



Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF
TECHNOLOGY IN APPLIED CHEMISTRY
BTAC

ACH 4203: THE CHEMISTRY OF AROMATIC COMPOUNDS

SPECIAL/SUPPLEMENTARY EXAMINATION

OCTOBER 2013 SERIES

2 HOURS

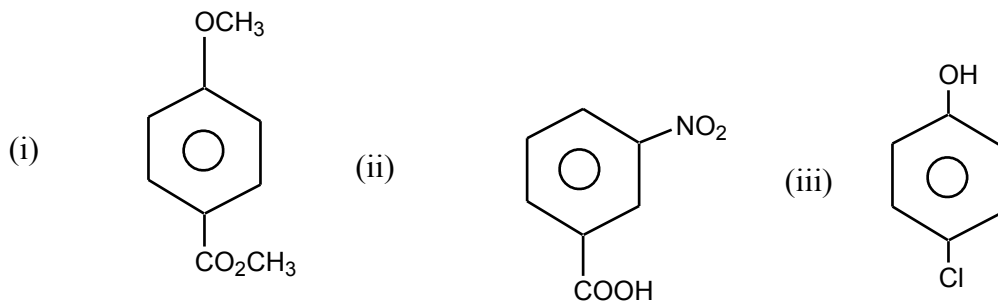
Instructions to candidates:

This paper consist of **FIVE** questions

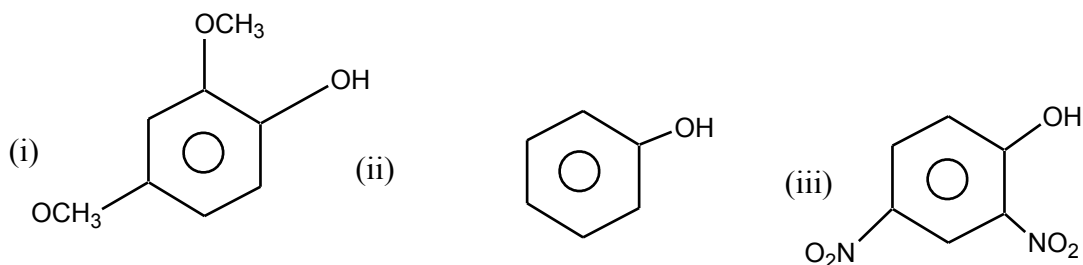
Answer question **ONE** (compulsory) and any other **TWO** questions

Question ONE

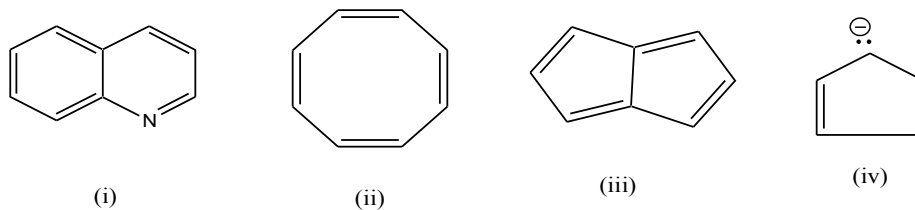
- a) Draw the structures corresponding to the following IUPAC names (3marks)
- (i) M-Ethylnitrobenzene
 - (ii) 1,5-dimetonaphthalene
 - (iii) 2-methyl pyridine
- b) Incidate with an arrow where an electrophile would add to the following benzene denratives (3marks)



c) Arrange with reasons the following aromatic compounds in order of increasing acidity of the phenolic proton (3marks)



d) Classify the following compounds as aromatic anti-aromatic or non-aromatic (4marks)



e) (i) Arrange the following benzene substituent's in order of their activating effect on electrophilic substitution (most activating first) : $-\text{OCH}_3$, $-\text{NO}_2$, $-\text{Cl}$, $-\text{CH}_3$ (2marks)

(ii) Giving reasons, identify the stronger base between phenylamine and cyclohexylamine (3marks)

f) Identify with reasons the most and the least reactive compound between methylbenzoate and phenylacetate with bromine in acetic acid. Draw the structure of the products

(4marks)

Determine the structure of the compound with the formula $\text{C}_{14}\text{H}_{21}\text{ON}$ and the $^1\text{H-NMR}$ and IR data given below: (8marks)

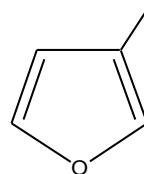
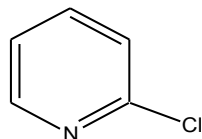
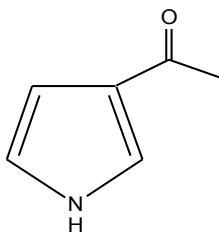
IR : 1720 cm^{-1} (strong)

2800 cm^{-1} (broad)

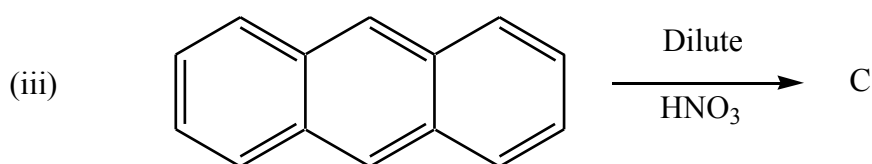
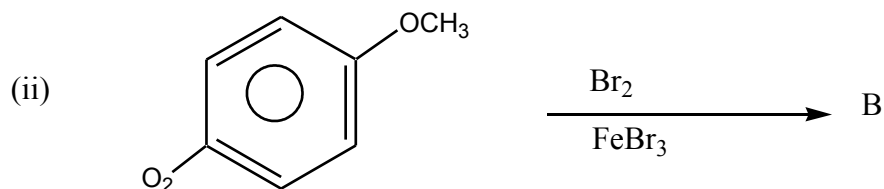
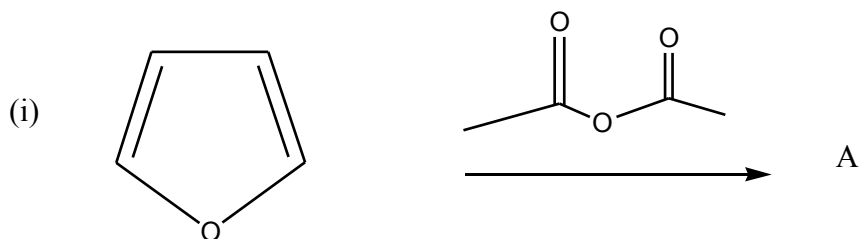
$^1\text{H-NMR}$: 1.04ppm (triplet, 3H)
1.20ppm (doublet, 6H)
1.28ppm (doublet, 2H)
2.87ppm (septet, 1H)
3.24ppm (Quartet, 2H)
3.52ppm (Quartet, 1H)
7.11ppm (doublet, 2H)
7.54ppm (doublet, 2H)
8.03ppm (broad singlet, 1H)

Question TWO

a) Name the following heterocyclic compounds and account for their aromaticity (6marks)



b) Draw the structure and give the name of each of the products A to C in the following reactions (6marks)

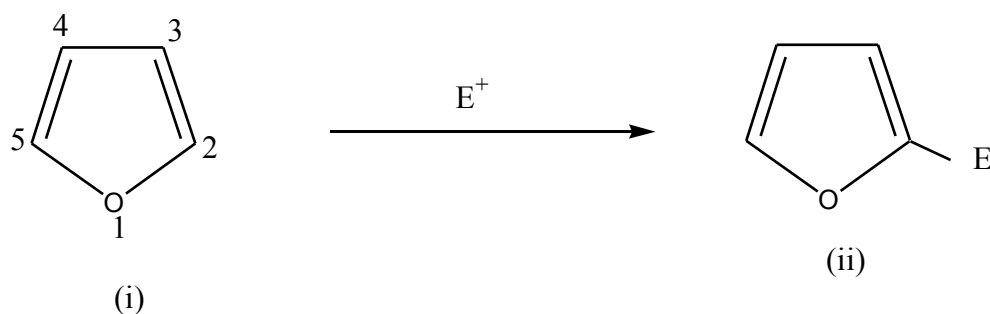


c) List any THREE uses of benzenes and its derivatives

(3marks)

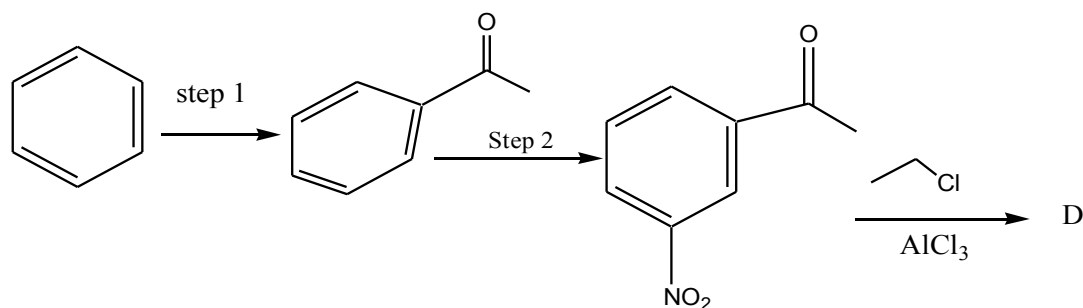
d) Using resonance structures explain why the electrophile attacks C-2 and not C-3 in the following reaction .

(5marks)



Question THREE

a) Product D can be obtained from benzene in three steps:



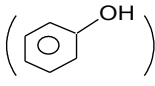
(i) Name the type of reaction for step 1 and 2 and suggest a suitable reagent or

combination of reagents (4marks)

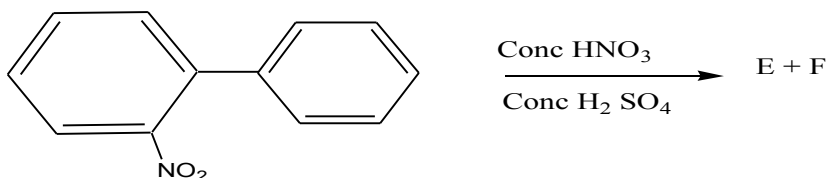
(ii) Draw and name the structure of D (2marks)

(iii) Write an equation showing how the electrophile is formed from the reagents in step 1 (2marks)

(iv) Outline a mechanism for subsequent reaction between benzene and the electrophile formed in (iii) above (4marks)

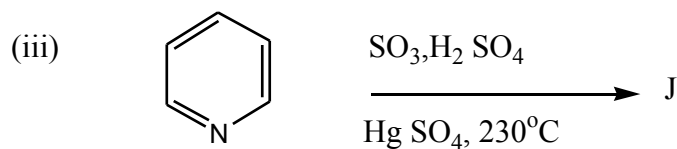
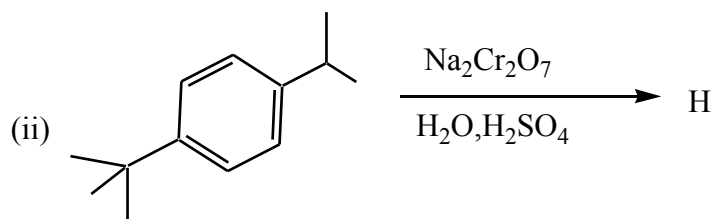
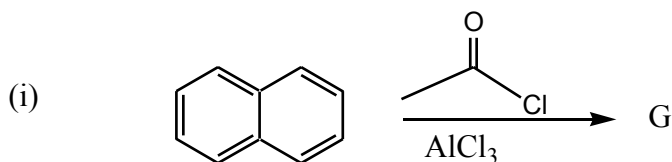
b) Draw all the resonance structures of para attack of phenol  by an electrophile E^+ (4marks)

c) Draw and name products E and F obtained in the following reaction

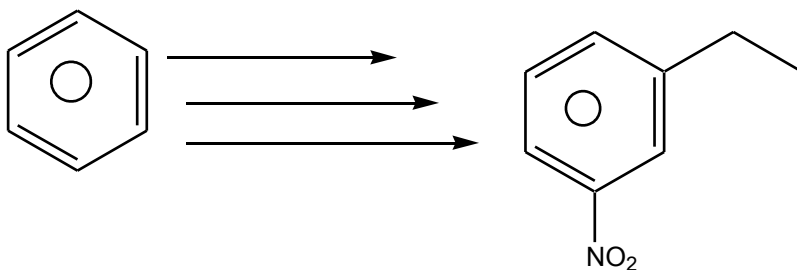


Question FOUR

a) Draw and name the structure of the main products in the following reactions (6marks)

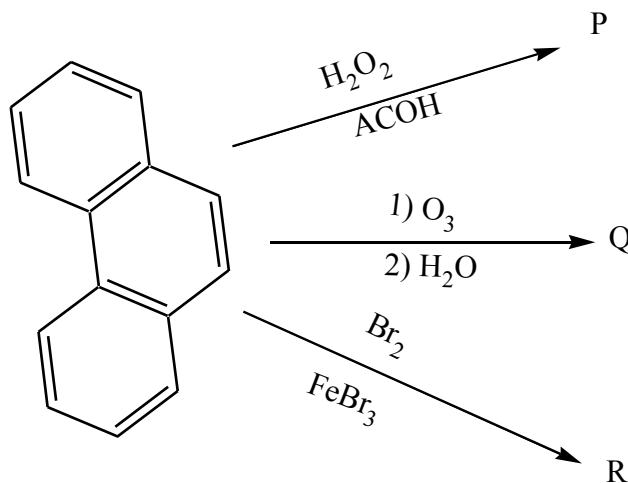


b) Provide a reasonable synthesis of L using benzene as the starting material (5marks)



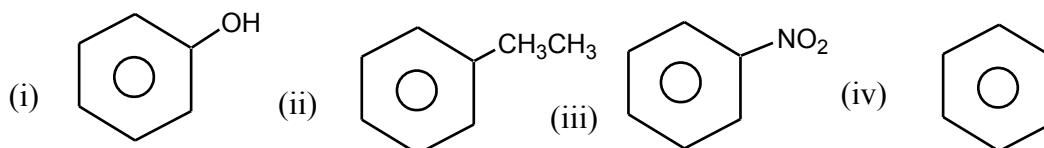
c) With a reason, identify the factor reaction between acetanilide ($C_6H_5NHCOCH_3$) and benzoic acid (C_6H_5COOH) with SO_3 in H_2SO_4 **(3marks)**

d) Draw and name structures P,Q and R of the reaction below **(6marks)**

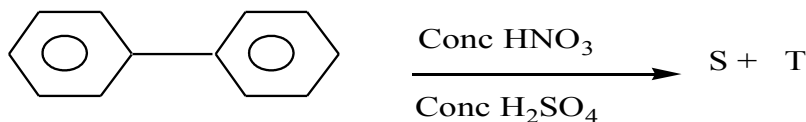


Question FIVE

a) Arrange with reasons the following compounds in order of decreasing rate of Bromination.



b) Draw and name product S and T of the reaction below **(4marks)**

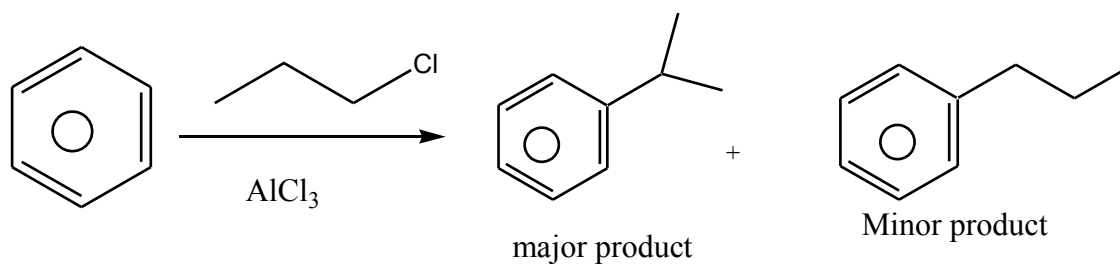


c) Pyridine under goes electrophilic substitution reactions for less easily than benzene.

Explain

(4marks)

d) Provide the mechanism for the formation of the major product shown below **(5marks)**



e) Draw the structure of the principle organic product formed from the reaction of Benzylbromide with

(i) Sodium ethoxide

(2marks)

(ii) Potassium hydrogen sulfide

(2marks)