

233/2
CHEMISTRY
PAPER 2
Time: 2 Hours

**STRATHMORE SCHOOL
MOCK EXAM**

Instructions to candidates

- Write your name and index number in the spaces provided above. Sign and write the date of the examination in the spaces provided above.
- Answer **ALL** the questions in the spaces provided.
- Mathematical tables and electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.

For Examiner's use only

| QUESTION | MAXIMUM SCORE | CANDIDATES SCORE |
|--------------------|------------------|---------------------|
| 1 | 12 | |
| 2 | 12 | |
| 3 | 10 | |
| 4 | 12 | |
| 5 | 11 | |
| 6 | 12 | |
| 7 | 11 | |
| Total Score | 80 | |

This paper consists of 9 printed pages.

Candidates should check the question paper to ensure that all the pages are printed as indicated and that no questions are missing.

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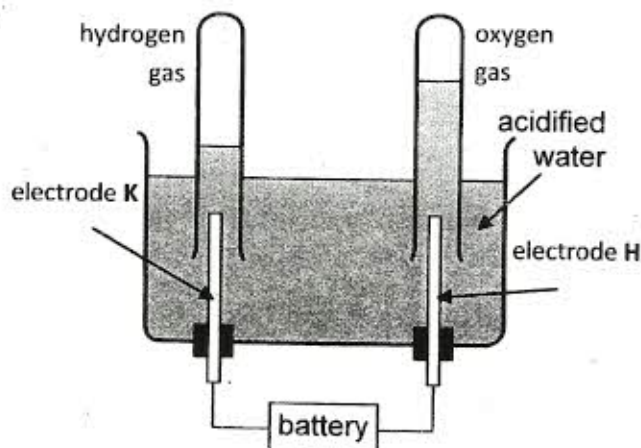
TURNOVER

1. (a) The table below shows the standard reduction potentials for four half-cells. Study it and answer the questions that follow. (Letters are not the actual symbols of the elements.)

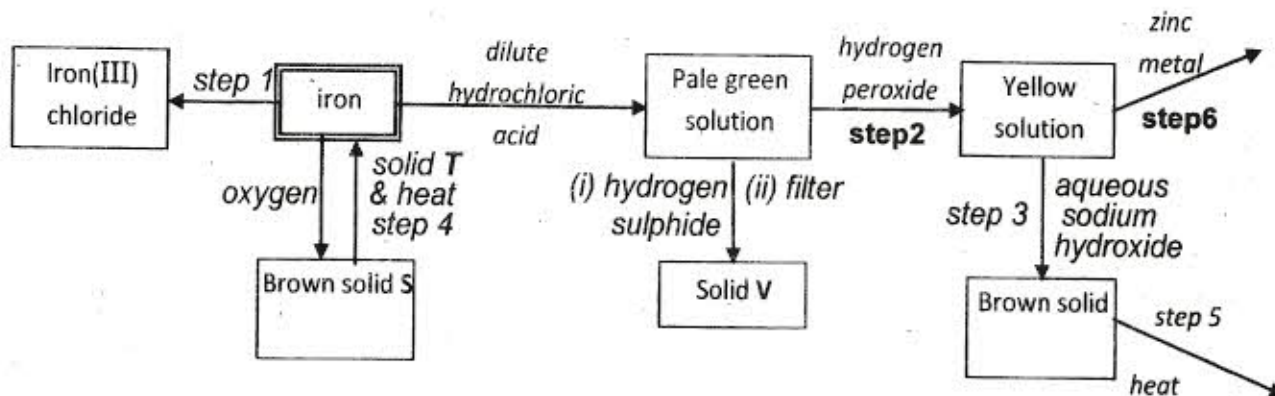
| | |
|--|---------------------------|
| $F_2(aq) + 2e \rightleftharpoons 2F^-(aq)$ | E° volts + 0.54 |
| $G^{2+}(aq) + 2e \rightleftharpoons G(s)$ | - 0.44 |
| $H^{2+}(aq) + 2e \rightleftharpoons H(s)$ | + 0.34 |
| $2J^+(aq) + 2e \rightleftharpoons J_2(g)$ | 0.0 |

- Identify the strongest reducing agent. (1 mark)
- Write the equation for the reaction which takes place when solid G is added to a solution containing H^{2+} ions. (1 mark)
- Calculate the E° value for the reaction in (ii) above. (1 mark)

- (b) The diagram below shows the apparatus that can be used to electrolyse acidified water to obtain hydrogen and oxygen gases. Study it and answer the questions that follow.



- Identify the electrode at which oxidation takes place. (1 mark)
 - Give a reason why it is necessary to acidify the water. (1 mark)
 - Explain why hydrochloric acid is not used to acidify the water. (2 marks)
- (c) During the electrolysis of aqueous copper(II) sulphate, 144750 coulombs of electricity were used. Calculate the mass of copper metal that was obtained. (Cu = 64; 1 Faraday = 96500 coulombs) (3 marks)
2. (a) The flow chart below shows a sequence of reactions starting with iron. Study it and answer the questions that follow.



- Name the reagent and state the conditions for the reaction in **step 1**. (3 marks)

(ii) Give the names of the following:

I. Solid S

(1 mark)

II. Solid T

(1 mark)

III. Solid V

(1 mark)

(iii) Give reasons for the colour change in **step 2**

(2 marks)

(iv) Write an ionic equation for the reaction that takes place in **step 3**.

(1 mark)

(v) Name **one** other substance that could be used instead of sodium hydroxide in **step 3**.

(1 mark)

(vi) Give the names of the types of reactions that took place in steps 2 and 3.

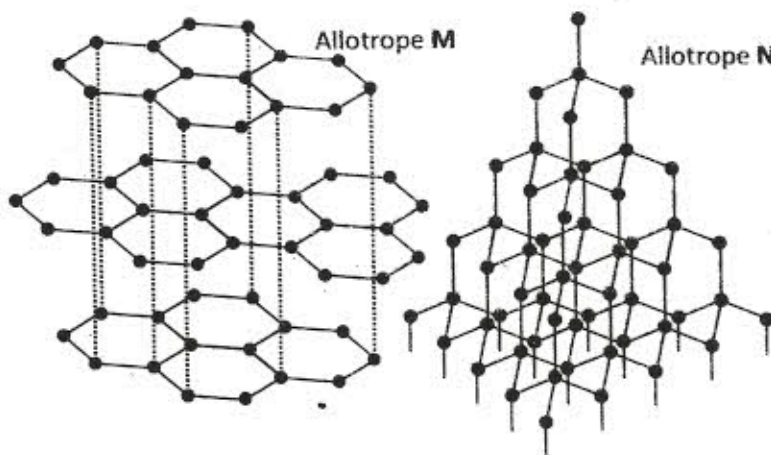
(1 mark)

- (b) (i) The reaction in step 6 leads back to one of the substances in the diagram. Which is the substance (or box containing it)? Write the equation of the reaction. (1 mark)
- (ii) The reaction in step 5 leads back to one of the substances in the diagram. Which is the substance (or box containing it)? Write the equation of the reaction. (1 mark)

(c) In an experiment, 3.36g of iron filings was added to excess aqueous copper(II) sulphate. Calculate the mass of copper that was deposited
(Cu = 64 S = 32, Fe = 56.0)

(3 marks)

3. (a) The diagrams below show the structures of two allotropes of carbon. Study them and answer the questions that follow.



(i) Name each allotrope

(2 marks)

M :

N :

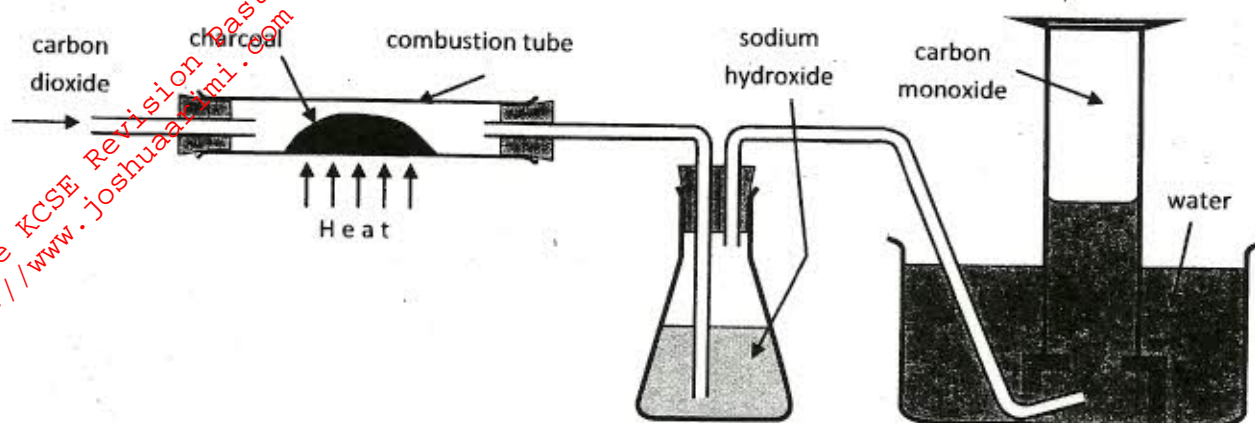
(ii) Give one use of N.

(1 mark)

(iii) Which allotrope conducts electricity? Explain.

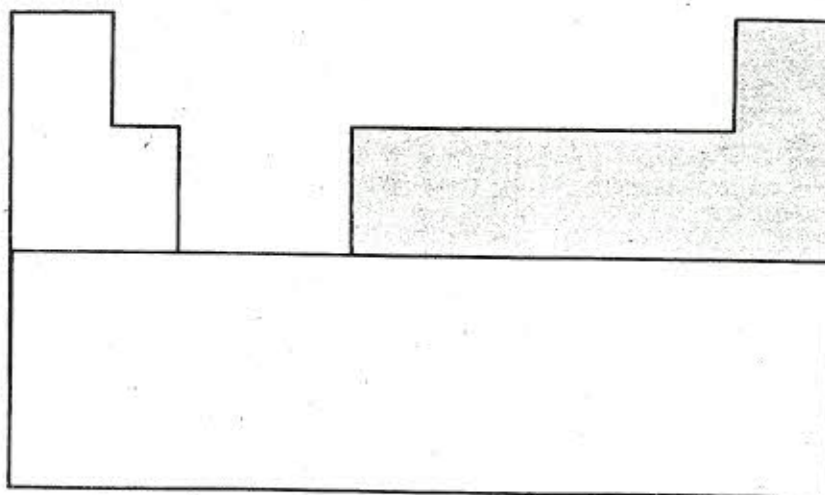
(2 marks)

- (b) In an experiment, carbon dioxide gas was passed over heated charcoal and the gas produced was collected as shown in the diagram below.



- (i) Write an equation for the reaction that took place in the combustion tube. (1 mark)
- (ii) What is the purpose of the sodium hydroxide? (1 mark)
- (iii) Name another substance that could be used instead of sodium hydroxide. (1 mark)
- (iii) Describe a simple chemical test that can be used to distinguish between carbon dioxide and carbon monoxide. (2 marks)
- (iv) Give **one** use of carbon monoxide. (1 mark)

4. (a) The chart below is an outline of part of the periodic table.



- (i) With the help of vertical and horizontal lines, indicate the direction of **increasing metallic** nature of the elements. (2 marks)
- (ii) Which type of element is represented in the shaded area? (1 mark)

- (b) (i) Element A is in the same group of the periodic table as chlorine. Write the formula of the compound formed when it reacts with potassium metal. (1 mark)
- (ii) What type of bonding exists in the compound formed in (b)(i) above? Give a reason for your answer. (3 marks)
- (c) Starting with aqueous magnesium sulphate, describe how you would obtain a sample of magnesium oxide. (3 marks)
- (d) Write two ionic equations to show that aluminium hydroxide is amphoteric. (2 marks)
- (e) Classify these three oxides according to the conventional acid-base scheme. (3 marks)

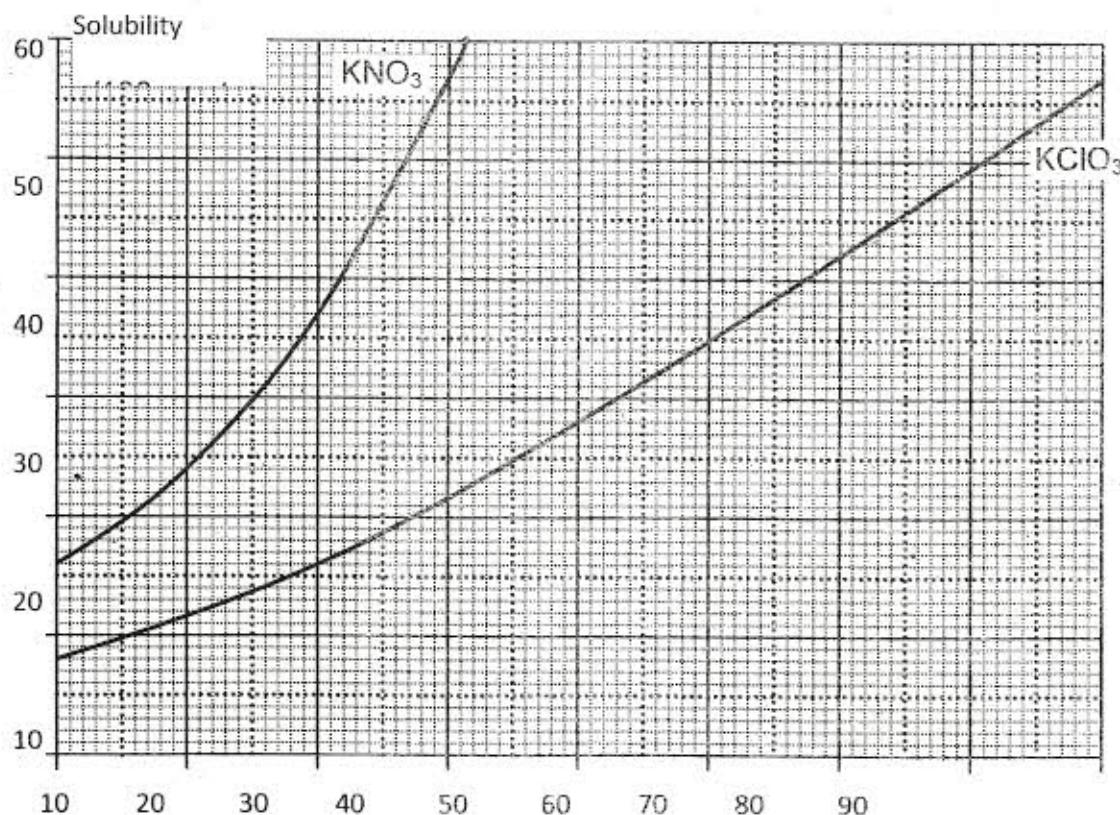
MgO:

NO:

Cl₂O:

- (f) Why does SiO₂ have a much higher melting point than CO₂? (Si = 28, C = 12) (1 mark)
- (g) Why does SO₂ have a higher melting point than CO₂? (S = 32, C = 12) (1 mark)

5. (a) At 25°C, 50g of potassium nitrate was added to 100g of water to make a saturated solution. What is meant by a saturated solution? (1 mark)
- (b) Study the solubility curves below and answer the questions that follow.

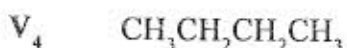
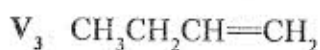
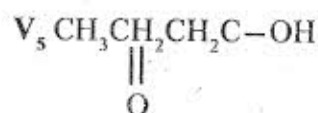
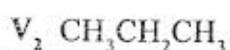
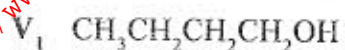


- (i) Using the graph:
- I Determine the mass of a solution of potassium nitrate formed by saturating 100g of water with the salt at 60°C. (1 mark)

- II Determine the solubility of potassium nitrate at 15°C. (1 mark)
- III Determine the molar concentration of potassium nitrate at 15°C. (Assume there is no change in density of water at this temperature.) (3 marks)
- (K = 39.0, N = 14.0, O = 16.0)

- (ii) What happens when a solution containing 40g of potassium chlorate and 40g of potassium nitrate in 100g of water at 90°C is cooled to 40°C? Explain. (3 marks)

6. (a) The list below gives the formulae of some organic compounds. Use it to answer the questions that follow. (Use the symbols V₁, V₂ etc)



- (i) Select two compounds which are **not** hydrocarbons. (1 mark)
- (ii) Select two compounds which belong to the same homologous series. (1 mark)
- (iii) Identify the compound that is likely to undergo polymerisation. Give a reason for your answer. (2 marks)

- (b) The structures below represent two cleansing agents. In the table, give one advantage and one disadvantage of using each of them.

| | Advantage | Disadvantage |
|---|-----------|--------------|
| R - COO ⁻ Na ⁺ | | |
| R - OSO ₃ ⁻ Na ⁺ | | |

- (c) Under certain conditions, ethanoic acid (C₂H₄O₂) and ethanol (C₂H₅OH) react to form a sweet smelling compound.
- (i) What is the general name of the class of compounds to which the sweet smelling compound belongs? (1 mark)
- (ii) Write the formula of the sweet smelling compound. (1 mark)
- (iii) Give **one** use of ethanoic acid other than the formation of the sweet smelling compounds. (1 mark)
- (iv) Write the equation for the reaction between dilute ethanoic acid and solid potassium carbonate. (1 mark)

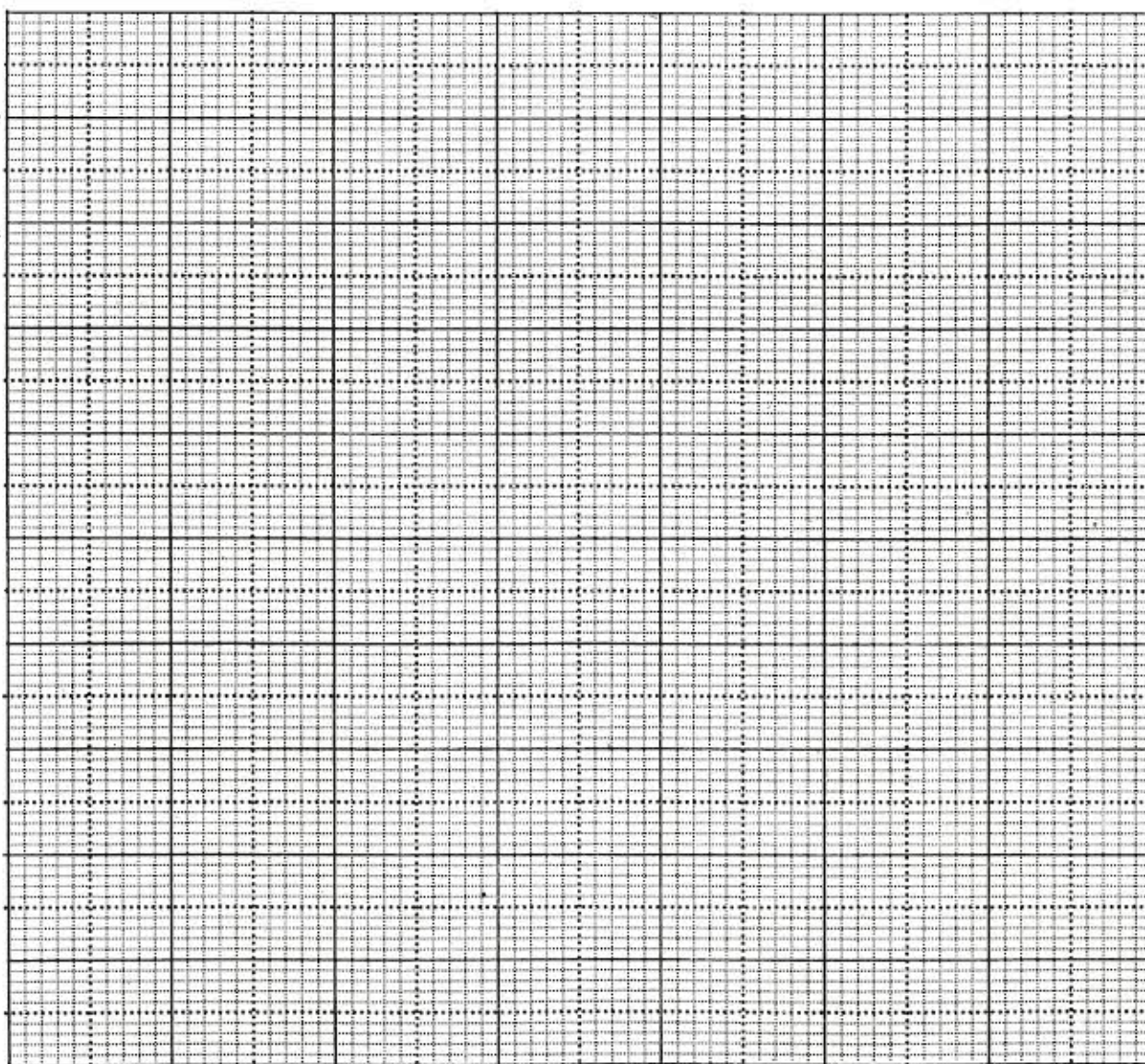
- (d) Write a general equation showing how a condensation polymer is formed. Define the symbols that you use in the equation. (2 marks)

7. (a) State **two** differences between chemical and nuclear reactions. (2 marks)

- (b) The table below gives the intensity of activity (counts per minute) of a radioactive isotope that over a period of time.

| Time (hour) | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|-------------|----|----|----|----|----|----|----|
| Count rate | 95 | 71 | 53 | 40 | 30 | 22 | 16 |

Plot a graph of count rate of the isotope (vertical axis) against time. (3 marks)



(c) (i) Using the graph determine the:

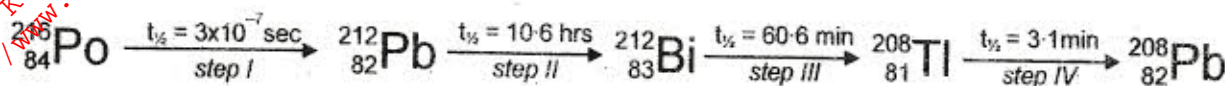
I. half-life of the isotope.

(1 mark)

II. original mass of the isotope given that the mass that remained after $5\frac{1}{2}$ hours was 0.45g

(2 marks)

(ii) Below is part of the thorium radioactive decay series starting from Po-216 and ending at Pb-208. Study it and answer the questions that follow.



Identify the particles emitted in steps I and II.

(2 marks)

I.

II.

(iii) Write the nuclear equation for the reaction which takes place in step I. (1 mark)

(iv) Why do you think the half life of Bi-212 is much less than that of Pb-212?

(1 mark)

(d) Give **one** use of radioactive isotopes in medicine.

(1 mark)