



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
END OF SECOND SEMESTER EXAMINATIONS – MAY 2011
ORGANIC CHEMISTRY – SCH 1221
FOR CHEMICAL ENGINEERING STUDENTS (TCE)

TIME – 3 HOURS

INSTRUCTIONS TO CANDIDATES

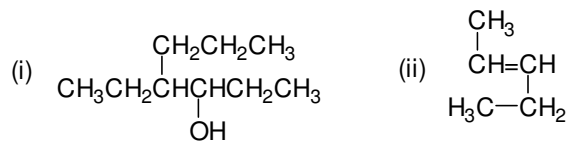
1. ANSWER **ALL** QUESTIONS FROM SECTION A AND **ANY THREE** FROM SECTION B. SECTION A CARRIES 40 MARKS AND EACH QUESTION IN SECTION B CARRIES 20 MARKS.
2. START NEW QUESTION ON A NEW PAGE. (NOT EACH PART OF A QUESTION.)
3. SHOW MECHANISM, CHEMICAL STEPS OR SYNTHESIS BY MEANS OF CURVED ARROWS.

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) cis-1,2-dimethylcyclohexane.
(ii) 3-propyl-4,7-dimethyl non-1-ene

(2 Marks)

(c) Draw E and Z configuration, indicate priority on the structure and also name cis and trans on the same configuration for the following alkene.



(4 Marks)

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

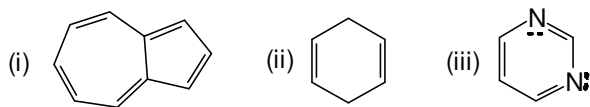


(6 Marks)

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

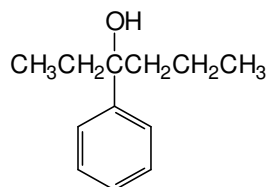
(4 Marks)

(g) State whether the following compounds are aromatic or non-aromatic and also indicate the number of pi electrons which support your answer.



(6 Marks)

(h) Write reaction mechanism for the following alcohol using appropriate Grignard reagent and carbonyl compound.



(5 Marks)

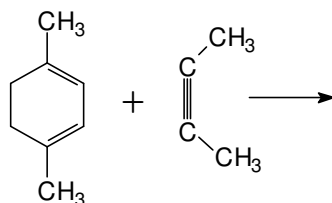
(i) Write reaction mechanism for the synthesis of the following ether.



What is the name of the reaction?

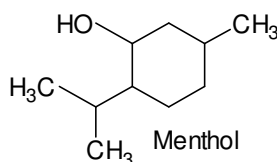
(4+1 Marks)

(j) Write reaction mechanism for the product of the following Diel-Alders reaction.



(3 Marks)

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



(3 Marks)

SECTION B:

2. (a) What do you understand by free radical reaction?

(2 Marks)

Write reaction mechanism for the reaction between pent-2-ene and HCl in the presence of peroxide. Indicate with good reason the major product.

(8 Marks)

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

(i) reaction of $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}=\text{CCH}_2\text{CH}_3$ with Li/NH_3 and H_2O .

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

(4 Marks)

(c) Acid catalysed dehydration of hexan-2-ol yields a mixture of two products.

(i) Write reaction mechanism for the reaction.

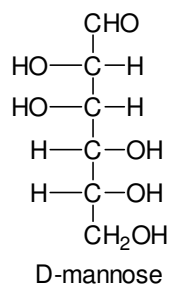
(ii) State with good reason which product you would expect to be predominant.

(6 Marks)

3. (a) The reaction between hex-3-ene and alkaline potassium permanganate produces dihydroxy hexane. This product is optically active. Use Fischer projections to draw as many stereoisomers as possible and label them as enantiomers, diastereoisomers and meso compounds.

(8 Marks)

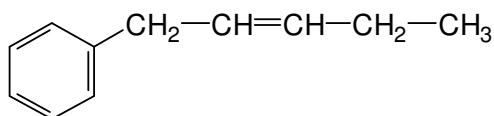
- (b) The structure of D-mannose is as follows.



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

(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? Write reaction mechanism for the reaction.



(8 Marks)

4. (a) Discuss Sp^2 hybridisation with an appropriate organic compound of your choice. Draw orbital as well as bonded structures and indicate the shape of the molecule.

(10 Marks)

- (b) Synthesise the following compounds. Use reagents of your choice. Assume that you can separate isomers if necessary.

(i) *p*-bromophenylamine from nitrobenzene

(6 Marks)

(ii) Propylbenzene from benzene

(4 Marks)

5. (a) Write reaction mechanism for $\text{S}_\text{N}1$ reaction. Use starting material of your choice.

(4 Marks)

(b) With an appropriate example write a reaction mechanism for electrophilic substitution reaction.

(6 Marks)

(c) Write the products and its IUPAC names for the chemical reaction between $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CHCH}_3$ and ozone followed by reduction with $\text{Zn}/\text{CH}_3\text{COOH}$. Suggest the importance of the reaction. (No reaction mechanism required).

(6 Marks)

(d) Draw the most stable chair conformation (one) for the compound 1,4-dichlorocyclohexane. Explain the stability of the conformation. Is this conformation cis or trans?

(4 Marks)

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