THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

233/2 – CHEMISTRY – Paper 2
(THEORY)
Nov. 2017 – 2 hours

Name ..... Index Number .....

Candidate's Signature ..... Date .....

Instructions to candidates

(a) *Write your name and index number in the spaces provided above.*
(b) *Sign and write the date of examination in the spaces provided above.*
(c) *Answer **ALL** the questions in the spaces provided.*
(d) *KNEC mathematical tables and silent non-programmable electronic calculators may be used.*
(e) *All working **MUST** be clearly shown where necessary.*
(f) ***This paper consists of 14 printed pages.***
(g) ***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***
(h) ***Candidates should answer the questions in English.***

For Examiner's Use Only

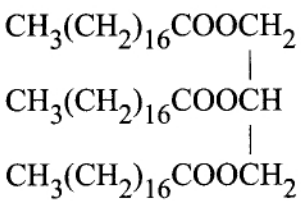
Question	Maximum Score	Candidate's Score
1	12	
2	13	
3	12	
4	11	
5	9	
6	12	
7	11	
Total Score	80	

1. (a) Name the homologous series represented by each of the following general formulae.

(i) $C_n H_{2n-2}$ ..... (1 mark)

(ii) $C_n H_{2n}$ ..... (1 mark)

(b) Compound **G** is a triester.



Compound G

(i) Give the physical state of compound **G** at room temperature. (1 mark)

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(ii) **G** is completely hydrolysed by heating with aqueous sodium hydroxide.

I Give the structural formula of the alcohol formed. (1 mark)

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II Write a formula for the sodium salt formed. (1 mark)

.....

III **State the use of the sodium salt.** (1 mark)

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(c) Ethyne is the first member of the alkyne family.

(i) Name **two** reagents that can be used in the laboratory to prepare the gas. (1 mark)

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(ii) Write an equation for the reaction. (1 mark)

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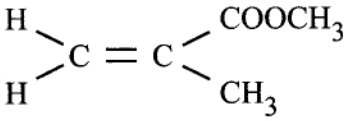
(d) Perspex is an addition synthetic polymer formed from the monomer,



(i) What is meant by addition polymerisation? (1 mark)

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(ii) Draw **three** repeat units of perspex. (1 mark)

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(iii) Give **one** use of perspex (1 mark)

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(iv) State **two** environmental hazards associated with synthetic polymers. (1 mark)

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2. The conductivity of some substances was investigated. The observations made were recorded in **Table 1**. Use it to answer the questions that follow.

Table 1

Substance	Conductivity in solid state	Conductivity in molten or aqueous state
F	Does not conduct	Conducts
G	Conducts	Conducts
H	Does not conduct	Does not conduct

(a) (i) Identify a substance that is a metal. Give a reason. (2 marks)

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(ii) Substance **F** does not conduct electricity in solid state but conducts in molten or aqueous state. Explain. (2 marks)

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(b) Copper(II) sulphate solution was electrolysed using the set up in **Figure 1**.

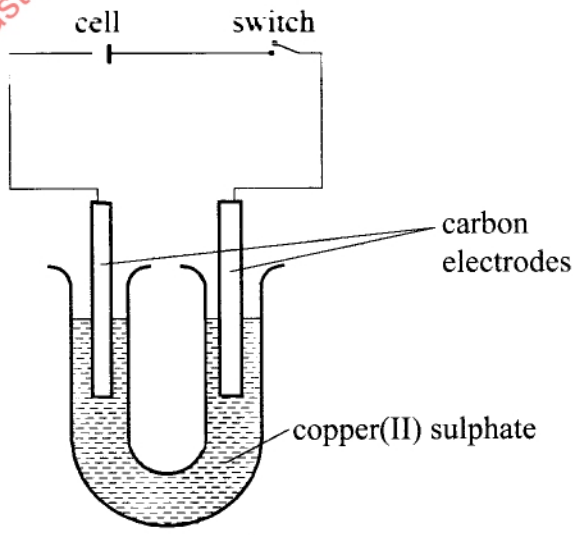

Figure 1

(i) State the observations made during electrolysis. (1½ marks)

.....

.....

(ii) Write the equation for the reaction that occurs at the anode. (1 mark)

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.....

(iii) State the expected change in pH of the electrolyte after electrolysis. (½ mark)

.....

.....

(c) The experiment was repeated using copper electrodes instead of carbon electrodes. Describe the observations made at each electrode. (1 mark)

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(d) Electroplating is an important industrial process.

(i) What is meant by electroplating. (1 mark)

.....

(ii) State the purpose of electroplating. (1 mark)

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(iii) During electroplating of an iron spoon, a current of 0.6 amperes was passed through aqueous silver nitrate solution for 1½ hours. Calculate the mass of silver that was deposited on the spoon. (3 marks)
(Ag = 108.0 ; 1F = 96,500 C mol^{-1})

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3. (a) A student used **Figure 2** to investigate the action of dilute sulphuric(VI) acid on some metals. Beaker **I** and **II** contained equal volumes of dilute sulphuric(VI) acid.
To beaker **I**, a clean iron rod was dipped and to beaker **II**, a clean copper rod was dipped.

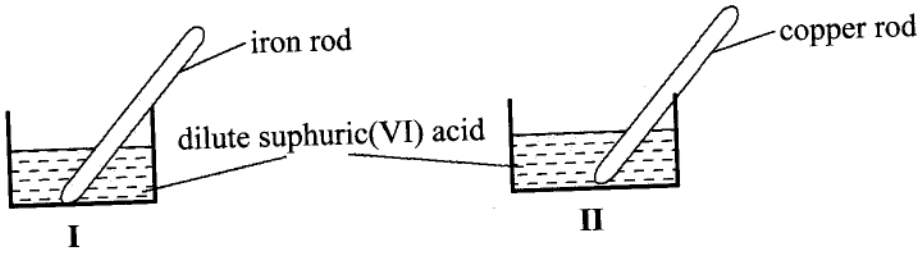

Figure 2

(i) Why was it necessary to clean the metal rods? (1 mark)

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(ii) Describe the observations made in each beaker.

Beaker **I**: (1 mark)

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Beaker **II**: (1 mark)

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(iii) Explain the observations in (a) (ii). (2 marks)

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(b) **Figure 3** shows the apparatus used to burn hydrogen in air. Use it to answer the questions that follow.

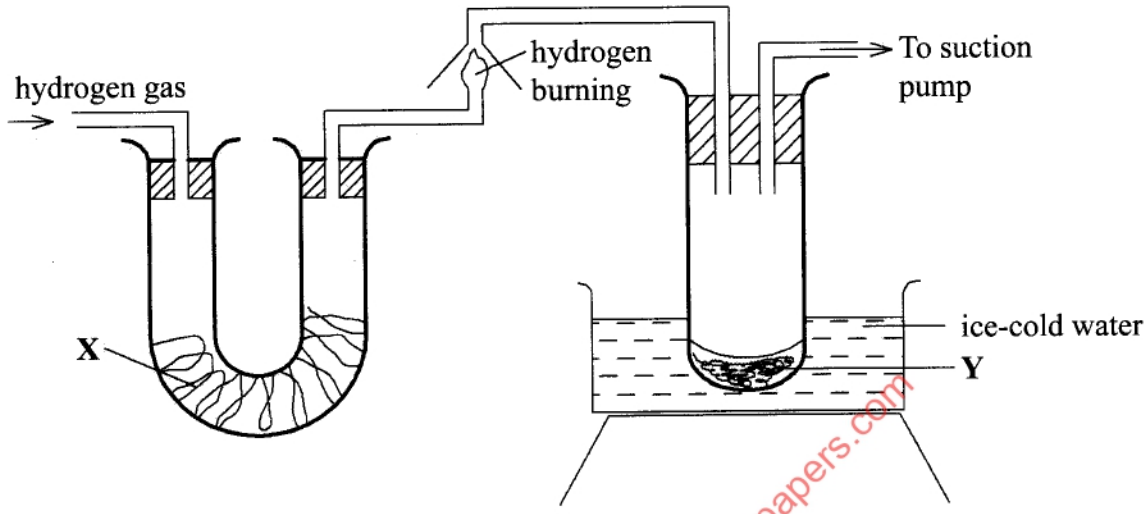

Figure 3

(i) State the role of substance **X**. (1 mark)

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(ii) Give the name of the substance that could be used as **X**. (1 mark)

.....

(iii) State the role of the suction pump. (1 mark)

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(iv) Name the product **Y** formed. (1 mark)

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(v) Give a simple physical test to prove the identity of **Y**. (1 mark)

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(vi) State the difference between 'dry' and 'anhydrous'. (2 marks)

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4. **W** is a colourless aqueous solution with the following properties:

I It turns blue litmus paper red.
II On addition of cleaned magnesium ribbon, it gives off a gas that burns with a pop sound.
III On addition of powered sodium carbonate, it gives off a gas which forms a precipitate with calcium hydroxide solution.
IV When warmed with copper(II) oxide powder, a blue solution is obtained but no gas is given off.
V On addition of aqueous barium chloride, a white precipitate is obtained.

(a) (i) State what properties (I) and (III) indicate about the nature of **W**. (1 mark)

.....

(ii) Give the identity of **W**. (1 mark)

.....

(iii) Name the colourless solution formed in (II) and (III). (2 marks)

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(iv) Write an ionic equation for the reaction indicated in (V). (1 mark)

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(b) Element **V** conducts electricity and melts at 933K. When chlorine gas is passed over heated **V**, it forms a vapour that solidifies on cooling. The solid chloride dissolves in water to form an acidic solution. The chloride vapour has a relative molecular mass of 267 and contains 19.75% of **V**. At a higher temperature, it dissociates to a compound of relative molecular mass 133.5. When aqueous sodium hydroxide is added to the aqueous solution of the chloride, a white precipitate is formed which dissolves in excess alkali. (V = 27.0 ; Cl = 35.5)

(i) Determine the:

I empirical formula (2 marks)

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II molecular formula (2 marks)

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(ii) Draw the structure of the chloride vapour and label the bonds. (1 mark)

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(iii) Write an equation for the reaction that form a white precipitate with sodium hydroxide. (1 mark)

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5. (a) When 0.048 g of magnesium was reacted with excess dilute hydrochloric acid at room temperature and pressure, 50 cm^3 of hydrogen gas was collected.
(Mg = 24.0; Molar gas volume = 24.0 dm^3)

(i) Draw a diagram of the apparatus used to carry out the experiment described above. (3 marks)

(ii) Write the equation for the reaction. (1 mark)

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(iii) Calculate the volume of hydrogen gas produced. (2 marks)

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(iv) Calculate the volume of 0.1M hydrochloric acid required to react with 0.048 g of magnesium. (3 marks)

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6. The following steps were used to analyse a metal ore.

(i) An ore of a metal was roasted in a stream of oxygen. A gas with a pungent smell was formed which turned acidified potassium dichromate(VI) green.
(ii) The residue left after roasting was dissolved in hot dilute nitric(V) acid. Crystals were obtained from the solution.
(iii) Some crystals were dried and heated. A brown acidic gas and a colourless gas were evolved and a yellow solid remained.
(iv) The solid was yellow when cold.
(v) The yellow solid was heated with powered charcoal. Shiny beads were formed.

Name the:

(a) gas formed when the ore was roasted in air. (1 mark)

.....

(b) gases evolved when crystals in step (iii) were heated. (2 marks)

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(c) yellow solid formed in step (iii). (1 mark)

.....

(d) shiny beads in step (iv). (1 mark)

.....

(e) The yellow solid from procedure (iii) was separated, dried, melted and the melt electrolysed using graphite electrodes.

I. Describe the observations made at each electrode. (2 marks)

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II. Write the equation for the reaction that took place at the anode. (1 mark)

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(f) Some crystals formed in step (ii) were dissolved in water, and a portion of it reacted with potassium iodide solution. A yellow precipitate was formed. Write an ionic equation for this reaction. (1 mark)

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(g) To another portion of the solution from (f), sodium hydroxide solution was added drop by drop until there was no further change.
Describe the observation made. (1 mark)

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(h) To a further portion of the solution from (f), a piece of zinc foil was added.

I. Name the type of reaction taking place. (1 mark)

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II. Write an ionic equation for the above reaction. (1 mark)

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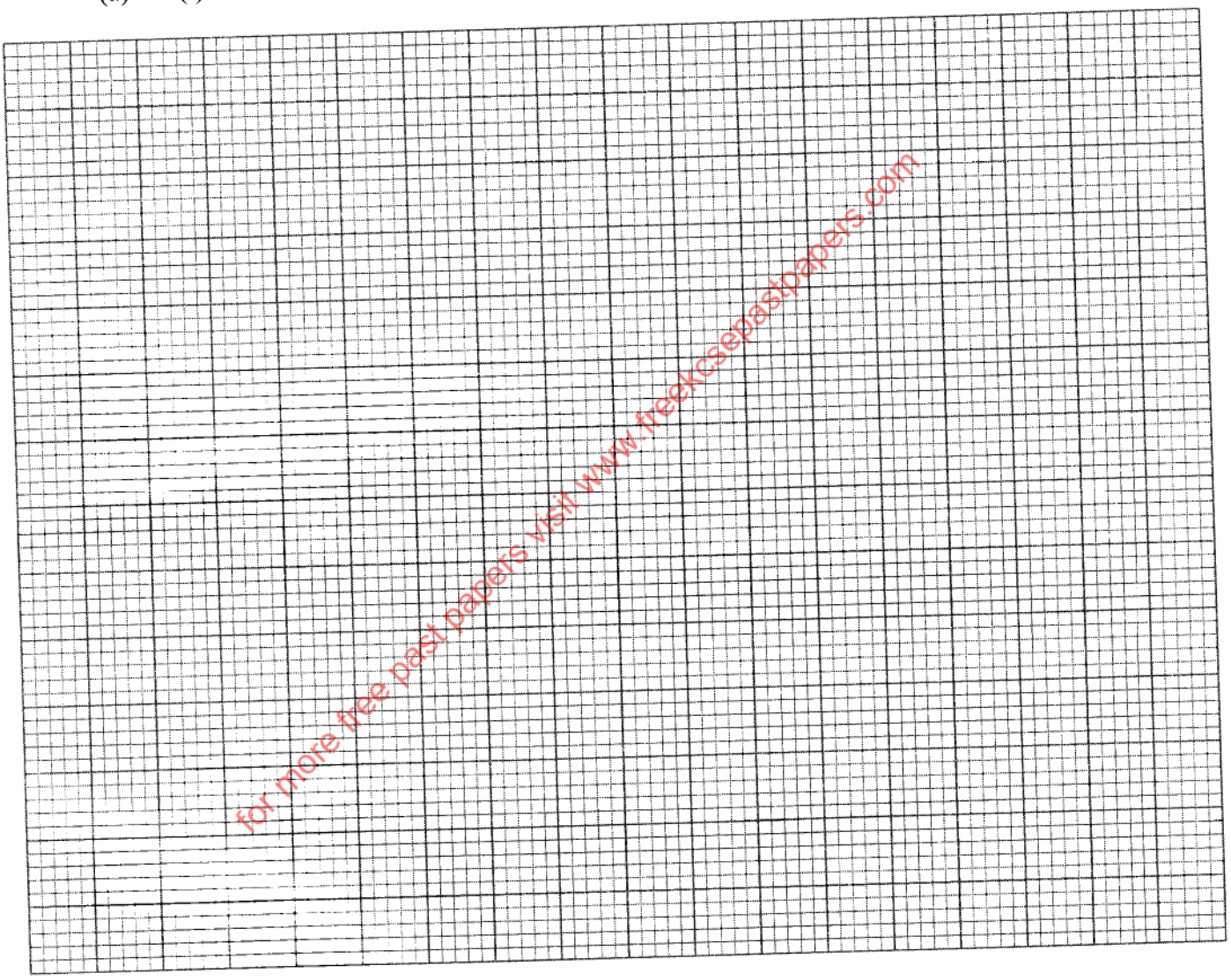
7. The decay rates of a sample of a radioisotope of bismuth at different time intervals is indicated in the folllowing table.

Time hours	0	5	10	15	20	25
Rate of disintegration in counts s^{-1}	730	570	455	365	292	232

(a) (i) Draw a graph of disintegration rate against time. (3 marks)



(ii) Determine the half-life of bismuth. (1 mark)

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(iii) What would be the effect on the curve if half the amount of sample of bismuth were used. (1 mark)

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(b) Radioactivity has several applications. State **one** application of radioactivity in:

(i) Medicine (1 mark)

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(ii) Agriculture (1 mark)

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(iii) Tracers (1 mark)

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(iv) Nuclear power station (1 mark)

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(c) State **two** dangers associated with radioactivity. (2 marks)

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