Name:…………………………………………….Centre / Index No ……………/………..

Signature:………………………………………..

**545/2**
**CHEMISTRY**
**Paper 2**
**2 hours**

**UCE CHEMISTRY**
**CHEMISTRY**
**Paper 2**

**INSTRUCTIONS TO CANDIDATES:**

Section **A** consists of **10** structured questions. Answer **all** questions in this section.

Answers to these questions **must** be written in the spaces provided.

Section **B** consists of **2**semi-structured questions. Answer **any two** questions. Answers to these questions **must** be written on the answer sheets provided.

**In both sections all working must be clearly shown.**

Where necessary use:

[  K = 39, Cl =35.5, Na =23 O=16,  C=12, H=1 ]

1 mole of gas occupies 24dm$^3$ at room temperature and pressure
1 mole of gas occupies 22.4dm$^3$ at s.t.p

**Turn Over**

**SECTION A: (50 marks)**
Answer **all** questions in this section.

**1.**(a) What is a **chemical change**? (1 mark)

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(b) Classify each of the processes below as either being *chemical* or *physical* changes. (2 marks)

(i) Electrolysis:……………………………………………………………………………………...

(ii) Sublimation:…………………………………………………………………………………….

(c)(i) Name **one** element which can undergo the process in b(ii) above. (1 mark)

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(ii) State what is observed when the element you have given in c(i) above undergoes this process.
(1 mark)
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**2.**(a)State the condition(s) under which each of the metals below reacts with water.

(i) Potassium:……………………………………………………………………….. (1 mark)

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(ii) Zinc:…………………………………………………………………………….. (1 mark)

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(b) Write equation for the reaction each of the metals in (a) above with water. (3 marks)

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**3.**(a)State what is observed when chlorine gas is bubbled through:

(i) Iron(II) chloride solution: (1 mark)

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(ii) Potassium iodide solution:                                                              (1 mark)

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(b)(i) State the chemical property exhibited by chlorine in the reaction in a(i) above.     (1 mark)

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(ii) Write equation for the reaction in a(ii) above.                                        (1½ marks)

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(c) To which chemical family does chlorine belong?                                          (½ mark)

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**4.**(a) Define the term **heat of combustion**.                                           (1 mark)

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(b) When 3000cm³ of methane gas measured at room temperature and pressure was burnt, 195kJ of heat were evolved.

(i) Write equation for the complete combustion of methane.                                  (1½ marks)

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(ii) Calculate the heat of combustion of methane.                                           (2½ marks)

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**5.** (a) The electronic configuration of the ion of an alkali metal, **M** is 2:8:8. Write the:

(i) electronic configuration of its atom.                                    (1 mark)

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(ii) formula of its ion.                                                     (1 mark)

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(b) Write equation for the reaction of the oxide of **M** with:

(i) water                                                              (1½ marks)

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(ii)  dilutesulphuric acid                                              (1½ marks)

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**6.**Figure 1 below is a diagram for the electrolysis of dilute sulphuric acid, between platinum electrodes.

(a) What is **electrolysis**?                                             (1 mark)

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(b) Which of the electrodes is the,

(i) *cathode*? (1 mark)

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(ii) *anode*? (1 mark)

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(c)(i) Write equation for the reaction at electrode **D** (1½ marks)

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(ii) Write the formula of the ion which is discharged at electrode **E** (½ mark)

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**7.** When solid **L** is heated with sodium hydroxide solution a gas that turns red litmus blue is evolved. On addition of concentrated sulphuric acid to solid **L** in a test tube, misty fumes are evolved.

(a) Identify:
(i) **L** : ………………………………………………………………………………………... . (1 mark)

(ii) the misty fumes : ………………………………………………………………………….. (1 mark)

(b) Write equation for the reaction between **L** and sodium hydroxide solution. (1½ marks)

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(c) To an aqueous solution of **L** a few drops of lead(II) nitrate solution are added and the mixture heated. State what is observed. (1 mark)
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**8.** A hydrocarbon **Z** contains 82.76% carbon. The formula mass of **Z** is 58g.

(a) Calculate the:
(i)  simplest formula of **Z**. (2 marks)

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(ii) molecular formula of **Z**. (1 mark)

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(b) Write:

(i) the structural formula of **Z**. (1 mark)

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(ii) equation for the *complete* combustion of **Z**. (1½ marks)

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**9.** One of the ores from which iron can be extracted is *spathic iron ore*( $FeCO_3$ ). This ore is first roasted in air before being fed into the blast furnace.

(a) What is meant by the term **ore** ? (1 mark)

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(b) (i) Name the other substances with which the ore is added into the blast furnace, from the top. (1 mark)

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(ii) Write equation for the reaction which occurs when the ore is roasted. (1½ marks)

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(c)(i) Name the by-product of extraction of iron. (1 mark)

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(ii) State **one** importance of the product in c(i) above. (½ mark)

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(iii) Give **one** reason why iron is converted into steel (1 mark)

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**10.** 6.3g of a hydrated dibasic acid, $H_2X.nH_2O$ were dissolved in water to form one litre of solution. 25cm³ of this solution was found to require 12.5cm³ of 0.2M sodium hydroxide solution for complete reaction.
The acid reacts with sodium hydroxide according to the equation.

$$H_2X(aq) + 2NaOH(aq) \qquad\qquad Na_2X(aq) + 2H_2O(l)$$

(a) Calculate the molar concentration of the acid. (2½ marks)

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(b) Determine the:
(i) relative formula mass of the acid (1½ marks)

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(ii) value of n in the formula, $H_2X.nH_2O$.    (X = 88) (1½ marks)
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**SECTION B: ( 30 marks)**

Answer **only two**questions from this section

**11.**(a) Sodium chloride is a *normal salt*.

(i) Give the reason why sodium chloride is considered to be a normal salt. (1 mark)

(ii) Describe how a sample of sodium chloride crystals can be prepared in the laboratory using sodium hydroxide solution. (8 marks)

(b)  Excess hydrogen chloride gas was bubbled into a mixture of copper(II) carbonate and water.

(i) State what was observed. (1½ marks)

(ii) State what would be observed if the experiment was repeated using a mixture of copper(II) carbonate and benzene. (1 mark)

(c) Explain the difference in observations in b(i) and b(ii) above. (3½ marks)


**12.**(a)(i) Draw a labelled diagram for the laboratory preparation of **dry** oxygen gas, using *sodium peroxide*. (4 marks)

(ii) State the method of gas collection in your diagram and give a reason why it is used in that experiment. (2 marks)

(b) When excess phosphorus was made to burn in 150cm$^3$ of air ,the volume of air decreased to 120cm$^3$, after the burning.

(i) Draw a labeled diagram of the set-up which was used during the experiment. (3 marks)

(ii) Write equation for the reaction which took place. (1½ marks)

(ii) Calculate the percentage of oxygen in the air. (2 marks)

(c) Potassium chlorate decomposes according to the equation:

$$2KClO_3(s) \quad \xrightarrow{\text{Heat}} \quad 2KCl(s) + 3O_2(g)$$
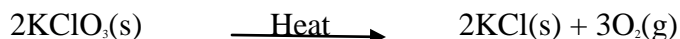
6.125g of potassium chlorate were heated to a constant mass. Calculate the loss in mass

which occurred. (2½ marks)


**13.**(a) Define the following terms:

(i) **Hydrocarbon** (1 mark)

(ii) **Polymer** (1 mark)

(b) Hydrocarbons  **R**and **T**are both alkenes, with two and three carbon atoms respectively. The two compounds both form polymers.

(i) Copy and complete the table below:                                                (3 marks)

| Hydrocarbon | Molecular formula | Structural Formula | Structural Formula of Polymer |
|---|---|---|---|
| **R** | | | |
| **T** | | | |

(ii) Write equation for the laboratory preparation of **R** .                          (2 marks)

(c)(i) Describe how the level of water hardness in water can be estimated in the laboratory.

(3 marks)

(ii) Explain why hard water does not readily form a lather with soap.                  (2½ marks)

(d) Sodium stearate, $C_{17}H_{35}CO_2Na$ , an example of soap can be prepared by heating a fat with sodium hydroxide solution. Calculate the mass of soap formed when $100cm^3$ of 2M sodium hydroxide solution is heated with excess fat.                                              (2½ marks)

( Mole ratio of NaOH : $C_{17}H_{35}CO_2Na$ = 1: 1)

**14.**(a) Define the term rate of **rate of reaction**.                                 (1mark)

(b) Explain how each of the factors below affects the rate of a reaction:

(i) concentration                                                                      (2 marks)

(ii) temperature                                                                       (2 marks)

(c) The table below shows the mass of a reaction mixture of zinc powder and dilute hydrochloric acid at various times, from the instant of mixing the two.

| Time(s) | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|---|
| Mass of reaction mixture (g) | 100.00 | 99.82 | 99.80 | 99.60 | 99.52 | 99.47 | 99.43 | 99.42 | 99.42 |

(i) Write an ionic equation for the reaction.                                          (1½ marks)

(ii) Plot a graph of loss in mass of reaction mixture against time.                     (4 marks)

(iii) Use the graph to determine the rate of reaction at t =25s. (2½ marks)

(v) On the same pair of axes draw a sketch graph for the results that would be obtained if copper(II) sulphate had been included in the reaction mixture and label this graph, **X**. Compare the shapes of the two graphs. (2 marks)

**END**