2915/104
ORGANIC AND INORGANIC CHEMISTRY I
June/July 2022
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN ANALYTICAL CHEMISTRY MODULE I

ORGANIC AND INORGANIC CHEMISTRY I

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination: Answer booklet:

Non-programmable scientific calculator.

This paper consists of TWO sections; A and B.

Answer ALL questions in section A and any THREE questions from section B.

Each question in section A carries 4 marks while each question in section B carries 20 marks.

Maximum marks for each part of the question are indicated.

Candidates should answer the questions in English.

This paper consists of 6 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A (40 marks)

Answer ALL questions in this section.

- 1. Given the systematic names of the following organic compounds:
 - , (a) (CH₃)₃CCH₂COOH

(c) C₂H₅OCH₂CH(CH₃)CH₃

.(d)
$$CH_2CH_2(OH)$$

Composer

(4 marks)

- . 2. (a) Using an example, explain the meaning of an ambident nucleophile. (2 marks)
 - (b) Give a chemical equation for the reaction of ethylbromide with potassium cyanide in aqueous ethanol. (2 marks)
 - Complete the following equations by providing the structure of the major products formed.

(a)
$$NaSH$$
 (1 mark)

(b)
$$CH_3(CH_2)_3CH_2OH + PCl_5 \longrightarrow$$
 (1 mark)

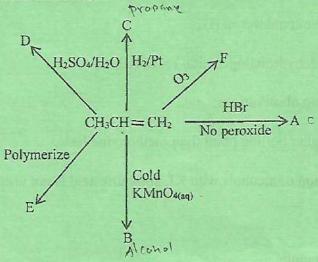
(c)
$$CH_3CH_2CH_2CO_2H \xrightarrow{(CH_3)_3C(OH); H^+}$$
 (1 mark)

$$(d) \qquad \begin{array}{c} HI \\ \end{array} \qquad (1 \text{ marks})$$

(2 marks)	(b) Write a chemical equation for the reaction.	
(2 marks)	(a) Explain the observation above.	
colour to	When chlorine gas is bubbled into a solution of MaBr, the solution slowly changes its obtown.	10.
ies from (4 marks)	Calculate the wavenumber that corresponds to a transition of the hydrogen spectral set the bracket series, to the balmers series given $R_{\rm H}=109677~{\rm cm}^{-1}$.	.6 •
(2 marks)	(b) State the law of triads.	
(2 marks)	(a) State the difference between Mendeleevs periodic law and the modern periodic	.8
(2 marks)	(b) Explain why the ionization energy of K ⁺ is higher than that of Ar.	
(2 marks)	$(8I = S) \text{ TA} \qquad (i)$ $(9I = S) + M \qquad (ii)$ $(2I = S) + M \qquad (ii)$	
	(a) Write the electronic configurations of the following compounds:	.Г
(4 marks)	(i) uncertainties principle; (ii) Hunds rule.	Lines
(2 marks)	State the following:	.9'
(2 marks)	 (a) Ethanol has a higher boiling point than methoxymethane. (b) During the reaction of alcohols with KI, sulphuric acid is not used. 	
	Account for the following observations:	·ç
(I mark)	(b) Define the term dehydrohalogenation reaction.	
(2 marks)	(ii) Explain your answer in (i).	
(1 mark)	2-Bromo-2-methylbutane, 1-bromopentane, 2-bromopentane.	
	(a) (i) Arrange the following compounds in order of reactivity towards SN ² displacement.	.4.

Answer any THREE questions from this section.

11. (a) The scheme below represents some of the reactions of propene. Study it and answer the questions that follow.



- (i) Define the term polymerization. (2 marks)
- (ii) Name compounds A, B, C and F. (4 marks)
- (iii) Name the process leading to formation of compound C. (1 mark)
- (iv) State the importance of the process in (iii). (1 mark)
- (v) State two uses of compound D (2 marks)
- (b) Starting with propane and other relevant reagents, show how propan-2-ol can be synthesized. (6 marks)
- (c) Illustrate with examples, the limitations of Williamson synthesis for the preparation of certain types of ethers. (4 marks)
- 12. (a) Explain the meaning of the following terms:
 - (i) Lindlar's catalyst. (2 marks)
 - (ii) Decarboxylation. (2 marks)
 - (b) Describe how you will separate propene from a mixture of propene and propyne.

 (3 marks)
 - (c) (i) Name all the structural isomers with the molecular formula C₄H₉Br.

(4 marks)

- (ii) Name the type of reaction that takes place between the isomers in 12.c(i) above with ammonia. (1 mark)
- (iii) Identify with reasons the most reactive isomer from 12.c(i) above. (2 marks

(d) Explain using chemical tests, how the following pair of compounds can be distinguished.

- (ii) n-butylalcohol and diethylether
- (iii) CH₃OH and C₂H₅OH

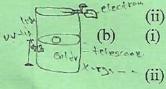
(6 marks)

- 13. (a) Alkanes are called paraffins while alkenes are called olefins. Account for this observation. (2 marks)
 - (b) Using curly arrows give the reaction mechanism for the reaction between ethanol and propanoic acid in acidic conditions. (3 marks)
 - (c) Identify with reasons, which acid from the following pair would be expected to be a stronger acid. CH₃COOH or CH₂FCOOH (3 marks)
 - (d) State two uses of ethanoic acid.

(2 marks)

- (e) Draw a well labelled diagram for the apparatus used to determine the charge on an electron using the Millikans oildrop experiment. (10 marks)
- 14. (a) (i) Sketch a graph of the trends of the 1st ionization energies of group 1 elements.

 (4 marks)



- Account for the trends of ionization energies of group 1 elements. (4 marks)
- Exlain why beryllium does not react with water.

(2 marks)

- (ii) Using two relevant examples in the periodic table, exlain the meaning of the word 'diagonal similarities'. (2 marks)
- (iii) Using relevant chemical equations, show two similarities between lithium and magnesium. (4 marks)
- (iv) Explain why alkali metals do not occur naturally in nature but as ores or oxides.
- (v) Explain why BeCl₂ is covalent in nature. (2 marks) (2 marks)

(a) State the significance of each of the four quantum numbers. (4 marks) Determine the number of electrons in atoms which have the following levels in ground (b) state. K shell, L shell, 3S subshell and a half filled 3P subshell. (i) (2 marks) K shell, L shell, M shell and 4s, 4p and 4d subshells. (ii) (3 marks) (c) State 4 shortfalls of Mendleev's periodic table. (i) (4 marks) (ii) Name the method used to extract alkali and alkali earth metals. (1 marks) Explain why the method in 15 c part ii above is favoured over other methods. (iii) (2 marks) With reasons, comment on the solubility of oxides of group 2. (d) (4 marks)

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PIP MR. ORGANIC