



INDEX NO:			
-----------	--	--	--

**THE OPEN UNIVRVERSTY OF SRI LANKA**  
**B. Sc. DEGREE PROGRAMME / STAND ALONE COURSE 2007 / 2008**  
**LEVEL 4 - FINAL EXAMINATION**  
**CHU 2221 / CHE 4221 - ORGANIC CHEMISTRY - PAPER I**  
**DURATION: 2 1/2 HOURS**

Saturday 05<sup>th</sup> July 2008

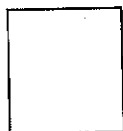
10.00 a.m.-12.30 p.m.

Attempt as many questions as possible.

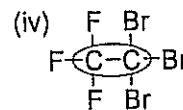
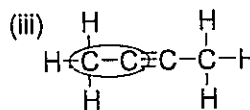
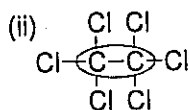
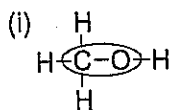
Maximum marks allocated to this paper are 120. However a candidate who scores 100 marks or above will be awarded 100% and those scoring less will be awarded the score they make.

Write your answers in the space provided at each question.

1. Answer both parts.



(a) Consider the encircled bonds in following molecules. State whether each of them is polar or non polar.



.....

.....

.....

.....

(2 Marks)

(b) State, whether each of the above compounds have a dipole moment or not (Yes /No)

i. ....

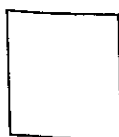
iii. ....

ii. ....

iv. ....

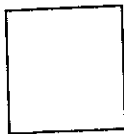
(2 Marks)

2. Give the structure of the product of the following reaction.



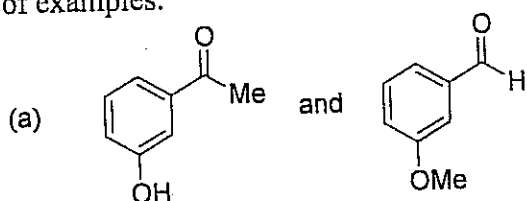
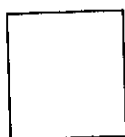
(2 Marks)

3. Briefly giving reasons state whether acetone or propanol has a higher boiling point.

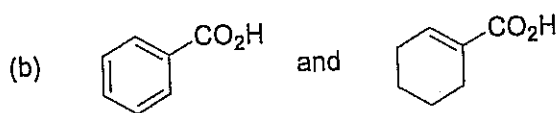


(4 Marks)

4. Give a chemical test to distinguish between the compounds in each of the following pairs of examples.



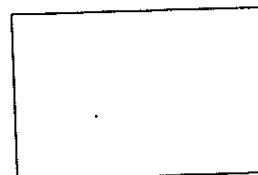
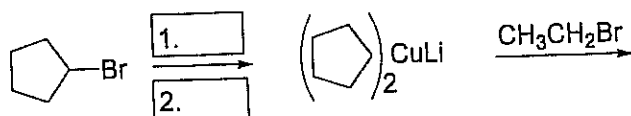
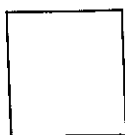
.....  
 .....  
 .....



.....  
 .....  
 .....

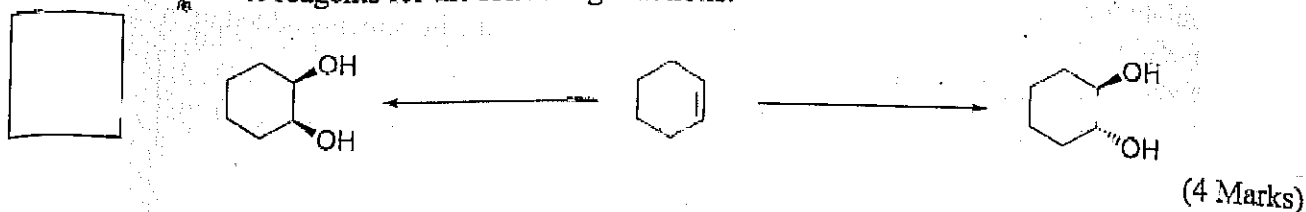
(4 Marks)

5. Give the missing reagents and products of the following reaction scheme.

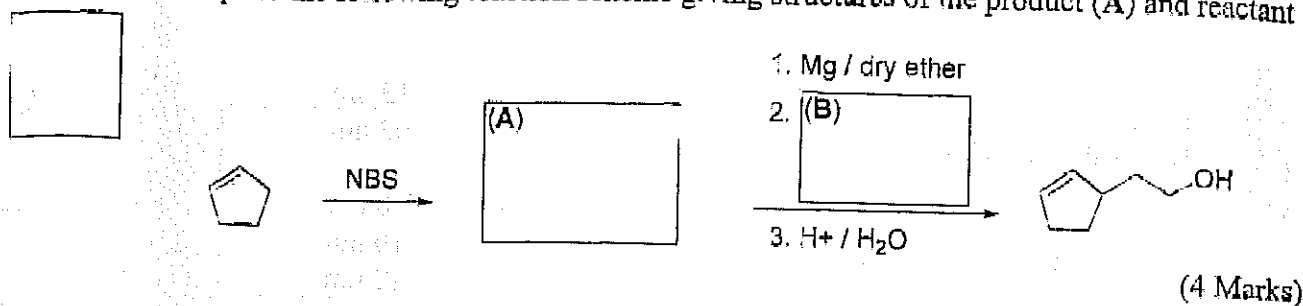


(4 Marks)

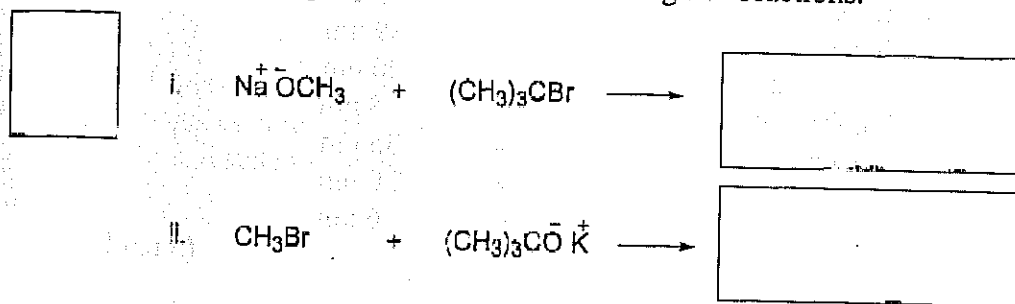
6. Give the reagents for the following reactions.



7. Complete the following reaction scheme giving structures of the product (A) and reactant (B).

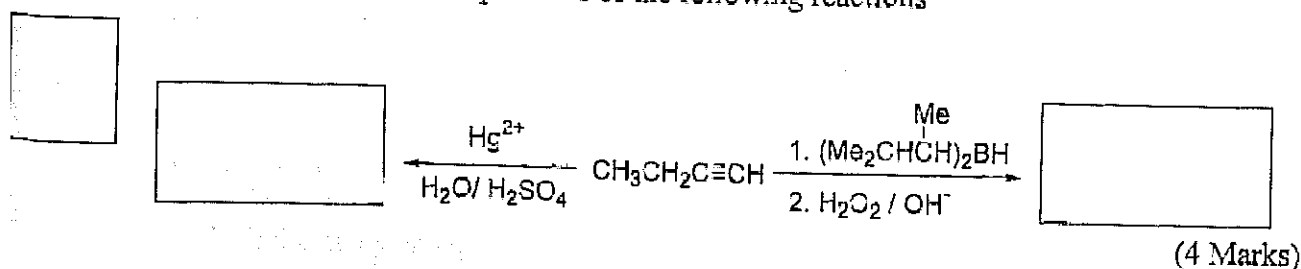


8. Give the major products of the following two reactions.

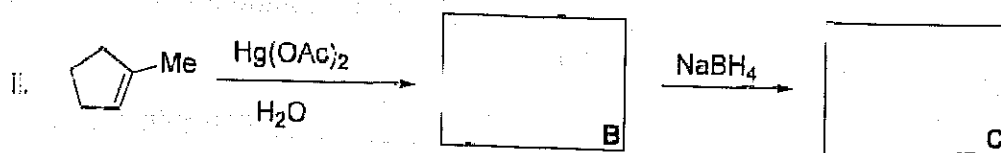
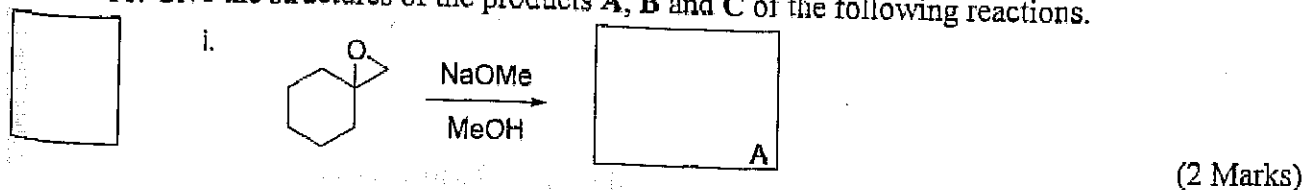


(4 Marks)

9. Give the structures of the products of the following reactions

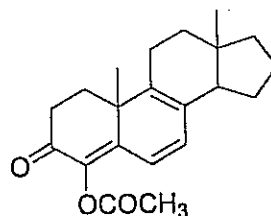
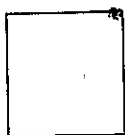


10. Give the structures of the products A, B and C of the following reactions.



(4 Marks)

11. Calculate the expected  $\lambda_{\text{max}}$  of an ethanolic solution of compound A. Some data that will be useful in your calculation are given below. State clearly the increments added to the base value in your calculation.



<b>A</b>		
Base value for a six membered ring enone	=	215 nm
Base value for a five membered ring enone	=	202 nm
Increments for		
Double extending conjugation	=	30 nm
Alkyl group or ring residue at $\alpha$	=	10 nm
$\beta$	=	12 nm
$\gamma$ and higher	=	18 nm
Exocyclic double bond	=	5 nm
Homo annular diene	=	39 nm
Solvent correction for ethanol	=	00 nm
Solvent correction for water	=	8 nm
Polar groupings OH at $\alpha$	=	35 nm
$\beta$	=	30 nm
OCOCH <sub>3</sub> at $\alpha$ or $\beta$	=	6 nm

(5 marks)

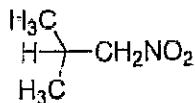
12. B is an aliphatic compound and contains C and H only. B shows peaks at  $3269 \text{ cm}^{-1}$  and  $2110 \text{ cm}^{-1}$  in the IR spectrum. Assign the peaks to the vibrations to the bonding you would expect to be present in the compound.



IR peaks	Bonding
$3269 \text{ cm}^{-1}$	
$2110 \text{ cm}^{-1}$	

(4 marks)

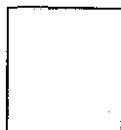
13. The approximate  $\delta$  values of the resonance signals (peaks) of the compound **C** are 1.1, 1.8 and 4.7 ppm. Assign the signals to the hydrogen atoms in **C** by labeling them as A, B and C. Draw the  $^1\text{H}$  NMR spectrum of the compound showing the splitting patterns of the peaks in the box provided.

**C**

5                      4                      3                      2                      1                      0 ( $\delta$  ppm)

(3 marks)

14. Mass spectrum of a compound containing C, H, X (where X is a halogen) only. It shows peaks at  $m/z$  108 and 110 in the ratio 1:1. Identify the element X present in the compound and state the number of atoms of X you would expect the compound to contain.

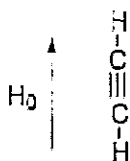


(4 Marks)

15. When acetylene is placed in an external magnetic field ( $H_0$ ).

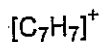
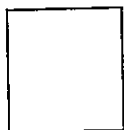


- (a) Draw the lines of force as the result of the secondary magnetic field ( $H_1$ ) generated.  
 (b) Indicate by an equation the magnetic field felt by the protons in acetylene.

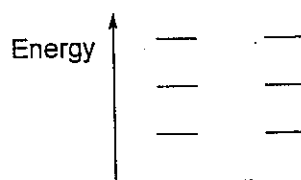


(4 marks)

16. Complete the  $\pi$  molecular orbital diagram of cycloheptatrienyl cation and determine whether it is aromatic or not.



Cycloheptatrienyl cation

 $\pi$  - molecular orbital diagram

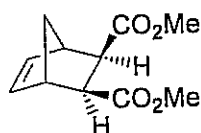
.....

.....

.....

(5 Marks)

17. Give the structures of the dienophile with its stereochemistry and the diene which you would employ to obtain the following compound.



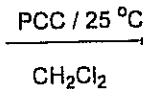
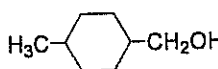
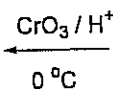
diene



dienophile with its stereochemistry

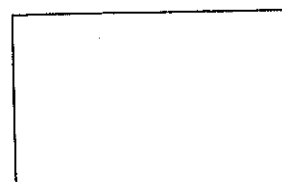
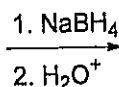
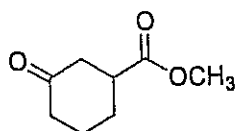
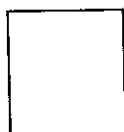
(6 Marks)

18. Give the structures of the products of the following reactions.



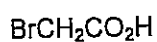
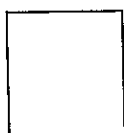
(4 Marks)

19. Give the structures of the products of the following reactions.

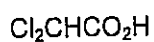


(3 Marks)

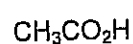
20. Arrange the following acids in the order of increasing acidity.



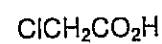
A



B



C

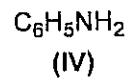
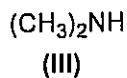
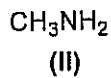


D



(2 Marks)

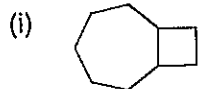
21. Arrange the following compounds in order of increasing basicity.



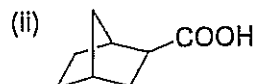
.....<.....<.....<.....

(2 marks)

22. Give the IUPAC name of the compounds given below.



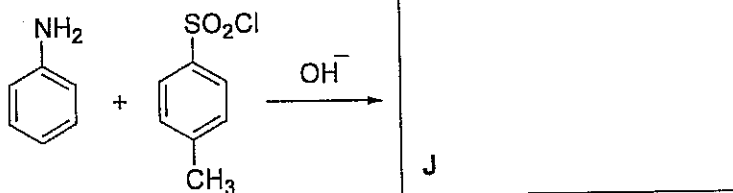
.....



.....

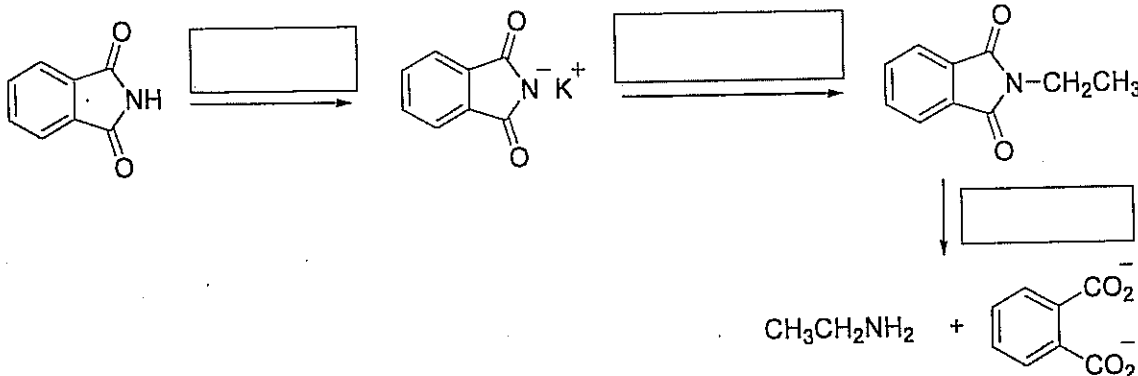
(6 marks)

23. Draw the structure of the product J you expect from the reaction given below.



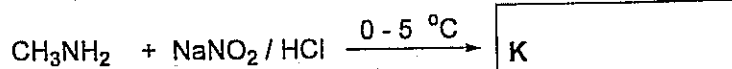
(3 Marks)

24. Complete the reaction given below by drawing the structures of the reagents in the boxes provided.



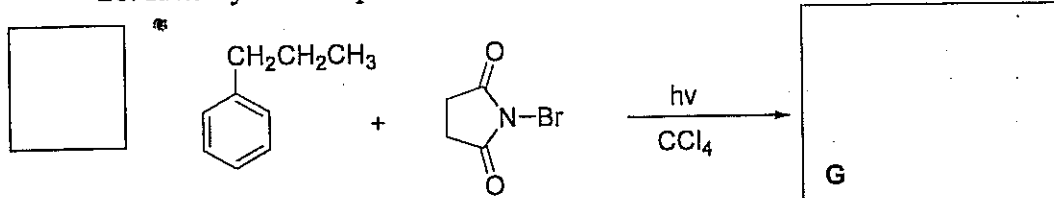
(6 marks)

25. Complete the reaction given below by identifying the product K.



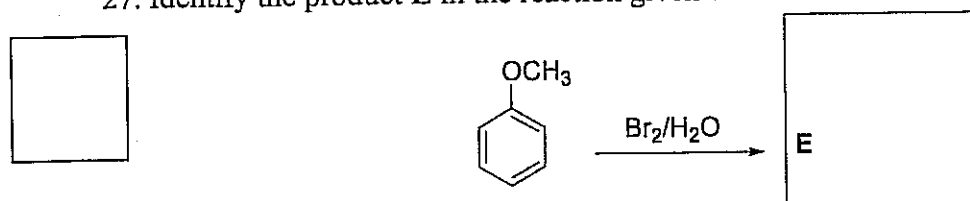
(3 marks)

26. Identify the compound **G**



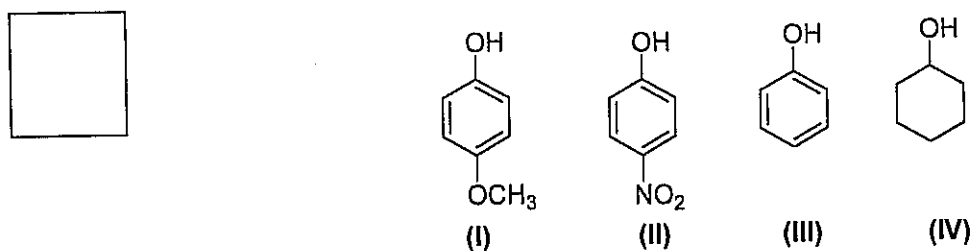
(4 marks)

27. Identify the product **E** in the reaction given below.



(4 marks)

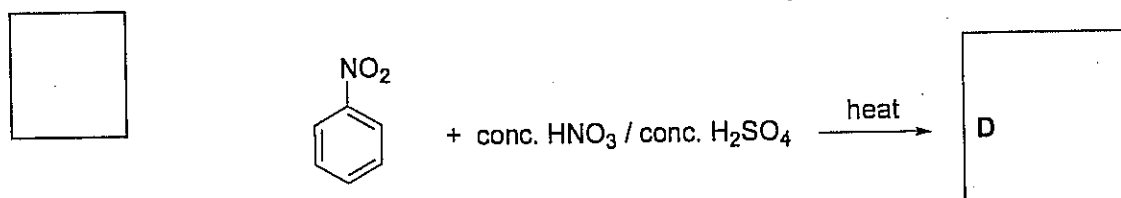
28. Arrange the following compounds in order of increasing  $pK_a$  values.



..... < ..... < ..... < .....

(3 marks)

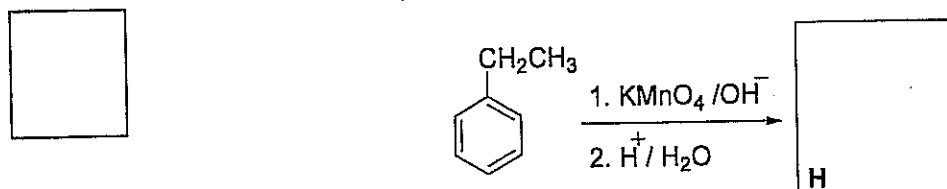
29. Identify the compound **D** in the reaction given below



Identify the electrophile. ....

(6 marks)

30. Predict the product **H** in the reaction given below.



(3 Marks)

Copyrights reserved





THE OPEN UNIVERSITY OF SRI LANKA  
B. Sc DEGREE PROGRAMME / STAND ALONE COURSE 2007/2008  
LEVEL 4 - FINAL EXAMINATION  
CHU 2221 / CHE 4221 - ORGANIC CHEMISTRY - PAPER II  
DURATION: 2 1/2 HOURS

Saturday, 05<sup>th</sup> July 2008

1.30 p.m.- 4.00 p.m.

Answer any FOUR (04) questions. Only the first four answers will be marked.

1. (a) An alkene A ( $C_7H_{12}$ ) underwent ozonolysis in the presence of  $Zn/H_2O$  to give B ( $C_7H_{12}O_2$ ). B gave an orange precipitate with Brady's reagent but did not give silver mirror with Tollens reagent. B when reacted with  $I_2 / NaOH$  followed by acidification gave C ( $C_5H_8O_4$ ) and iodoform. C showed a triplet for 4H, a quintet (split into 5 lines) for 2H and broad singlet for 2H in its  $^1H$  NMR spectrum. C gave the hydrocarbon D when heated with sodalime.

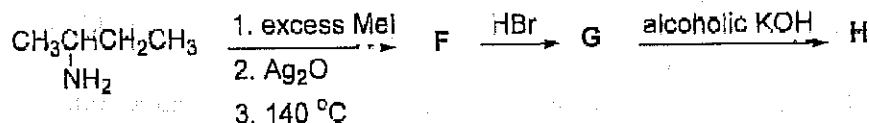
i. Deduce the structures of A, B, C and D.

Compound B when heated with NaOH gave E ( $C_7H_{10}O$ ).

ii. Giving the mechanism, predict the structure of E.

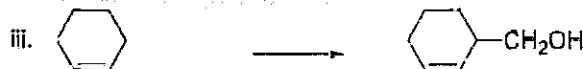
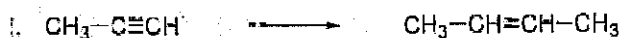
(80 Marks)

- (b) Give the structures of products F, G and H the following reaction scheme.



(20 Marks)

2. (a) Giving necessary reagents and conditions show how you would perform any two (02) of the following conversions.



(30 Marks)

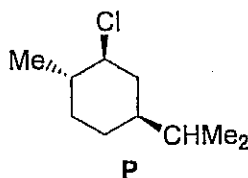
- (b) Rate of hydrolysis of *tert*-butyl chloride [ $\text{Me}_3\text{CCl}$ ] in aqueous medium ( $\text{H}_2\text{O}$ ) depends only on the concentration of alkyl halide.

(i) Give the mechanism of the reaction.

(ii) Draw the completely labeled energy diagram for the reaction.

(30 Marks)

- (c) Draw the two chair conformations of the following compound **P** and label them as **P1** and **P2**. Which conformation is more stable?



**P** was treated with alcoholic KOH. Giving explanations, answer the following.

- (i) Which conformation is capable of reacting with alcoholic KOH?
- (ii) Give the mechanism of the above reaction.
- (iii) What is/are the product(s) of this reaction?

(40 Marks)

3. (a) 'In the IR spectrum of  $\text{CH}_3\text{COCH}_3$  the absorption due to  $>\text{C}=\text{O}$  stretching is seen at  $1715\text{ cm}^{-1}$  while that in acetophenone ( $\text{C}_6\text{H}_5\text{COCH}_3$ ) is at  $1683\text{ cm}^{-1}$ . Explain the above statement.

(25 Marks)

- (b) Explain why benzene shows a resonance signal at  $\delta = 7.27\text{ ppm}$  in the  $^1\text{H NMR}$  while ethylene shows the signal at  $\delta = 4.6\text{ ppm}$ .

(25 Marks)

- (c) Toluene ( $\text{C}_6\text{H}_5\text{CH}_3$ ) shows a base peak at  $m/z\ 91$ .

- (ii) Draw the structure of the stable positively charged fragmented ion responsible for this peak
- (iii) Indicate the mechanism for the formation of this fragmented ion.

(25 Marks)

- (d)  $\text{CH}_3\text{CHO}$  shows a UV absorption at  $190\text{ nm}$  ( $\log \epsilon = 2.0$ ) and at  $290\text{ nm}$  ( $\log \epsilon = 1.0$ ).

- (i) Indicate the transitions responsible for the above absorptions.
- (ii) Explain why the two absorptions differ in wave length.

(25 Marks)

4. (a) What do you understand by the term "resonance energy of benzene"?

(15 Marks)

- (b) 'Typical reactions of benzene are electrophilic substitution reactions'. Explain the above statement in relation to the structure and relative stability of benzene.

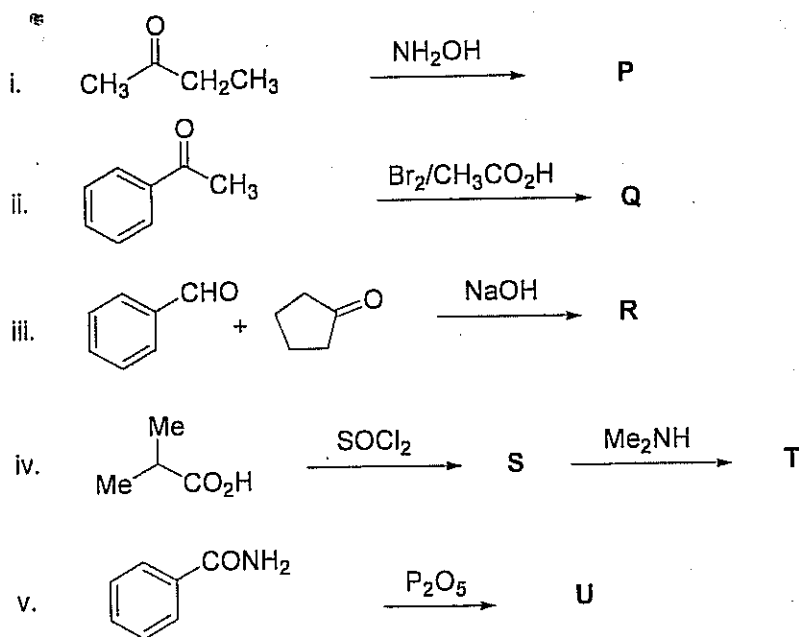
(15 Marks)

- (c) Consider the reaction of acetaldehyde ( $\text{CH}_3\text{CHO}$ ) with ethanol ( $\text{EtOH}$ ).

- (i) Explain why the reaction is extremely slow without the presence of mineral acids while mineral acids catalyze the reaction.
- (ii) Give the mechanism and the product of the above mechanism.

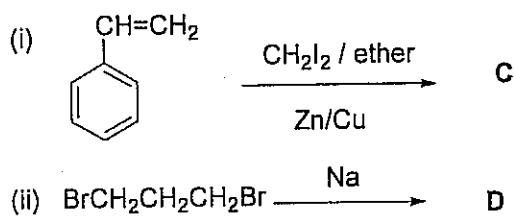
(30 Marks)

(d) Give the structures of **P – U** of the following reactions.



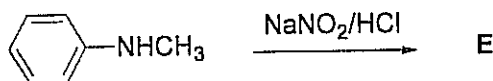
(40 Marks)

5. (a) Identify the compounds **C** and **D** in the reactions given below.



(20 Marks)

(b) (i) Identify the compound **E** in the reaction given below.  
 (ii) Give the mechanism of the reaction involved.

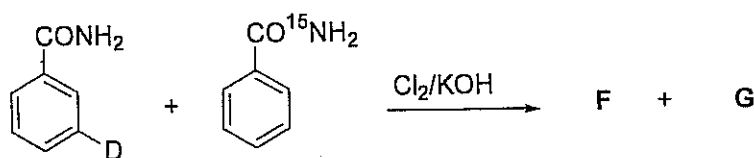


(30 Marks)

(c) Explain why  $K_b$  value of aniline is  $4.2 \times 10^{-10}$  while that of *p*-nitroaniline is  $0.001 \times 10^{-10}$ .

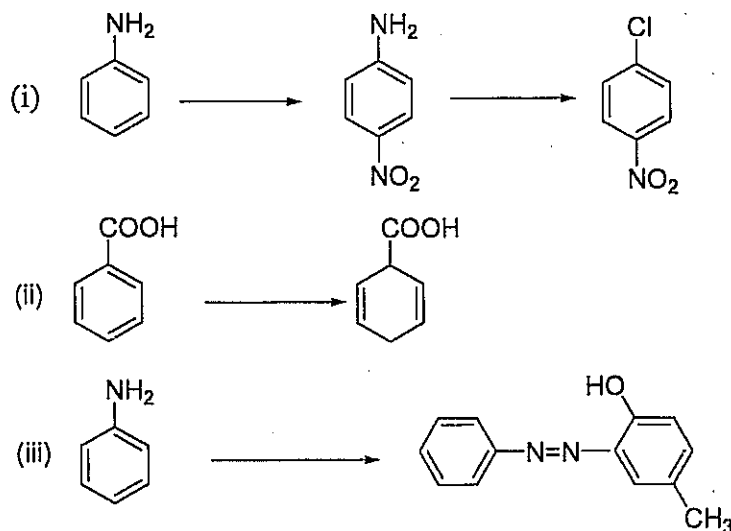
(25 Marks)

(d) Identify the products **F** and **G** in the reaction given below and indicate the positions of the isotopes ( $\text{D}$  and  $^{15}\text{N}$ ) in the products.



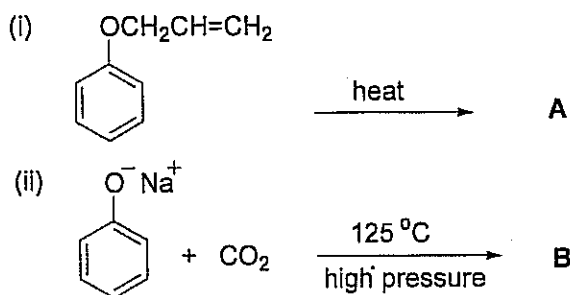
(25 Marks)

- i. (a) Giving necessary reagents and reaction conditions indicate how you would effect the following conversions.  
**N.B. Conversions may involve more than one step.**



(60 Marks)

- (b) (i) Identify the products **A** and **B** in the reactions given below.  
 (ii) Give the mechanism of the reactions involved in the formation of compounds **A** and **B**



(40 Marks)

*Copyrights reserved*