



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**DEPARTMENT OF APPLIED CHEMISTRY**

**SUPPLEMENTARY EXAMINATIONS – OCTOBER 2009**

**ORGANIC CHEMISTRY – SCH 1116/1221**

**FOR SBB, ESH, EFW, TXT AND TCE**

**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.

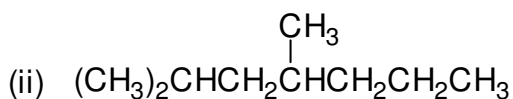
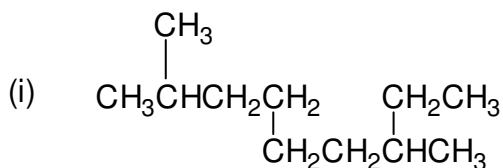
- (i) 3-propyl-4,7-dimethyl nonane  
(ii) cis-1,2-dimethylcyclohexane

(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, -CH<sub>3</sub>, -I, -NO<sub>2</sub>, -COOH, -NH<sub>2</sub>, -N(CH<sub>3</sub>)<sub>3</sub>, -OH,

(Mark will be deducted for wrong answer from the total marks).

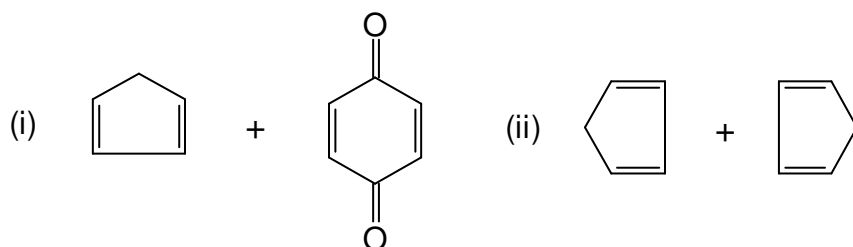
(4 Marks)

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



(4 Marks)

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



(2 Marks)

(g) The following names are incorrect. Draw the structures and provide proper IUPAC names.

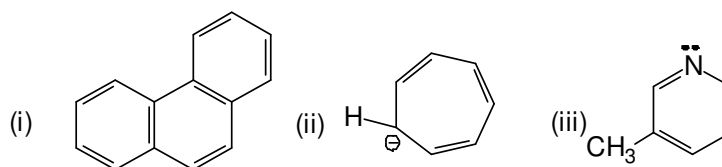
- (i) 2,2-dimethyl-6-ethyl heptane
- (ii) 3-propyl-4,4-dimethyl hexane

(4 Marks)

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

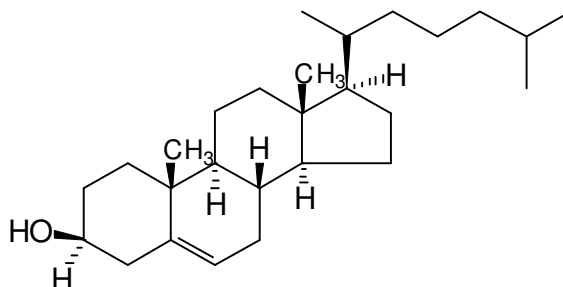
(4 Marks)

(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).



(8 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) Draw all possible isomers of a compound with molecular formula  $C_4H_9OH$  and give IUPAC name for each isomer.

(8 Marks)

(b) Draw the most stable chair conformation for the compound 1,3-dibromocyclohexane. 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. (Draw chemical structures not the IUPAC names).

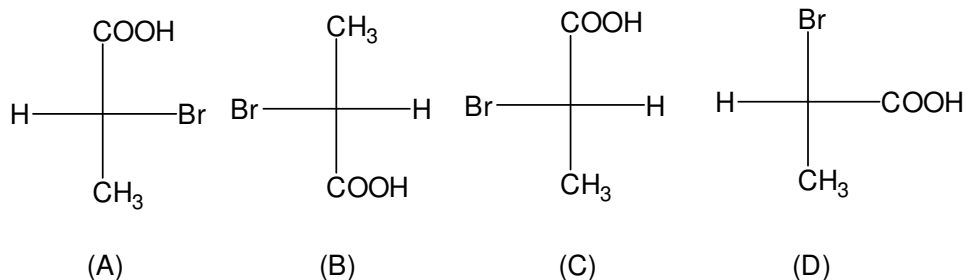
(i) Ethyl phenyl ether      (ii) Diethyl ether

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

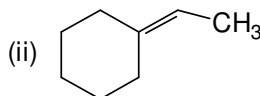
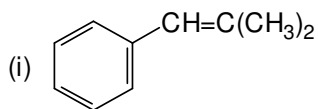


(8 Marks)

5 (a) In the reaction of 1-chlorobutane with hydroxide ( $\text{HO}^-$ ), 1-butanol and other products are formed. 1-butanol does not normally react with chloride ion ( $\text{Cl}^-$ ) but does so in the presence of an acid. With the aid of reaction mechanism wherever possible indicate the type of reactions is taking place. Predict the product(s) and give IUPAC names for the products formed.

(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? What is 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\*\*\*\*\*