



233/2 -

**CHEMISTRY**  
**(THEORY)**  
**Nov. 2017 - 2 hours**

- Paper 2

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

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

**Instructions to candidates**

- Write your name and index number in the spaces provided above.
- Sign and write the date of examination in the spaces provided above.
- Answer **ALL** the questions in the spaces provided.
- KNEC mathematical tables and silent non-programmable electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.
- This paper consists of 14 printed pages.**
- Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- 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	
<b>Total Score</b>	<b>80</b>	

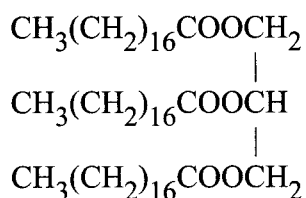


1. (a) Name the homologous series represented by each of the following general formulae.

(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)

.....

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)

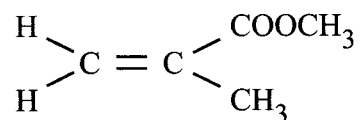
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(ii) Write an equation for the reaction. (1 mark)

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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

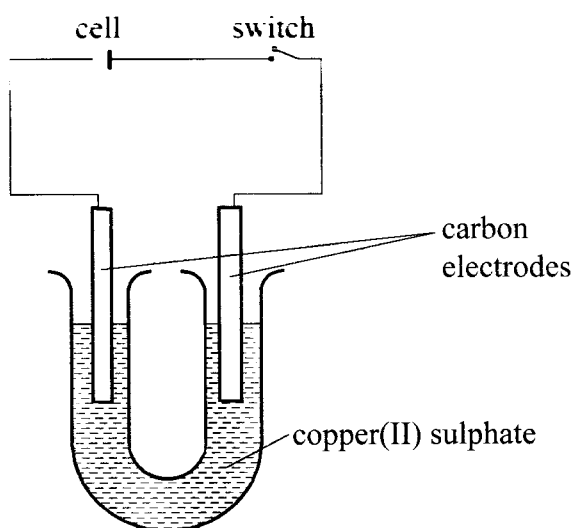
- (a) (i) Identify a substance that is a metal. Give a reason. (2 marks)

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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)

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 .....



(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)

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(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)

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

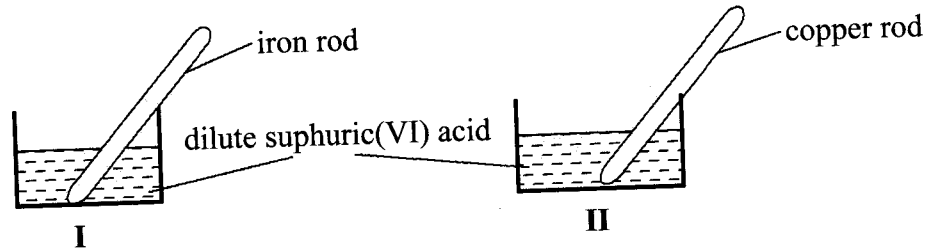
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(iii) During electroplating of an iron spoon, a current of 0.6 amperes was passed through aqueous silver nitrate solution for 1½ hours. Calculate the mass of silver that was deposited on the spoon. (3 marks)  
(Ag = 108.0 ; 1F = 96,500 C mol<sup>-1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

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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. (1 mark)

Beaker **I**:

.....  
 .....

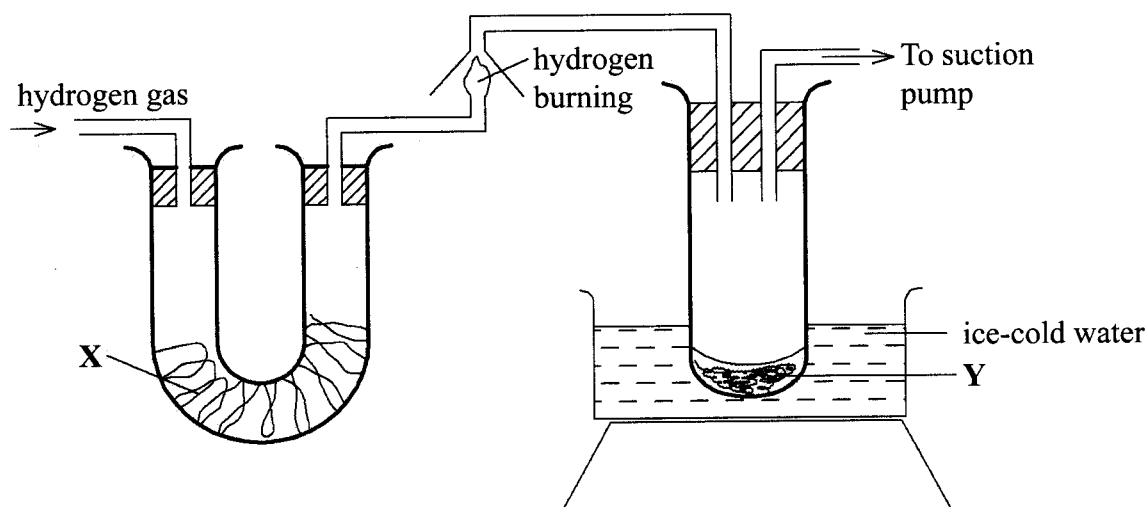
Beaker **II**:

.....  
 .....

- (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)  
 .....
- (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)  
 .....
- (iv) Name the product **Y** formed. (1 mark)  
 .....
- (v) Give a simple physical test to prove the identity of **Y**. (1 mark)  
 .....  
 .....
- (vi) State the difference between 'dry' and 'anhydrous'. (2 marks)  
 .....

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 powdered 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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 .....  
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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<sup>3</sup> of hydrogen gas was collected.  
(Mg = 24.0; Molar gas volume = 24.0 dm<sup>3</sup>)

(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)

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- (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)

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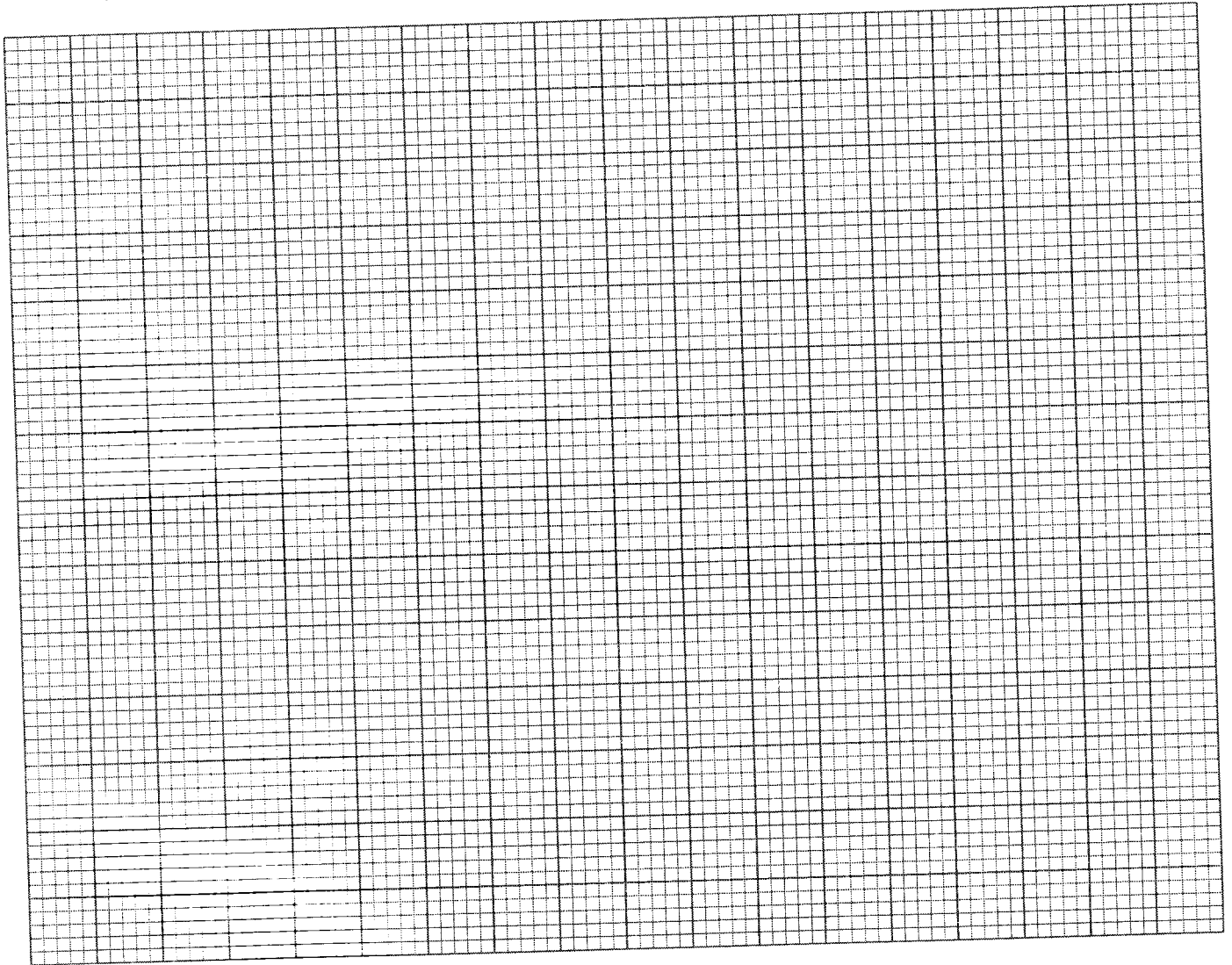
- II. Write an ionic equation for the above reaction. (1 mark)

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

<b>Time hours</b>	0	5	10	15	20	25
<b>Rate of disintegration in counts s<sup>-1</sup></b>	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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