



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY

BACHELOR OF SCIENCE HONOURS DEGREE

END OF SEMESTER EXAMINATIONS – AUGUST 2009

ORGANIC CHEMISTRY – SCH 1221

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 **FIVE PRINTED PAGES** (ON ONE SIDE ONLY) INCLUDING THE TOP PAGE WITH THE INSTRUCTIONS.

SECTION A :

1. (a) Draw the structural formulae for the following compounds.

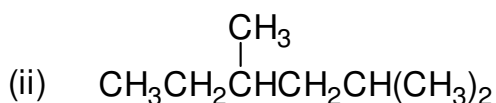
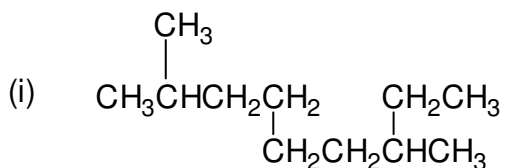
- (i) 3-propyl-4,7-dimethyl nonane
(ii) trans-1,2-dimethylcyclopentane

(2 Marks)

(b) What is plane-polarised light?

(4 Marks)

(c) Give IUPAC names of the following compounds.



(2 Marks)

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

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

-CN, -OCH₃, -Cl, -NO₂, -COOCH₃, -NH₂, -N(CH₃)₃, -Br,

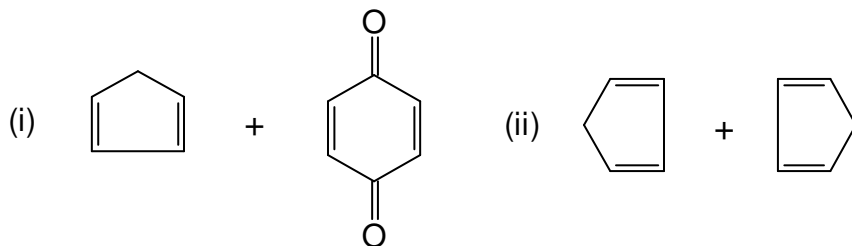
(4 Marks)

(e) Draw E or Z configuration for the following alkene and indicates priority on the structure.



(3 Marks)

(f) Draw the structures of the products arising from the following pericyclic reactions.



(2 Marks)

(g) What are the functions of the following spectrometers?

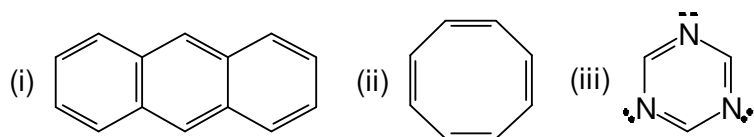
- (i) Mass spectrometer
- (ii) Infra-red spectrometer
- (iii) NMR spectrometer
- (iv) UV-visible spectrometer

(4 Marks)

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

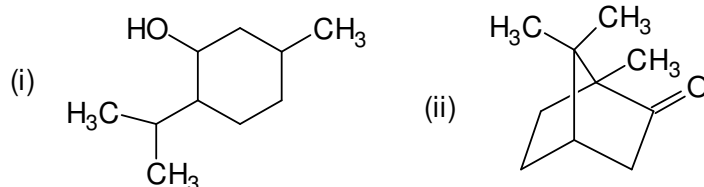
(4 Marks)

(i) State whether the following compounds are aromatic or non-aromatic and state the number of pi electrons present in each compound.



(6 Marks)

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



(5 Marks)

(k) What are the limitations of Friedel-Craft alkylation. (no description required).

(4 Marks)

SECTION B

2. (a) Acid catalysed dehydration of butan-2-ol produces mixture of products.

(i) Write reaction mechanism for the reaction.

(6 Marks)

(ii) State with good reason which product you would expect to be the major product.

(3 Marks)

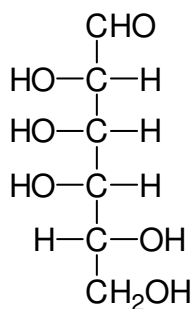
(b) Suggest four criteria which indicate that benzene is very stable compound.
(no description required).

(4 Marks)

(c) Explain in detail with an appropriate example of your choice the Sp^2 hybridisation. Draw orbital structure, bonded structure and indicate the shape of the molecule.

(7 Marks)

3. (a) The structure of D-talose is as follows.



D - TALOSE

Draw Fischer projection and write mechanism for Haworth projection for D-talose. Suggest the type of reaction that has taken place.

(4 Marks)

(b) Draw all possible isomers of a compound with molecular formula C_3H_8O and give IUPAC name for each isomer.

(6 Marks)

(c) Draw the most stable chair conformation for the compound 1,3-dichlorocyclohexane. Explain why the chair conformation you have drawn is the most stable. Is this compound cis or trans?

(6 marks)

(c) Give starting materials which would react under basic conditions to give following ethers.

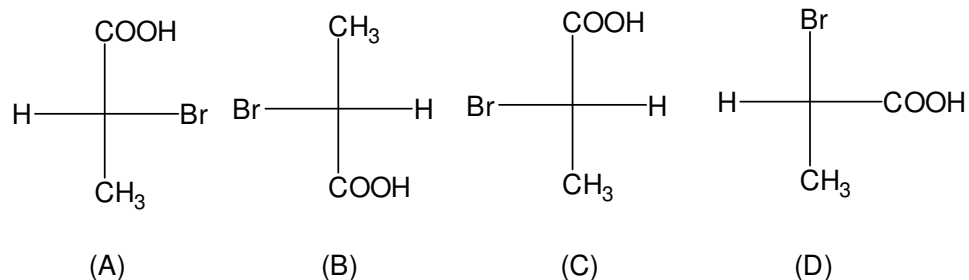
(i) Ethyl phenyl ether (ii) Diethyl ether

(4 marks)

4. (a) Write the reaction mechanism for the reaction between 2-butene and chlorine (Cl_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) Assign R or S designation to the following Fischer projections (show your workings) and comment on the relationship between them.

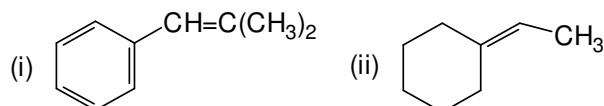


(8 Marks)

4. (a) Predict the product(s) and give IUPAC names for the following reactions.
 [(i) No reaction mechanism required. (ii) The main or major product will be considered first then other products].
- (i) Reaction of benzene with 1-chlorobutane in presence of aluminium chloride.
 - (ii) Reaction of benzene with nitronium ion followed by reduction with tin and hydrochloric acid. The product is then treated with nitrous acid in hydrochloric acid solution below 10°C. The final product is then treated with phenol.
 - (iii) Reduction of $\text{CH}_3\text{C}=\text{CCH}_2\text{CH}_3$ with Lindler catalyst.

(12 Marks)

(b) What carbonyl compounds and what phosphorus ylides might you use to prepare the following alkenes? What is the name of this reaction and also the importance of the reaction?



(6 Marks)

(c) What Grignard reagents and what carbonyl compounds might you start with to synthesise butan-2-ol. (Draw the chemical structures of the compounds).

(2 Marks)

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