



# **MAASAI MARA UNIVERSITY**

**REGULAR UNIVERSITY EXAMINATIONS  
2017/2018 ACADEMIC YEAR  
THIRD YEAR FIRSTSEMESTER**

**SCHOOL OF SCIENCE  
BACHELOR OF SCIENCE & B.ED (SCIENCE)**

**COURSE CODE: CHE 312  
COURSE TITLE: CHEMISTRY OF ALICYCLIC  
AROMATIC COMPOUNDS**

**DATE: 18<sup>TH</sup> APRIL, 2018**

**TIME: 1100 – 1300HRS**

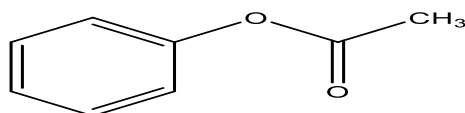
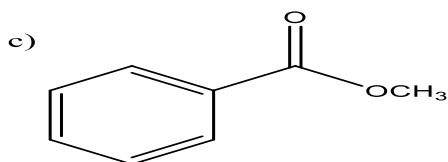
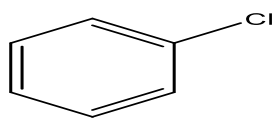
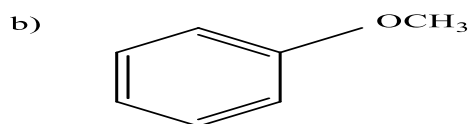
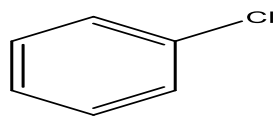
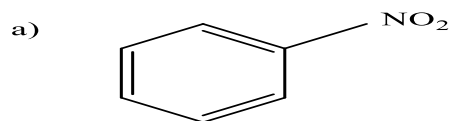
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## **INSTRUCTIONS TO CANDIDATES**

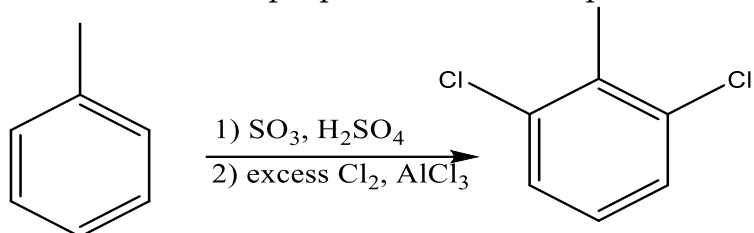
1. Answer Question **ONE** and any other **TWO** questions.
2. All Examination Rules Apply.

### QUESTION ONE (30 MARKS)

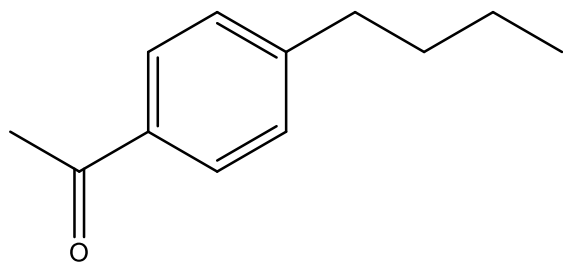
I. For each pair of reagents, circle the one that will react faster in an electrophilic aromatic substitution reaction. (3mks)



II. What is the purpose of the first step in the following reaction sequence? (2mks)



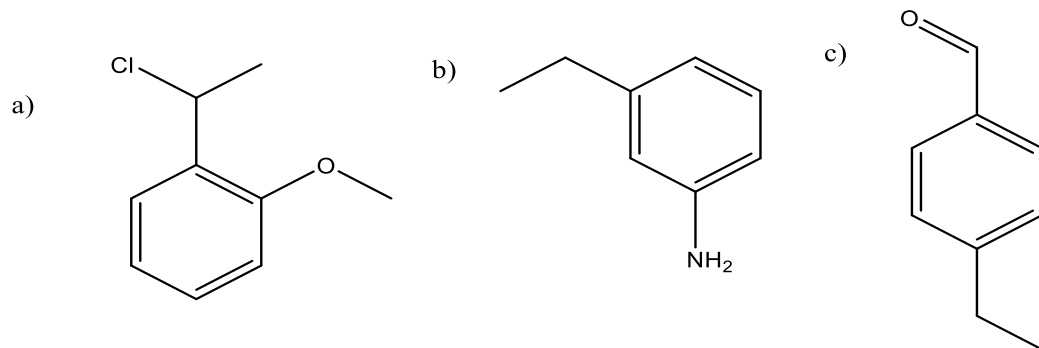
III. Provide a synthesis of the target compound from benzene. You may use any additional reagents you need. Clearly separate the reagents used for each step of these multi-step syntheses. You may use a retrosynthetic analysis if you wish, but be sure to write your final answer in the forward direction. (5mks)



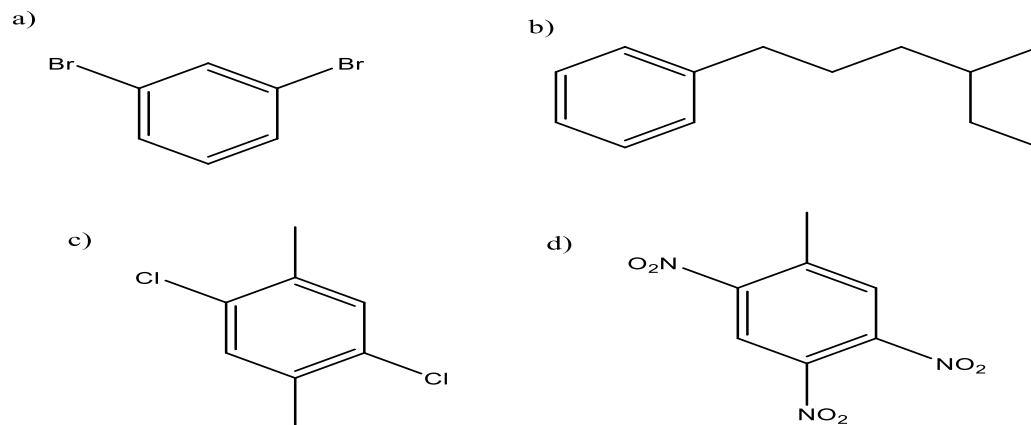
IV. When a mixture containing one mole each of the three dimethylbenzenes (o-, m-, and p-xylene) is treated with one mole of chlorine in the presence of a Lewis acid catalyst, one of the three hydrocarbons is monochlorinated in 100% yield, whereas the other two remain completely unreacted.

- Which isomer reacts? (1mk)
- Briefly explain why only that isomer reacts. (2mks)
- Provide a mechanism for the main product of the reaction assuming that  $\text{AlCl}_3$  is the Lewis acid catalyst. (5mks)

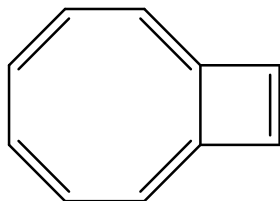
V. State wither the following is para, meta, or ortho substituted (3mks)



VI. Name the following compounds. (4mks)



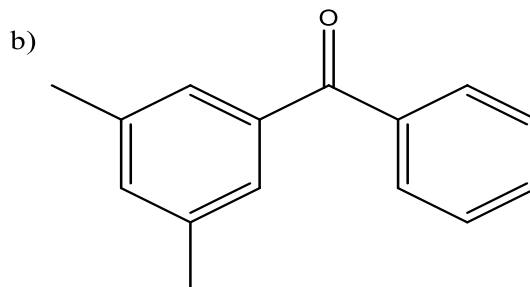
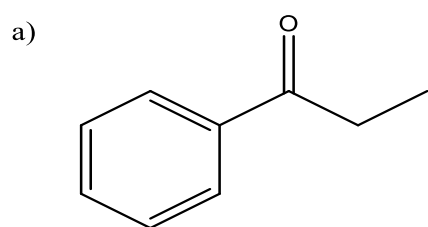
VII. This is an isomer of naphthalene. Is it aromatic? Draw a resonance structure for it. (2mks)



VIII. If toluene is treated with  $D_2SO_4$  all the hydrogen's are replaced with deuterium. Explain by drawing a reaction mechanism (3mks)

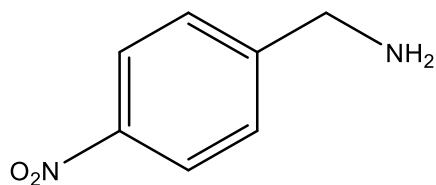
### QUESTION TWO (20 MARKS)

I. Suggest an acyl chloride that was used to make the following compounds: (2mks)



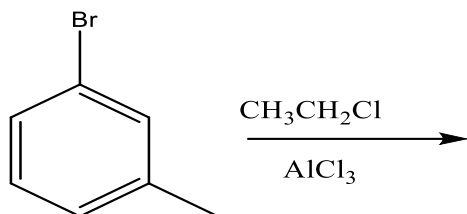
II. Draw the resonance structures for benzaldehyde to show the electron-withdrawing group. (2mks)

III. Starting from benzene and any other reagents you need, propose an efficient synthesis of the following compound. (5mks)

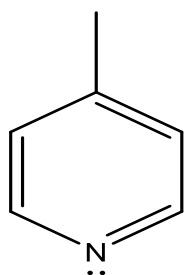


IV. Draw the resonance structures for methoxybenzene and show the electron-donating group. (2mks)

- V. Predict the products of the following reaction by drawing reaction mechanism. Show all resonance contributors (6mks)

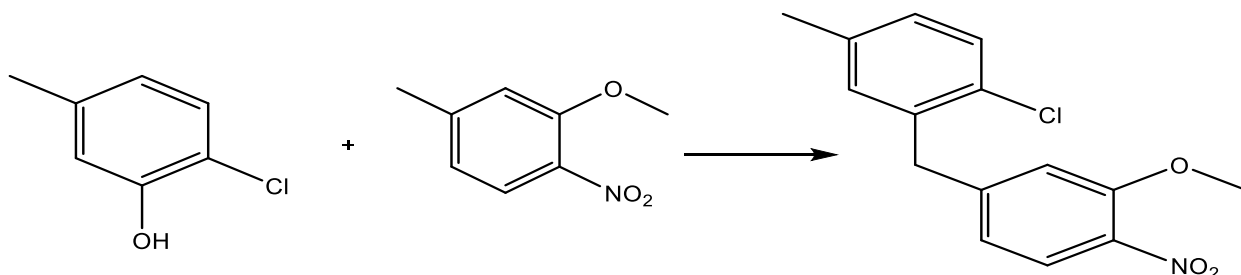


- VI. The molecule shown, *p*-methylpyridine, has similar properties to benzene (flat,  $120^\circ$  bond angles). Draw the pi-orbitals for this compound. (3mks)

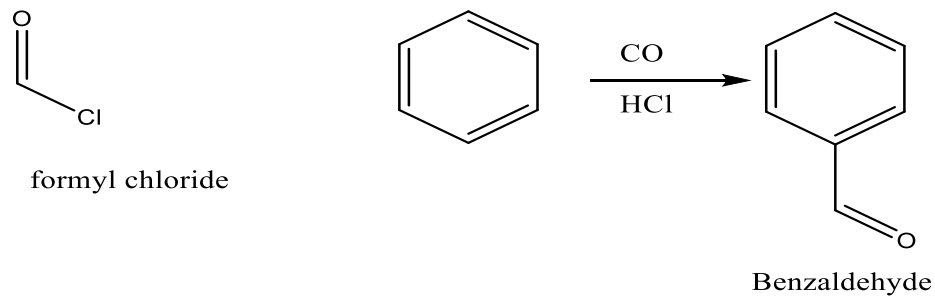


### QUESTION THREE (20 MARKS)

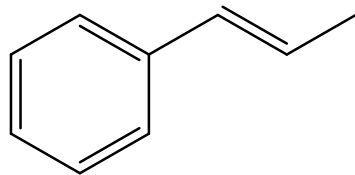
- I. Propose a mechanism for the following reaction: (4mks)



- II. Since formal chloride does NOT exist, it cannot be used to synthesize benzaldehyde via a Friedel-Crafts reaction. Benzaldehyde can be prepared from benzene, carbon monoxide, and HCl in a process known as the Gatterman-Koch reaction. Propose a full electron-pushing mechanism for the reaction. (7mks)



III. How would you make the following molecule? (5mks)



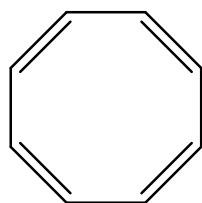
IV. In each case, how many products would be expected for the bromination of *p*-xylene, *o*-xylene, and *m*-xylene? (4mks)

#### QUESTION FOUR (20 MARKS)

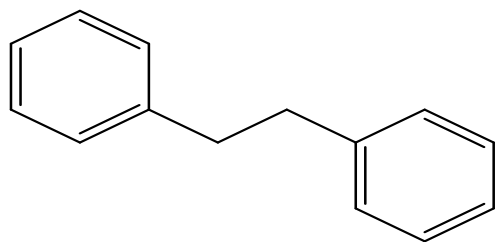
I. Draw the following structures (4mks)

- a) *p*-chloriodobenzene
- a) *m*-bromotoluene
- a) *p*-chloroaniline
- a) 1,3,5-trimethylbenzene

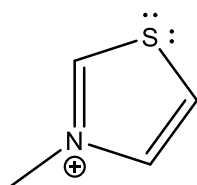
II. To be aromatic, a molecule must be planar conjugated, and MUST obey the  $4n+2$  rule. Look at the following molecule AND decide if it is aromatic. Explain (2mks)



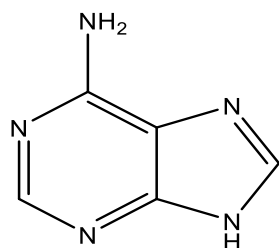
III. Propose the reaction mechanism, how you would make the following molecule from benzene and an acid chloride? (4mks)



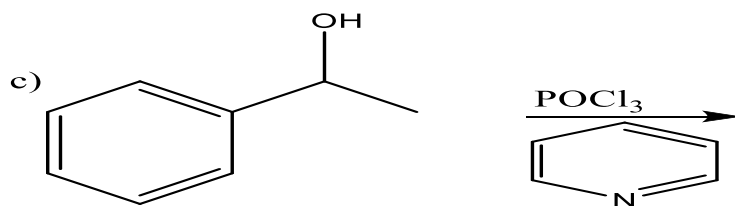
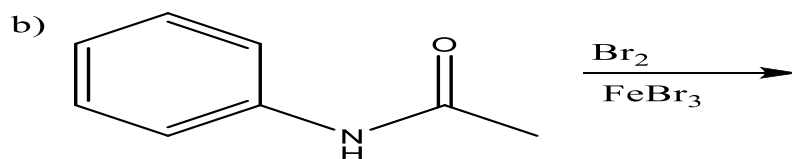
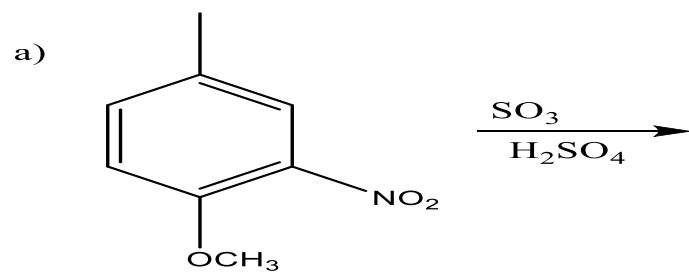
- IV. The following ring is called a thiazolium ring. Describe how it is aromatic. (2mks)



- V. The following molecule is adenine. It has a purine core. Of the nitrogen in the core, how many electrons are donated into the pi system? (2mks)



- VI. Provide the major organic product for each of the following reactions. (6mks)



END//