



KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF CHEMISTRY AND BACHELOR
OF EDUCATION

COURSE CODE: SCH 112/113

COURSE TITLE: INTRODUCTION TO ORGANIC CHEMISTRY

DURATION: 2 HOURS

DATE: 19/02/2021

TIME: 2:00-4:00 PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
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This paper consists of 8 printed pages. Please Turn Over



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QUESTION 1 Compulsory 30 marks

(a) The boiling points of some alcohols are shown in the table below.

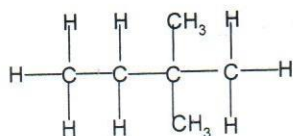
Alcohol	Number of carbon atoms	Boiling point in °C
Methanol	1	65
Ethanol	2	78
Propanol	3	98
Butanol	4	
Pentanol	5	138
Hexanol	6	157

- (i) Plot a graph of the boiling point of the alcohols, and use your graph to estimate the boiling point of butanol, C_4H_9OH . [4 marks]
- (ii) In a cracking reaction, an alkane with 14 carbon atoms breaks down to produce two smaller hydrocarbon molecules. One is an alkane with 8 carbon atoms and the other is an alkene. Write a balanced symbol equation for this reaction. [1 mark]
- (iii) Describe the reaction of propene with bromine water, including the name or structure of the product. [4 marks]
- (iv) A student is trying to distinguish between three colourless liquids. One of them is an alkene, one of them is an alcohol and the other is a carboxylic acid. Describe an experiment that would allow the student to identify which is which. You should state and explain the expected results in your answer. [5 marks]

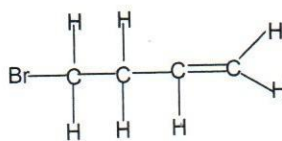
(b) Name the following compounds:

[5 marks]

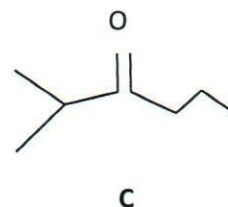
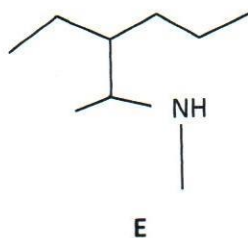
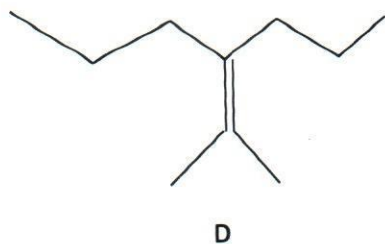
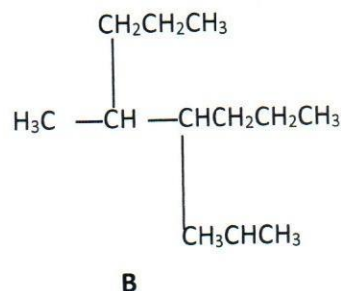
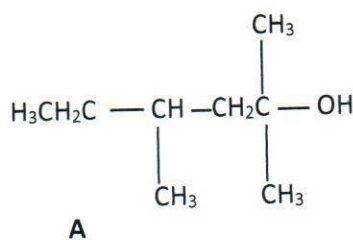
i)



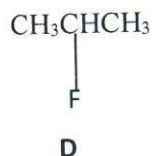
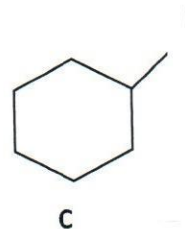
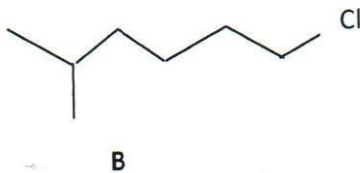
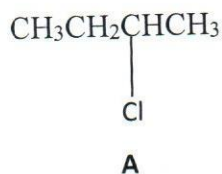
ii)



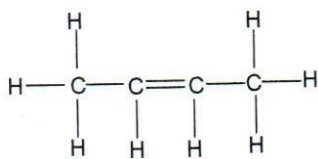
- (i) Considering that carbon is tetravalent, determine the molecular formula of the compound from this stick structure [3mks]
- (ii) Identify the all the classes of compounds represented by the functional groups present in the molecule. [3mks]
- (iii) Give general formulae for the homologous series for each of the classes of compounds named in (ii) above. [3mks]
- (iv) Give systematic names for compounds with the following structure. [5mks]



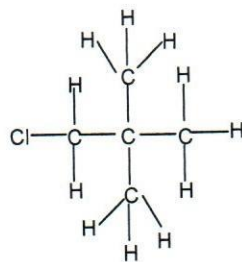
- (v) Give two IUPAC names for each of the haloalkanes given below and tell whether each is primary, secondary or tertiary. [6 marks]



iii)



iv)



v) $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_3$

(c) Write the structural formulae for these compounds

[4 marks]

(i) Propyne

(ii) Cis-pent-2-ene

(iii) Cycloocta-1,3,5,7-tetraene

(iv) 2-methylpent-2-ene

(d) How would you distinguish between the compounds in each of the following pairs using simple test tube reactions? [3 marks]

(i) $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CH}$ and $\text{CH}_2=\text{CHCH}=\text{CH}_2$

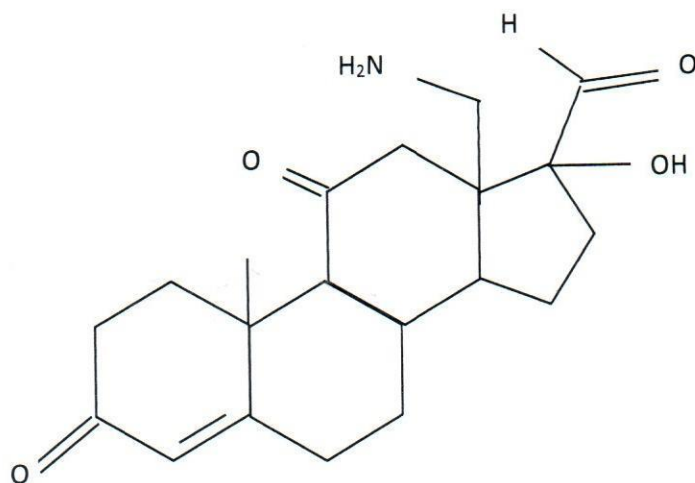
(ii) Hex-1-ene and cyclohexane

(iii) $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CH}$ and $\text{CH}_3\text{C}\equiv\text{CCH}_3$

(e) A hydrocarbon has a molecular weight of approximately 60 and contains 17.2% of hydrogen. Work out the molecular formula of the hydrocarbon and write down all of the structural isomers which have this formula [4 marks]

Question 2 (20 marks)

(a) Cortison whose chemical structure is given below is an adrenocortical steroid that is used as an anti-inflammatory agent.



Question 3 (20 marks)

(a) Categorise these molecules as either polar or non – polar

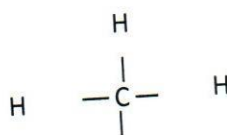
[4 mks]



A

HCl

B



C

CCl₄

D

(b) Draw the structures of the seven constitutional isomers that have the formula C₄H₁₀O.
Classify the isomers as either alcohols or ethers [8mks].

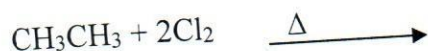
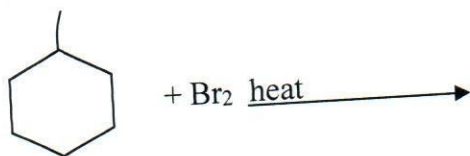
(c) Consider the compounds in question 2(b) above;

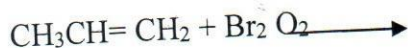
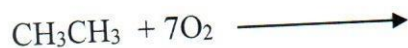
- (i) Between the alcohols and the ether, which class of compound would have higher boiling? Explain [2mks]
- (ii) Name the intermolecular bonding involved both in the alcohols and ethers. [4 mks]

Which of the alcohols do you expect to have the higher melting point? Explain. [2 marks]

Question 4 (20 marks)

(a) Give the products for the reaction given below indicating the major and minor products where applicable. [6 marks]





(b) Refer to question 4(a) above to answer the following question;

(i) Give a reason for the major product in (i) [1 mark]

(ii) What changes would be made in the reaction conditions in (i) to increase percentage of the major product? Explain [2marks]

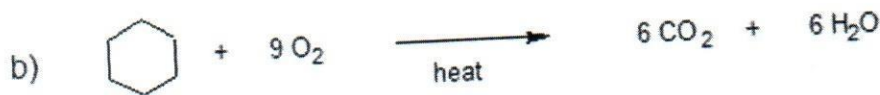
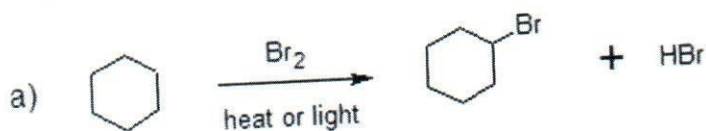
(iii) Explain results in (v) [1mark]

(iv) Give mechanism leading to major product in (i) [6marks]

(c) 1,2-dichlorocyclopropane has cis and trans isomers. Explain why this is so and draw the structures of the two isomers [4marks]

Question 5 (20 marks)

a) Classify the following reactions as combustion or halogenation. (2 marks)



b) There are five alkane isomers of hexane C_6H_{14} . Draw and name all of them. (5 marks)

c) The heat of combustion of hexane is 4163.2 kJ/mol. Heat of combustion of neohexane is 4159.5 kJ/mol. Predict the relative stability of these two compounds? (2 marks)

d) Draw and name all cycloalkane isomers of C_5H_{10} , including all possible geometric (cis-trans) stereoisomers. (5 marks)

e) Which of the following structures represent the same compound? Name the structures given in part (a), (d), (e), (f), (g) (6 marks)

