



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY

END OF FIRST SEMESTER EXAMINATIONS – JANUARY 2011

ORGANIC CHEMISTRY – SCH 1116

FOR SBB, ESH, EFW, TXT STUDENTS

TIME = THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

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. MARKS ARE ALLOCATED AS INDICATED IN BRACKET.
2. START EACH QUESTION ON A NEW PAGE. (NOT EACH PART OF A QUESTION).
3. SHOW MECHANISM, CHEMICAL STEPS OR SYNTHESIS BY MEANS OF CURVED ARROWS.

TOTAL MARKS = 100

THIS QUESTION PAPER CONSISTS OF **SIX PRINTED PAGES** (ON ONE SIDE ONLY) INCLUDING THE TOP PAGE WITH THE INSTRUCTIONS.

SECTION A :

1. (a) 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)

(b) Draw the structural formulae for the following compounds.

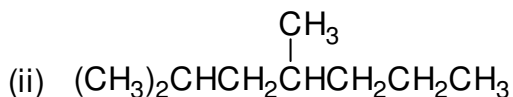
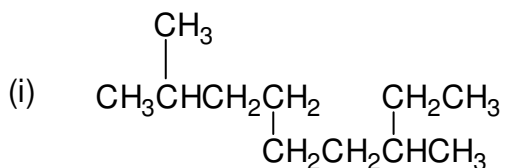
- (i) 3-propyl-4,7-dimethyl nonane
(ii) cis-1,2-dimethylcyclopropane

(2 Marks)

(c) What is plane-polarised light?

(4 Marks)

(d) Give IUPAC names of the following compounds.



(2 Marks)

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

- (i) ortho/para-directing
(ii) meta-directing

-CN, -NH₂, -CHO, -Cl, -NO₂, -COOCH₃, -NHCOCH₃, -OH

(Mark will be deducted for wrong answer).

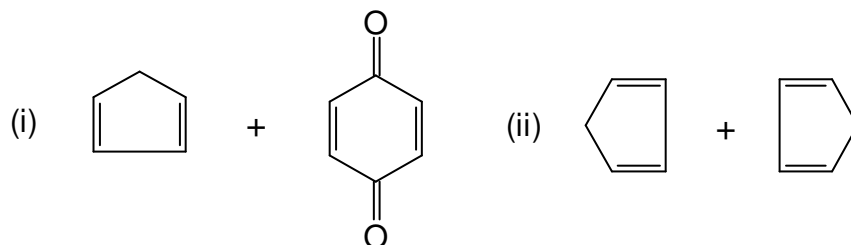
(4 Marks)

(f) Draw E and Z configuration for the following alkene and indicate priority on the structure.



(4 Marks)

(g) Draw the structures of the products arising from the following pericyclic reactions. Use curved arrows to indicate the pathways.

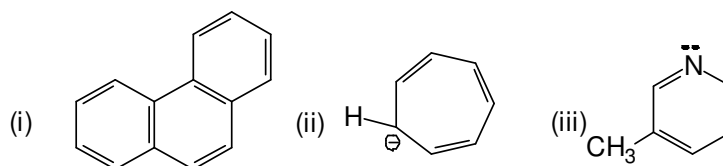


(4 Marks)

(h) Describe Huckel's rule in your own words.

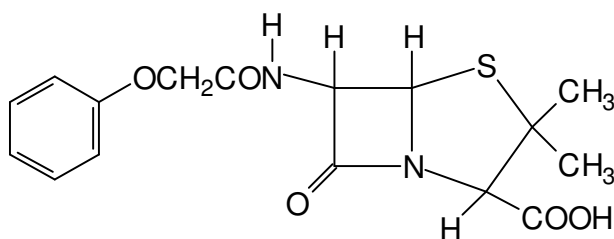
(4 Marks)

(i) State whether the following compounds are aromatic or non-aromatic and state the number of pi electrons present in each compound. (Marks will not be given if one of the answers is not correct).



(6 Marks)

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



penicillin V (antibiotic)

(3 marks)

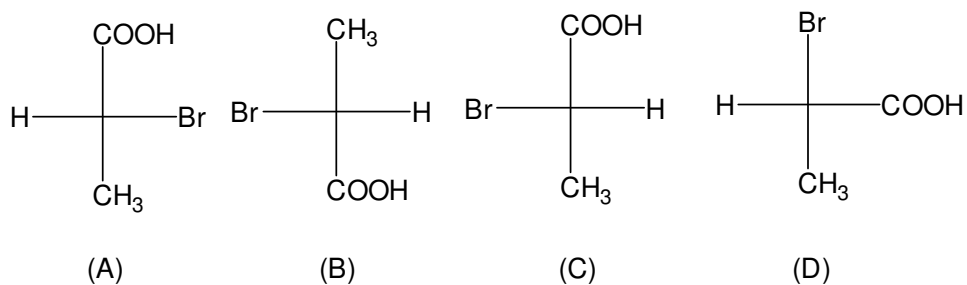
(k) What Grignard reagents and what carbonyl compounds might you start with to synthesise butan-2-ol. Write reaction mechanism.

(3 marks)

SECTION B

2. (a) Acid catalysed dehydration of pentan-2-ol produces mixture of products.
- (i) Write reaction mechanism for the reaction. (7 marks)
- (ii) State with good reason which product you would expect to be the major product. (3 marks)
- (b) Explain in detail with an appropriate example of your choice the Sp^3 hybridisation. Draw orbital structure, bonded structure and indicate the shape of the molecule. (10 marks)

3. (a) Assign R or S designation to the following Fischer projections (show your workings) and comment on the relationship between them.



(8 marks)

- (b) Draw the structures of the product/s of the following reactions and provide IUPAC names of the product/s.
- (i) Reduction of hex-2-yne in presence of Lindler catalyst.
- (ii) Oxidation of hex-2-ene with ozone.

(6 marks)

- (c) Give starting materials which would react under basic conditions to give following ether. Write reaction mechanism for one of the products. What is the name given to this reaction?

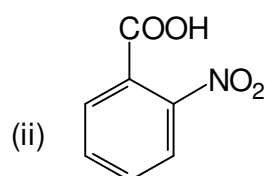
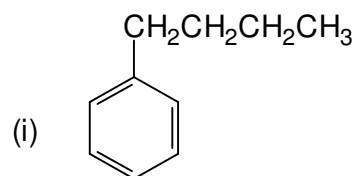
Ethyl phenyl ether

(6 marks)

4. (a) Write the reaction mechanism for the reaction between 2-butene and bromine (Br_2). The product is optically active. Draw all possible Fischer projections for stereoisomers. Indicate the relationship between them such as enantiomers, diastereoisomers and meso compounds.

(12 marks)

(b) Starting from benzene as your only source of aromatic compound, how will you synthesise the following compounds? Use reagents of your choice.



(8 marks)

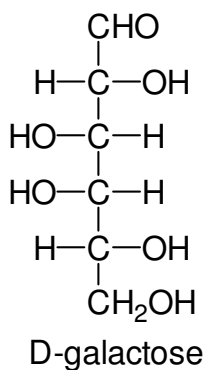
5. (a) (i) What is an isoelectric point? (3 marks)

(ii) You are given the isoelectric point of various amino acids as follows:
With the aid of a labelled diagram, predict the direction of migration of each amino acid.

Amino acid	Isoelectric point
Leucine	6.0
Arginine	10.8
Proline	6.3

(6 marks)

(b) The structure of D-galactose is as follows:

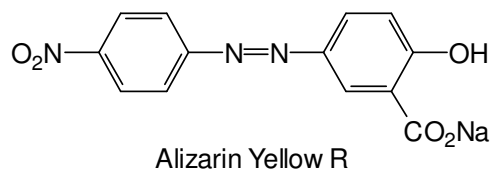


(i) Suggest why galactose is dextro-rotatory. (1 marks)

(ii) Draw Fischer and Haworth projections for D-galactose. (3 marks)

(iii) Draw α - and β -anomers of D-galactopyranose. (4 marks)

(c) Alizarin Yellow R is an azo dye used for dyeing wool and its structure is as follows:



Draw two structures which couple together and indicate the reaction conditions needed for the reaction.

(3 marks)

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