



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

ORGANIC CHEMISTRY I

SCH 1102

FOR SCH STUDENTS ONLY

First Semester Examination Paper

December 2017

This examination paper consists of 5 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: Graph paper on request

Examiner's Name: DR C T PAREKH

INSTRUCTIONS

- 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. Show mechanism, chemical steps or synthesis by means of curved arrows.**

MARK ALLOCATION

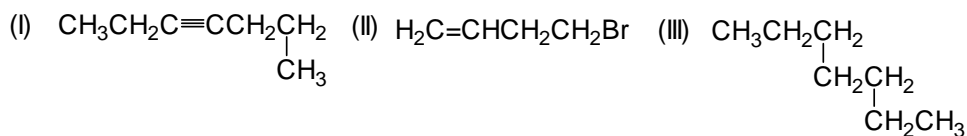
QUESTION	MARKS
1.	40
2.	20
3.	20
4.	20
5.	20
TOTAL POSSIBLE MARKS	100

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SECTION A:

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



(3 Marks)

(b) The following names are incorrect. Draw the structure and provide proper IUPAC names.

- (i) 2,2-dimethyl-6-ethylheptane
(ii) 4-heptyne

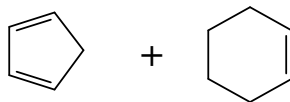
(4 Marks)

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



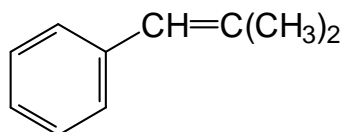
(6 Marks)

(d) Predict the product of the following pericyclic reaction. Use curved arrows to illustrate how you got the product.



(4 Marks)

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



(3 Marks)

(f) What information does the term below give?

$$[\alpha]_D^{25} = + 1.8^\circ$$

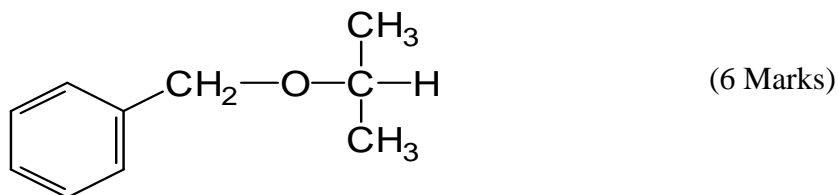
(4 Marks)

(g) With an appropriate example explain “functional isomer”.
(4 Marks)

(h) What Grignard reagent and what carbonyl compound might you start with to prepare the following alcohol? Write a reaction mechanism for the preparation of the alcohol. (Use curved arrows to express the mechanism).



(i) What metal alkoxide and what halide might you start with to synthesise the following ether? Write a reaction mechanism for the preparation of the ether. (Use curved arrows to express the mechanism).



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 SN1 and SN2 reactions depends on mainly four factors. With an example, suggest those factors that are involved in the rate determining steps. (No mechanism or structures are required)

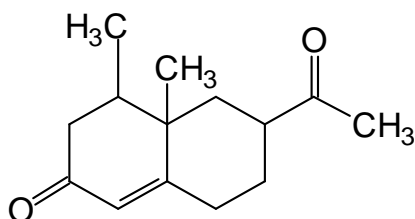
(8 Marks)

(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 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) (i) Draw and suggest the name of various Newman projections for 1,2-dichloroethane. (4 Marks)
(ii) Indicate the most stable conformation and the least stable conformation. (2 Marks)
- (c) Draw resonance structures of an allylic cation formed by protonation of 1,3-butadiene. (4 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 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)
- (c) You are given prop-1-yne, chloromethane, base such as sodium amide, reducing agent such as hydrogen(H_2) and a catalyst. Write a reaction mechanism for the synthesis of cis-but-2-ene. 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 KMnO_4 . (3 Marks)
- (ii) Oxidation of hept-3-ene with ozone and $\text{Zn}/\text{CH}_3\text{COOH}$. (4 Marks)
- (b) Mark with an asterisk (*) all chiral centres present in the following compound. (Marks will be deducted for the wrong marking).



(3 Marks)

(c) A compound X with a molecular formula of 185 contains 52.4% carbon, 4.8% hydrogen and 42.8% bromine.

(i) Calculate the empirical formula and

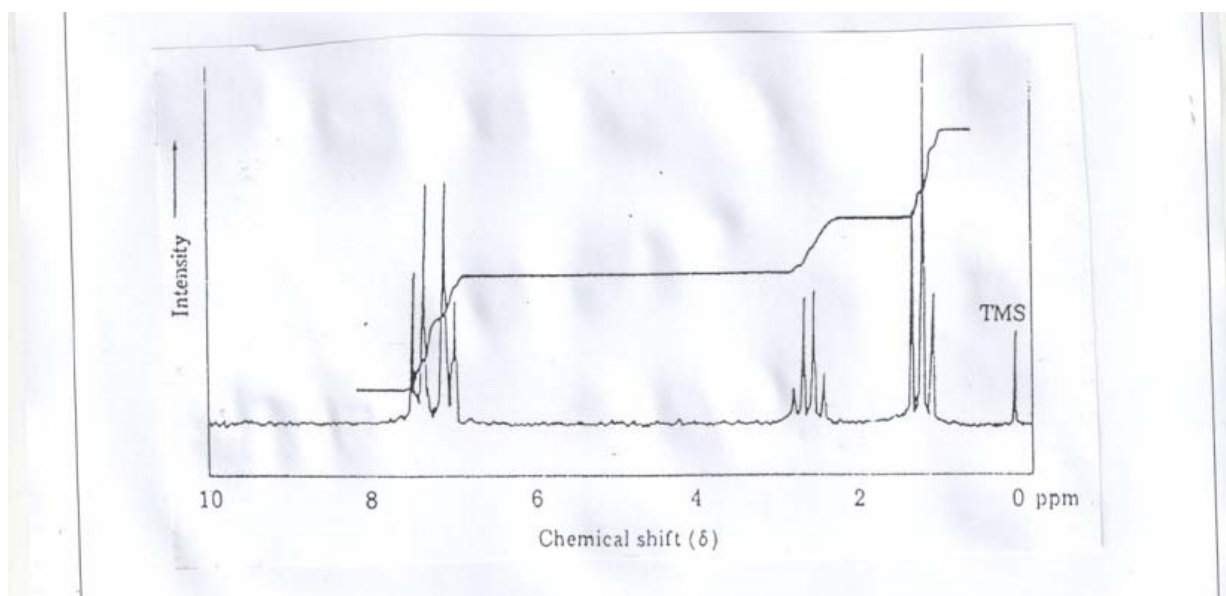
(ii) Calculate molecular formula

The proton NMR spectrum of compound X is given in the figure below.

Propose a possible structure for X and assign peaks in the NMR spectrum to your answer.

Relative Atomic Mass: C = 12; H = 1; Br = 80

(10 Marks)



END OF QUESTION PAPER

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