



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**DEPARTMENT OF APPLIED CHEMISTRY**

**BACHELOR OF SCIENCE HONOURS DEGREE**

**SUPPLEMENTARY EXAMINATIONS – SEPTEMBER 2010**

**ORGANIC CHEMISTRY I – SCH 1102**

**FOR APPLIED CHEMISTRY STUDENTS**

**TIME: 3 HOURS**

**INSTRUCTION TO CANDIDATES**

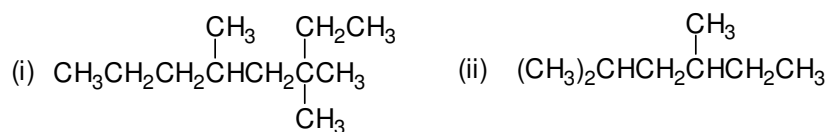
1. ANSWER ALL QUESTIONS IN SECTION A AND ANY THREE FROM SECTION B. SECTION A CARRIES 40 MARKS AND EACH QUESTION IN SECTION B CARRIES 20 MARKS.
2. SHOW MECHANISM, CHEMICAL STEPS OR SYNTHESIS BY MEANS OF CURVED ARROWS.
3. GRAPH PAPER WILL BE PROVIDED ON REQUEST.

**TOTAL MARKS = 100**

THIS QUESTION PAPER CONSISTS OF **FOUR 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) The following names are incorrect. Draw the structure and provide proper IUPAC names.

- (i) 3-propyl-4,7-dimethyl nonane  
(ii) 4-heptyne  
(iii) 4,4,3-trimethylpentane

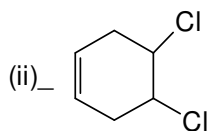
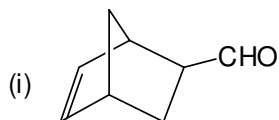
(6 Marks)

- (c) Assign E or Z configuration to the following alkene. Indicate priority on the structure.



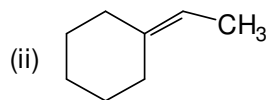
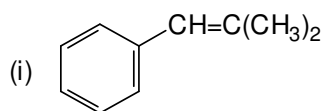
(4 Marks)

- (d) Draw the structures for dienes and dienophiles to synthesise the following products.



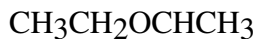
(4 Marks)

- (e) What carbonyl compounds and what phosphorus ylides might you use to prepare the following compounds?



(4 Marks)

- (f) Predict the splitting pattern you would expect from the underlined protons indicated in the following molecule.



(4 Marks)

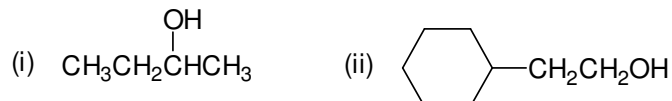
- (g) What information does the term below give?

$\alpha = -3.5^\circ$

(4 Marks)

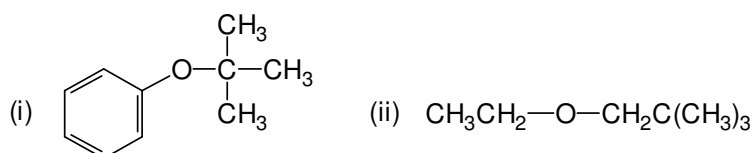
(h) With an appropriate example explain positional isomer. (4 Marks)

(i) What Grignard reagent and what carbonyl compound might you start with to prepare the following alcohol.



(4 Marks)

(j) What metal alkoxides and what halides might you start with to synthesise the following ethers?



(4 Marks)

### **SECTION B:**

2. (a) Write a reaction mechanism of acid catalysed dehydration of 3-methyl-hexan-3-ol. Draw the structures of all possible products. With a good reason explain which product will be predominant.

(8 Marks)

(b) With an appropriate example write reaction mechanism for  $\text{S}_{\text{N}}^1$  and  $\text{S}_{\text{N}}^2$  reactions.

(8 Marks)

(c) What are the functions of the following spectrometers?

- (i) Infra-red spectrometer
- (ii) Ultraviolet/visible spectrometer
- (iii) proton ( $^1\text{H}$ ) NMR spectrometer
- (iv) mass spectrometer

(4 Marks)

3. (a) The reaction between hex-3-ene and bromine produces dibromohexane. The product is an optically active compound. Use Fischer projections to draw as many stereoisomers of the product as possible and label them as enantiomers, diastereoisomers and meso compound.

( 10 Marks)

(b) Construct a potential energy diagram for 1,2-dichloro ethane.

- (i) Draw Newman projections to indicate locations of the various conformations on the graph. Ignore the energy value for the each projection.  
 (ii) Suggest the most stable conformation and the least stable conformation.  
 (10 Marks)

4. (a) An organic compound A, of molecular weight 122, has the following composition by mass: C = 78.7%; H = 8.2%; and O = 13.1%
- (i) Calculate empirical formula (3 Marks)  
 (ii) Calculate molecular formula. (2 Marks)

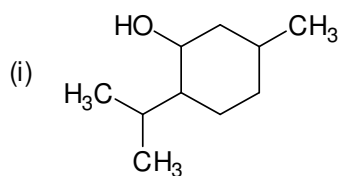
Relative Atomic Mass: C = 12; H = 1; O = 16

- (b) Discuss  $sp^3$  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)

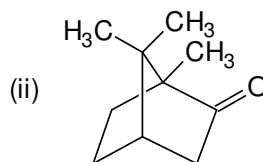
- (c) You are given prop-1-yne, chloromethane, base such as sodium amide and a catalyst. Write reaction mechanism for the synthesis of cis-butene. Suggest the name of the catalyst you will use.  
 (7 Marks)

5. (a) Predict the product(s) of the following reactions and provide IUPAC names for the product(s). (No mechanism required)
- (i) Reaction of hex-2-ene with alkaline  $KMnO_4$ . (2 Marks)  
 (ii) Oxidation of pent-2-ene with ozone and  $Zn/CH_3COOH$ . (4 Marks)

- (c) Mark with an asterix (\*) all chiral centres present in the following compounds. (Marks will be deducted for the wrong marking).



Menthol



Camphor

(5 Marks)

- (e) Addition of one mole of  $Cl_2$  to  $CH_2=CHC(CH_3)=CH_2$  gives more than one product. Write reaction mechanism for this reaction and draw all possible structures. With a good reason, explain which product will be predominant.  
 (9 Marks)

**END OF QUESTION PAPER**