



# KCSE 2024

# CHEMISTRY

233/1

**PAPER 1 (THEORY)**

TIME: 2 HRS

NAME.....

INDEX NO..... CANDIDATE'S SIGN.....

DATE .....

## **Kenya Certificate of Secondary Education.**

### **INSTRUCTIONS TO CANDIDATES**

- a) Write your name and index number in the spaces provided above*
- b) Sign and write date of examination in the space provided.*
- c) All working must be clearly shown where necessary.*
- d) Mathematical tables and silent electronic calculations may be used*
- e) Answer all questions in English.*

### **For examiners use only**

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1-29	80	

Answer all questions

1. A magnesium ribbon sample was heated in separate volumes of pure oxygen and air.

a) In which sample was the mass of the product higher? Explain. (2 Marks)

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b) Write the equations for the reactions in the sample with air. (2 Marks)

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2. Give the systematic name of the following compound and draw the structure of the polymer it forms:



Name \_\_\_\_\_ (1 Mark)

Structure (1 Mark)

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3. When aqueous sodium hydroxide solution was added to freshly prepared acidified iron (II) sulphate solution, a green precipitate was formed. When hydrogen peroxide was first added to iron (II) sulphate solution followed by sodium hydroxide solution, a brown precipitate was formed. Explain these observations. (3 Marks)

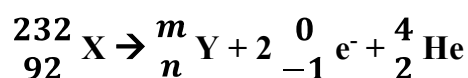
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4. Study the following nuclear reaction and complete it by giving the values of **m** and **n**



m \_\_\_\_\_ (1 Mark)

n \_\_\_\_\_ (1 Mark)

5.

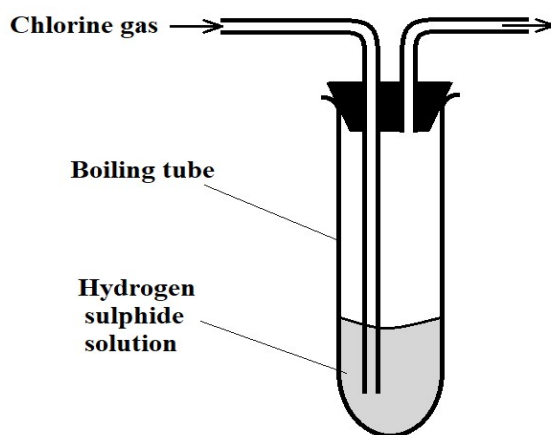
a) State Charles' Law (1 Mark)

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b) A certain mass of carbon (IV) oxide gas occupied  $200\text{cm}^3$  at  $25^\circ\text{C}$  and  $750\text{mmHg}$  pressure. Calculate the volume occupied by the same mass of gas if pressure is lowered to  $300\text{mmHg}$  and the temperature raised to  $30^\circ\text{C}$ . (2 Marks)

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6. Chlorine gas was bubbled into a solution of hydrogen sulphide as shown in the diagram below.



a) Explain the observation made in the boiling tube (2 Marks)

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b) What precaution should be taken in this experiment? (1 Mark)

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c) Distinguish between the bleaching action of chlorine and that of sulphur (IV) oxide. (1 Mark)

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7. Concentrated sulphuric (VI) acid was left exposed in air for a few days. It was found that the level of the acid had risen.

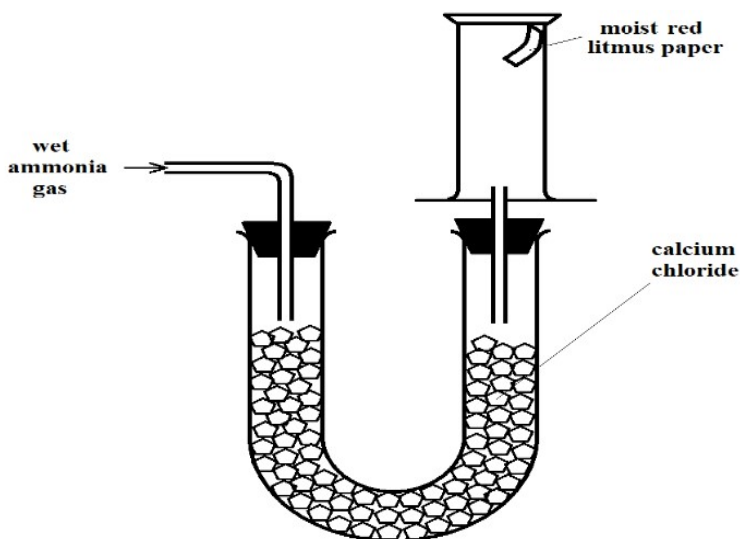
a) Why did the level of the acid in the container rise? (1 Mark)

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b) How is this property useful in the laboratory? (1 Mark)

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8. The setup below can be used to dry and collect ammonia gas. Use it to answer the questions that follow.



a) The wet red litmus paper remained red. Explain. (1 Mark)

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b) Name the method used when collecting ammonia gas. (1 Mark)

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9. 400cm<sup>3</sup> of **gas D** diffuses from a porous plug in 50 seconds while 600cm<sup>3</sup> of oxygen gas diffuses from the same apparatus in 30 seconds. Calculate the relative molecular mass of **gas D**. **(3 Marks)**

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10. Use the information in the table below on solubility to answer the questions that follow.

Salt	Solubility at	
	70°C	35°C
CuSO <sub>4</sub>	38	28
Pb(NO <sub>3</sub> ) <sub>2</sub>	78	79

A mixture containing 38g copper (II) sulphate and 78g of lead (II) nitrate in 100g of water at 70°C is cooled to 35°C.

a) Which of the two salts will crystallize? **(1 Mark)**

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b) Calculate the mass of crystals formed. **(1 Mark)**

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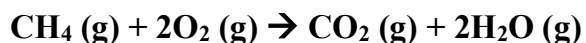
c) State the salt that will be unsaturated at 35°C **(1 Mark)**

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d) How much of the salt in c) above would be required to make a saturated solution at 35°C? **(1 Mark)**

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11. Methane burns in oxygen as shown by the equation below.



Given the following bond energies:

Bond	Bond Energy (kJ/mole)
C – H	413
O = O	497
C = O	740
O – H	463

a) Calculate the heat change for the reaction.

(2 Marks)

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b) Define molar heat of combustion.

(1 Mark)

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12. Given solid sodium carbonate, lead (II) nitrate crystals and water, explain how you can obtain a solid sample of lead (II) carbonate.

(3 Marks)

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13. Calculate the volume of oxygen produced when 10g of silver nitrate was completely decomposed by heating at s.t.p. (Ag = 108, N = 14, O = 16, MGV at s.t.p. = 22.4dm<sup>3</sup>)

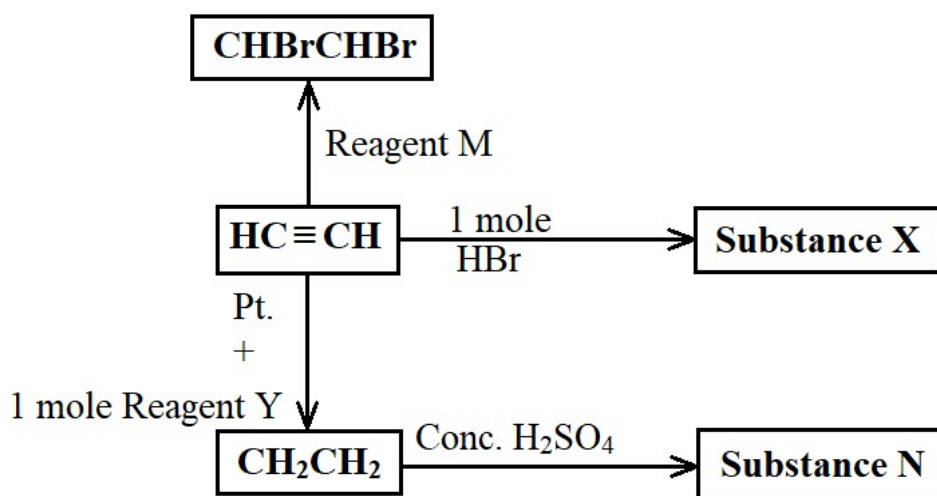
(3 Marks)

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14. A solution of hydrogen chloride gas in water conducts an electrical current, while that of hydrogen chloride in methylbenzene does not conduct. Explain. (2 Marks)

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15. The scheme below shows some reactions, starting with ethyne. Study it and answer the questions that follow.



a) Name substance

- i) X \_\_\_\_\_ (½ Mark)  
ii) N \_\_\_\_\_ (½ Mark)  
iii) M \_\_\_\_\_ (½ Mark)

- b) Ethene undergoes polymerization to form a polymer. Give an equation for the reaction and name the product. (1½ Marks)

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16. When 16g of ammonium nitrate was dissolved in 100cm<sup>3</sup> of water at 25°C, the temperature of the solution drops to 19°C.

a) Calculate the molar enthalpy of solution of ammonium nitrate (3 Marks)

(N = 14, O = 16, H = 1, Specific Heat Capacity for Water = 4.2kJ/kg/k)

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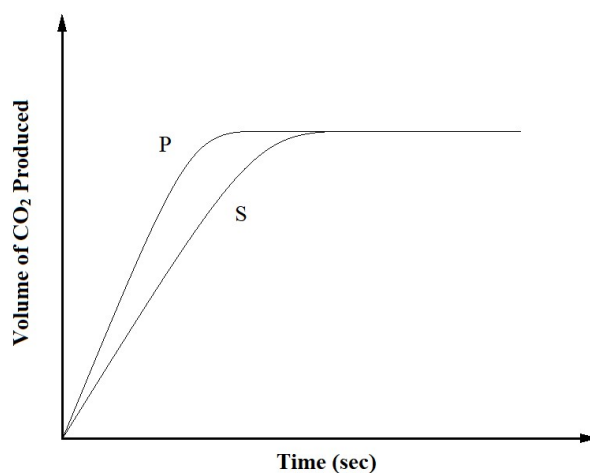
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b) Is the enthalpy change endothermic or exothermic? Give a reason (1 Mark)

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17. The curves below represent the volume of carbon (IV) oxide gas evolved when 2M hydrochloric acid was reacted with 100g of powdered calcium carbonate and when 1M hydrochloric acid was reacted with the same quantity of calcium carbonate.



a) Which of the two curves represents the reaction of 2M concentrated hydrochloric acid? Explain.

(2 Marks)

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b) Why do the two curves flatten at the same level of production of CO<sub>2</sub>? (1 Mark)

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18. The electron arrangement of ions X<sup>3+</sup> and Y<sup>2-</sup> are 2.8, and 2.8.8 respectively.

a) In which groups do X and Y belong? (1 Mark)

X \_\_\_\_\_ Y \_\_\_\_\_

b) State the formula of the compound that would be formed between X and Y (1 Mark)

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19.

a) State **two** ores from which sodium metal can be extracted. (1 Mark)

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b) During the extraction, calcium chloride solid is added into the sodium chloride solid. Why is calcium chloride added to the sodium chloride? (1 Mark)

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c) State **two** uses of sodium metal. (2 Marks)

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20. Using an energy cycle diagram, calculate the enthalpy change of formation of carbon disulphide, given: (3 Marks)



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21. The table below shows tests carried out in a sample of water and the results obtained.

Sample	Results	observations
A	Addition of sodium hydroxide dropwise until excess	Whit precipitate which dissolves in excess
B	Addition of excess ammonia solution	White precipitate
C	Addition of dilute nitric (V) acid followed by barium chloride	White precipitate

a) Identify the **anion** present in the water sample (1 Mark)

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b) Write an ionic equation for the reaction in C (1 Mark)

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22. Use the following information to answer the questions that follow:



a) Write the cell representation for the cell made up of the two half cells (1 Mark)

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b) Identify the reducing species

(1 Mark)

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c) Calculate the  $E^\theta$  value for the cell

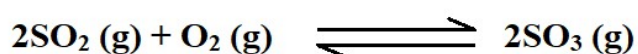
(1 Mark)

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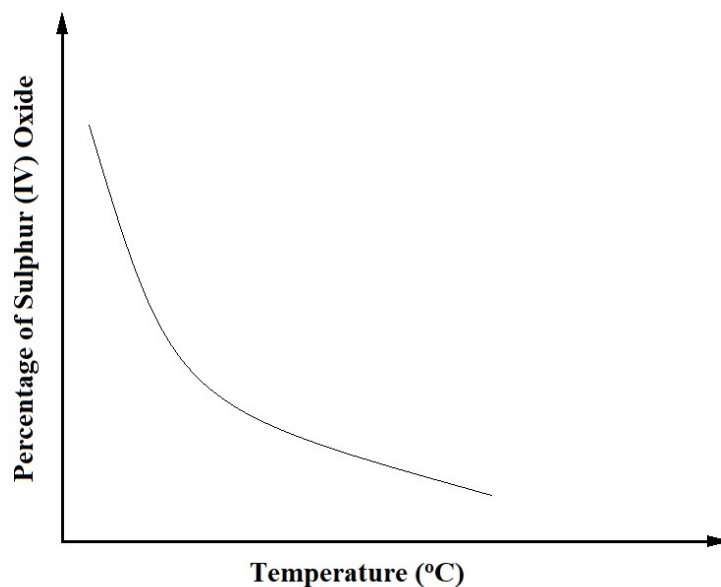
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23. The following is a reaction of an equilibrium mixture:



The percentage of sulphur (VI) oxide in the equilibrium mixture varies with temperature as illustrated in the sketch graph below



a) How does the percentage of sulphur (VI) oxide in the equilibrium mixture vary as the temperature increases? Explain.

(1½ Mark)

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**b)** Is the forward reaction in the equilibrium exothermic or endothermic? Give a reason for your answer. (1½ Mark)

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**24.** Radioactive polonium (Po) with a mass number of 212 and atomic number of 84 was detected in a sample of water. The water had an activity of 1000 counts per second.

**a)** If the water is boiled, explain whether the activity would be affected or not. (1 Mark)

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**b)** Given that polonium resulted from bitumen (B) following emission of a beta ( $\beta$ ) particle, write a nuclear equation for the decay. (1 Mark)

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**c)** State **one** medical application of radioactivity. (1 Mark)

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**25.** Name and give the formula of:

**a)** The **chief ore** from which zinc is extracted (1 Mark)

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**b)** The **main impurity** in the ore. (1 Mark)

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**c)** The ore is concentrated by froth floatation. What is froth floatation? (1 Mark)

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26. The atomic number of sulphur is 16. Write the electron arrangement of sulphur in the following compounds

a)  $\text{H}_2\text{S}$  \_\_\_\_\_ (1 Mark)

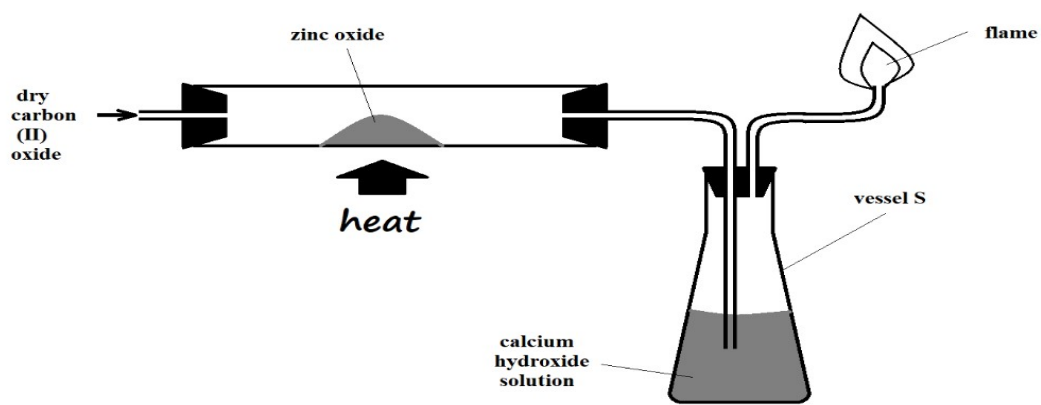
b)  $\text{SO}_3^{2-}$  \_\_\_\_\_ (1 Mark)

27. For the reaction:  $\text{Cl}_2 (\text{g}) + 2\text{I}^- (\text{aq}) \rightarrow 2\text{Cl}^- (\text{aq}) + \text{I}_2 (\text{s})$

Using oxidation numbers, state and explain the reducing species. (2 Marks)

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28. The setup below was used to investigate the effect of carbon (II) oxide on zinc oxide.



a) State the observations made on the setup. (2 Marks)

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b) Write equations for the reactions that took place. (2 Marks)

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# KCSE 2024

# CHEMISTRY

233/2

**PAPER 2 (THEORY)**

TIME: 2 HRS

**NAME**.....

**INDEX NO**..... **CANDIDATE'S SIGN**.....

**DATE** .....

## ***Kenya Certificate of Secondary Education.***

### **INSTRUCTIONS TO CANDIDATES**

- a) Write your name and index number in the spaces provided above*
- b) Sign and write date of examination in the space provided.*
- c) All working must be clearly shown where necessary.*
- d) Mathematical tables and silent electronic calculations may be used*
- e) Answer all questions in English.*

### **FOR EXAMINERS USE ONLY**

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1-7	80	

**Answer all questions**

**1.**

- a)** The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters do not represent actual symbols of the elements

<b>C</b>				<b>F</b>	<b>G</b>		<b>I</b>	
						<b>H</b>		<b>K</b>
<b>D</b>	<b>E</b>							
							<b>J</b>	

- i)** Identify the most reactive non-metal. Explain **(2 Marks)**

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- ii)** What is the name given to the family of elements to which **I** and **J** belong? **(1 Mark)**

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- iii)** Using dots (•) and crosses (×) to represent electrons, show bonding in the compound formed between **C** and **H**. **(2 Marks)**

- iv)** How does the atomic radius of **F** compare with that of **I**? Explain. **(2 Marks)**

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b) Study the table below and answer the questions that follow.

Substance	M	N	O	P	Q	R
Melting Point (°C)	801	1356	-101	26	-39	113
Boiling Point (°C)	1410	2850	-36	154	457	445
Electrical conductivity in solid state	Poor	Poor	Poor	Poor	Good	Poor
Electrical conductivity in molten state	Good	Poor	Poor	Poor	Good	Poor

i)Explain why **substance M** is a good conductor of electricity in the molten state but not in the solid state. (2 Marks)

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ii)What is the most likely structure and bond in **substance N**? Explain. (2 Marks)

Structure \_\_\_\_\_

Bond \_\_\_\_\_

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iii)Identify, with a reason, a substance that exists as a liquid at room temperature. (2 Marks)

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2.

a)

i)What name is given to different forms of an element which exist in the same physical state? (1 Mark)

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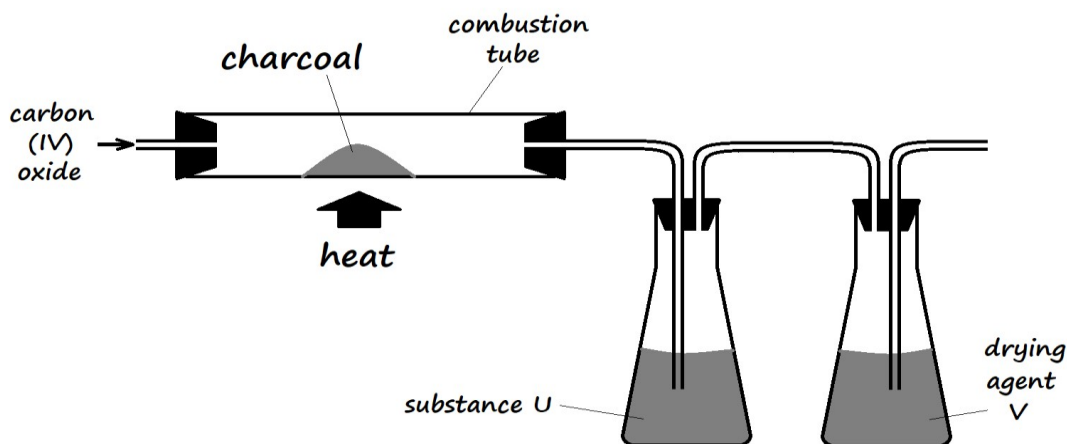
ii)Name **two** crystalline forms of carbon (1 Mark)

\_\_\_\_\_

\_\_\_\_\_



**b)** The figure below is part of a setup used to prepare and collect dry carbon (II) oxide from carbon (IV) oxide.



**i)** Complete the diagram to show how dry carbon (II) oxide gas is collected. **(1 Mark)**

**ii)** Identify:

- Substance U and state its use

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- Drying agent Y

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**iii)** Write a chemical equation for the reaction which takes place in the combustion tube **(1 Mark)**

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**iv)** Carbon (II) oxide is a major environmental pollutant.

- Give **one** major source of carbon (II) oxide in the atmosphere **(1 Mark)**

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- Explain how carbon (II) oxide causes poisoning **(1 Mark)**

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c) State **one** use of carbon (II) oxide (1 Mark)

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d) Write an equation for the formation of water gas. (1 Mark)

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e) Explain why sodium hydroxide solution is not used in testing for carbon (IV) oxide gas, while calcium hydroxide is preferably used. (2 Marks)

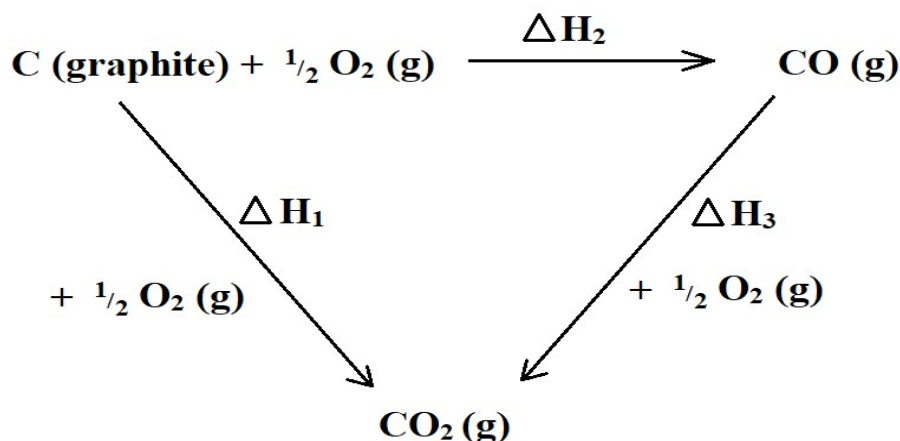
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3.

a) Study the following energy cycle diagram and then answer the questions that follow.



i) Name the enthalpy change represented by  $\Delta H_2$ . (1 Mark)

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ii) Use the following information to calculate the value of  $\Delta H_1$  for 144g of graphite. (2 Marks)

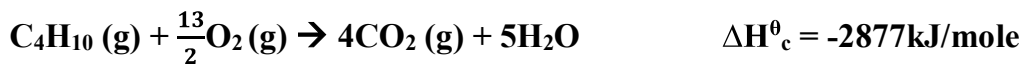
$$\Delta H_2 = -110 \text{ kJ/mole} \quad \Delta H_3 = -283 \text{ kJ/mole}$$

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b) The following are thermochemical equations for molar enthalpies of combustion for some substances. Study them and answer the questions that follow.



i)What is molar enthalpy of combustion of a substance? (1 Mark)

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ii)Calculate the molar enthalpy of formation of butane ( $\text{C}_4\text{H}_{10}$ ) using the information given above. (3 Marks)

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c) The following results were obtained in an experiment, to determine the heat of neutralization of  $25\text{cm}^3$  of 2M sodium hydroxide solution, using  $25\text{cm}^3$  of hydrochloric acid:

Initial temperature of acid =  $25.0^\circ\text{C}$

Initial temperature of alkali =  $26.0^\circ\text{C}$

Final temperature of mixture of acid + alkali =  $38.5^\circ\text{C}$

Density of solution =  $1\text{g/cm}^3$

Specific heat capacity of solution =  $4.2\text{ J/g/K}$

i)Define molar heat of neutralization (1 Mark)

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ii)Write an **ionic equation** for the neutralization reaction involving hydrochloric acid and sodium hydroxide solution. (1 Mark)

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iii) Calculate:

- The enthalpy change during this experiment.

(2 Marks)

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- The molar enthalpy of neutralization for this reaction

(2 Marks)

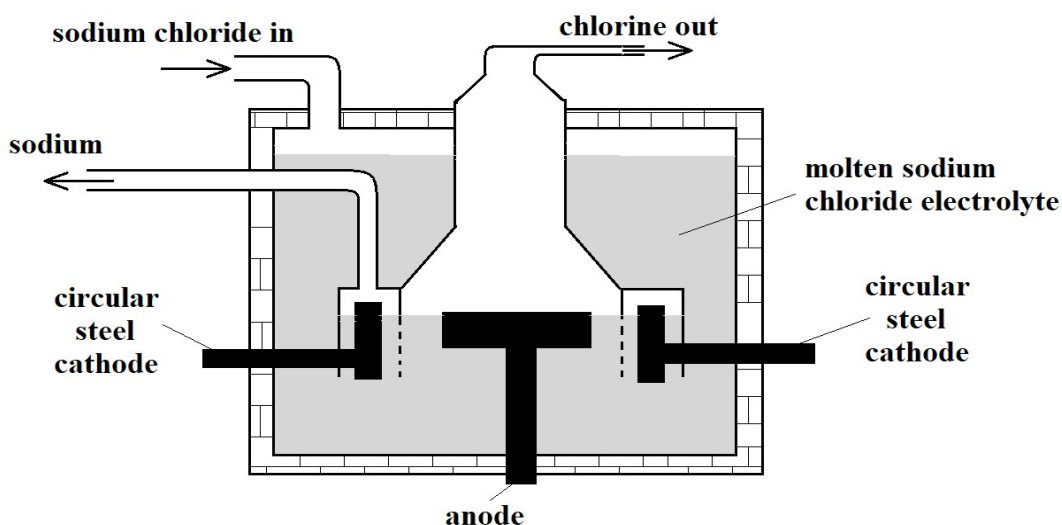
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4.

- a) Below is a simplified diagram of the Down's Cell, used for the manufacture of sodium. Study it and answer the questions that follow.



- i) What material is the anode made of? Give the reason why that material is used. (2 Marks)

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ii)What precaution is taken to prevent chlorine and sodium from re-combining? (1 Mark)

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iii)Write an ionic equation for the reaction in which chlorine gas is formed (1 Mark)

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b) In the Downs process, (used for manufacture of sodium), a certain salt is added to lower the melting point of sodium chloride from about 800°C to about 600°C.

i)Name the salt that is added. (1 Mark)

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ii)State why it is necessary to lower the temperature in b) above (1 Mark)

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c) Explain why aqueous sodium chloride is not suitable as an electrolyte for the manufacture of sodium in the Down’s Process. (2 Marks)

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d) Sodium metal reacts with air to form two oxides. Give the formulae of the two oxides (1 Mark)

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e) State **two** uses of sodium (2 Marks)

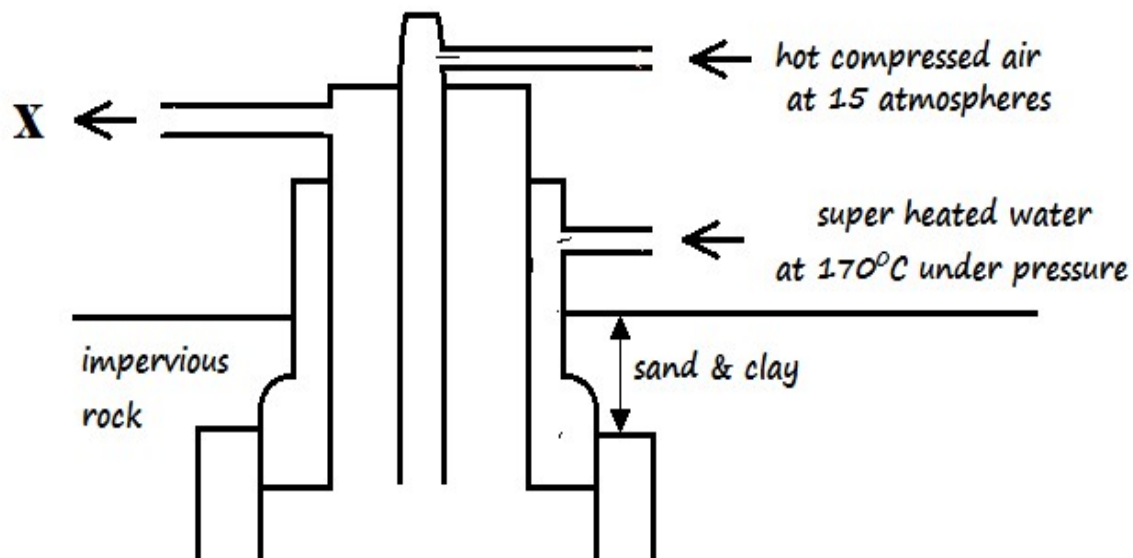
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5.

a) The diagram below shows part of the Frasch process, used for the extraction of sulphur. Use it to answer the questions that follow.



i)Identify X (1 Mark)

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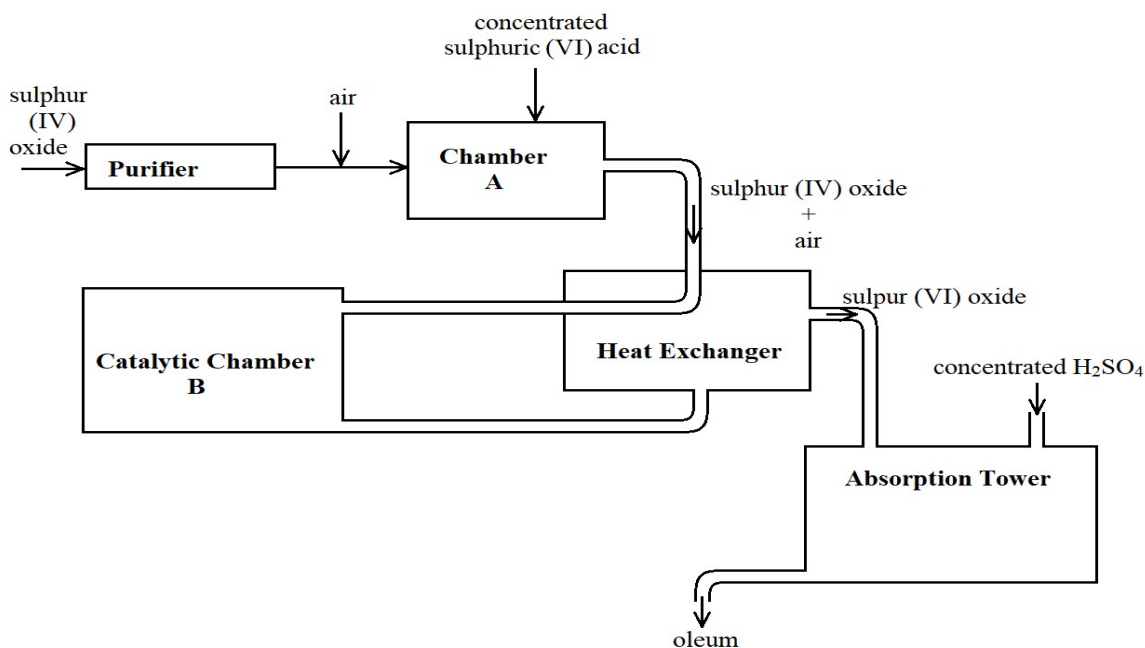
ii)Why is it necessary to use superheated water and hot compressed air in this process? (2 Marks)

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iii)State **two** physical properties of sulphur that makes it possible for it to be extracted by this method. (2 Marks)

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b) The diagram below shows part of the process in the manufacture of sulphuric (VI) acid. Study it and use it to answer the questions that follow.



i)Give **two** reasons why air is referred to as a mixture (2 Marks)

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ii)What is the role of concentrated sulphuric (VI) acid in **Chamber A**? (1 Mark)

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iii)Name **two** catalysts that can be used in the Catalytic **Chamber B**. (2 Marks)

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iv)State **two** roles of the heat exchanger (2 Marks)

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v) Describe the test for sulphite anion,  $\text{SO}_3^{2-}$

(2 Marks)

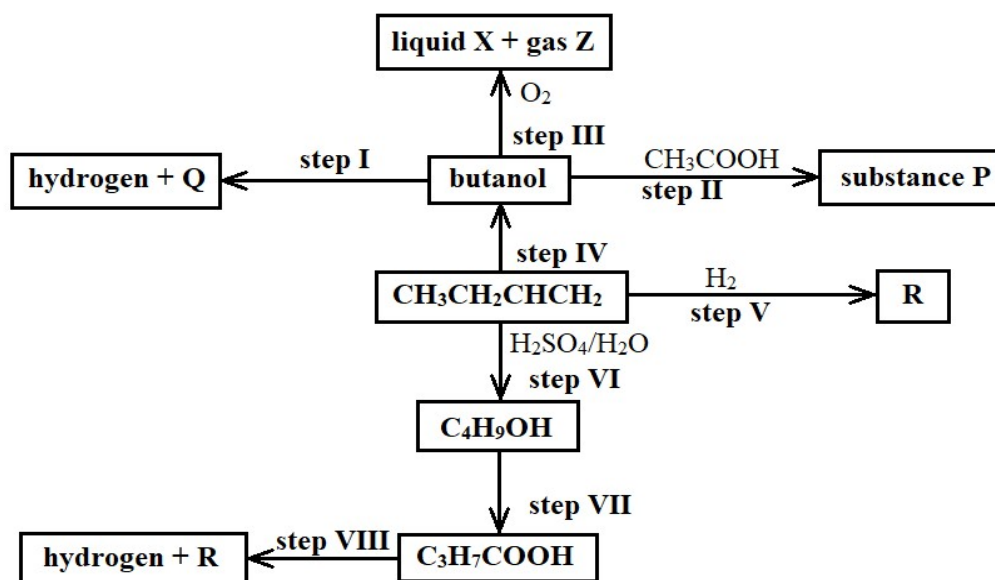
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vi) Explain the observation made when a few drops of concentrated sulphuric (VI) acid are added to crystals of hydrated copper (II) sulphate. Explain your answer.

(2 Marks)

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6. Study the reaction scheme below and answer the questions the follow:



i) What is the distinguishing physical property of **Substance P**?

(1 Mark)

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ii) Identify a suitable reagent that can be used in **Step I**.

(1 Mark)

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iii) Describe a chemical test on how  $\text{C}_3\text{H}_7\text{COOH}$  can be distinguished from  $\text{C}_4\text{H}_9\text{OH}$ . (2 Marks)

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iv) Write an equation for the reaction that takes place in Step III (1 Mark)

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v) Name the types of reaction that occur in steps II, III, V, and VII (2 Marks)

II \_\_\_\_\_

III \_\_\_\_\_

V \_\_\_\_\_

VII \_\_\_\_\_

vi) If 7.4g of butanol completely underwent Step III, determine the volume of gas Z produced at s.t.p.  
(MGV = 22.4 litres, C = 12, H = 1, O = 16) (3 Marks)

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vii) Write an equation for the reaction between R and one mole of fluorine gas (1 Mark)

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viii) Describe a chemical test for liquid X (2 Marks)

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# KCSE 2024

# CHEMISTRY

233/3

**PAPER 3 (Practical)**

TIME: 2¼ HRS

**NAME**.....

**INDEX NO.**..... **CANDIDATE'S SIGN**.....

**DATE** .....

**Kenya Certificate of Secondary Education.**

## **CONFIDENTIAL REPORT**

### **INSTRUCTIONS.**

*Apart from the normal fittings in the laboratory, each candidate will need the following chemicals and apparatus.*

- a) 500ml of distilled water supplied in a wash bottle*
- b) 50ml burette*
- c) 25ml*
- d) a pipette filler*
- e) 2 conical flasks (250ml)*
- f) Source of heat (means of heating)*
- g) Stop watch/clock*
- h) A ruler*
- i) 100ml measuring cylinder*
- j) 50ml measuring cylinder*
- k) Complete retort stand*
- l) 12cm long magnesium ribbon labelled C*
- m) 100ml of solution A (sulphuric acid)*
- n) 80ml of solution B (Sodium hydroxide soltn.)*
- o) 100ml empty beaker*
- p) Funnel*
- q) Sand paper*
- r) 3g of solid E*
- s) 1g of solid F*

- t) Means of labeling*
- u) Six clean test tubes in a test tube rack*
- v) 3 boiling tubes in a rack*
- w) Metallic spatula*
- x) About 0.2g of sodium hydrogen carbonate*
- y) Glass rod.*

#### **Access**

- 1. 2M Ammonia solution supplied with a dropper*
- 2. 2M Sodium hydroxide solution supplied with a dropper*
- 3. 2M Lead (II) Nitrate supplied with a dropper*
- 4. 0.2M Silver Nitrate solution supplied with a dropper*
- 5. Acidified potassium dichromate (VI) supplied with a dropper*
- 6. Acidified Potassium Manganate (VII) supplied with dropper*

#### **N/B**

- 1. Solution A is prepared by accurately measuring  $27.5\text{cm}^3$  of concentrated Sulphuric acid, then adding it to 700ml of distilled water then topping it to one litre.  
Density of acid  $1.84\text{g/cm}^3$*
- 2. Solution B is prepared by accurately measuring 20g of NaOH pellets and dissolving it in  $800\text{cm}^3$  of distilled water then topping to one litre with distilled water.*
- 3. Solid E – sodium chloride*
- 4. Solid F – maleic acid*



# KCSE 2024

## CHEMISTRY

233/3

**PAPER 3 (Practical)**

TIME: 2¼ HRS

**NAME**.....

**INDEX NO**..... **CANDIDATE'S SIGN**.....

**DATE** .....

### **Kenya Certificate of Secondary Education.**

#### **INSTRUCTION TO CANDIDATES:**

- a) Write your name and class in the spaces provided on this page above*
- b) Sign and write the date of examination in the spaces on this page above.*
- c) Answer ALL the questions in the spaces provided after EACH question in the question-paper.*
- d) You are NOT allowed to start working with the apparatus for the first 15 minutes of the 2¼ hours allowed for this paper. This time is to enable you read the question-paper and make sure you have ALL the chemicals and apparatus that you may need.*
- e) Mathematical tables and silent electronic calculator may be used.*
- f) ALL working MUST be clearly shown where necessary.*

Questions	Maximum Score	Candidate's Score
1	25	
2	15	
Total Score	40	

### **QUESTION 1.**

You are provided with:

- Sulphuric acid solution A
- 0.5M sodium hydroxide solution B
- Magnesium ribbon labelled C

You are required to:-

- Investigate the rate of reaction between solution A and metal C
- Determine the concentration of sulphuric acid in moles per litre

### **Procedure I**

- (i) Using a ruler, make 6 marks at 2cm length interval on the Magnesium ribbon provided. Cut the magnesium ribbon into 2 cm long pieces.
- (ii) Transfer 50cm<sup>3</sup> of acid solution using a measuring cylinder into a clean dry 100ml beaker. Place 2cm length piece of magnesium ribbon into the beaker with the acid and immediately start the stop watch/clock. Shake gently and note the time taken for the piece of magnesium ribbon to react completely.
- (iii) Record in table I below. Place another piece of magnesium ribbon (2cm) to the same solution and again note the time taken.
- (iv) Repeat the procedure until all six pieces of magnesium ribbon have reacted with the same solution initially placed in the beaker
- (v) Complete the table I below:

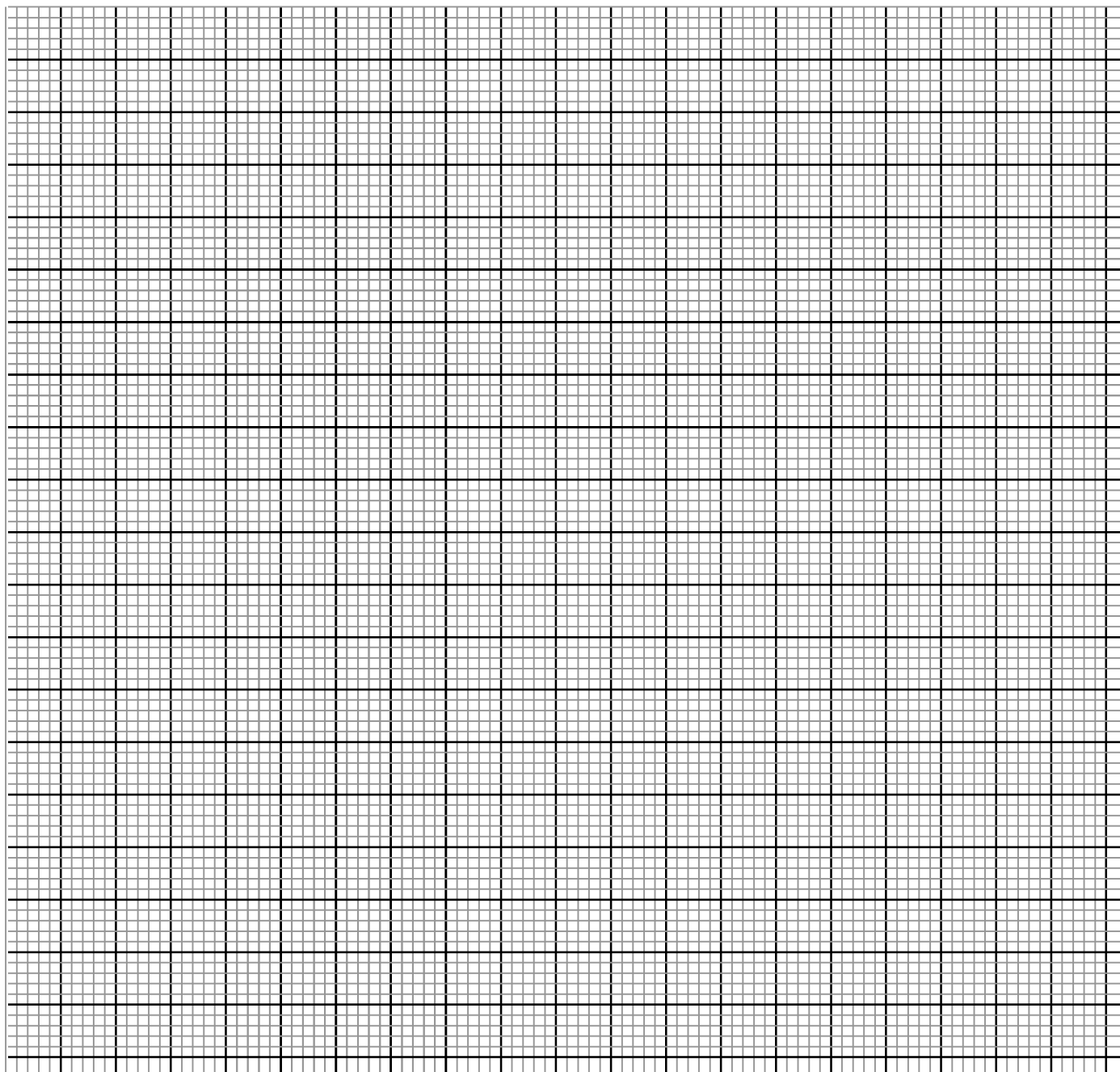
**Note:** Keep the solution obtained in this experiment for use in procedure II

#### **(a) Table I**

Piece of magnesium added	1	2	3	4	5	6
Length of magnesium added (cm)	2	4	6	8	10	12
Time taken t(second)						
Reciprocal of time $1/t(s^{-1})$						

**(4 marks)**

**(b) (i)** On the grid provided, plot a graph of total length of magnesium ribbon added against reciprocal of time ( $1/t$ ) for the reaction to go to completion. **(3 marks)**



**(ii)** From your graph, determine the time taken when 4.5cm length of magnesium ribbon to react completely. **(1 mark)**

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.....

(iii) Write a chemical equation for the reaction between magnesium and sulphuric acid. (1 mark)

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(iv) Given that the mass of solid V, which reacted was 0.12g and that atomic mass of magnesium is 24.0g, determine the number of moles of sulphuric (VI) acid that were used up during the reaction. (1 mark)

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(v) From your graph, state and explain the relationship between the length of magnesium ribbon and the reciprocal of time ( $1/t$ ) (1 mark)

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.....  
.....

### **Procedure II**

Place all the solution obtained in procedure I in a clean 100ml measuring cylinder. Add distilled water to make 100cm<sup>3</sup> of solution. Transfer all the solution into a beaker and shake well. Label it solution D. Fill the burette with solution B. Pipette 25.0cm<sup>3</sup> of solution D into a conical flask. Add 2-3drops of phenolphthalein indicator and titrate with solution. Record your results in the table II below. Repeat the titration two more times

**Table II**

<b>Titration</b>	<b>I</b>	<b>II</b>	<b>III</b>
Final burette reading (cm <sup>3</sup> )			
Initial burette reading (cm <sup>3</sup> )			
Volume of solution B (cm <sup>3</sup> ) used			

(4 marks)

**(c) (i)** Determine the average volume of solution B used . **(1 mark)**

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**(ii)** Calculate the number of moles of sodium hydroxide solution B used. **(1 mark)**

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.....

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**(d)** Calculate:

**(i)** The number of moles of sulphuric acid in 25.0cm<sup>3</sup> of solution D. **(1 mark)**

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.....

**(ii)** The number of moles of sulphuric acid in 100cm<sup>3</sup> of solution D. **(1 mark)**

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**(e)** Determine the total number of moles of sulphuric acid in 50cm<sup>3</sup> of solution A. **(1 mark)**

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**(f)** Calculate the concentration of the original sulphuric acid solution A in moles per litre.**(1 mrk)**

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## QUESTION 2.

You are provided with solid E. Carry out the following tests and write your observations and inferences in the table below:

**(a)** Place all the solid E in a boiling tube. Add about 15cm<sup>3</sup> of distilled water and shake vigorously for about 2 minutes.

Observations	Inferences
<p style="text-align: center;"><b>½ mark</b></p>	<p style="text-align: center;"><b>1 mark</b></p>

**b) Divide the solution into five equal portions in five different clean test tubes.**

**(i)** To the first portion, add 2M ammonia solution drop wise until in excess.

Observations	Inferences
1 mark	½ mark

**ii) To the second portion add 2M Sodium hydroxide solution drop wise until in excess.**

Observations	Inferences
1 mark	1 mark

iii) To the third portion add 4 drops of 2M Lead (II) nitrate solution.

Observations	Inferences
1 mark	1 mark

iv) To the fourth portion, add 4 drops of 0.2M silver nitrate solution.

Observations	Inferences
1 mark	1 mark

(v) Clean one end of the glass rod provided. Dip the clean end of the glass rod in the fifth portion. Remove the end and heat it in the non-luminous part of a Bunsen burner flame. Note the colour of the flame and record below.

Observations	Inferences
1 mark	1 mark

**QUESTION 3.**

You are provided with solid F. Carry out the tests below. Write your observations and inferences in the spaces provided

**(a)** Place about a half of solid F on a metallic spatula and burn it using a Bunsen burner flame.

Observations	Inferences
<p><b>½ mark</b></p>	<p><b>½ mark</b></p>

**(b)** Place the remaining of solid F in a boiling tube. Add about 10cm<sup>3</sup> of distilled water and shake the mixture well.

Observations	Inferences
1 mark	1 mark

**(c)** Divide the mixture obtained into three portions.

(i) To the first portion, add a small amount of solid sodium hydrogen carbonate.

Observations	Inferences
1 mark	1 mark

**(ii)** To the second portion, add about 1 cm<sup>3</sup> of acidified potassium dichromate (VI) and warm.

Observations	Inferences
1 mark	1 mark

(iii) To the third portion, add two drops of acidified potassium manganate (VII).

Observations	Inferences
1 mark	1 mark