MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL AND BIOLOGICAL SCIENCES

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

SECOND YEAR **SECOND** SEMESTER EXAMINATION FOR BACHELOR OF EDUCATION SCIENCE

ACH 202 – ORGANIC CHEMISTRY II

DURATION: 2 HOURS

DATE: 16th April 2019

TIME: 9:00-11:00 am

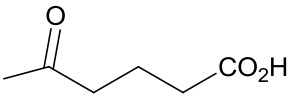
Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

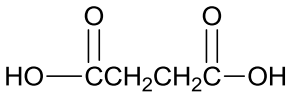
SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) Give the IUPAC names of the following compounds indicating stereochemistry where possible



(i)



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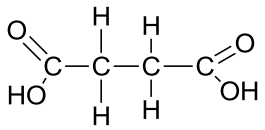

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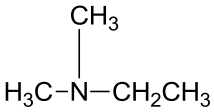

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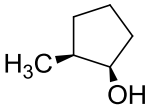


(v)

(5 marks)

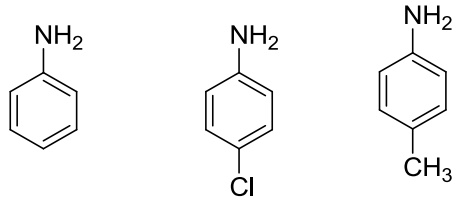
b) Draw the structures of the following compounds: (5 marks)

i. Benzaldehyde
ii. *Trans*-2-Butenoic acid
iii. 2,4-dibromoaniline
iv. 2,2,-dimethylpropanediol
v. 2,2,4-trimethylpentanone

c) A student was given a sample of a compound which was suspected to contain alcohol. The student tested with lucas reangent and no observable change was made even after ten minutes. Then the sample was tested with iodine and sodium hydroxide, a yellow precipitate was observed. Give the identity of the alcohol giving reasons. (3 marks)

d) Explain how propylamine can be separated from a mixture of propylamine with other non-basic organic compounds. (4 marks)

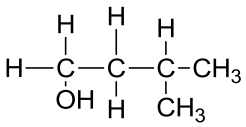
e) Arrange the following in the order of increasing basicity and explain your sequence. (3 marks)



f) A student was asked to give the compounds that might be used to prepare ethylamine and their ratios. The student gave Bromoethane and ammonia in the ratio of 1:1. Explain why the teacher disagreed with that ratio and how the problem could be corrected. (4 marks)

g) Explain why alcohols behave both as acids and bases. (2 marks)

h) Given the alcohols below, which has the highest boiling point and why? (2 marks)



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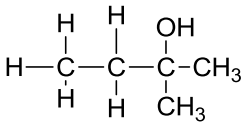
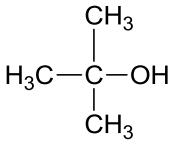


Y

i) Explain how you can differentiate the following alcohols in a laboratory using a chemical test. (2 marks)



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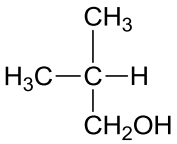


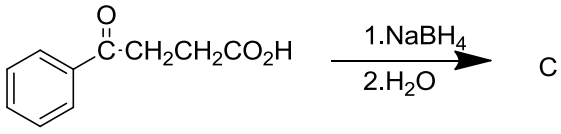
Q

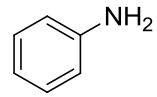
SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

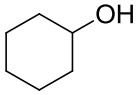
QUESTION TWO (20 MARKS)

a) Complete the following reactions (6 marks)

(i) $CH_3CH_2CH_2OH + HBr \longrightarrow A + B$

(ii) 

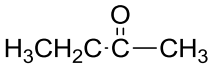
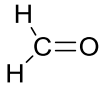
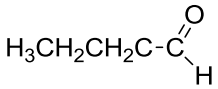
(iii)  + HCl ⟶ D

(iv)  $\xrightarrow[H_2SO_4]{K_2CrO_3}$ E

(v) $CH_3C(=O)H$ + HCN ⟶ F

b) Explain why aldehydes and ketones with few number of carbon atoms dissolve in water? (1 mark)

c) Given the following molecules, arrange them in the order of increasing reactivity and account for your order (2 marks)

d) A student wanted to prepare propan-2-one and propanol from propan-2-ol and propan-1-ol respectively. The student decided to use potassium permanganate in both cases. Did he get the two products? And if not give reasons. (3 marks)

e) During substitution reactions of alcohols, the solution must be acidic, why? (3 marks)

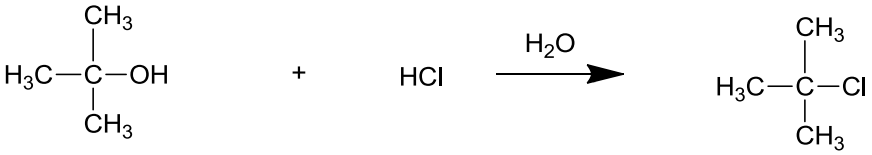
f) Give three uses of alcohols (3 marks)

g) Explain why aldehydes get contaminated easily when they are not corked properly (2 marks)

QUESTION THREE (20 MARKS)

a) Between $NH_2CH_2CH_2CH_2COOH$ and $Cl_2CHCH_2CH_2COOH$, which one is more acidic? Explain. (3 marks)

b) Show the mechanism of the reaction below (4 marks)



c) Give four uses of amines (4 marks)

d) Explain how a mixture of propanoic acid and non-acid organic compound can be separated. (4 marks)

e) Explain how a sample of propanal can be differentiated from propanone in the laboratory. (3 marks)

f) How do boiling points of ketones and aldehydes compare with those of alcohol with comparable molecular weights? Give reasons. (2 marks)

QUESTION FOUR (20 MARKS)

a) Carboxyl acids are more acidic than alcohols, why? (2 marks)

b) Given that an alcohol has a molecular formula $C_4H_{10}O$, draw all possible structures that can be represented by that molecular formula giving their IUPAC names. (4 marks)

c) Give three uses of aldehydes. (3 marks)

d) Give the structures of the alkenes produced when 2-butanol undergoes dehydration. With reasons, identify the structure that represents the major compound formed. (3 marks)

e) Write a balanced equation that represents the reaction of butanoic acid with zinc metal (1 mark)

f) Explain why aliphatic amines are more basic than ammonia. (2 marks)

g) Between ethanol and ethanediol, which has higher boiling point? Explain. (2 marks)

h) In the reaction represented by the following equations, label the reaction as SN^1 or SN^2, E1 or E2.

(i) $CH_3CH_2CHOHCH_3 + HCl \longrightarrow CH_3CH{=}CHCH_3$

(ii) $CH_3CH_2OH + HCl \longrightarrow CH_3CH_2Cl$

(2 marks)

i) Why is CH_3CHO less reactive than $ClCH_2CHO$? (1 mark)