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**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS  
2022/2023 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE (CHEMISTRY) & (INDUSTRIAL  
CHEMISTRY)**

**COURSE CODE: SCH 233/ SIC 263**

**COURSE TITLE: AROMATICITY AND CHEMISTRY OF ARENES**

**DATE: Wednesday 12<sup>th</sup> April 2023**

**TIME: 12.00 - 2.00 PM**

**INSTRUCTIONS TO CANDIDATES**

Answer ALL questions

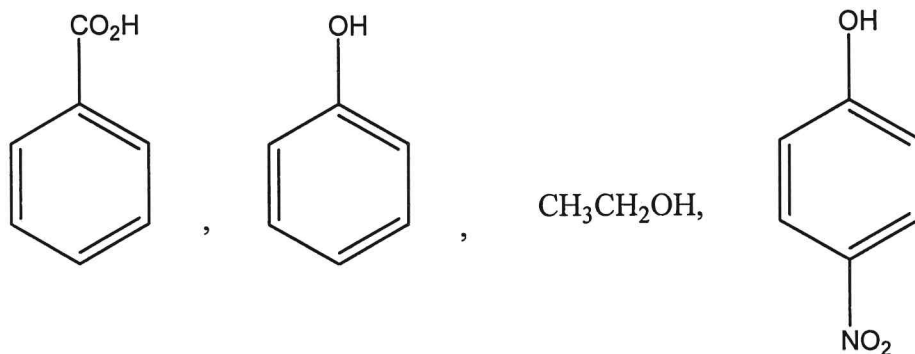
TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

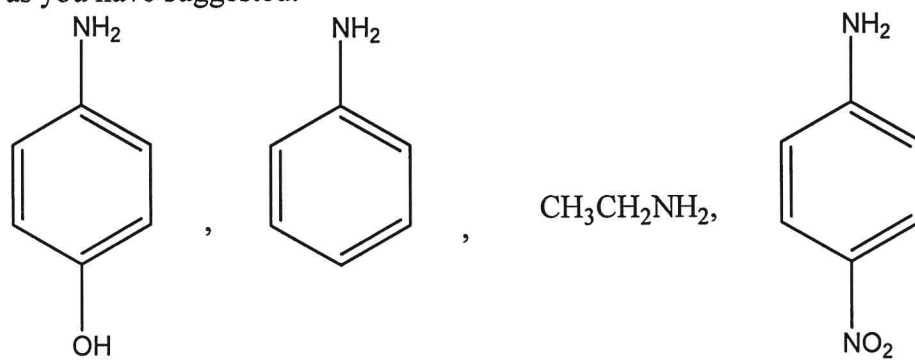
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Q1 a)

i) Arrange the following compounds in order of their increasing acidity and explain why the order is as you have suggested. [4 marks]

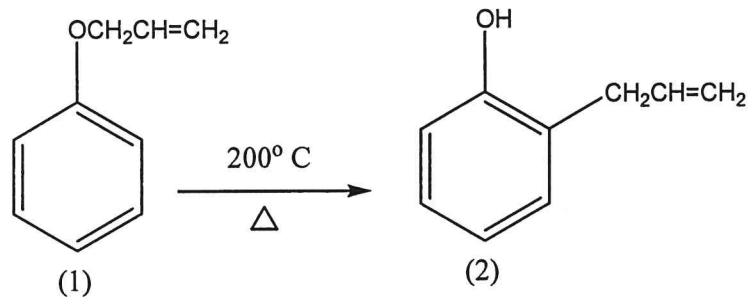


ii) Arrange the following amines in order of their increasing basicity and explain why the order is as you have suggested. [4 marks]

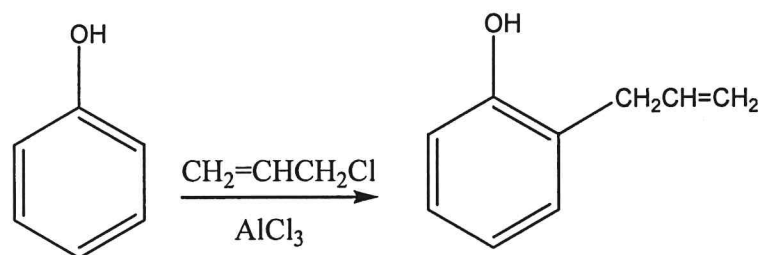


b)

i) The synthesis of *o*-allylphenol (2) can be done from allylphenyl ether (1) in one pot synthesis. Give the mechanism of the reaction [3½ marks]

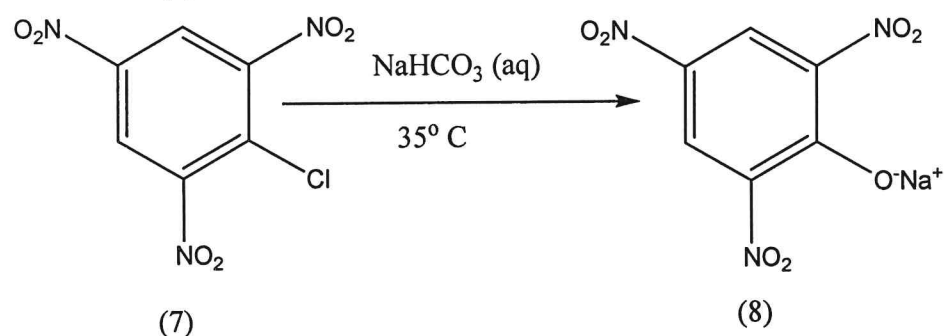
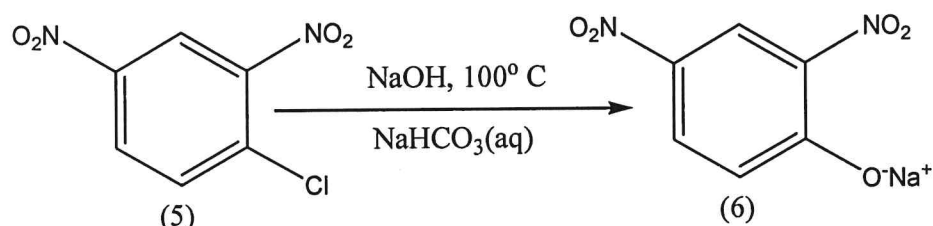
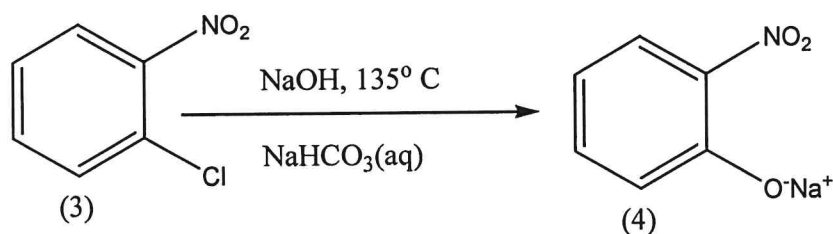


ii) Why is the above method preferred over the Friedel-Crafts alkylation detailed below. [1 mark]

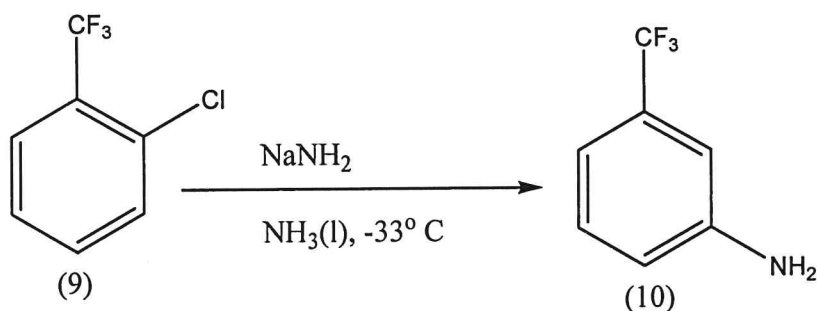


c) Explain why the reaction conditions in the following reactions are as observed.

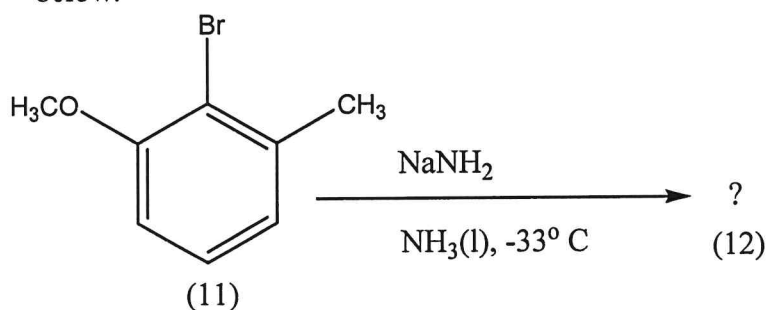
[2 marks]



d) i) Explain, with the aid of reaction mechanism, why the reaction between *o*-chloro(trifluoromethyl)benzene (9) and sodamide in ammonia gives the unexpected product (10). [3½ marks]

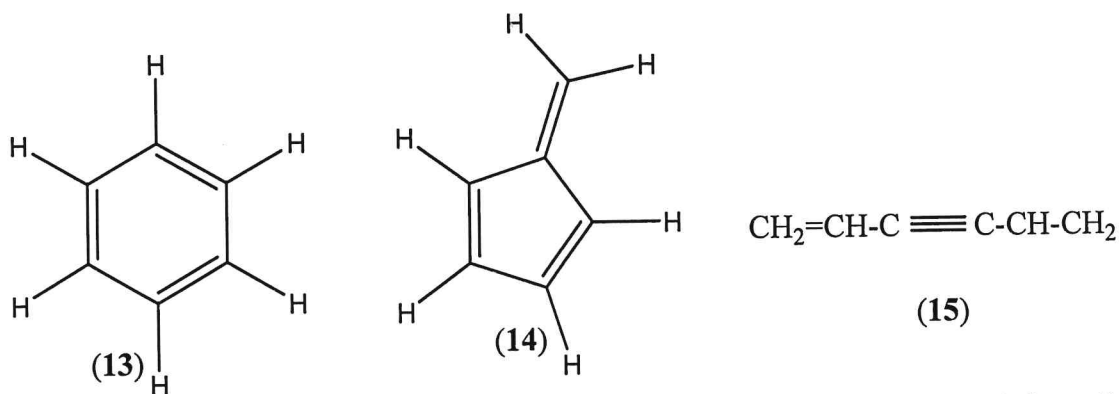


ii) Using the mechanism in (i) above predict the products expected in the reaction given below. [1 mark]

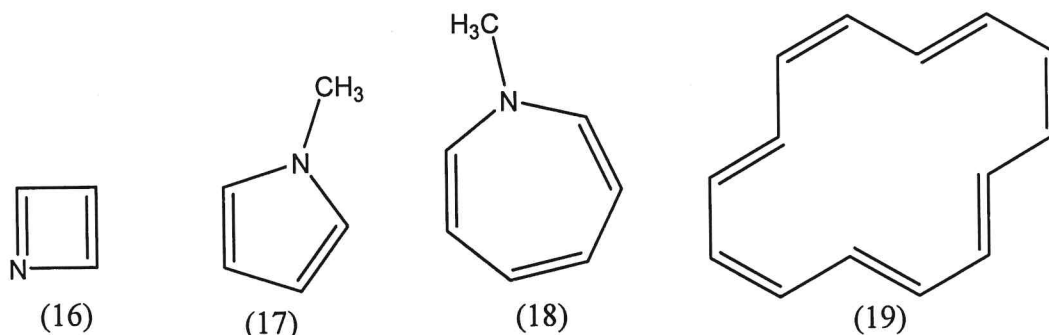


Q2

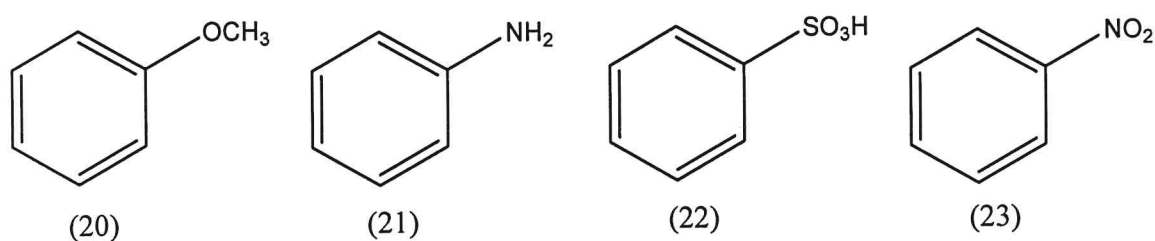
a) Between the period 1931-1934 when the molecular formula for benzene was first determined as  $\text{C}_6\text{H}_6$ , and the following structures were proposed as possible benzene structures.



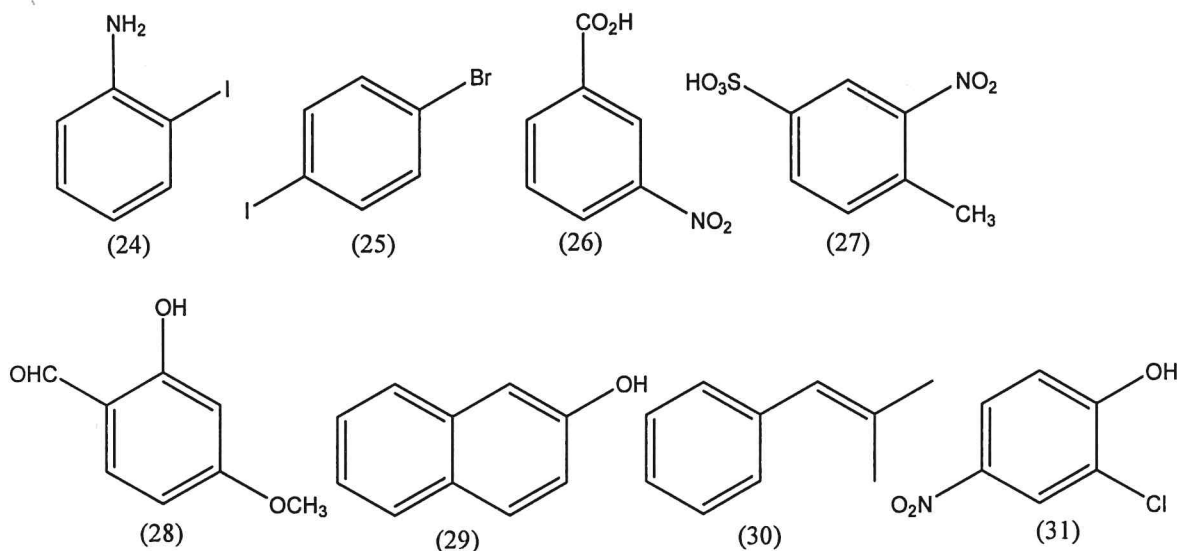
- i) State any two organic reactions that can be used to distinguish structure (13) from (14) and (15) [2 marks]
- ii) With reason use the reactions stated to explain why structure (13) is the right structure for benzene and not (14) and (15). [2 marks]
- b)
- i) State the Huckel's rule of aromaticity [1 mark]
- ii) With reasons, which of the following organic molecules (16-19) are aromatic, non-aromatic and anti-aromatic? [6 marks]



- c) Arrange the following compounds (20-23) in their increasing order of reactivity towards an electrophilic reagent. [4 marks]

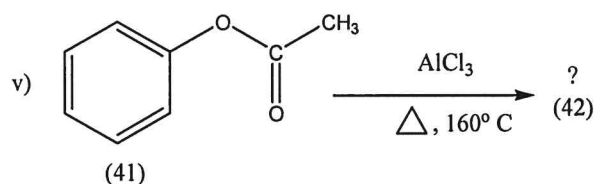
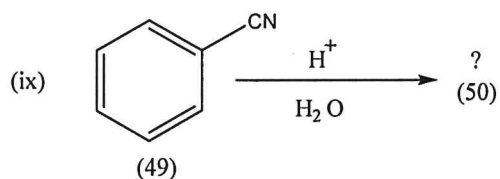
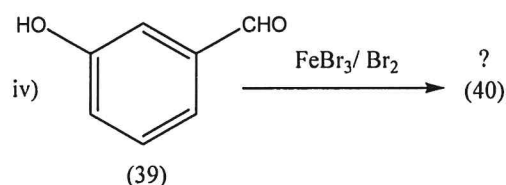
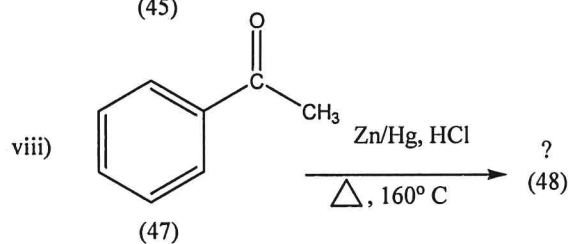
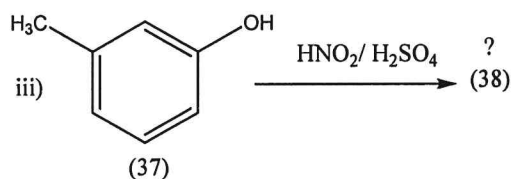
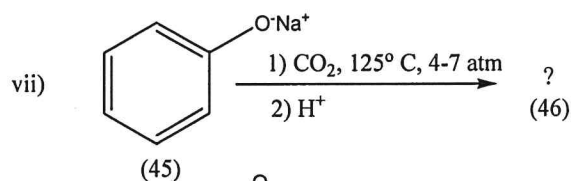
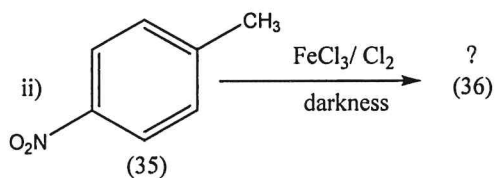
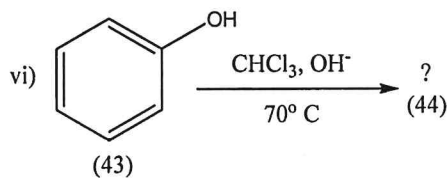
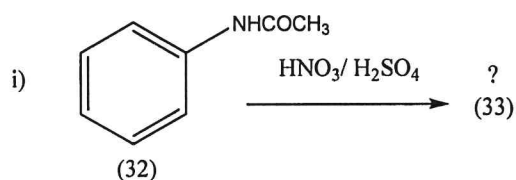


- d) Give the IUPAC names of compounds (24-31) [8 marks]

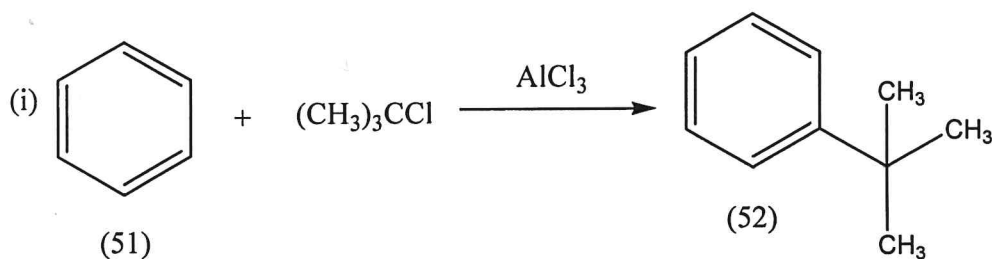


Q3

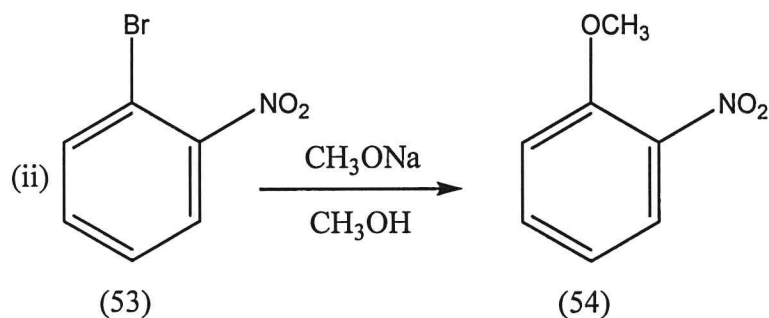
a) Give the major products in the following reactions giving reasons why the product suggested is the major product in each case. [11 marks]



b) Suggest the mechanism for the following reactions



[4 marks]

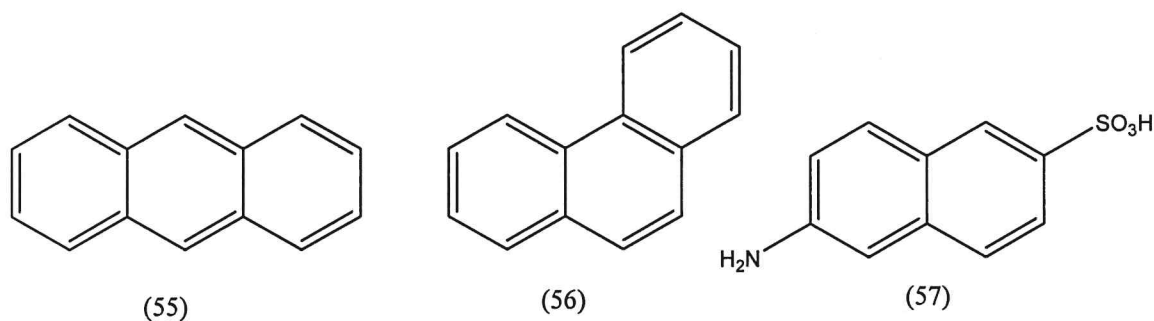


[4 marks]

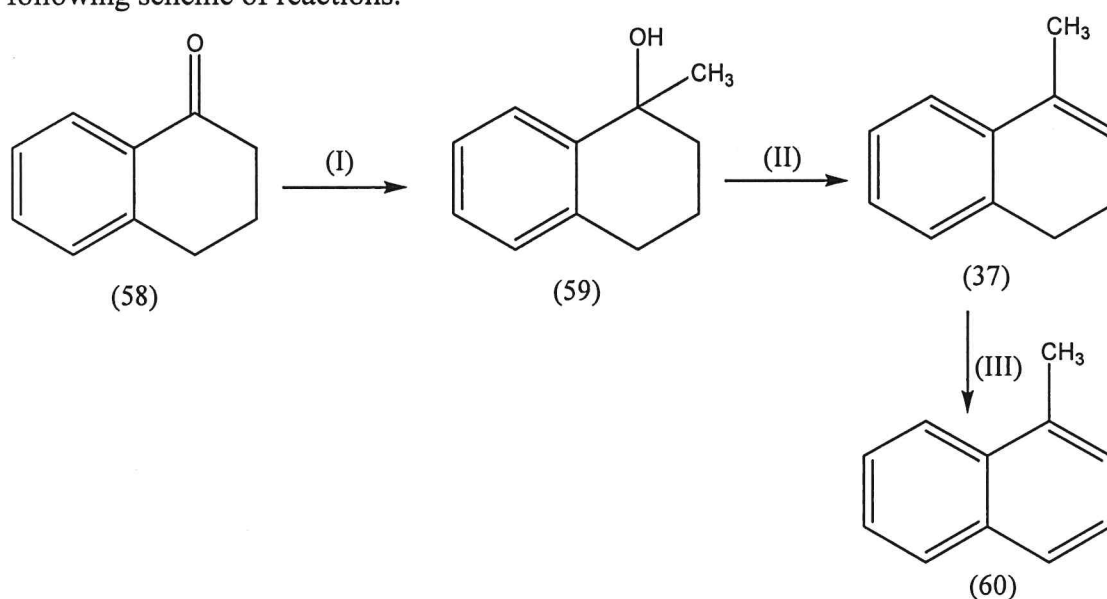
Q4.

a) Provide the IUPAC names to the following polynuclear aromatic compounds

[3 marks]



b) 1-methylnaphthalene can be synthesized from the starting material shown below through the following scheme of reactions.



i) Suggest the reagents (I), (II), (III).

[4 marks]

ii) Why is this route preferable over the direct alkylation of naphthalene? [2 marks]

[2 marks]

c) Suggest the products in the following reactions. [3 marks]

[3 marks]

