



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY

BACHELOR OF SCIENCE HONOURS DEGREE

FIRST SEMESTER EXAMINATIONS – JANUARY 2011

ORGANIC CHEMISTRY I – SCH 1102

FOR SCH AND TTE STUDENTS

TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES

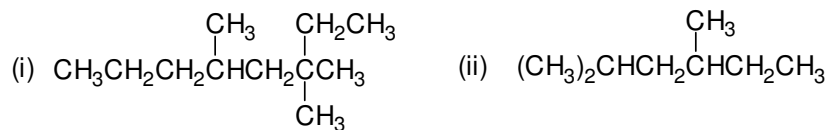
1. ANSWER ALL QUESTIONS IN SECTION A AND ANY THREE FROM SECTION B. SECTION A CARRIES 40 MARKS AND EACH QUESTION IN SECTION B CARRIES 20 MARKS.
2. SHOW MECHANISM, CHEMICAL STEPS OR SYNTHESIS BY MEANS OF CURVED ARROWS.
3. GRAPH PAPER WILL BE PROVIDED ON REQUEST

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) 4-hexyne
(ii) 4,4,3-trimethylpentane

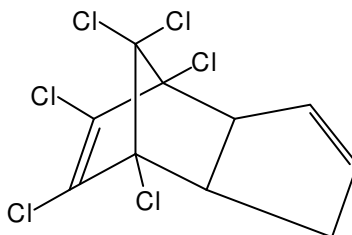
(4 Marks)

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



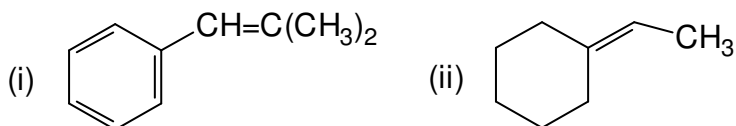
(2 Marks)

- (d) Draw the structures for diene and dienophile to synthesise the following product. Write reaction mechanism for the product. Use curved arrows for the reaction mechanism.



(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?

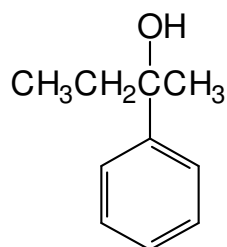
$$[\alpha] = -3.5^\circ$$

(4 Marks)

(h) With an appropriate example explain positional isomer.

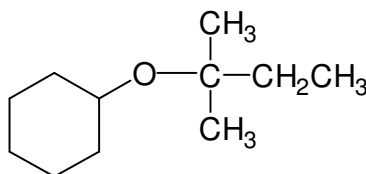
(4 Marks)

(i) What Grignard reagent and what carbonyl compound might you start with to synthesise the following alcohol. Write reaction mechanism for the product.



(4 Marks)

(j) What metal alkoxides and what halide might you start with to synthesise the following ether? Write reaction mechanism for the ether.



(4 Marks)

(k) The following names are incorrect. Draw the structures and provide correct IUPAC names.

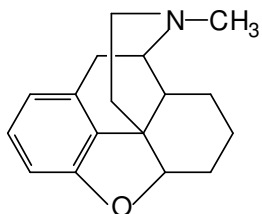
- (i) 2,2-dimethyl-6-ethyl heptane
- (ii) pentan-4-ol

(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 appropriate examples write reaction mechanism for S_N^1 and S_N^2 reactions. (8 Marks)
- (c) What are the functions of the following spectrometers?
- (i) Infra-red spectrometer
 - (ii) Ultraviolet/visible spectrometer
 - (iii) proton (^1H) 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. (12 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. (8 Marks)
4. (a) A liquid L has the composition by mass as follows:
C= 54.4%; H=9.1%; and O=36.4%
- (i) Calculate empirical formula (3 Marks)
 - (iii) Calculate molecular formula. (3Marks)
- Relative Atomic Mass: C = 12; H = 1; O = 16
- The mass spectrum, the infra-red spectrum and ^1H (proton) NMR is given in Fig.1, Fig.2 and Fig.3 respectively
- Propose a possible bonded structure for the compound L.
- Explain your interpretation of IR and NMR spectrum which support your proposed structure of liquid L. (6 Marks)
- (b) You are given prop-1-yne, chloromethane, base such as sodium amide and a catalyst. Write reaction mechanism for the synthesis of cis-but-2-ene. Suggest the name of the catalyst you will use. (8 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 hept-3-ene with acidic KMnO_4 . (2 Marks)
- (ii) Oxidation of pent-2-ene with ozone and $\text{Zn}/\text{CH}_3\text{COOH}$. (4 Marks)
- (c) Mark with an asterisk (*) all chiral centres present in the following compounds. (Marks will be deducted for the wrong marking).



morphine

(5 Marks)

- (e) Addition of one mole of Br_2 to $\text{CH}_2=\text{CHC}(\text{CH}_3)=\text{CH}_2$ 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