

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.

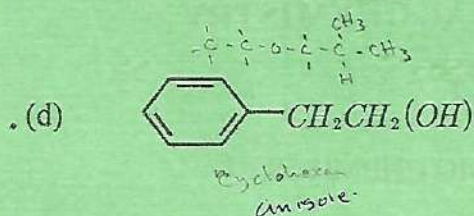
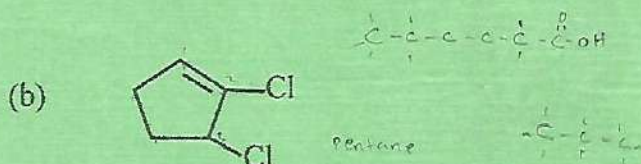
This paper consists of 6 printed pages.

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.

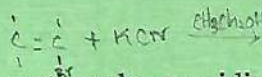
1. Given the systematic names of the following organic compounds:



(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)

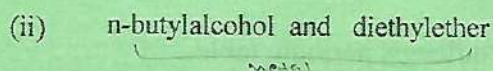
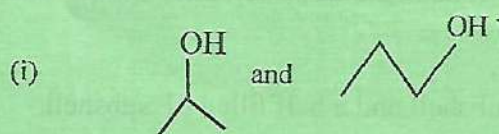


3. Complete the following equations by providing the structure of the major products formed.



4. (a) (i) Arrange the following compounds in order of reactivity towards SN^2 displacement.
2-Bromo-2-methylbutane, 1-bromopentane, 2-bromopentane. (1 mark)
- (ii) Explain your answer in (i). (2 marks)
- (b) Define the term dehydrohalogenation reaction. (1 mark)
5. Account for the following observations:
(a) Ethanol has a higher boiling point than methoxymethane. (2 marks)
- (b) During the reaction of alcohols with KI , sulphuric acid is not used. (2 marks)
6. State the following:
(i) uncertainties principle; (1)
- (ii) Hund's rule. (1)
7. (a) Write the electronic configurations of the following compounds:
(i) Ar ($Z = 18$)
(ii) K^+ ($Z = 19$) (2 marks)
- (b) Explain why the ionization energy of K^+ is higher than that of Ar. (2 marks)
8. (a) State the difference between Mendeleev's periodic law and the modern periodic law. (2 marks)
- (b) State the law of triads. (2 marks)
9. Calculate the wavenumber that corresponds to a transition of the hydrogen spectral series from the bracket series, to the balmer series given $R_H = 109677 \text{ cm}^{-1}$. (4 marks)
10. When chlorine gas is bubbled into a solution of NaBr , the solution slowly changes its colour to brown.
(a) Explain the observation above. (2 marks)
- (b) Write a chemical equation for the reaction. (2 marks)

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



(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. CH_3COOH or CH_2FCOOH (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 oil drop experiment. (10 marks)

14. (a) (i) Sketch a graph of the trends of the 1st ionization energies of group 1 elements. (4 marks)

(ii) Account for the trends of ionization energies of group 1 elements. (4 marks)

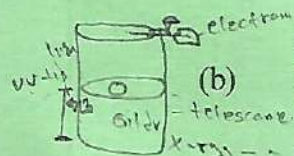
(b) (i) Explain why beryllium does not react with water. (2 marks)

(ii) Using two relevant examples in the periodic table, explain 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. (2 marks)

(v) Explain why BeCl_2 is covalent in nature. (2 marks)



15. (a) State the significance of each of the four quantum numbers. (4 marks)
- (b) Determine the number of electrons in atoms which have the following levels in ground state.
- (i) $1s^2$ K shell, 2 L shell, 3 3S subshell and a half filled 3P subshell. (2 marks)
- (ii) 2 K shell, 3 L shell, 3 M shell and 2 4s, 4 4p and 10 4d subshells. (3 marks)
- (c) (i) State 4 shortfalls of Mendeleev's periodic table. (4 marks)
- (ii) Name the method used to extract alkali and alkali earth metals. (1 marks)
- Down process*
- (iii) Explain why the method in 15 c part ii above is favoured over other methods. (2 marks)
- (d) With reasons, comment on the solubility of oxides of group 2. (4 marks)

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R.I.P MR. ORGANIC