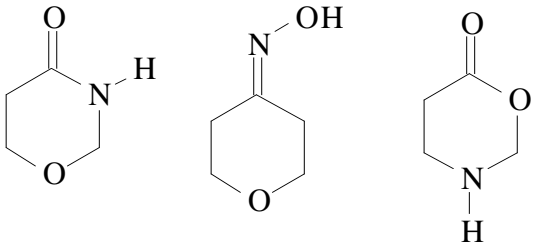
b) is a β,γ-unsaturated ketone



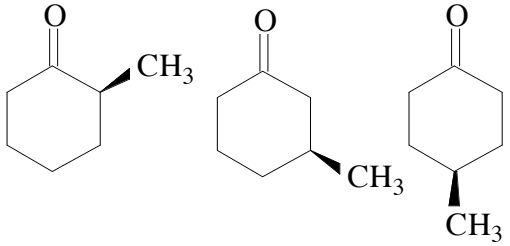
c) the compound likely to react the slowest with KOH(aq)



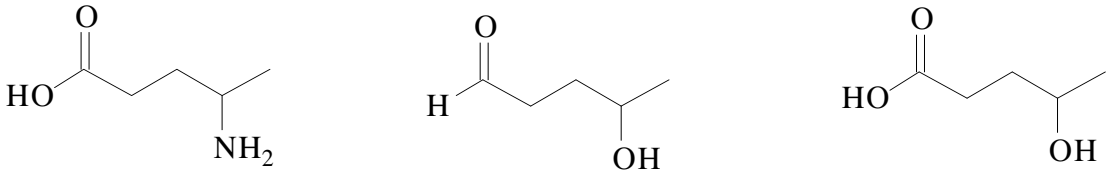
d) best described as a lactone



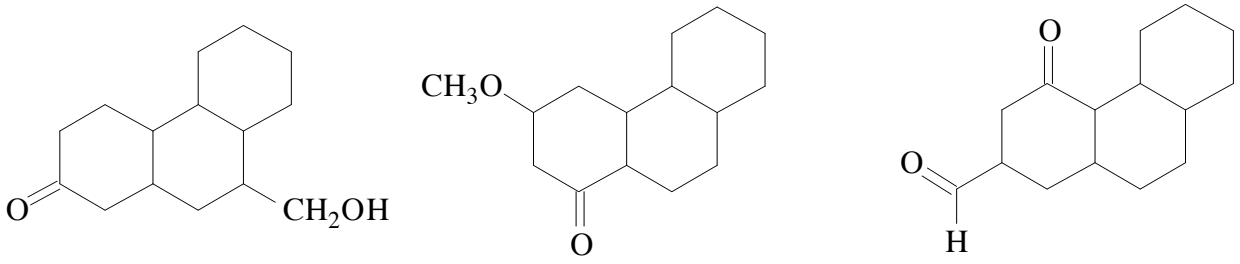
e) would undergo racemization with $^{-}OH/H_2O$



f) would not undergo an intramolecular cyclization reaction (catalytic amount of H^+ present)



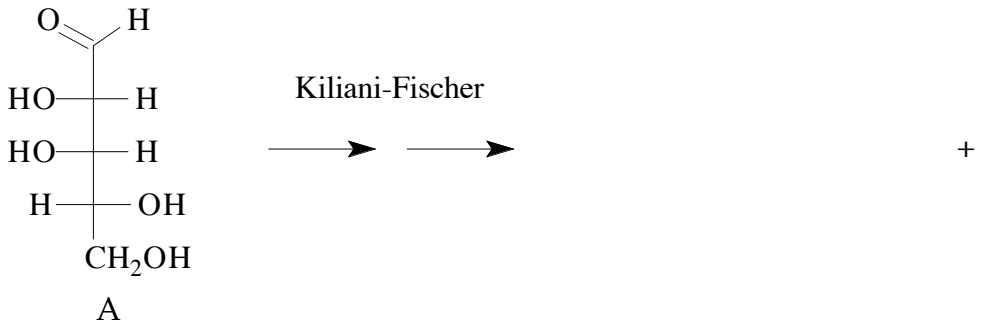
For each of the following compounds, give a number to indicate the increase in mass when the compound is stirred overnight in a $^{-}OD/D_2O$ solution.



____ ____ ____

Question 2. (17 Marks)

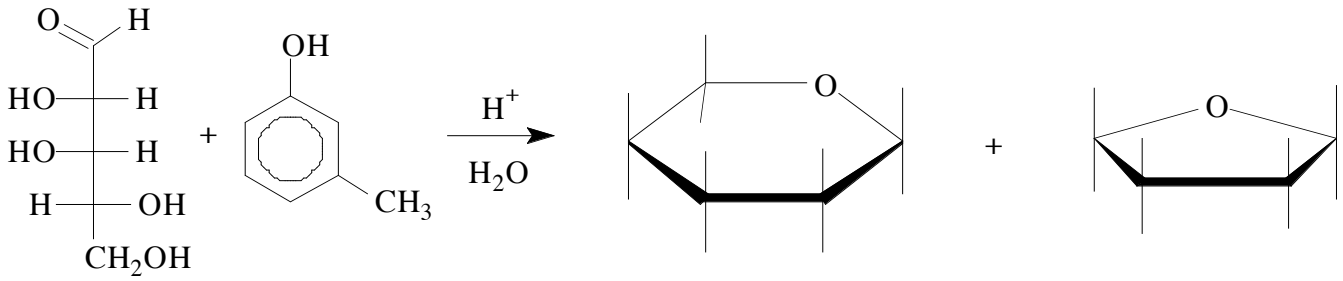
a) The following monosaccharide A is subjected to the conditions used for a Kiliani-Fischer synthesis. Give the Fischer projection of the two products expected at the completion of the synthesis. **(3)**



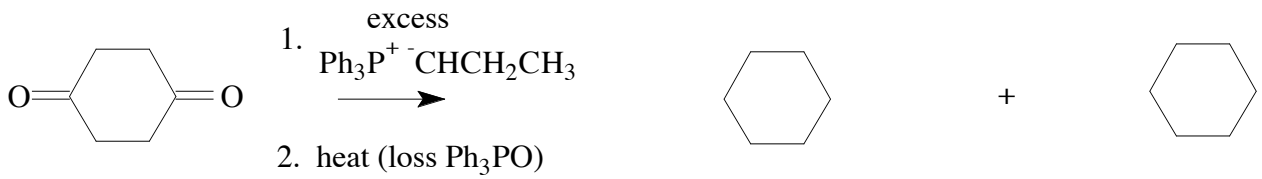
Two of the intermediate compounds formed during the above sequence of reactions are: **(2)**

carbinolamines **cyanohydrins** **enamines** **imines** **ylids** **betaines**

b) Complete the following structures for two non-reducing glycosides formed from the reaction of monsosaccharide A with an aqueous solution of m-cresol (3-methyl-1-hydroxybenzene). **(4)**



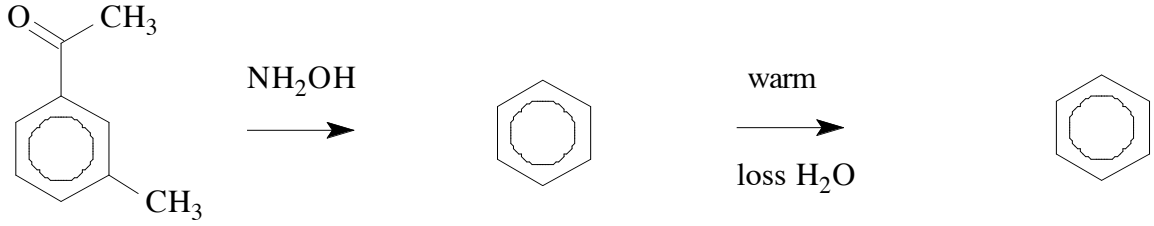
c) Complete the structures for the compounds formed in the following sequence of reactions. **(3)**



Two of the intermediate compounds involved in the above sequence of reactions are: **(2)**

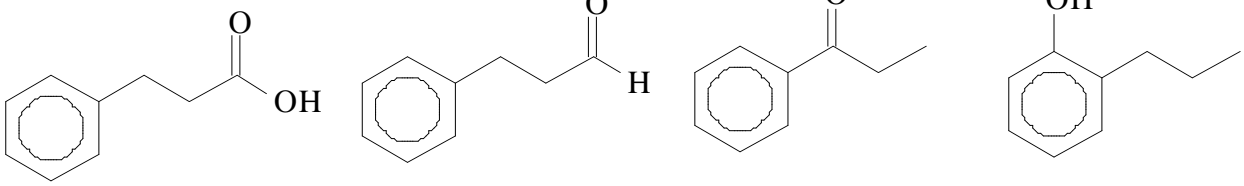
carbinolamines **cyanohydrins** **enamines** **imines** **ylids** **betaines**

d) Complete the structures for the compounds formed in the following sequence of reactions. **(3)**



Question 3. **(8 Marks)** Rank the following two sets of 4 species in order of decreasing acidity (i.e., 1 = most acidic, 4 = least acidic)

$CH_3NH_3^+$ $CH_3OH_2^+$ CH_3NH_2 CH_3OH



Question 4. **(12 Marks)**

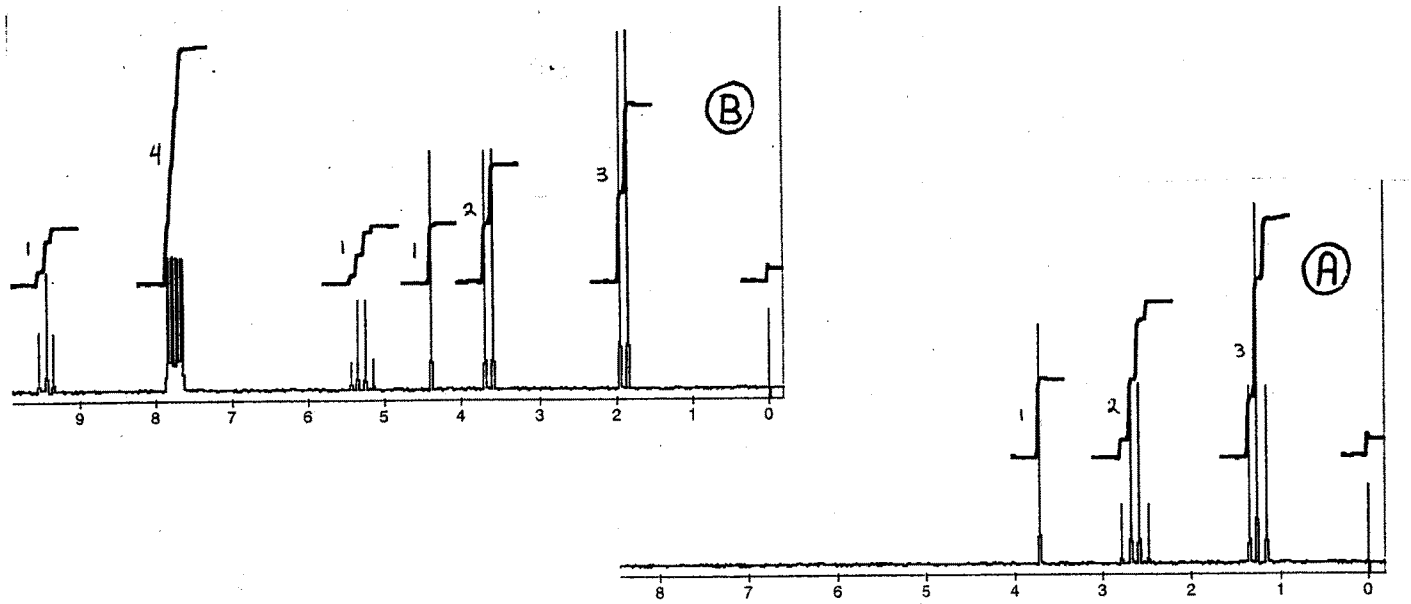
a) Provide the structure of the following compound: **(2)** N-ethyl 3-cyano-5-oxopentanamide

b) Provide the structure of an isomer that would be: **(2)**

a weaker acid than 3-bromohexanoic acid

a stronger acid than p-methoxytoluene

c) Provide the structure of compounds A ($C_7H_{12}O_2$) and B ($C_{10}H_{12}O_2$). Both A and B have a single strong band in the IR at ~ 1700 cm^{-1}; B also has a strong band at ~ 3400 cm^{-1}. A has a pK_a value of ~ 9; B gives a positive Iodoform test and a positive Tollens test. **(8)**



Question 5. **(10 Marks)** As you have seen many times in the course, the same molecular formula can give rise to a variety of different compounds. Give the structure (no IUPAC name necessary) of a compound which will satisfy the following requirements (**use the same formula $C_6H_{12}O_2$ for each compound**). The structures of the products formed in any reactions are not required.

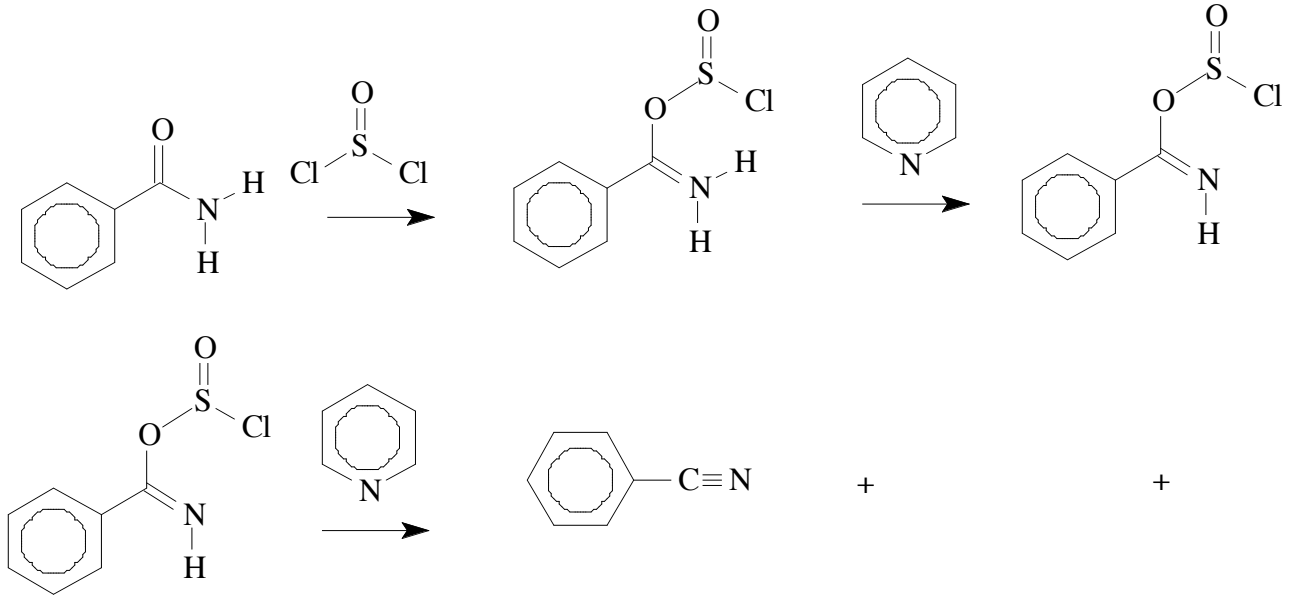
A gives a +ve Iodoform test and a -ve 2,4-DNP test

B gives a -ve Iodoform test and a +ve 2,4-DNP test

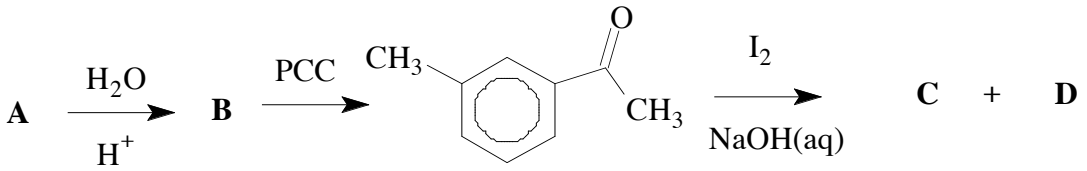
C would not react with CH_3MgBr, $LiAlH_4$ or H_2/Pt

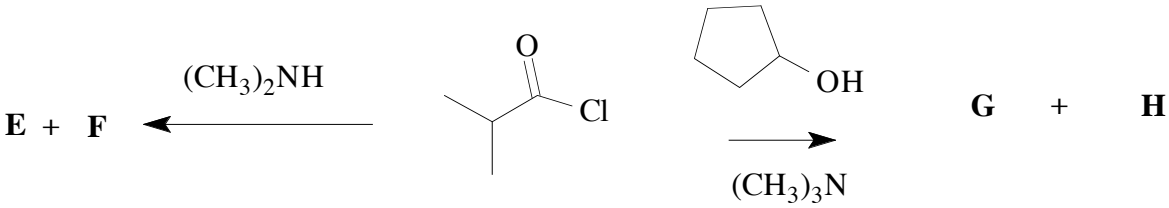
D reacts with excess $LiAlH_4$ to produce (after acidic workup) two alcohols, one 1° and one 2°

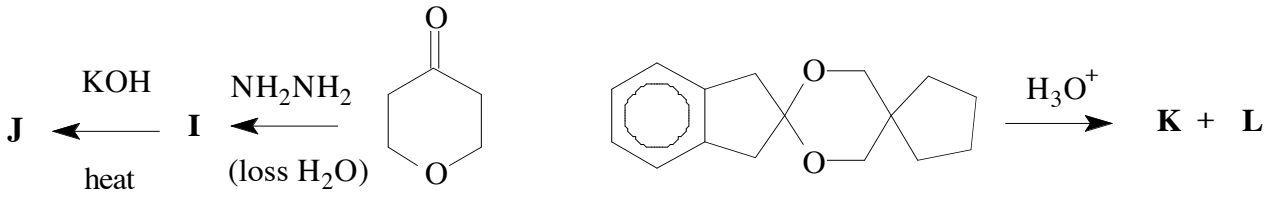
Question 6. **(6 Marks)** Complete the following mechanism by providing the appropriate arrows to describe the movement of any pertinent lone pairs of electrons, pi bonds or atoms. You should indicate the location of any charges as well as the identity of the other two products formed in the final step of the mechanism.



Question 7. **(21 Marks)** Provide the identity of each lettered unknown. All reactions go to completion and you have excess reagent available if it is required.

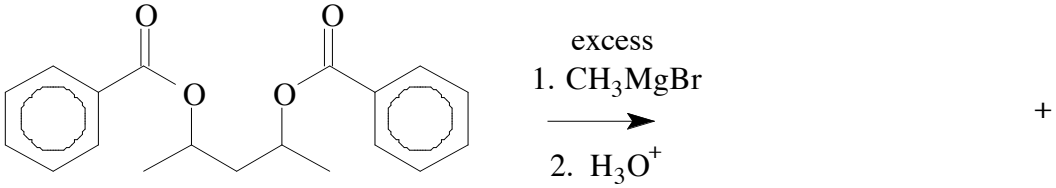




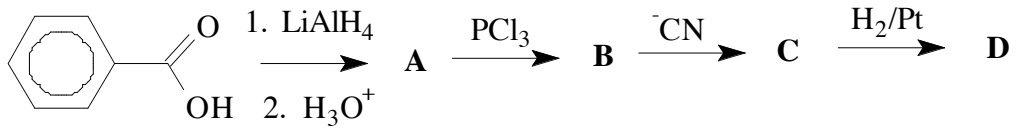


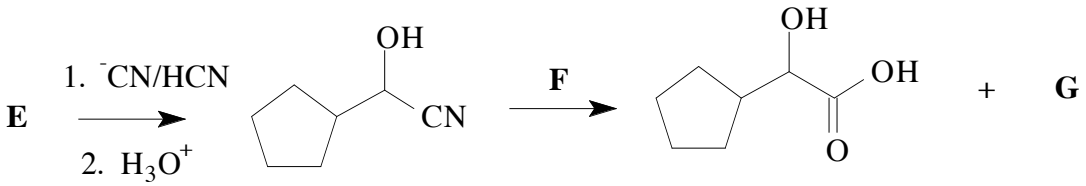
A	B	C	D
E	F	G	H
I	J	K	L

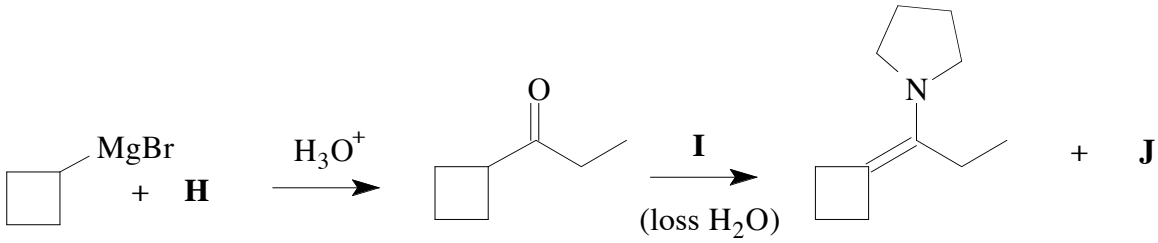
Give the structure of the 2 organic products expected from the following process:

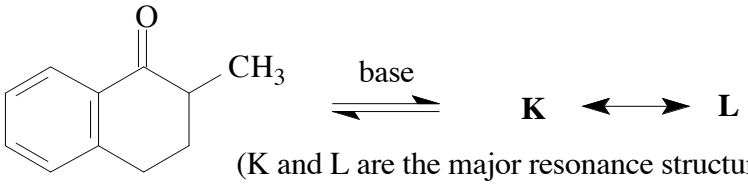


Question 8. **(18 Marks)** Provide the identity of each lettered unknown. All reactions go to completion and you have excess reagent available if it is required.





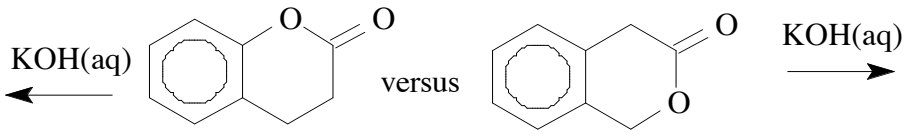


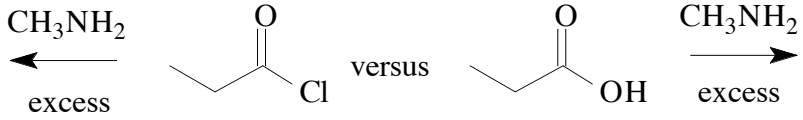


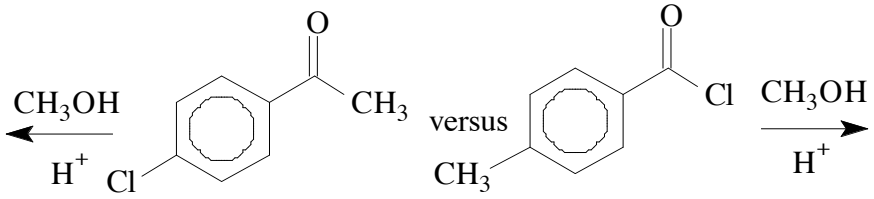
(K and L are the major resonance structures of the enolate formed in the reaction)

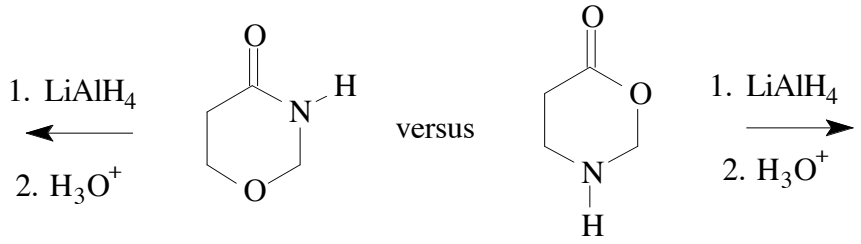
A	B	C	D
E	F	G	H
I	J	K	L

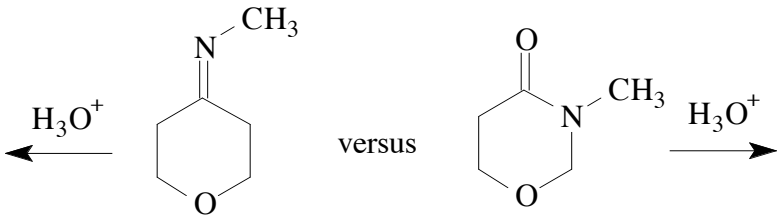
Question 9. (21 Marks) Making a small change in the structure of the starting material can result in a significant change in the structure of the products isolated in a chemical reaction. Provide the structures of the expected carbon-containing products in the following reactions. You may assume that you have **as much reagent as necessary to make the reactions go to completion.**

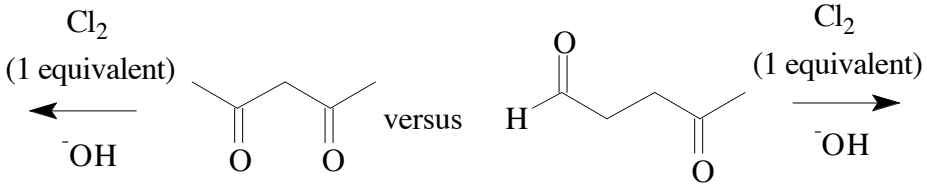




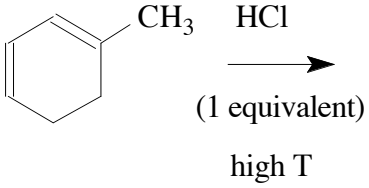


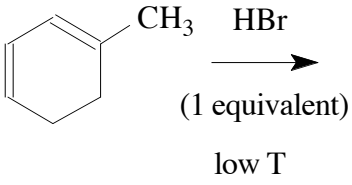


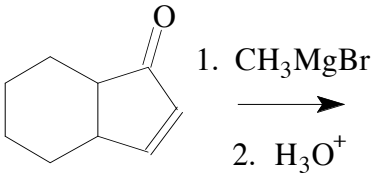


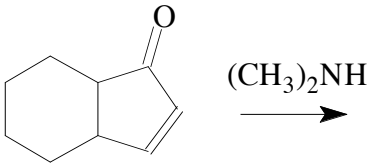


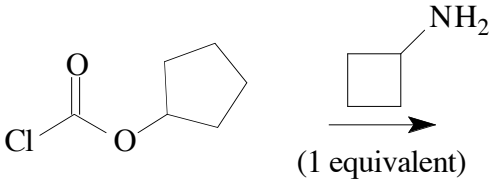
Question 10. (12 Marks) As you have seen in class, a molecule may have more than one reactive centre. The choice of reagent or reaction conditions may determine the outcome of the process. Provide the structure of the major **organic** product(s) expected in each of the following reactions.

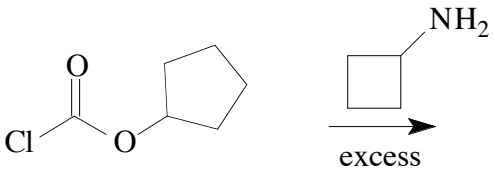




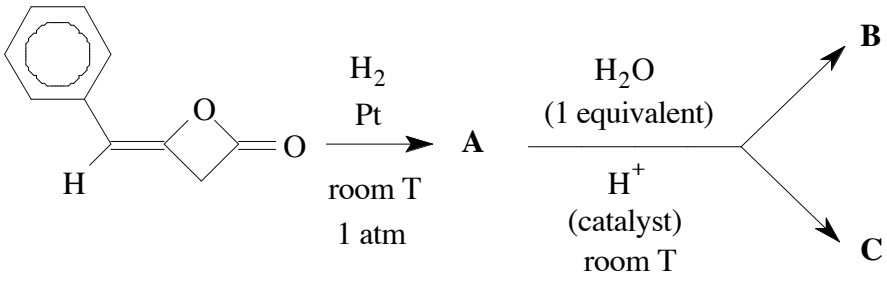








Bonus Question (9 Marks) A research team of Chem 2420 students studied the following process:



Compound A was cleanly converted to compound B in 30 minutes. If the reaction mixture was allowed to stand at room temperature for 6 hours no trace of compound B could be found, instead a new product, compound C, was isolated. Compounds A, B and C all had strong bands in the IR at ~1700 cm^{-1}, while compound B had an additional broad band in the region from 2800 to 3400 cm^{-1}.

Propose structures for compounds A, B and C.

A	**B**	**C**