



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY

BACHELOR OF SCIENCE HONOURS DEGREE

SUPPLEMENTARY EXAMINATIONS – AUGUST 2014

ORGANIC CHEMISTRY I – SCH 1102

FOR SCH AND TTE STUDENTS

TIME: 3 HOURS

INSTRUCTION TO CANDIDATES

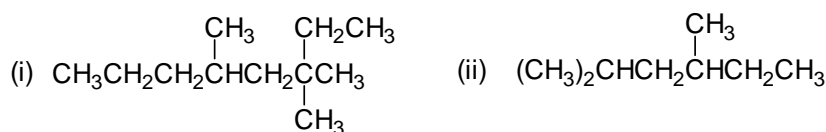
1. ANSWER ALL QUESTIONS IN SECTION A AND ANY THREE FROM SECTION B. SECTION A CARRIES 40 MARKS AND EACH QUESTION IN SECTION B CARRIES 20 MARKS.
2. SHOW MECHANISM, CHEMICAL STEPS OR SYNTHESIS BY MEANS OF CURVED ARROWS.
3. GRAPH PAPER WILL BE PROVIDED ON REQUEST.

TOTAL MARKS = 100

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

- (i) 2,2-dimethyl-6-ethylheptane
- (ii) 4-heptyne
- (iii) 1,5-dimethylcyclohexane

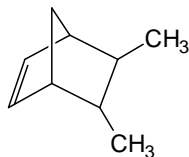
(6 Marks)

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



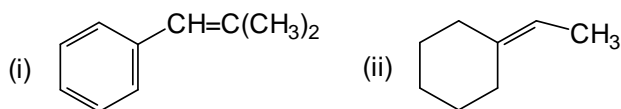
(6 Marks)

(d) Draw orbital diagram for diene and dienophile for the formation of the following pericyclic product.



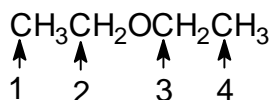
(4 Marks)

(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 in proton NMR spectrum indicated in the following molecule.



(4 Marks)

(g) What information does the term below give?

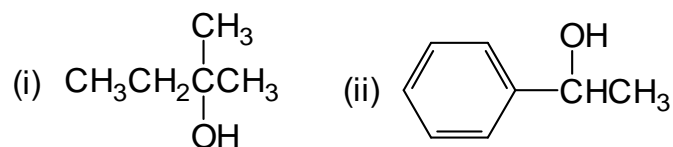
$$[\alpha]^{25} = +2.5^\circ$$

(4 Marks)

(h) Draw functional isomer for the molecular formula $\text{C}_3\text{H}_6\text{O}$ With an appropriate example explain functional isomer.

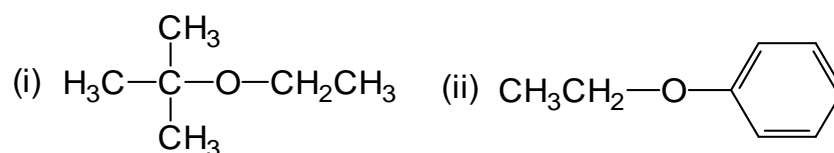
(4 Marks)

- (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?

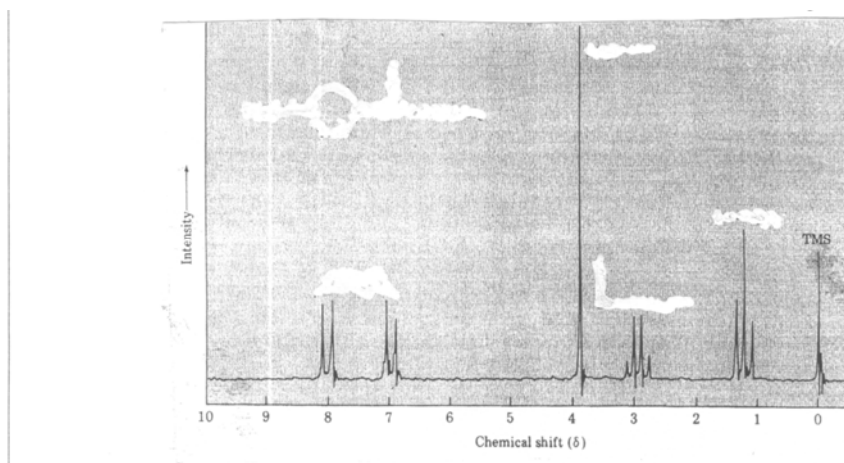


(4 Marks)

SECTION B:

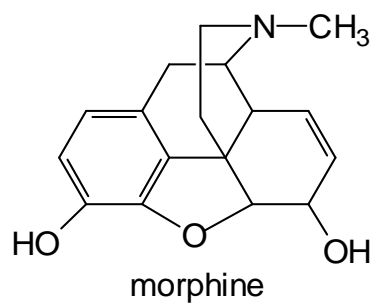
2. (a) Write a reaction mechanism of acid catalysed dehydration of 2-methyl-butan-2-ol. Draw the structures of all possible products. With a good reason explain which product will be predominant. (8 Marks)
- (b) The rate of for S_{N}^1 and S_{N}^2 reactions depend on certain factors. Indicate those factors that involve in rate determining steps. (No mechanism or structures required) (8 Marks)
- (c) What are the functions of the following spectrometers? (4 Marks)
- (i) Infra-red spectrometer
 - (ii) Ultraviolet/visible spectrometer
 - (iii) proton (^1H) NMR spectrometer
 - (iv) mass spectrometer
3. (a) The reaction between but-2-ene and alkaline KMnO_4 produces dihydroxybutane. 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 against the rotation between C₂ and C₃ for butane.
- (h) 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) Hydrogenation of (S)-3-amino hex-1-yne gives optically active 3-hexylamine of opposite configuration (R) to that of the original substance. With the aid of Fischer projections, explain this observation. (5 Marks)
- (b) Discuss S_p 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 acidic KMnO₄. (2 Marks)
- (ii) Oxidation of hept-3-ene with ozone and Zn/CH₃COOH. (4 Marks)
- (b) The ¹H (proton) NMR of aromatic compound with molecular formula C₁₀H₁₂O given below. Propose a possible structure and assign peaks in the spectrum to your structure. This compound contains alkoxy as well as keto group.



(9 Marks)

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



(5 Marks)

END OF QUESTION PAPER