| REGISTRATION CENTRE NUMBER | CENTRE NAME |
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| CANDIDATE'S FULL NAMES | |
| CANDIDATE IDENTIFICATION NUMBER | SUBJECT CODE **0515** / PAPER NUMBER **2** |

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**GENERAL CERTIFICATE OF EDUCATION BOARD**
**ORDINARY LEVEL EXAMINATION**

| SUBJECT TITLE | SUBJECT CODE | PAPER NUMBER |
|---|---|---|
| **CHEMISTRY** | **0515** | **2** |
| | EXAMINATION DATE: **JUNE 2025** | |

**Duration: Two and a Half Hours**

Enter the information required in the boxes above.

This paper is arranged in three sections, A, B and C.

*Section A: ANSWER ALL 5 questions. You will be graded for the best 4 answers.*

*Section B: ANSWER ALL 2 questions in this section.*

*Section C: ANSWER 2 QUESTIONS OUT OF 3. **If you attempt more than 2 questions, only the first two will be considered.***

**In calculations, you are advised to show all the steps in your working, giving your answer at each stage.**

**Calculators are allowed**

***You are reminded of the necessity for good English and orderly presentation in your answers.***

**Useful Data**

Specific heat Capacity of water = 4.2J/g/°C
1 Faraday = 96000 coulombs. Avogadro Number = $6.02 \times 10^{23}$
Molar volume of a gas at r.t.p. = $24000 cm^3$

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|---|---|
| Marked by..... | ***SCORE*** |
| Signature of Examiner: .....Date:..... | |
| Checked by..... | |
| Signature:..... Date:..... | |

Turn Over

**SECTION A: Answer ALL questions in this section.**

1. Chlorine exists naturally as two isotopes: $^{37}_{17}Cl$ and $^{35}_{17}Cl$

(a) (i) What are isotopes?

.....

.....

(ii) State the atomic number of chlorine.

.....

(iii) State the number of protons, neutrons and electrons in Cl-37

Protons:.....

Neutrons:.....

Electrons:.....

**(6 marks)**

(b) Determine the RAM of chlorine, given that Cl-35 and Cl-37 exist in a ratio of 3:1

.....

.....

.....

.....

**(2 marks)**

(c) Chlorine exists as diatomic molecules.

(i) What is a diatomic molecule?

.....

.....

(ii) Name the intermolecular forces holding chlorine molecules

.....

**(2 marks)**

**(Total = 10 marks)**

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2. Fluorine, Bromine and Iodine are some members of a family of elements on the Periodic Table.

(a) (i) Give the family name for the elements.

.....

(ii) What is the physical state of

Fluorine? .....

Bromine? .....

Iodine? .....**(3 marks)**

(b) Chlorine is prepared by action of Manganese(IV) oxide, $MnO_2$, on concentrated Hydrochloric acid

(i) State the specific role of $MnO_2$ in the reaction.

.....

(ii) Write an equation for the reaction.

.....

**(3 marks)**

(c) When Bromine is bubbled through colourless Potassium iodide solution, the following reaction occurs

$Br_{2(l)} + 2KI_{(aq)} \longrightarrow 2KBr(aq) + I_{2(s)}$

(i) State one colour change likely to occur during the reaction.

.....

(ii) Suggest what you think would happen if $I_2$ vapour is bubbled into $KBr_{(aq)}$ solution. Explain

Suggestion: .....

.....

Reason:.....

.....

**(4 marks)**

**(Total = 10 marks)**

---

3. This question is based on the following redox equations; I and II.

I : $2Cu_{(S)} + O_{2(g)} \longrightarrow 2CuO(s)$

II : . $CuO(s) + H_{2(g} \longrightarrow Cu_{(s)} + H_2O_{(l)}$

(a) Define;

(i) Oxidation in terms of oxygen

.....

.....

(ii) Reduction in terms of hydrogen

.....

.....

**(2 marks)**

(b) Identify;

(i) The reducing agent in equation I

.....

(ii) The oxidizing agent in equation II

.....

**(2 marks)**

(c) Determine the oxidation state of,

(i) Copper in Cu

.....

(ii) Oxygen in $H_2O$

.....

.....

**(3 marks)**

(d) State whether each of these reactions involves oxidation or reduction or both.

(i) $Al^{3+} + 3e \longrightarrow Al$ .....

(ii) $2O^{2-} \longrightarrow O_2 + 4e$ .....

(iii) $2H_2 + O_2 \longrightarrow 2H_2O$ .....

**(3 marks)**

**(Total 10 marks)**

---

**4.** This question concerns the following organic compounds.

**A: $C_2H_6$** **B: $(C_3H_7OH)$** **C: $C_2H_4$**

(a) Identify the homologous series to which A, B and C each belongs.

A: .....

B: .....

C: .....

**(3 marks)**

(b) (i) Define isomerism.

.....

.....

(ii) Suggest which of the compounds will exhibit isomerism. .....

(iii) Draw two structures of the isomers in b (ii).

.....

.....

.....

**(4 marks)**

(c) Write an equation, stating reaction condition, for the conversion of C to A.

Equation .....

Reaction condition: .....

**(2 marks)**

(d) Describe a simple chemical test for B.

.....

.....

**(1 mark)**

**(Total = 10 marks)**

---

5. A farmer tested a soil sample that had a pH of 4.5 and was deficient in one of the main elements needed for crop yield.

(a) (i) State the three main elements needed for crop yield

.....

(ii) Give one chemical substance that contains all 3 elements.

.....

**(4 marks)**

(b) You are given the following nitrogenous fertilisers: $NH_4NO_3$ and $(NH_4)_2SO_4$

(i) Give the name of the fertilizer $(NH_4)_2SO_4$

.....

(ii) Which of the two fertilizers has a higher nitrogen content?

.....

Show how you arrived at your answer

.....

.....

.....

**(4 marks)**

(c) (i) What does a pH of 4.5 indicate about the soil?

.....

(ii) Suggest a substance that can be used to raise the pH of the soil.

..... **(2 marks)**

**(Total 10 marks)**

# SECTION B

**Answer BOTH questions in this section using the spaces provided.**

**Both questions carry equal marks**

6. A student carried out a series of laboratory tests on two unknown salts, **X, Y** and an organic compound **Z**, in order to determine their identities. Study the following table and complete the information required.

| | PROCEDURE | OBSERVATION | INFERENCE OR CONCLUSION | |
|---|---|---|---|---|
| a)i | To 2 $cm^3$ of compound **X** in a test tube is added dilute HCl(aq) | Colourless, odourless gas is evolved, which turns lime water milky | Identify the gas ..... Which anion is present in **X**? ..... | **2marks** |
| ii | Clean a graphite pencil with concentrated HCl. Pick up a bit of solid **X** on the pencil and introduce it in a blue Bunsen flame | Brick red flame colour | Which cation is present in **X**? ..... Using the ions in a(i) and a(ii) above, identify the compound **X** ..... | **2marks** |
| b)i | To 2 $cm^3$ of **Y** in a test tube, a few drops of aqueous sodium hydroxide are added | ..... | $Cu^{2+}$ ions are present in **Y** | **1mark** |
| ii | To 2 $cm^3$ of solution **Y** are added 2 $cm^3$ of $BaCl_2$(aq) followed by dilute $HCl_{(aq)}$ | White precipitate is observed. Precipitate is insoluble in excess acid | Identify the precipitate ..... Which anion is present in **Y**? ..... Identify the compound **Y**, using information from b(i) and b(ii) ..... | **3marks** |
| c)i | Liquid **Z** is tested with both red and blue litmus paper | No change in colour in each case | What can you say about liquid **Z**? | **1mark** |
| ii | To 2 cm3 of liquid compound **Z** is added a piece of sodium metal. | Effervescence occurs. The gas released burns with a 'pop' sound | Identify the gas evolved ..... Give the functional group I Z ..... | **2marks** |
| iii | Liquid **Z** is introduced to a Bunsen flame | Liquid burns with a pale blue flame | Suggest one substance that can be **Z** | **1 mark** |

**(12 marks)**

(d) Figure I is a graph to show the volume of hydrogen gas collected by a student from the reaction between dilute hydrochloric acid and Magnesium ribbon.

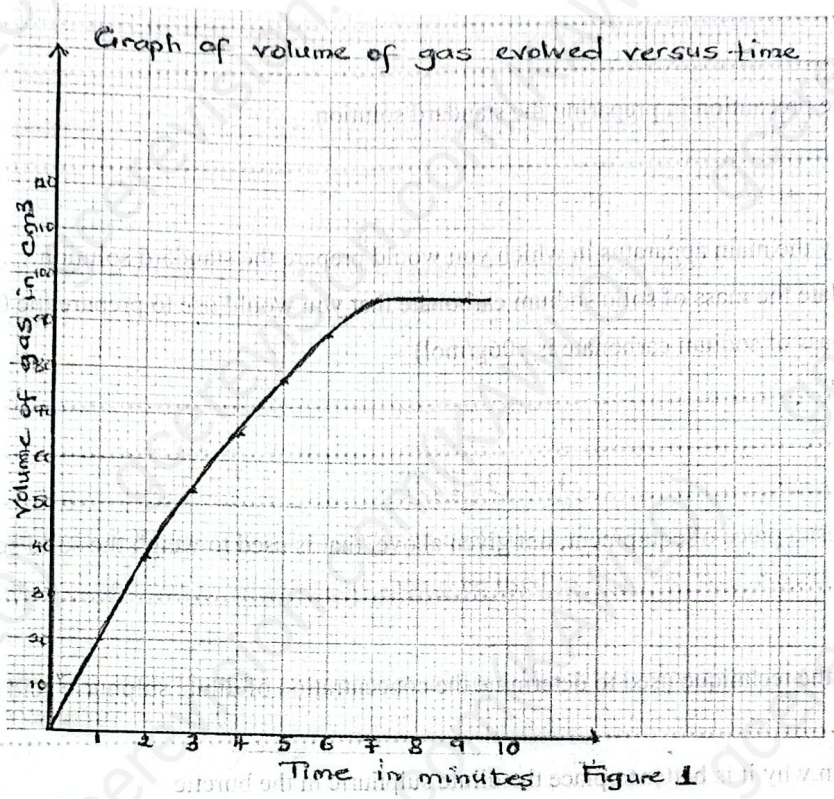


Figure 1

(i) At what time did the reaction come to an end?

.....

(ii) Determine the volume of gas produced after 3 minutes

.....**(4 marks)**

(e) A student is required to prepare and collect a dry sample of ammonia gas in the laboratory.

(i) State the reagents used

.....and .....

(ii) State the reaction condition.....

(iii) Why is the ammonia collected by downward displacement of air?

.....

**(4 marks)**

**(Total: 20 marks)**

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7. You are provided with the following requirements;

Beaker, pipette, 250 $cm^3$ volumetric flask, burette, conical flask, anhydrous sodium carbonate, wash bottle, dilute sulphuric acid, distilled water, phenolphthalein indicator.

You are required to prepare 250 $cm^3$ of 0.1M$Na_2CO_3$(aq) and use this standard solution to determine the concentration of dilute sulphuric acid.

(a) (i) Outline 3 key steps to prepare the standard solution

.....

.....

.....

..... **(3 marks)**

(ii) State one precaution in preparing the standard solution

.....

**(1 mark )**

(b) (i) Identify the main apparatus in which you would prepare the standard solution.....

(ii) Calculate the mass of solid sodium carbonate that you would use to prepare the $0.1M Na_2CO_{3(aq)}$

(Molar mass of sodium carbonate is 106g/mol)

.....

.....

.....**(3 marks)**

(iii) Suggest a piece of equipment, not given above, that is used to weigh the solid sodium carbonate

.....

**(1 mark )**

(c) (i). Name the technique used to determine the concentration of dilute sulphuric acid using the standard solution.....

(ii) Explain why it is better to place the dilute sulphuric in the burette

.....

.....

(iii) Suggest an appropriate cleaning procedure for the

Burette.....

.....

Pipette:

.....

.....

**(4 marks)**

(d) In an experiment to determine the concentration of $H_2SO_4$ using $0.1M Na_2CO_3$, 25 $cm^3$ of $Na_2CO_3(aq)$ exactly neutralized 20 $cm^3$ of dilute $H_2SO_4$ (aq).

(i ) Determine the concentration of the acid in $mol/dm^3$

The reaction is

$H_2SO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + CO_2 + H_2O$

.....

.....

.....

**(3 marks)**

(e) Sublimation, use of a separating funnel, evaporation to dryness, fractional distillation, filtration and crystallization are techniques used to separate mixtures.

(i) Choose the most suitable technique to separate;

Salt from sea water .....

Silver chloride from its mixture with water.....

Water from kerosene..... ....**(3 marks)**

(ii) State the property of water and kerosene that enables them to be separated by the method in (e)iii above.....

.....**(1 mark)**

(iii) Give an example of a mixture that can be separated by chromatography

..... **(1 mark)**

**(Total 20 marks)**

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## SECTION C

Answer **ONLY TWO** questions in this section. If you attempt more than two questions, only the **FIRST TWO** will be considered. Where appropriate, equations and diagrams should be used to illustrate your answer. Write your answers on the sheets that follow.

8. Electrolysis can be used to purify metals and in electroplating. Describe, using a specific example and adequate equations in each case how this is done.

**(10,10 marks)**

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9. Write short notes on each of the following:

(a) Esterification

(b) Saponification

(c) Deliquescence

(d) Chemical change

**(5,5,5,5 marks)**

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10. Particles in the following substances are held by different chemical bonds. You are given: sodium chloride (NaCl), Hydrogen gas(H2), and Aluminium metal (Al).

(a) Identify the bond type in each substance and briefly explain, using diagrams if need be, how each chemical bond type is formed.

(b) State one physical property of each substance and relate this property to the bond type.

**(14,6 marks)**