# MURANG'A UNIVERSITY OF TECHNOLOGY

## SCHOOL OF PURE AND APPLIED SCIENCE

DEPARTMENT OF APPLIED SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

**FIRST** YEAR, **SECOND** SEMESTER EXAMINATION FOR BACHELOR OF EDUCATION (SCIENCE) AND BACHELOR OF SCIENCE IN ANALYTICAL CHEMISTRY

ACH102: ORGANIC CHEMISTRY I

DURATION: 2 HOURS

DATE: 20TH APRIL 2018

TIME: 9.00AM – 11.00AM

**Instructions to Candidates:**

1. Answer **Section A** and **Any Other Two** questions in **Section B**.
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 (30 Marks)

**QUESTION ONE**

a) i) Draw all the structures of mono chlorination products that would be obtained from the free radical bromination of methyl propane using molecular bromine. (2 Marks)
ii) Which one would be obtained in greatest yield? Explain. (2 Marks)

b) Provide systematic (???) names for the following compounds indicating stereochemistry where possible. (5 Marks)

i. ii.

iii. iv.

v.

c) Provide the structures of the major organic compounds expected in the following reactions. Indicate stereochemistry where possible. (5 Marks)

i.

ii.

iii.

iv.

d) Draw structures for each of the following; (3 Marks)

i. 4-(1,1-dimethylethyl) octane

ii. (Z)-1-bromo-1,2-dichloroethane

iii. 1-Penten-4-yne

e) What is the hybridization of the indicated carbon atoms a, b, c, and d. (4 Marks)

f) Write a balanced equation to show the products formed when the compound K shown below is completely burnt in oxygen. (1 Mark)

g) Using equation show how the following compounds can be prepared from 1-methylcyclopentene (3 Marks)

i. ii.

h) Complete combustion of 0.15 of a sample of Q gave 0.228g of carbon dioxide ($CO_2$) and 0.0931j of water ($H_2O$). The molecular mass of the compound is 174.
Use C=12.01, H=1.008, O=15.99 as relative atomic mass.

i. What is the percentage composition of oxygen in compound Q? (2 Marks)

ii. Calculate the empirical formula of compound Q (2 Marks)

iii. What is the molecular formula of compound Q? (1 Mark)

## SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

**QUESTION TWO (20 MARKS)**

a) Three different alkenes yield the alkyl halide shown below when they are reacted with the same reagents. State the reagent and draw the structure of the three possible alkenes.

(4 Marks)

Alkyl halide

b) Ethane reacts with water in the presence of an acid to give ethanol. Give the mechanism of the reaction in steps. (5 Marks)

c) Draw the structure of the compound which reacts with hot zinc to produce propyne. (1 Mark)

d) i) By use of equations, show the possible products obtained from cracking of propane. (2 Marks)

ii) Name two factors that dictate the product during the cracking of alkenes. (1 Mark)

e) Arrange the following in the increasing order of band length (2 Marks)

f) Give the structures of the two possible products of the reaction below. (2 Marks)

g) Draw at least four possible isomeric structures with molecular formula $C_4H_qCl$ indicating their IUPAC names. (4 Marks)

**QUESTION THREE (20 MARKS)**

a) Give four uses of halogen derivatives. (4 Marks)

b) Provide the following compounds A and B in the reaction below. (2 Marks)

c) Starting with 1-hexyne show using chemical equation how 3-octyne can be prepared. (2 Marks)

d) Which of the following is expected to have a higher octane number and why. ( 2 Marks)

**X** **Y**

e) Indicate which of the following molecules have covalent, co-ordinate covalent bond and polar covalent bond. (3 Marks)

f) Give the reagents labeled 1 to 5 for the following conversions; (5 Marks)

i.

ii.

iii.

g) The following are the bond disassociation energies in kJMol for each step of methane molecule ($CH_4$).

Use the above information to calculate the bond energy of C – H bond in methane ($CH_4$) molecule. (2 Marks)

**QUESTION FOUR (20 MARKS)**

a) A student was asked to give reagents that can be used to prepare pentane and gave bromoethane, 1-bromopropane and sodium but the teacher did not agree with him. Giving equations for the reactions from the above reagent explain why the teacher differed with him and by use of a chemical equation, suggest a method that can be used to prepare pentane. (5 Marks)

b) When 2-chlorobutane is treated with potassium hydroxide two products are produced. Write the equation for the reaction and identify the major and minor products. Give account for the major product. (2 Marks)

c) A certain organic compound Q reacts with R to form P according to the equation

$$3Q + R \rightarrow P$$

If 0.15moles of Q reacted with 0.1moles of R to form the product P, determine the limiting reagent ant the number of moles of P. (2 Marks)

d) Write down the reaction mechanisms showing the initiation, propagation and termination steps in free radical reaction in bromination of ethane to bromoethane using molecular bromine in presence of light. (6 Marks)

e) How can you distinguish chlorobenzene from 1-chloronexane? (2 Marks)

f) How do the boiling points of alkylamides compare with alkanes with the same carbon atoms and why? (2 Marks)

g) Define the term pyrolysis. (1 Mark)