MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL AND BIOLOGICAL SCIENCES

UNIVERSITY POSTGRADUATE EXAMINATION

2018/2019 ACADEMIC YEAR

FIRST YEAR **SECOND** SEMESTER EXAMINATION FOR MASTER OF SCIENCE IN CHEMISTRY

ACH 624 – ADVANCED ORGANIC SYNTHESIS

DURATION:3 HOURS

DATE: 26/4/2019

TIME: 9-12 P.M.

Instructions to candidates:

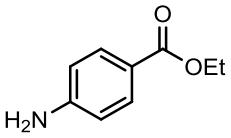
1. Answer **ANY FOUR** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

QUESTION ONE (25 MARKS)

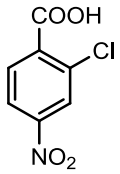
a) Define the following terms as used in organic synthesis. Give an example in each case.
   i. Synthon
   ii. Function group interconversion (4 marks)

b) Describe the steps involved in designing organic synthesis (4 marks)

c) Design a synthesis for compounds A and B using toluene as a starting material. In each case, explain the order of events. (10 marks)

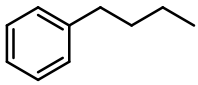


A



B

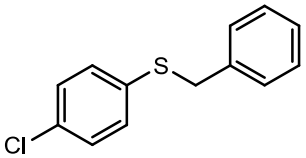
d) Use the structure of the alkylbenzene below to answer the following questions:
   i. Suggest two possible retrosynthetic routes for the molecule (3 marks)
   ii. Suggest how the molecule might be synthesized in the laboratory and explain why the alternative route is not useful. (4 marks)



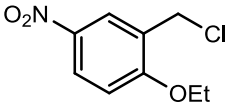
Alkylbenzene

QUESTION TWO (25 MARKS)

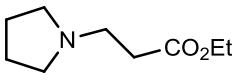
a) Use the structure C, D and E below to answer the questions that follow



C (Acariside)



D



E

   i. Carry out a retrosynthetic analysis of compounds C, D and E to identify the starting material (9 marks)
   ii. Suggest how the compounds C, D and E might be synthesized (9 marks)

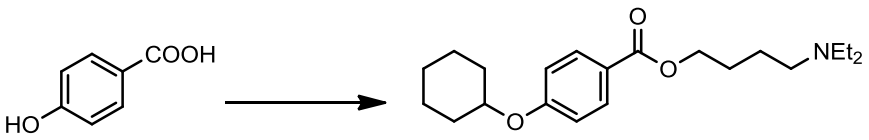
b) (i) Define green chemistry (1 mark)

(ii) Describe the principles of green chemistry (6 marks)

QUESTION THREE (25 MARKS)

a) Define chemoselectivity (1 mark)

b) Use the equation below to answer the questions that follow:

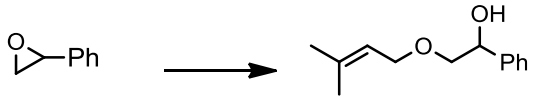


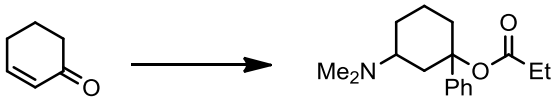
4-Hydroxybenzoic acid Cyclometycine

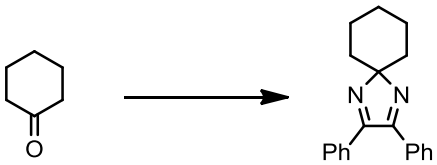
i. Do retrosynthetic analysis of cyclomelthycine, an anesthetic drug. (3 marks)

ii. Suggest a synthetic pathway for the molecule and explain how chemoselectivity issue is circumvented. (3 marks)

c) Use the structures I-III to answer the following questions

I 

II 

III 

i. Do retrosynthetic analysis of the difunctionalized compound I-III (9 marks)

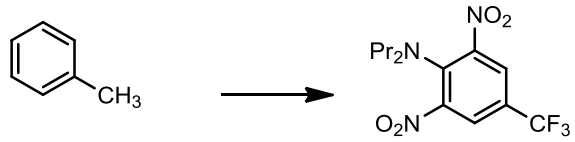
ii. Suggest a synthesis for the compounds I-III (9 marks)

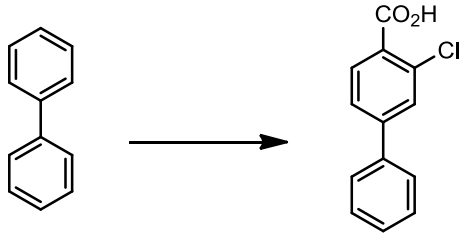
QUESTION FOUR (25 MARKS)

a) Identify any three qualities of a good protecting group (3 marks)

b) Explain two methods by which aromatic nucleophilic substitution might be effected (6 marks)

c) Use the structures below to answer the questions that follow

I 

II 

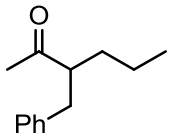
i. Do retrosynthetic analysis of compounds I and II (8 marks)

ii. Suggest how the products in I and II might be synthesized from the indicated starting materials. Explain the order of events. (8 marks)

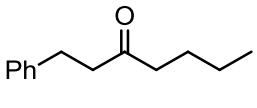
QUESTION FIVE (25 MARKS)

a) (i) Define regioselectivity (1 mark)

(ii) Suggest how the isomeric ketones M and N might be synthesized in the laboratory using acetone as a starting material. Explain how the problem of regioselectivity is circumvented. (7 marks)

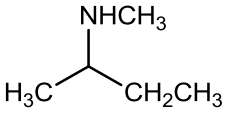


M

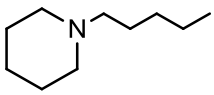


N

b) Use the structures of the amines X and Y to answer the following questions



X



Y

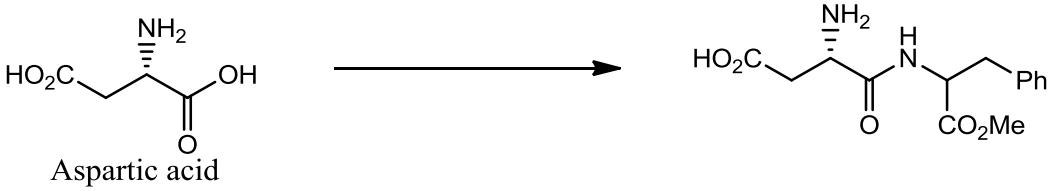
i. Do retrosynthetic analysis of the amines I and II (4 marks)

ii. Suggest a synthetic route for the amines I and II (5 marks)

c) Aspartame is a dipeptide that is 150times sweeter than sugar and is used as a sugar substitute.

i. Suggest a synthesis for aspartame using aspartic acid as a starting material (4 marks)

ii. Explain how the problem of chemoselectivity is solved using Cbz-Cl and $PhCH_2OH$ as protecting groups (4 marks)



Aspartic acid