

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**DEPARTMENT OF APPLIED CHEMISTRY**

**BACHELOR OF SCIENCE HONOURS DEGREE**

**END OF FIRST SEMESTER EXAMINATIONS – JUNE 2010**

**ORGANIC CHEMISTRY I –SCH 1221**

**FOR CHEMICAL ENGINEERING STUDENTS (TCE)**

**TIME: 3 HOURS**

**INSTRUCTIONS TO CANDIDATES**

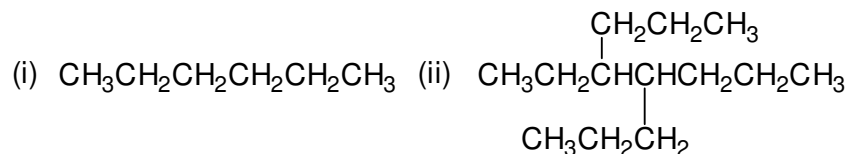
1. ANSWER **ALL** QUESTIONS FROM SECTION A AND **ANY THREE** FROM SECTION B. SECTION A CARRIES 40 MARKS AND EACH QUESTION IN SECTION B CARRIES 20 MARKS.
2. START EACH QUESTION ON A NEW PAGE. (NOT EACH PART OF THE QUESTION.)
3. SHOW MECHANISM, CHEMICAL STEPS OR SYNTHESIS BY MEANS OF CURVED ARROWS.

**TOTAL MARKS = 100**

THIS QUESTION PAPER CONSISTS OF **FIVE PRINTED PAGES** (ON ONE SIDE ONLY) INCLUDING THE TOP PAGE WITH THE INSTRUCTIONS.

**SECTION A:**

1. (a) Give IUPAC names for the following compounds.



(2 Marks)

(b) Draw the structural formulae for the following compounds.

- (i) trans-1,2-dimethylcyclopentane.  
(ii) 3-propyl-4,7-dimethyl nonane

(2 Marks)

(c) Draw E and Z configuration for the following alkene and indicate priority on the structure.



(4 Marks)

(d) Show the steps to assign either R and/or S designation to each chiral centres in the following compound.



(6 Marks)

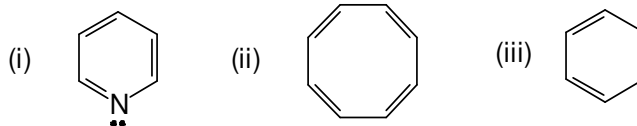
(e) With good explanation draw the most stable chair conformation for 1-bromo-2-methyl cyclohexane.

(4 Marks)

(f) Explain Huckel's rule in your own words.

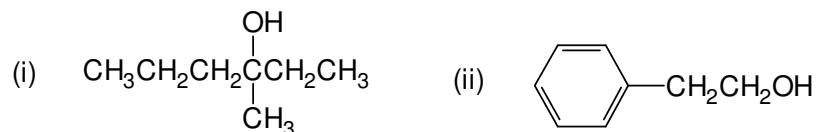
(4 Marks)

(g) State whether the following compounds are aromatic or non-aromatic and also indicate the number of pi electrons which support your answer. Marks will not be given if one of the answers is not correct.



(6 Marks)

- (h) What Grignard reagents and what carbonyl compounds might you start with to prepare the following alcohols. Write reaction mechanism for one of the alcohols.



(6 Marks)

- (i) Draw the structures for the starting materials which would react under basic condition to give the following ether. Write reaction mechanism for the ether.



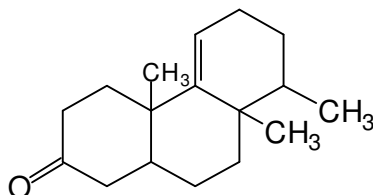
(4 Marks)

- (j) Draw the structures of the final products for the reaction between but-2-ene with

- (i) alkaline  $\text{KMnO}_4$   
(ii) acidic  $\text{KMnO}_4$

(3 Marks)

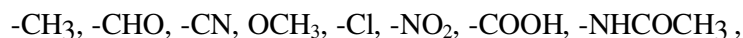
- (k) Mark with an asterisk (\*) all chiral centres present in the following compound. (Marks will be deducted for the wrong marking).



(3 Marks)

### SECTION B:

2. (a) From the list given below, select the substituents, which are (i) ortho/para directing and (ii) meta-directing. (Mark will be deducted for the wrong answer.)



(4 Marks)

(b) Draw the structures of the products and give IUPAC names for the following reactions. Indicate also if there is a major product. (No reaction mechanism required.)

(i) reaction of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}\equiv\text{CCH}_2\text{CH}_3$  with  $\text{Li}/\text{NH}_3$  and  $\text{H}_2\text{O}$ .

(ii) reaction of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}\equiv\text{CCH}_2\text{CH}_3$  with Lindler catalyst.

(iii) reaction of  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$  with  $\text{HCl}$  in presence of peroxide.  
(8 Marks)

(c) Dehydrohalogenation of 2-bromobutane with potassium hydroxide in ethanol yields a mixture of two products.

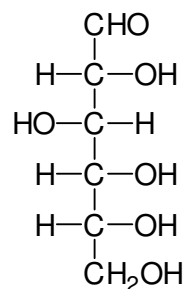
(i) Write reaction mechanism for the reaction.

(ii) State with good reason which product you would expect to be predominant.  
(8 Marks)

3. (a) What are anomers?

(4 Marks)

(b) The structure of D-glucose is as follows.



D - GLUCOSE

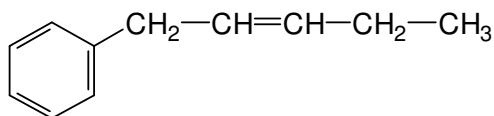
Draw reaction mechanism for Haworth projection from D-glucose. Suggest the name of the chemical reaction that has taken place

(5 Marks)

(ii) Draw  $\alpha$  and  $\beta$  anomers of D-glucopyranose.

(4 Marks)

(c) What carbonyl compound and what phosphorus ylide might you use to prepare the following alkene? What is the importance of the reaction?



(3 Marks)

(d) Draw all the possible isomers of a compound with molecular formula  $C_4H_9Br$ . Write IUPAC names for the compounds. (4 Marks)

4. (a) Discuss  $sp$  hybridisation with an appropriate organic compound of your choice. Draw orbital as well as bonded structures and indicate the shape of the molecule. (8 Marks)

(b) Starting with benzene as your only source of aromatic compound, how would you synthesise the following compounds? Assume that you can separate isomers if necessary.

(i) *m*-chloronitrobenzene (4 Marks)

(ii) *o*-bromonitrobenzene (4 Marks)

(iii) Propylbenzene (4 Marks)

5. (a) Write reaction mechanism for  $S_N^1$  and  $S_N^2$  reactions. Use starting material of your choice. (10 Marks)

(b) Write reaction mechanism for the acid catalysed dehydration of 3,3-dimethylbutan-2-ol. Explain with good reason if there is a major product. (6 marks)

(c) Write the chemical reaction between alkene and ozone followed by  $Zn/CH_3COOH$ . Suggest the importance of the reaction. Use alkene of your choice. (4 Marks)

\*\*\*\*\* **END OF QUESTION PAPER** \*\*\*\*\*