

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
SUPPLEMENTARY EXAMINATIONS – AUGUST 2004
ORGANIC CHEMISTRY II – SCH 1202
TIME – THREE (3) HOURS.

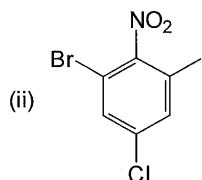
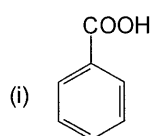
INSTRUCTIONS TO CANDIDATES

Answer **ALL** questions from **Section A** and **ANY THREE** questions from **Section B**. **Section A** carries **40 marks** and each question in **Section B** carries **20 marks**. Marks distribution within questions is as indicated.

Total Marks = 100 marks

SECTION A

1. (a) Give IUPAC names to each of the following compounds.



(4 marks)

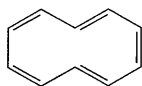
- (b) Draw structures for all the isomeric dibromotoluenes

(4 marks)

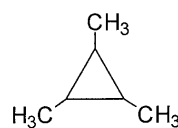
- (c) With an appropriate structure, define the term “aromatic” and show how it is related to Huckel’s rule.

(6 marks)

- (d) Explain why compounds (i) and (ii) are not aromatic.



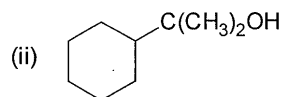
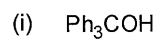
(i)



(ii)

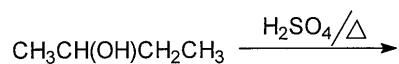
(3x2 marks)

- (e) Give the Grignard reagent and the ester or carbonyl compounds, which are precursors for each of the following products.



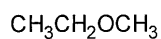
(2x2 marks)

- (f) What are the product(s) of the following reaction? With a good reason indicate the major product.



(5 marks)

- (g) Give starting materials and reagents, which would react under basic conditions to give the following compound shown below.



(3 marks)

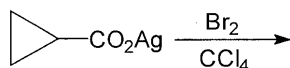
- (h) Explain the following observations:

(i) Treatment of benzene with excess fuming nitric acid and sulphuric acid yields m-dinitrobenzene but not the trinitrated product.

(ii) Under the same conditions toluene (methylbenzene) yields 2,4,6-trinitrotoluene.

(2x3 marks)

- (i) Give the major product for the following reaction.



(2 marks)

SECTION B

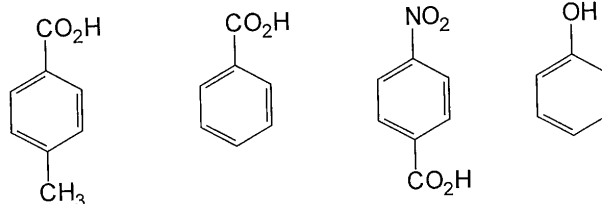
- 2 (a) From the list given below, pick out the substituents, which are:
- o/p-directing with activation
 - o/p-directing with deactivation
 - m-directing with deactivation

with respect to electrophilic substitution reactions in benzene derivatives.

-OCH₃; -CH₃; -Cl; -OH; -CO₂H; -I; -CHO; -CBr₃; -Br; -NO₂
(10 marks)

- (b) The self-condensation of acetone (2-propanone) under basic conditions gives 4-methyl-3-pentene-2-one, (mesityl oxide). Write reaction mechanism for the formation of the product.
(5 marks)

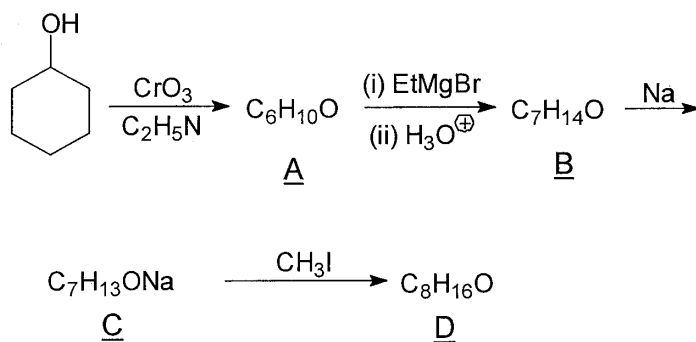
- (c) With brief explanations, arrange the following compounds in order of increasing acidity:



(5 marks)

- 3 (a) Nitriles usually react with carbonyl compounds to form cyanohydrins; however aromatic aldehydes behave differently. With detailed mechanism outline a route to the synthesis of benzoin, PhCOCH(OH)Ph, starting from benzaldehyde and any other reagents of your choice.
(15 marks)
- (b) Give a molecular-orbital representation of benzyne and state what factors are responsible for the instability of the molecule.
(5 marks)
- 4 (a) With specific examples write reaction mechanism and for each state the major difference(s) between Friedel-Crafts alkylation and Friedel-Craft acylation reactions.
(12 marks)

- (b) In the following sequence of reactions, draw the structures of compounds A to D shown below.



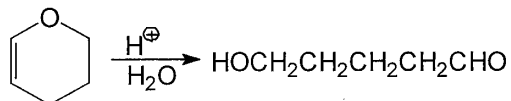
(8 marks)

5. (a) Using carbonium-ion stability approach, show all the possible resonance structures for the nitration of phenol i.e. *ortho*, *meta* and *para* and hence explain why the -OH group is *o/p*-directing with activation.

(14 marks)

- (b) Suggest a synthetic route to each of the following (no mechanism required).

- (i) Give mechanism for the following transformation .



(3 marks)

- (ii) 1,2,3-trichlorobenzene starting from aniline and any other reagents of your choice.

(3 marks)

END OF QUESTION PAPER