



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

**ORGANIC CHEMISTRY
SCH 1116**

**FOR SBB, SBB(P), EFW, EFW(P), EFW AND TXT
STUDENTS ONLY**

**First Semester Examination Paper
December 2016**

This examination paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: NONE

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 |

Copyright: National University of Science and Technology, 2016

SCH 1116

SECTION A :

1. (a) Write structural formulae for the following compounds.
- (i) 3-hydroxy pentanal
 - (ii) cis-1,3-dichlorocyclobutane (2 Marks)
- (b) The following product names are incorrect. Draw their structures and provide proper IUPAC names.
- (i) 5-ethyloctane
 - (ii) 1,1-dimethylpentane (4 Marks)
- (c) Assign E and Z configurations to the following alkene. Indicate priority on the structure.

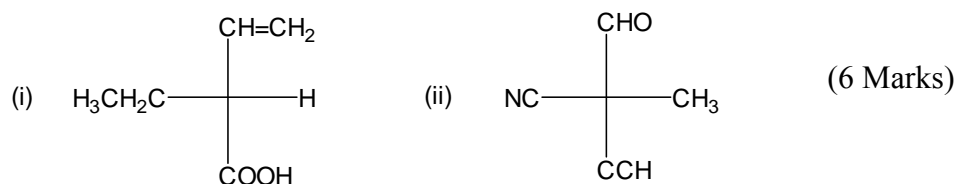


- (d) Predict the product of the following pericyclic reaction. Use curved arrows to illustrate how you got the product.

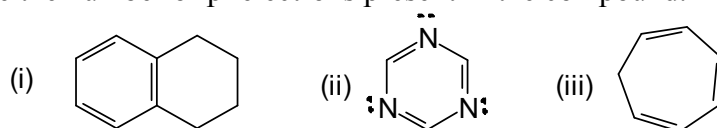


(4 Marks)

- (e) Show the steps to assign R or S configurations to each chiral centre in the following molecules.



- (f) Draw functional isomers and give IUPAC names of a compound with molecular formula $\text{C}_4\text{H}_8\text{O}$. (4 Marks)
- (g) State whether the following compounds are aromatic or non-aromatic and also indicate the number of pi electrons present in the compound.



(6 Marks)

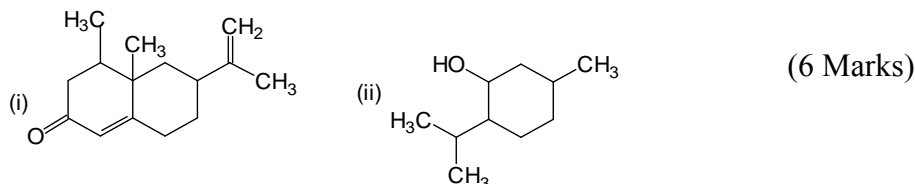
- (h) Give starting materials which would react under basic condition to give ethyl phenyl ether. (Draw chemical structures and not the IUPAC names of the compounds). (2 Marks)
- (i) What Grignard reagent and carbonyl compound might you start with to synthesise 2-methyl butan-2-ol? (Draw chemical structures and not the IUPAC names of the compounds). (2 Marks)
- (j) What information does the term below give?

$$[\alpha] = + 2.5^\circ$$

(4 marks)

SECTION B

2. (a) Draw and label (i) the most stable and (ii) the least stable Newman projections for 1,2-dichloroethane. Suggest the names of the conformers. (6 Marks)
- (b) Mark with an asterisk (*) all chiral carbons present in the following compounds. (Marks will be deducted for the wrong marking).



- (c) Explain with the aid of chemical equations, why phenyl amine is less basic than ethylamine. (4 Marks)
- (d) What are the functions of the following spectrometers?
- (i) Infra-red spectrometer
 - (ii) Ultraviolet/visible spectrometer
 - (iii) Proton NMR spectrometer
 - (iv) Mass spectrometer

(4 Marks)

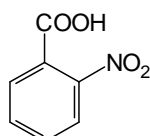
3. (a) With an appropriate example (organic compound) of your choice explain the sp^3 hybridisation. Draw the orbital diagram, bonded structure and the shape of the molecule. (9 Marks)
- (b) You are given the isoelectric point of various amino acids as shown in the table below:
With the aid of a labelled diagram, predict the direction of migration of each amino acid. You are provided buffer solution of pH 6.3

| Amino acid | Isoelectric point |
|------------|-------------------|
| Leucine | 6.0 |
| Arginine | 10.8 |
| Proline | 6.3 |

(7 Marks)

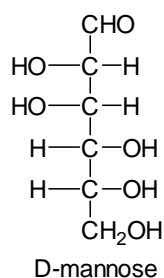
- (c) With an appropriate example write reaction mechanisms for S_N1 reactions. (4 Marks)

4. (a) Synthesise the following compound from benzene. Use reagents of your choice.



(7 Marks)

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



(i) Draw Fischer projection and Haworth projection for D-mannose. (No mechanism required). (1+2 Marks)

(ii) Draw the structures of α - and β -anomers of D-mannopyranose. Indicate by circling the anomeric carbon in α - and β -anomers. (4+2 Marks)

(c) Draw the structures of the products and give the IUPAC names for the following reactions. (No mechanism required).

(i) reduction of $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}\equiv\text{CCH}_3$ in the presence of Lindler catalyst.

(ii) oxidation of $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_3$ in the presence of alkaline KMnO_4 . (4 Marks)

5. (a) Dehydrohalogenation of 2-chlorobutane (alkyl halide) with potassium hydroxide in ethanol yields a mixture of products. State with good reason which product you would expect to be the major product. (6 Marks)

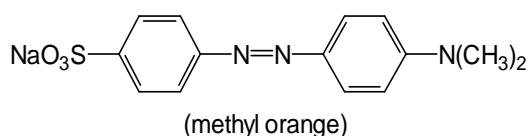
(b) The reaction between hex-3-ene and bromine produces dibromo hexane. This product is optically active. Use Fischer projections to draw as many stereoisomers as possible and label them as enantiomers, diastereoisomers and meso compounds. (8 Marks)

(c) From the list given below, select the substituents, which are

(i) ortho/para-directing (ii) meta-directing
-OH, -CHO, -NH₂, -Cl, -NO₂, -COOH,
(Marks will be deducted for wrong answers).

(3 Marks)

(d) Methyl orange is an azo dye and its structure is as follows:



Draw two structures which couple together and also indicate the reaction conditions needed for the formation of azo dyes.

(3 Marks)

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