KCSE 2024 REGIONAL MOCKS

CHEMISTRY

The PDF Comprises of A Compilation of 4 Top Joint National Mocks Administered across the 47 Counties for KCSE Class of November 2024

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Success to all KCSE 2024 Candidates

KENYA EDUCATORS CONSULTANCY

MINISTRY OF EDUCATION (KNEC COMPLIANT)

NAME……CLASS……ADM……SIGN…

233/1

CHEMISTRY

(THEORY)

PAPER 1

CLASS OF KCSE 2024

TIME: 2 HOURS

THE NAIROBI & CENTRAL REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

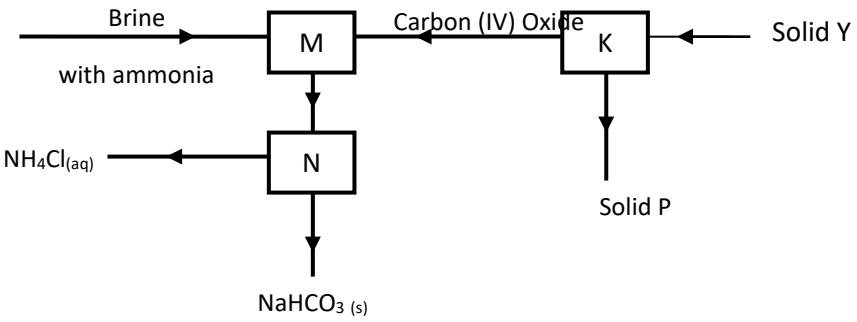
INSTRUCTIONS TO STUDENTS:

- Write your **name** and **adm** 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.
- All working **must be** clearly shown where necessary
- 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

Questions	Maximum Score	Candidate's Score
1 – 29	80	

1. The diagram below shows part of Solvay process.



(a) Name solid P (1 Mark)

(b) State the process taking place in chamber N. (1mark)

(c) State two uses of calcium chloride which is a by-product in this process.
(1 mark)

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2. $100cm^3$ of methane gas diffused through a porous partition in 40 seconds. How long would it take $90cm^3$ of ozone gas to diffuse through the same partition? C = 12, H = 1, O = 16 (3marks)

3. Ammonia is produced in large scale by Haber process.
   (i) Write an equation for the formation of ammonia gas. (1 mark)

   (ii) State **two** optimum conditions for obtaining a high yield of ammonia in the process.
(2 marks)

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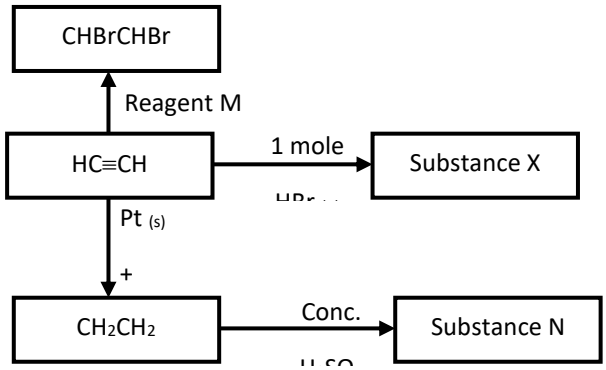
4. The scheme below shows some reactions starting with ethyne. Study it and answer the questions that follow.



   (a) Name substance X and N (1mark)

   (b) Name reagent M (1 Mark)

(c) Ethene undergoes polymerization to form a polymer. Give an equation for the reaction and name the product.

(i) Equation; (1 mark)

(ii) Name: (1mark)

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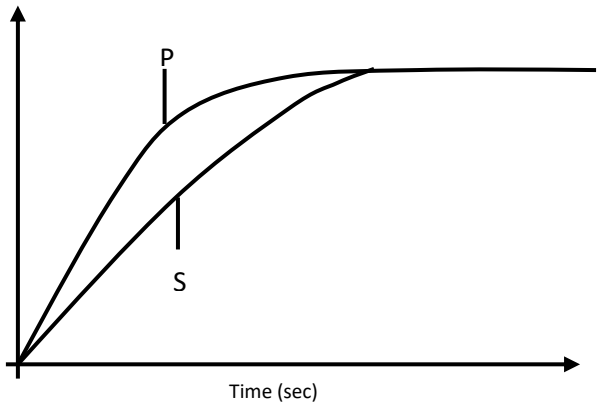
5. The curves below represent the volume of carbon (IV) oxide gas evolved once 2M(concentrated) hydrochloric acid was reacted with 100g of powdered calcium carbonate and also when 1M concentrated hydrochloric acid was reacted with the same quantity of carbonate.



(i) Which of the two curves represents the reaction of 2M concentrated HCl with powdered calcium carbonate. Give a reason. (2 marks)

(ii) Why do the two curves flatten at the same level of production of CO_2 (1 mark)

---

6. Study the following equilibrium equation.

$2X_2(g) + Y_{2(g)} \rightleftharpoons 2X_2Y_{(g)}$ $\Delta H = -197Kj/mol$

Suggest two ways of increasing the yield of X_2Y. (1 mark)

---

7. The table below gives some elements in the periodic table. Use it to answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	A	B	C	D	E
Atomic number	12	13	14	15	16

Which of the above letters represent:

(a) A metallic element which forms ions with the smallest ionic radius? Explain (2 marks)

(b) A non metallic element with the largest atomic size? Explain. (1mark)

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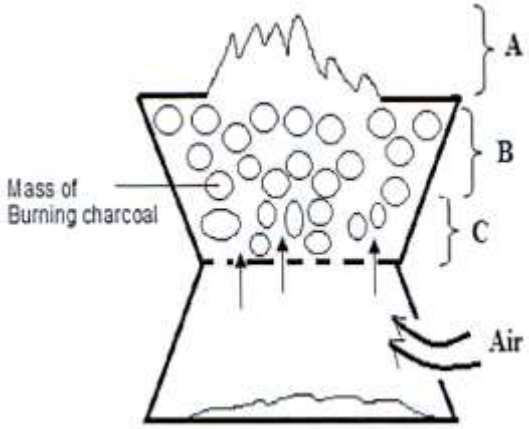
8. The diagram below shows a burning jiko. Study it and answer the questions that follow.



(a) Write the equation for the reaction taking place in region A. (1 Mark)

(b) Name the gas produced at region B. (1 Mark)

(c) State ONE use of the gas named in (b) above. (1 Mark)

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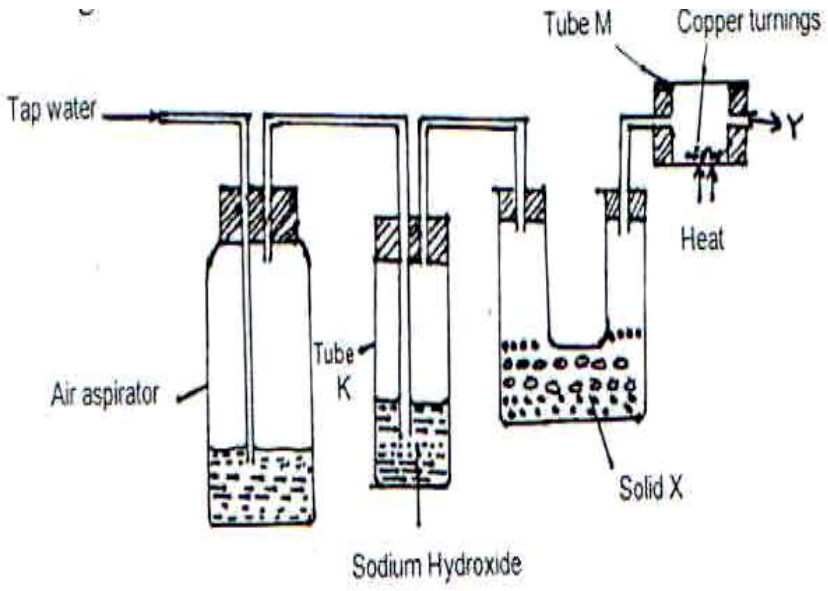
9. Study the diagram below and answer the questions that follow.



(i) What is the purpose of passing tap water through the air aspirator? (1 Mark)

(ii) State and explain the observation that would be made in tube M after sometime.

(1 Mark)

---

10. 15g of sodium chloride was dissolved in 120cm^3 of distilled water. Calculate the concentration of the resulting solution in moles per litre. (Na = 23, Cl = 35.5)

(3Marks)

11. (a) State Boyle's Law. (1 Mark)

(c) The volume of a gas at 30^{0}C and 780mmHg is 400cm^3. What will be its volume at 50^{0}C at 600 mmHg. (3marks)

12. Sulphur exhibits allotropy.
    (a) What is allotropy? (1 Mark)

    (b) Name the **two** allotropes of sulphur. (2 Marks)

    (c) Sulphur powder was placed in a deflagrating spoon and heated on a Bunsen Burner.
        (i) State the observation made. (1 Mark)

        (ii) The product obtained was dissolved in water. Comment on the PH of the solution formed. (1 Mark)

        ---

13. 0.318g of an oxide of metal M was completely reduced by hydrogen gas to 0.254g of metal. Calculate empirical formula of the metal oxide. (M = 63.5, O = 16) (3 Marks)

14. Given the following reagents: Solid sodium Carbonate, water, solid Lead (II) nitrate. Describe how a sample of Lead (II) Carbonate can be prepared in the laboratory.(3 Marks)

---

15. Volume of liquids can be measured using a pipette; measuring cylinder or burette. Explain which one would be best for measuring 29.1cm^3 of liquid. (1 Mark)

---

16. Study the information in the table and answer the questions below.

Substance	Solubility g/100g water
V	126
W	2

Describe how a solid sample of substance **V** could be obtained from a solid mixture of **V** and **W**.(2 Marks)

---

17. Use the bond energies given below to calculate the heat of reaction for;(3 marks)

$$H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$$

Bond	Energy (Kj/Mol)
H – H	435
Cl – Cl	243
H – Cl	431

18. The PH of a soil sample was found to be 5.7. An agricultural officer recommended addition of lime.

(a) State **two** functions of the lime. (2 Marks)

(b) Give the name of the process applied in (a) above. (1mark)

---

19. The electronic configuration of ions X^{2+} is 2.8 while that of ion Y^{-} is 2.8.8.

(a) Write down the electron arrangement of the atoms of X and Y (2 Marks)

(b) Compare the atomic radii of the two elements. (1 Mark)

(c) Give the name of the chemical family to which element X belongs (1 Mark)

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20. Use the information below to answer the questions that follow.

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H_1 = -393$ KJ/mol

$H_{2(g)} + \frac{1}{2} O_{2(g)} \longrightarrow H_2O_{(l)}$ $\Delta H_2 = -286$ KJ/mol

$C_4H_{10} + 6\frac{1}{2} O_{2(g)} \longrightarrow 4CO_{2(g)} + 5H_2O_{(l)}$ $\Delta H_3 = -2877$KJ/mol

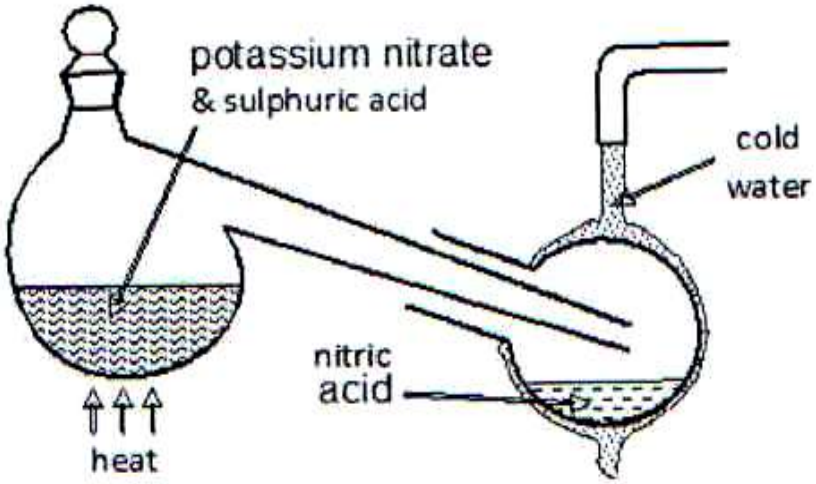
(a) Calculate the molar enthalpy of formation of butane (C_4H_{10}) from its elements in their normal states. (3mks)

21. (a) (i) A student found a colourless liquid in the laboratory which he suspected to be water. Describe a chemical test the could have performed to confirm that the liquid is water.

(2 Marks)

(ii) What other test could he have done to prove that the liquid is pure water?(1 Mark)

22.The diagram below shows that the set-up that was used to prepare and collect a sample of nitric acid

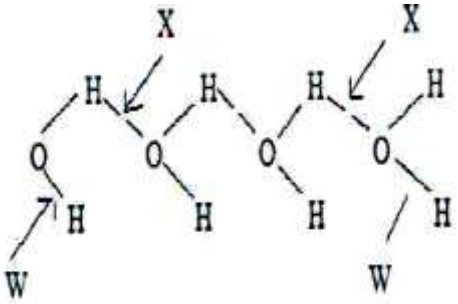


(a) Give a reason why it is possible to separate nitric acid from sulphuric acid in the set-up. (1 Mark)

(b) Name another substance that can be used instead of potassium nitrate.(1 Mark)

(c) Give one use of nitric acid.(1mark)

23.The structure of water molecules can be represented as shown below.



(i) Name the bond type represented by letter X and W. (1 Mark)

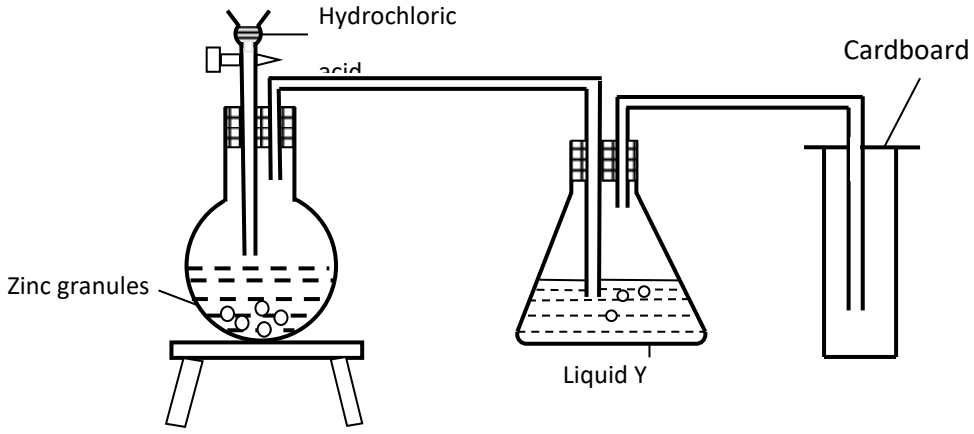
(ii) Relative molecular mass of methane and water are almost similar, however the boiling of water is 100^0C while that of methane is -161^0C. Explain. (1 Mark)

24.Diamond and graphite are allotropes of carbon. In terms of structure and bonding, explain why?

(i) Diamond is used in drilling of hard rocks. (1 Mark)

(ii) Graphite is a lubricant. (1Mark)

25.The set up was used to prepare dry hydrogen gas. Study it and answer the questions that follow.



(i) Is set-up used to prepare the gas correct? Give reason. (1 Mark)

(ii) What would be liquid Y?(1mark)

(iii) Give two physical properties of hydrogen gas (1 Mark)

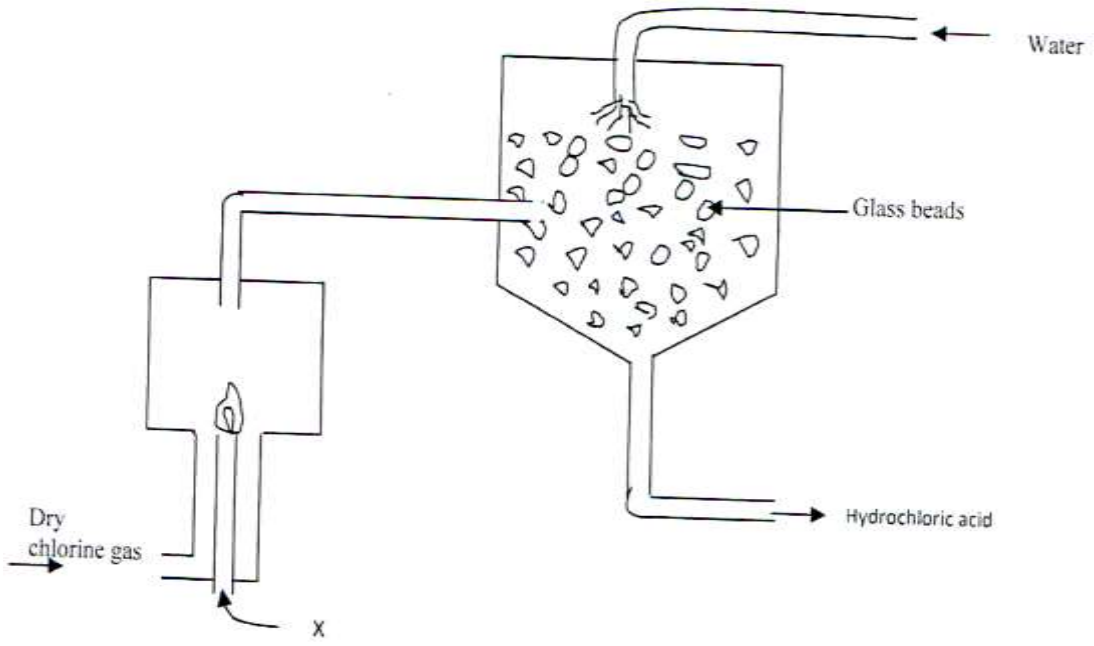
---

26. Given element W has atomic number 14 and consists of isotopes as shown below.

Isotope	A	B	C
Isotope mass	28	29	30
Percentage abundance	92.2	4.7	3.1

Determine the relative atomic mass of W (2 Marks)

27.The diagram below represents a set up used for the large scale manufacture of hydrochloric acid.



(a) Name substance X (1Mark)

(b) What is the purpose of the glass beads? (1 Mark)

(c) Give one use of hydrochloric acid (1Mark)

---

28. A mixture contains Iron (III) Chloride, calcium chloride and iron filings. Describe how one can separate and recover the substances in the mixture.(3marks)

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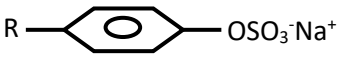
29. The structure below represents two cleansing agents A and B. Which cleansing agent would be suitable for washing in water containing calcium chloride? Give a reason.

(2marks)



A

$R{-}COO^-Na^+$

B

MINISTRY OF EDUCATION (KNEC COMPLIANT)

NAME……CLASS……ADM……SIGN…

233/2

CHEMISTRY

(THEORY)

PAPER 2

CLASS OF KCSE 2024

TIME: 2 HOURS

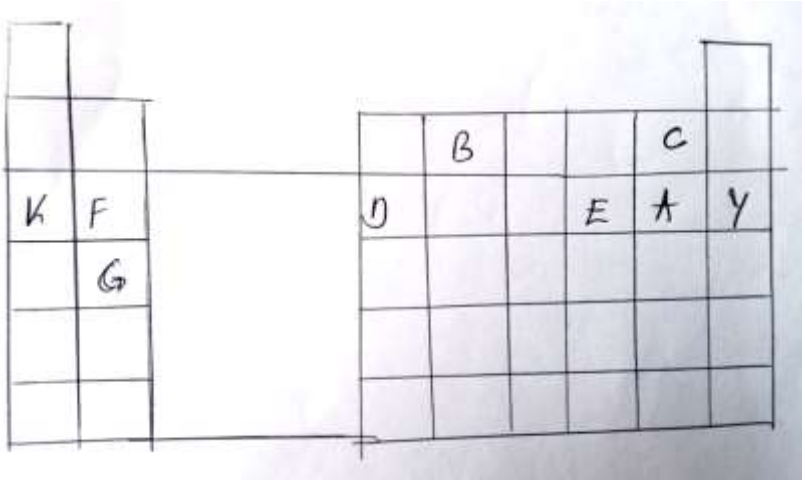
THE NAIROBI & CENTRAL REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

INSTRUCTIONS TO CANDIDATES:

Answer all the questions in the spaces provided.
Mathematical tables and electronic calculators may be used.
All working must be clearly shown where necessary.

1. The grid below represents part of the periodic table. Study it and answer the questions that follow.



(a) Identity the family name to which element F and G belong. (1 mk)

(b) Name the type of bond formed when a and F belong. (1 mk)

(c) Write the formula of the oxide formed when D reacts with oxygen. (1 mk)

(d) What type of oxide is formed in (c) above. (1 mk)

(e) Compare the atomic radii of F and D. Explain. (2 mks)

(f) Element F burns in air to form two products. Write two equations of the two products formed. (3 mks)

(g) Stat e two uses of element K and its compounds. (2 mks)

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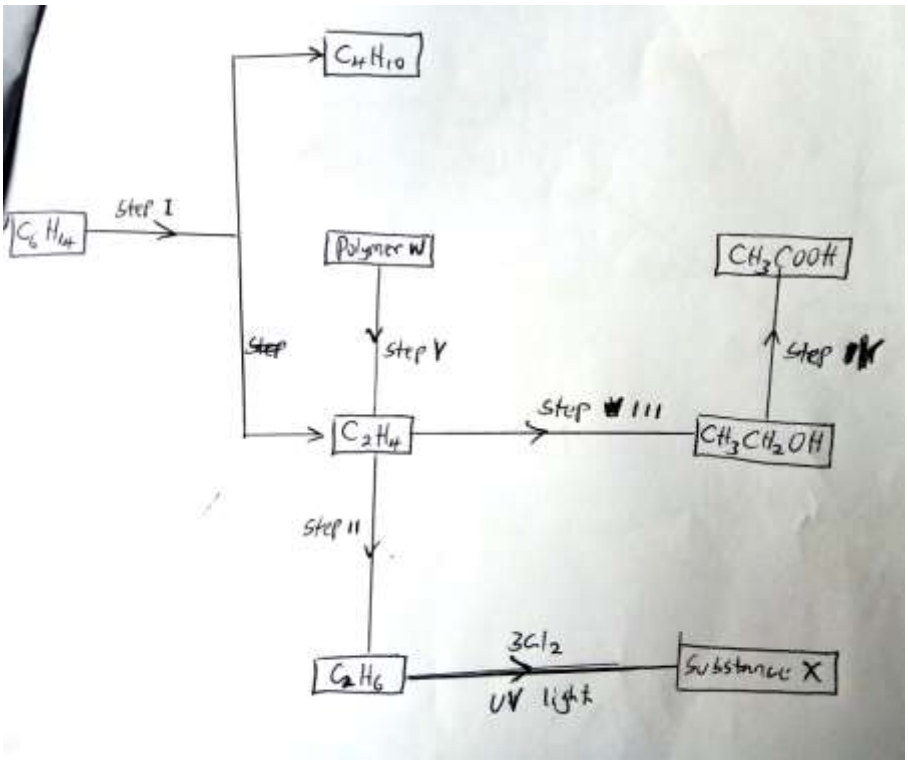
2. (a) Name the following organic compounds.

(i) $CH_3CH_2CH(Br)CH_3$

(ii) $CH_3\text{-}CH_2CH_2\text{-}CH_2\text{-}C(=O)\text{-}OH$ (OH)

(iii) $CH_2CHCH_2CH(Br)CH_3$

(b) Study the flow chart below and answer the questions that follow.

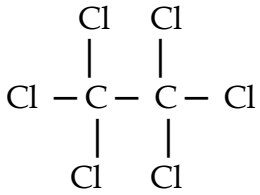


Name:-

(i) The process that occur in steps marked I, II and IV. (1 mk)

(ii) The reagent and conditions in step II. (1½ mks)

(iii) Draw the structural formula of substance X, give the name of the substance. (2 mks)



(c) The diagram below shows a structure of a cleansing agent.

(i) Name the cleansing agent above. (1 mk)

(ii) State the type of cleansing agent above. (1 mk)

(iii) Name the material added to the cleansing agent in order to improve its cleansing property.

---

3. (a) 50cm^3 of 1M copper (II) Sulphate solution was placed in a 100cm^3 plastic beaker. The temperature of the solution was measured. Excess metal A powder was added to the solution, the mixture stirred and the maximum temperature was repeated using powder of metal B and C. The results obtained are given in the table below.

	A	B	C
Maximum temperature ^oC	2.63	31.7	22.0
Initial temperature (^oC)	22.0	22.0	22.0

(i) Arrange the metal A, B, C and Copper in order of reactivity starting with the least reactive. Give reasons for the order. (3 marks)

(ii) Other than temperature change, state one other observation that was made when the most reactive metal was added to the copper (II) Sulphate solution. (1 mk)

(b) The Standard enthalpy change of formation of methanol is -239Kjmol-1

(i) Write the thermal chemical equation for the standard enthalpy change of formation of methanol. (1 mk)

(ii) Use the following data to calculate the enthalpy change for the manufacture of methanol from carbon (II) oxide and hydrogen.(3 mks)

$CO_{(g)} + \frac{1}{2} O_{2(g)} \longrightarrow CO_2$; $\Delta H^e = -283Kj/mol$

$H_{2(g)} + \frac{1}{2} O_{2(g)} \longrightarrow H_2O_{(l);} = \Delta H^e = -286Kj/mol$

$CH_3OH + {}^3/_2 \longrightarrow CO_{2(g)} + 2H_2O; \Delta H^e = -715Kj/mol$

(d) Study the information given in the table below and answer the questions that follow.

Bond	Bond energy ($Kjmol^{-1}$
C – H	414
Cl – Cl	244
C – Cl	326
H - Cl	431

Calculate the enthalpy change for the reaction. (3 mks)

4. Carbon IV oxide is produced when solid X is heated strongly. It can also be prepared by adding dilute hydrochloric acid to solid X. The reaction between X and dilute Sulphuric acid, however gradually slows down and stops.

(a) (i) Name solid X. (1 mk)

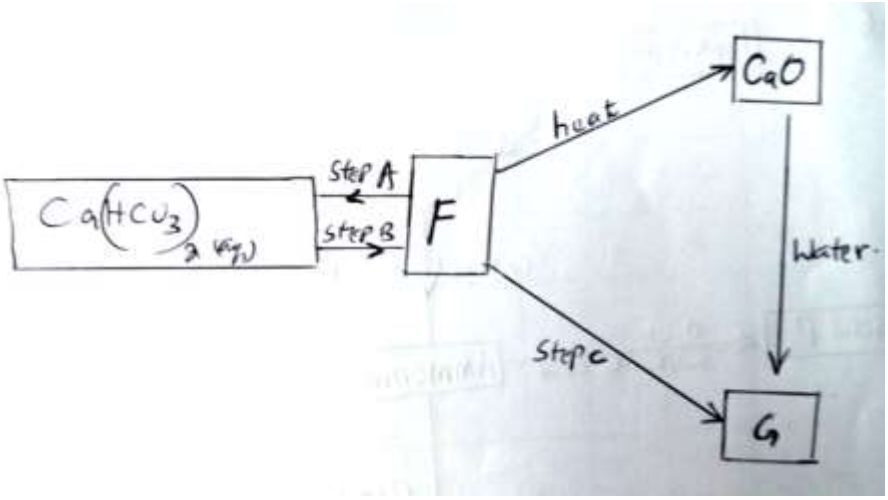
(ii) Write an ionic equation for the reaction of X and acid. (1 mk)

(b) A gas jar full of Carbon (IV) oxide was inverted over burning candle.
(i) State the observations made. (1 mk)

(ii) What two properties of carbon (IV) oxide does this observation illustrate. (2 mks)

(iii) Name a practical everyday use of this property of carbon (IV) oxide. (1 mk)

(c) The flow diagram below shows some reactions of calcium compounds.



(i) Name compound F and G. (2 mks)

(ii) Write equations for reactions in step A, B and C. (3 mks)

---

5. A piece of sodium metal which had been exposed to air, was found to be covered with a white powder. The piece was dropped into 50g of ethanol and 2400cm^3 of hydrogen gas measured at room temperature and pressure was obtained. The unused ethanol was distilled off and a white solid remained (Na = 23, molar gas volume at room temperature and pressure = 24dm^3)

(i) Name the other substance formed other than hydrogen. (1 mk)

(ii) Calculate the mass of sodium that dissolved in ethanol. (2 mks)

(iii) What mass of ethanol was distilled of assuming there was no loss during the process? (2 mks)

(iv) The ethanol was distilled off at 80°C, while the white solid remained unaffected at this temperature. What is the difference in structure of ethanol and the white solid. (2 mks)

(b) Name another liquid which produces;

(i) Hydrogen with sodium metal. (1 mk)

(iii) What difference would you observe if identical pieces of sodium were dropped separately into small beakers containing ethanol and this other liquid? (2 mks)

(d) (i) Name the white powder coating the original piece of sodium, explain how it was formed. (3 mks)

(ii) Describe one test by which you could identify white powder which originally covered sodium. (2 mks)

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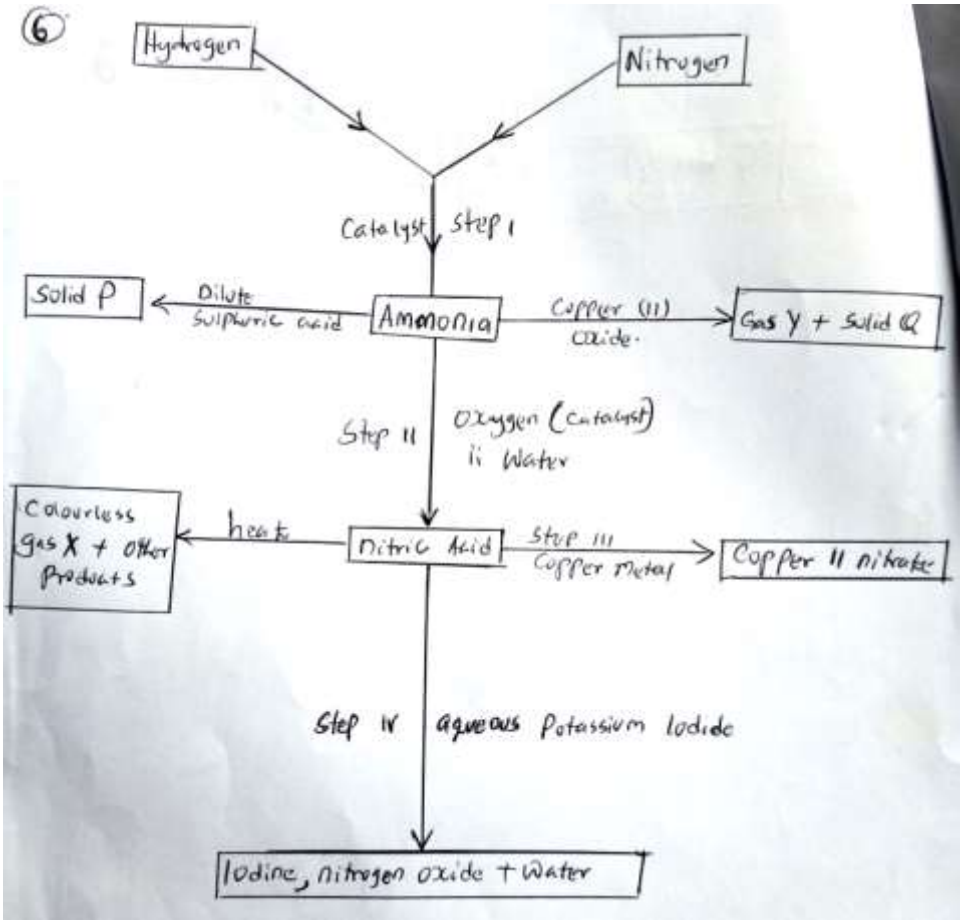
6. The scheme below shows various reactions starting with hydrogen and nitrogen. Study it carefully and answer the questions that follow.



(i) Give one condition other than the of a catalyst that would favour the reaction in step I. (1 mk)

(ii) Name the catalysts used in step I and II. (2 mks)

(iii) Name substances P, Q, X and Y . (2 mks)

(iv) Write equations for the reactions that takes place in step II. (3 mks)

(iv) Name the oxidizing agent for the reaction that takes place in step IV. (1 mk)

(v) Why is a concentrated nitric acid transported on aluminium container and not copper? (1 mk)

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7. Use standard electric potentials for elements A, B, C, D and F given below to answer the questions that follow.

		$E^{\ominus}$ (volts)
$A^{2+}_{(aq)} + 2e^- \rightleftharpoons A_{(s)}$		-2.90
$B^{2+}_{(aq)} + 2e^- \rightleftharpoons B_{(s)}$		-2.38
$C^{+}_{(aq)} + 2e^- \rightleftharpoons \frac{1}{2} C_{(g)}$		-0.00
$D^{2+}_{(aq)} + 2e^- \rightleftharpoons D_{(s)}$		+0.34
$\frac{1}{2} F_{2(g)} + e^- \rightleftharpoons F^-_{(aq)}$		+2.87

(i) Which element is likely to be hydrogen? Give a reason for your answer. (2 mks)

(ii) What is the E^{o} value of the strongest reducing. (1 mk)

(iii) In the space provided, draw a labeled diagram of the electrochemical cell that would be obtained when half-cells of elements B and D are combined. (3 mks)

(iv) Calculate the E^{o} value of the strongest reducing agent. (2 mks)

(c) During the electrolysis of aqueous copper II Sulphate using copper electrodes, al current of 0.2 amperes was passed through the cell for 5 hours.

(i) Write an ionic equation for the reaction that took place at the anode.(1 mk)

(ii) Determine the change in mass of the anode which occurred as a result of the electrolysis process. (C.u = 63.5, 1 Faraday = 96,500 coulombs) (2 mks)

MINISTRY OF EDUCATION (KNEC COMPLIANT)

NAME……CLASS……ADM……SIGN…

233/3

CHEMISTRY

(PRACTICAL)

PAPER 3

CLASS OF KCSE 2024

TIME: 2 HOURS

THE NAIROBI & CENTRAL REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

CONFIDENTIAL

Requirements for candidates

In addition to the apparatus and fittings found in a Chemistry laboratory, each candidate will require the following.

1. about 100cm^3 of solution F
2. about 50cm^3 of solution G
3. 30cm^3 of solution M
4. 30cm^3 of solution N
5. one burette 0 – 50ml
6. one pipette 25ml
7. two conical flasks
8. 100ml measuring cylinder
9. 200ml or 250ml beaker
10. About 500ml distilled water
11. Phenolphthalein indicator
12. thermometer (0 – 110^{0}C)
13. Source of strong heat (preferably Bunsen burner)
14. clock or stop watch
15. 2 boiling tubes
16. one CLEAN METALLIC spatula
17. 6 clean dry test-tubes
18. one test-tube holder
19. at least 6cm length of universal indicator paper
20. 0.5g of sodium hydrogen carbonate
21. pH chart pH 1 – 14
22. Bromine water supplied with a dropper
23. 0.5g of solid K – oxalic acid.
24. 0.5g of solid P – Sodium sulphite

The students should have access to the following

a. 2.0M NaOH solution with a dropper
b. 1.0M barium nitrate solution with a dropper
c. Bromine water with a dropper
d. Acidfied potassium manganate (vii) with a dropper
e. 2.0M HCl with a dropper

1. Bromine water is prepared by adding 1ml of liquid bromine to 100cm^3 of distilled water and shaking thoroughly in a fume cupboard.

2. Acidified potassium permanganate is prepared by adding 3.16g of solid potassium permanganate to 400cm^3 of 2M sulphuric acid and diluting to one litre of solution using distilled water.

3. Solution M is made by dissolving 12.6g of oxalic acid in 400cm^3 distilled water and making it to 1 litre.

4. Solution N is prepared by dissolving 3.16g of potassium manganate (VII) in 200cm^3 of 2M sulphuric acid and adding more water to make 1 litre

5. Solution F is prepared by dissolving 4g of sodium hydroxide pellets in about 800cm^3 of distilled water and diluting it to one litre solution.

6. Solution G is prepared by dissolving 9.0g of oxalic acid (ethan-1,2-dioic acid) in 200cm^3 of distilled water and diluting it to 250cm^3 solution.

NAME.....CLASS.....ADM.....SIGN...

233/3

CHEMISTRY

(PRACTICAL)

PAPER 3

CLASS OF KCSE 2024

TIME: 2 HOURS

THE NAIROBI & CENTRAL REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

Instructions to candidates

- *You are not allowed to start working with the apparatus for the first 15 minutes of the 2 ¼ hours allowed for this paper. This time is to enable you to read the question paper and make sure you have all the chemicals and apparatus that you may need.*
- *All working MUST be clearly shown.*
- *Mathematical tables and electronic calculators may be used.*

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1. You are provided with:

   - 0.1m sodium hydroxide solution F

   - Solution G made by dissolving 9.0g of dibasic acid H_2MO_4 in 250cm^3 of distilled water

   You are required to:

   (i) Dilute solution G

   (ii) Standardize the diluted solution H using the sodium hydroxide solution F

   (iii) Determine the mass of M in the formula H_2MO_4

   Procedure 1

Using a measuring cylinder measure 20cm^3 of solution G and transfer it into a beaker.

Measure 80cm^3 of distilled water and add it to the 20cm^3 of solution G in the beaker. Label this as solution H.

Procedure II

Place solution H in a burette. Pipette 25cm^3 of solution F into 250cm^3 conical flask. Add 2 – 3 drops of phenolphthalein indicator and Titrate with solution H. Record your results in table 1. Repeat the titration two more times and complete the table.

a) Table 1

	1	**II**	**III**
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution H used (cm^3)			

(4 marks)

b) Calculate the average volume of solution H used. (1 mark)

c) Determine the number of moles of:-

I Sodium hydroxide in Solution F in 25cm^3 (1 mark)

II Acid in solution H in the average volume used. (1 marks)

III acid in 100cm^3 of solution H. (1 marks)

IV acid in $20cm^3$ of solution G. (1 mark)

V acid in $250cm^3$ of solution G (2 marks)

d) Calculate the:

I Molar mass of acid H_2MO_4 (2 marks)

II Mass of M in the formula H_2MO_4 given that H = 1, O=16. (1 marks)

2. You are provided with:

- 0.15M ethan-1,2-dioc acid (oxalic), solution M

- 0.02M acidified potassium manganate (VII) solution N

You are required to determine the rate of reaction between acidified potassium manganate (VII) and ethan – 1,2 – dioc (oxalic) acid at different temperatures.

Procedure

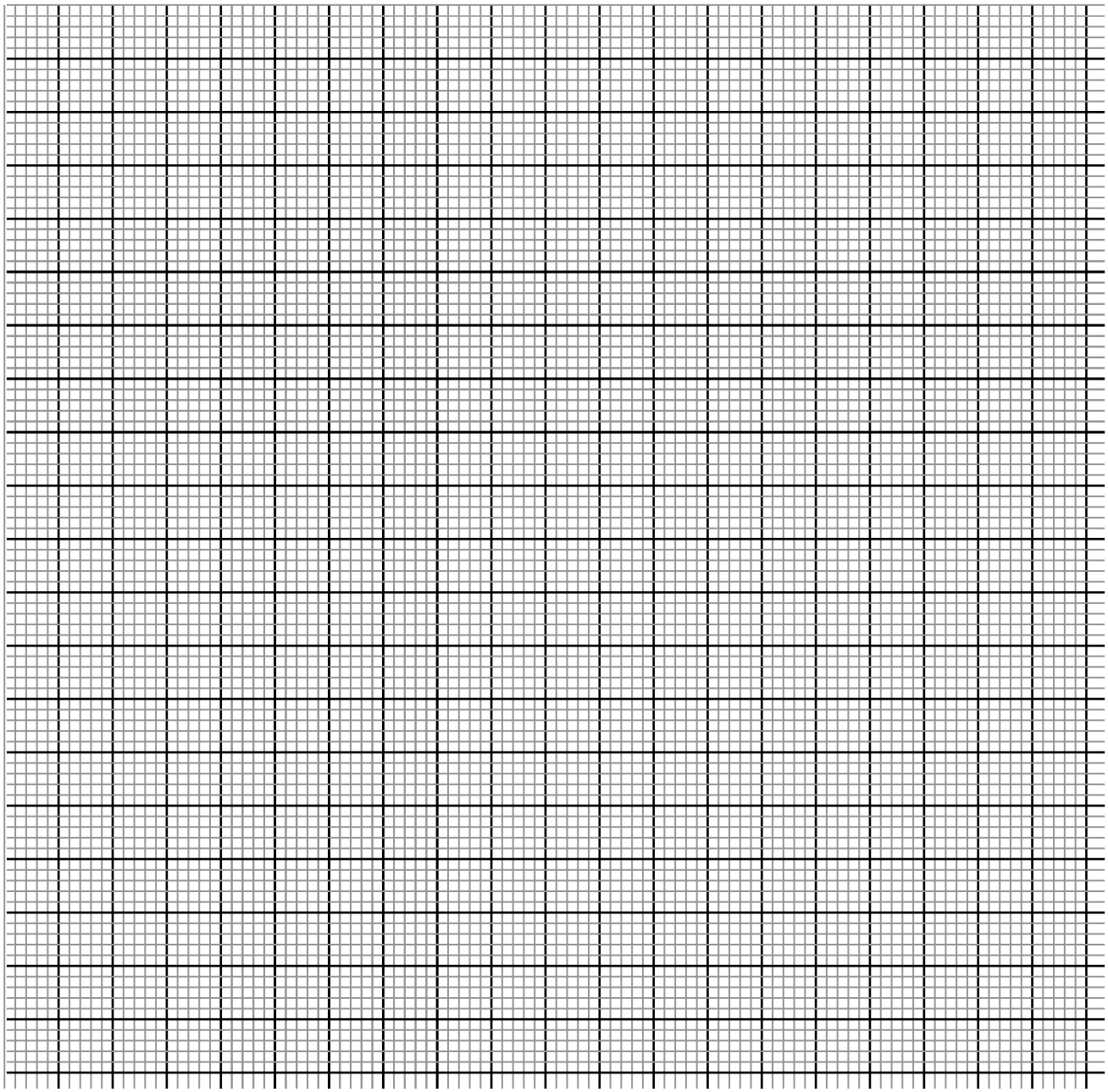
1. Place $5cm^3$ of solution N in a boiling tube
2. Place another $5cm^3$ of solution M in another boiling tube.
3. Heat solution N on a Bunsen burner flame to 80^0C. Allow it to cool to 70^0C.
4. Add all solution M into solution N and at the same time start the stop watch
5. Stir the mixture and record in table II the time taken for purple colour to disappear. At the same time record the temperature.
6. Using clean boiling tubes repeat the procedure while allowing solution N to cool to 60^0, 50^0C and 45^0C in each case to complete table II below.

a) Table II

Temperature before mixing ^oC	**70**	**60**	**50**	**45**
Temperature at which purple colour disappear ^0C				
Time taken for purple colour to disappear				
$^1/_{time}$ sec				

(4 marks)

b) On the grid of graph paper provided plot $^{1}/_{time}$ (y-axis) against temperature at which the purple colour disappears. (3 marks)



b) From your graph;

I. determine the time taken for purple colour to disappear at 47.5^{0}C. (1 marks)

II State the relationship between rate of reaction and the temperature at which purple colour disappears. (1 mark)

……

……

……

3. a) You are provided with substance ***P*** for this question. ***Transfer*** the substance into a clean boiling tube. ***Add*** about 10cm^3 of distilled water and ***stir***. ***Pour*** the mixture into ***four*** clean test tubes of about 2cm^3 each.

Observations	*Inferences*
1mk	1mk

i) To the ***first*** portion of the solution, ***add*** sodium hydroxide solution dropwise ***until*** in excess.

Observations	*Inferences*
1mk	1mk

ii) ***Dip*** a clean stirring rod/glass rod/nichrome wire into the second portion and then ***place*** into the side of a blue bunsen flame.

Observations	*Inferences*
½ mk	1mk

iii) To the ***third*** portion, ***add*** 2-3 drops of barium nitrate solution ***followed by excess*** hydrochloric acid.

Observations	*Inferences*
1mk	½ mk

iv) To the ***fourth*** portion, ***add*** 2-3 drops of acidified potassium manganate (VII)

Observations	*Inferences*
½ mk	1mk

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

i) Using a clean metallic spatula, heat about one third of solid K in a Bunsen burner flame.

Observations	*Inferences*
(1mk)	(1mark)

ii) Dissolve the remaining portion of solid K into about $10cm^3$ of distilled water and divide the solution into 4 portions.

To the first portion, add two drops of acidified potassium permanganate solution.

Observations	*Inferences*
(1mark)	(1 mark)

iii) To the second portion, add two drops of bromine water.

Observations	*Inferences*
(1mark)	(1mark)

iv) Determine the pH of the third portion using universal indicator paper.

Observations	*Inferences*
(½ mk)	(½ mk)

v) To the fourth portion, add a small amount of solid sodium hydrogen carbonate.

Observations	*Inferences*
(1mark)	(1mark)

NAME_____**ADMNNO**_____**CLASS**_____

SCHOOL_____**DATE**_____**SIGN**_____

233/1

CHEMISTRY

PAPER 1 THEORY

CLASS OF KCSE 2024

TIME: 2 HOURS

THE NYANZA & WESTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

Instructions to students

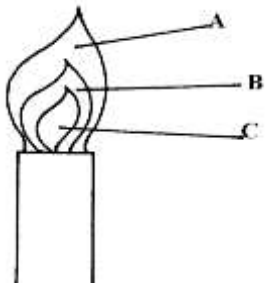
a) Write your name, Admission number, school and class in the space provided above.
b) All working must be shown clearly in the space provided.
c) Non programmable silent electronic calculators may be used.
d) Students should check the questions paper to ascertain that all the pages are printed.
e) Students should answer the questions in English.
f) Answer **ALL** questions in the spaces provided.

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATES' SCORE
1-28	80	

1. Using reagents provided only, explain how you could prepare a salt of Zinc carbonate solid. Dilute nitric(v) acid, zinc, sodium carbonate (3mks)

2. The diagram below shows a Bunsen burner when in use



Describe an experiment that would confirm that region labeled C is unsuitable for heating. (2mks)

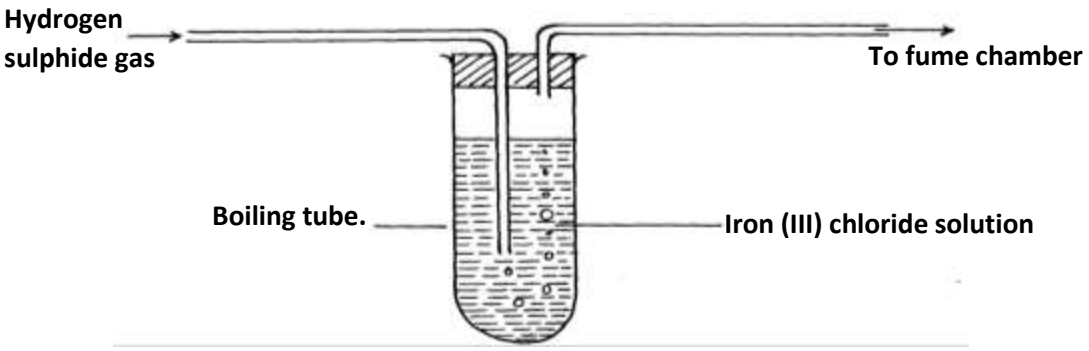
3. a) On the grid provided sketch a graph of pressure against volume for fixed mass of a gas at constant temperature (1mk)

b) A fixed mass of a gas has a volume of 250cm^3 at 27^{o}C and 750mmHg pressure.

Calculate the gas volume that the gas would occupy at 41°C and 750mmHg pressure. (0° = 273k) (2mks)

4. 22.2cm^3 of sodium hydroxide solution containing 4.0g per litre sodium hydroxide were required for complete neutralisation of 0.1g of a dibasic acid. Calculate the relative formula mass of the dibasic acid. (Na = 23, O=16, H=1) (3mks)

5. The diagram below represents a laboratory experiment to investigate the reaction between hydrogen - sulphide gas and an aqueous iron (III) chloride.



a) Write chemical equation for the reaction which takes place in the boiling tube. (1mk)

b) What adjustment need to be made in the above set-up if the laboratory does not have a fume chamber. (1mk)

c) Describe a laboratory chemical test for a sample of hydrogen sulphide gas. (1mk)

6. A group of compounds called chlorofluorocarbons have a wide range of uses but they have harmful effects on the environment. State and explain one harmful effect of chlorofluorocarbons on the environment. (2mks)

7. X grams of a radioactive isotope takes 120 days to decay to 3.5 grams. The half-life period of the isotope is 20 days.
   a) Calculate the initial mass of the isotope (2mks)

   b) State the application of radioactivity in agriculture. (1mk)

8. Sulphur and sodium belong to the same period on the periodic table. State and explain the difference in M.P of the oxide of sulphur and the oxide of sodium.
   (3mks)

9. a)Water is an example of a polar solvent. What is a polar solvent? (1mk)

   b) Explain the following observations HCl gas dissolves in water to form an electrolyte, while the same chloride dissolves in methylbenzene to form a non-electrolyte
   (1mk)

10. a)Define the term deposition (1mk)

    b) Describe how you can obtain copper powder from a mixture containing copper and zinc powder. (2mks)

11. a) Name the main ore from which iron is extracted. (1mk)

    b) Name two substances that convert iron (III) oxide to iron in the blast furnace.
    (2mks)

12. a)Write an equation showing how boiling can remove temporary water hardness.

(1mk)

b) Name one method that can be used to remove both temporally and permanent water hardness. (1mk)

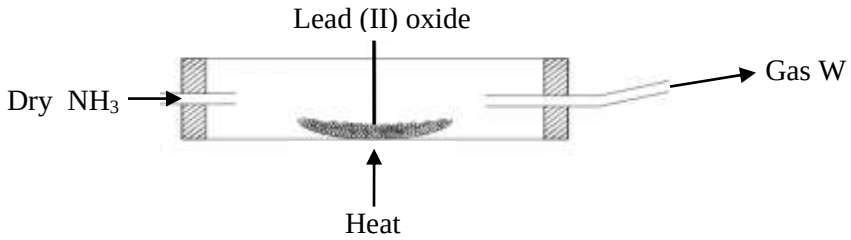
c) Other than wastage of soap during cleaning, state one other disadvantage of hard water. (1mk)

13. a)Name two pure allotropes of carbon. (1mk)

b)State and explain using relevant equations the observation made when carbon(IV) oxide is bubbled through calcium hydroxide solution for a long time.
(2mks)

14. When $Na_2CO_3.xH_2O$ is strongly heated it loses 63.2% of its mass. Determine the value of x in the compound(Na = 23, O = 16, H = 1) (3mks)

15. Dry ammonia was passed over a heated lead(II) oxide in a combustion tube as shown



a) What observations would be made in the combustion tube (1mk)

b) Write a chemical equation for the reaction in the combustion tube (1mk)

c) State one industrial use of ammonia (1mk)

16. An ion of P^{2+} has a configuration of 2.8

a) Name the family to which P belong (1mk)

b) Compare the atomic and ionic radius of P. Explain (2mks)

17. a)Explain why alkanes are used as fuel (1mk)

b) Draw the structure of the following compounds (2mks)
i) 3-methylbut – 1 yne

ii) But – 2 –ene

18. a)Define solubility (1mk)

b) Study the information in the table and answer the questions below

Salt	Solubility (g) 100g water	
	At 40^0C	At 60^0C
$CUSO_4$	28	38
$Pb(NO_3)_2$	79	98

i)Calculate the mass of $CuSO_4$ that would saturate 200g of water at 60^0C (1mk)

ii)A solution containing 80g of $Pb(NO_3)_2$ in 100g of water at 60^0C was cooled to 40^0C. Calculate the mass of $Pb(NO_3)_2$ that crystallized (1mk)

19. Dilute hydrochloric acid was added to a compound Z of copper. The solid reacted with the acid to form a colourless gas which formed a white precipitate when bubbled through lime water.

a) Name solid Z (1mk)

b) State the observation that would be made if a similar compound of lead is used. Explain. (2mks)

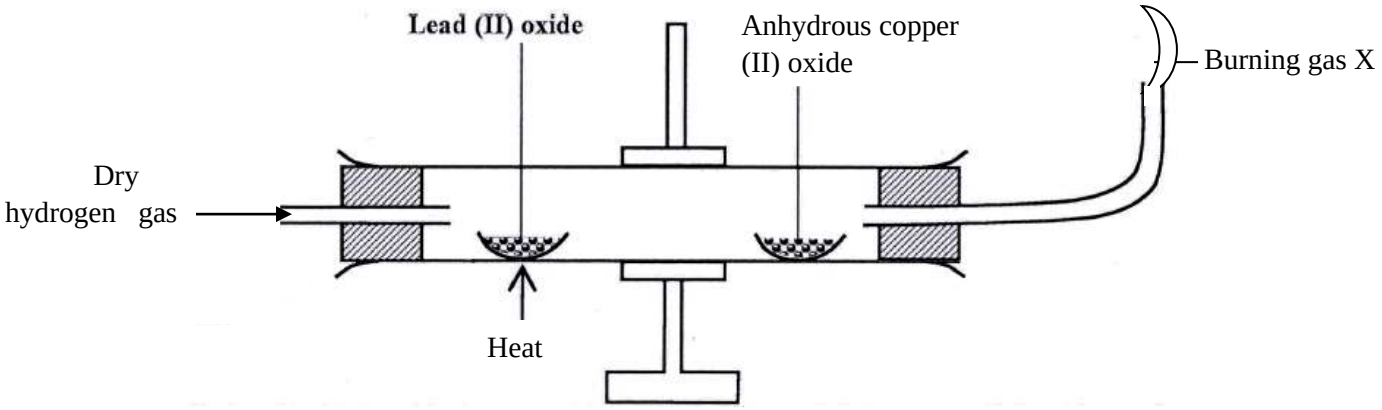
20. a)Explain why the reactivity of group(VII) elements decrease down the group (2mks)

c) Moist blue litmus and dry blue litmus paper were introduced into gas jars of dry chlorine. State the observations that would be made. (1mk)

21. a)Name the reagents that are commonly used in the preparation of hydrogen (1mk)

b) Study the diagram below and answer the questions that follow

Copper (II) oxide



i) Name gas x (1mk)

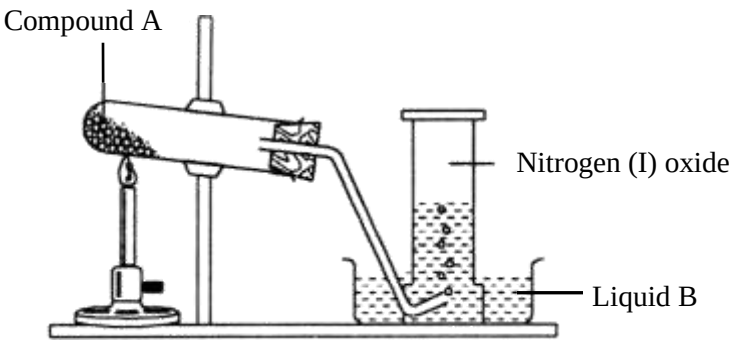
ii) State and explain the observation made in the anhydrous copper(II) sulphate after sometime (1mk)

22. a) State two physical properties of sulphur (IV) oxide (1mk)

b) Explain why when sulphur (IV) oxide is bubbled into acidified potassium dichromate(VI) the solution changes colour from orange to green. Explain the observation (1mk)

d) In the contact process of manufacture of sulphuric(VI) acid, explain how pollution by SO_2 is reduced. (1mk)

23. Study the setup below and answer questions that follow



a) Name (1mk)

i) Compound A

ii) Liquid B

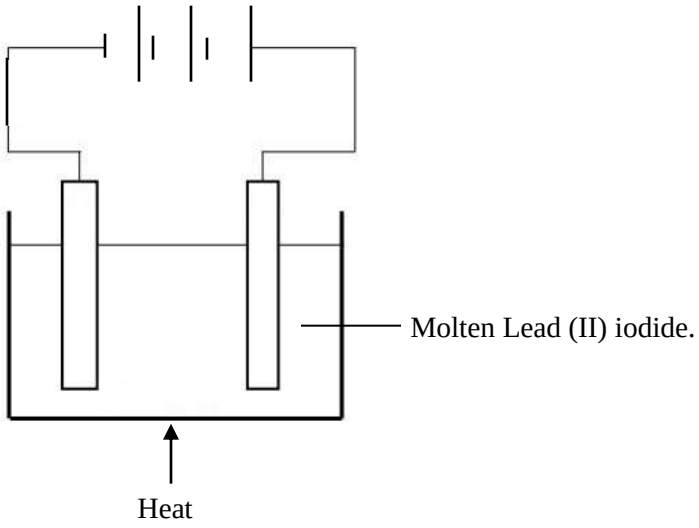
b) Why is the boiling tube tilted downwards (1mk)

24. Explain why

a) Aluminium is commonly used for making cooking pots and pans. (1mk)

b) Silicon(IV) oxide is a poor conductor of heat and electricity (1mk)

25. The set up below was used to show electrolysis in molten lead(II) iodide



i) On the diagram label the cathode (1mk)

ii) State the observation that was made at the anode during the electrolysis. Give a reason for your answer (2mks)

26. 100cm^3 of carbon (II) oxide gas was reacted with 100cm^3 of oxygen. (All volume were measured under the same conditions of temple and pressure.

a) Determine

i) Volume of the product formed (1mk)

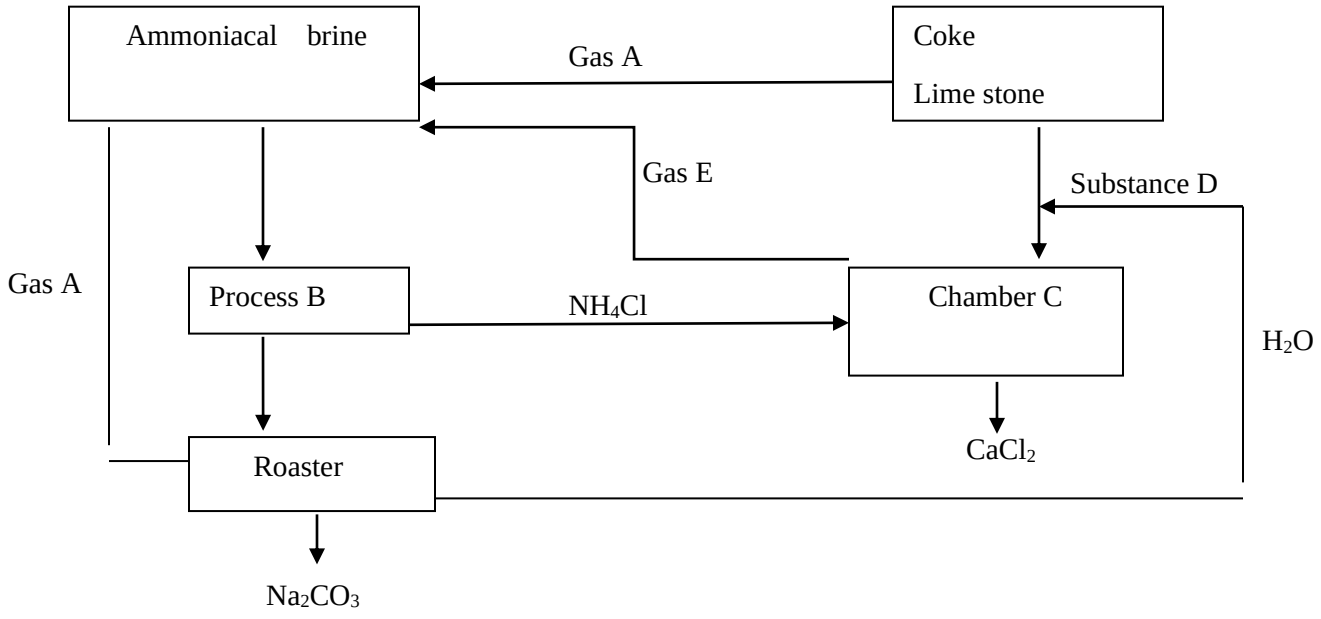
ii) The gas which was in excess and by what volume (2mks)

27. a) Using a dot(.) and cross(x) diagram of carbon(II) oxide, differentiate between a covalent and a co-ordinate bond (1mk)

b) Use dot (.) and cross(x) diagrams to show bonding in between the elements represented by the following symbols. (2mks)

i) $^{24}_{12}X$ and $^{19}_{9}Y$

28. Study the flow diagram below



a) Name

i) Gas A (½ mk)

ii) Process B (½ mk)

iii) Substance D (½ mk)

iv) Gas E (½ mk)

b) Write the equation for the reaction in chamber C (1mk)

MINISTRY OF EDUCATION (KNEC COMPLIANT)

NAME_____ **ADMNNO**_____ **CLASS**_____

SCHOOL_____ **DATE**_____ **SIGN**_____

233/2

CHEMISTRY

PAPER 2 THEORY

CLASS OF KCSE 2024

TIME: 2 HOURS

THE NYANZA & WESTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

Instructions to candidates.

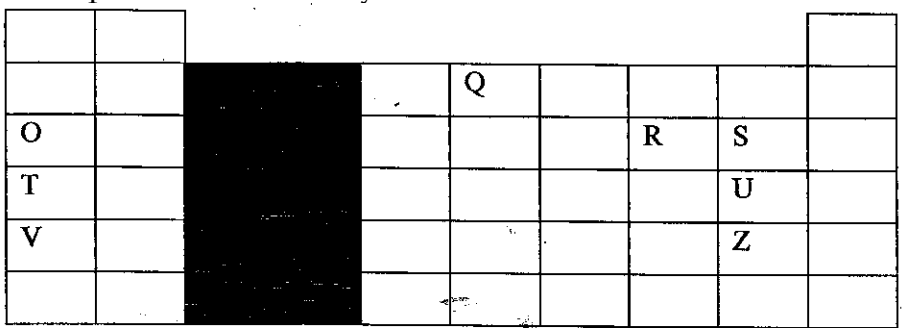
a) *Write your name and adm number in the spaces provided above.*
b) *Sign and write the date of examination in the spaces provided above.*
c) *Answer **All** the questions in the spaces provided.*
d) *KNEC mathematical tables and silent non-programmable electronic calculators may be used.*
e) *All working **MUST** be clearly shown where necessary.*
f) *All answers should be written in the spaces provided.*
g) ***This paper consists of 12 printed pages.***
h) ***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***
i) ***Candidates should answer all the questions in English.***

For Examiner's Use Only

Question	Maximum Score	Candidate's Score
1	13	
2	12	
3	15	
4	12	
5	8	
6	10	
7	10	
Total Score	80	

1. (a) The grid below represents part of the periodic table. Study it and answer the questions that follow.

The letters do not represent the actual symbols of the elements.



i. Which element will require the least amount of energy to remove one of the outermost electrons? (1mk)

_____

ii. Select the most reactive non-metal. (1mk)

_____

iii. Which of the elements has the greatest tendency of forming covalent compounds? Explain (2mks)

_____

_____

_____

iv. What name is given to the family of elements to which elements **O**, **T** and B belong?

(1mk)

_____

v. An element **W** has atomic number 15.m indicate the position of **W** on the grid.

(1mk)

_____vi. Explain

why the atomic radius of **S** is smaller than that of **R**. (2mks)

_____

_____

vii. Explain why the atomic radius of **Z** is smaller than its ionic radius.

(1mk)

_____

(b) Study the information given in the table below and answer question that follow.

Formula of compound	NaCl	$MgCl_2$	$AlCl_2$	$SiCl_4$	PCl_5	SCl_2
Boiling point ^0C	1470	1420	Sublimes at 180^0C	60	75	60
Melting point ^0C	800	710		-70	-90	-80

i. Give **two** chlorides that are liquids at room temperature. Give a reason for your answer. (2mks)

_____

_____

_____

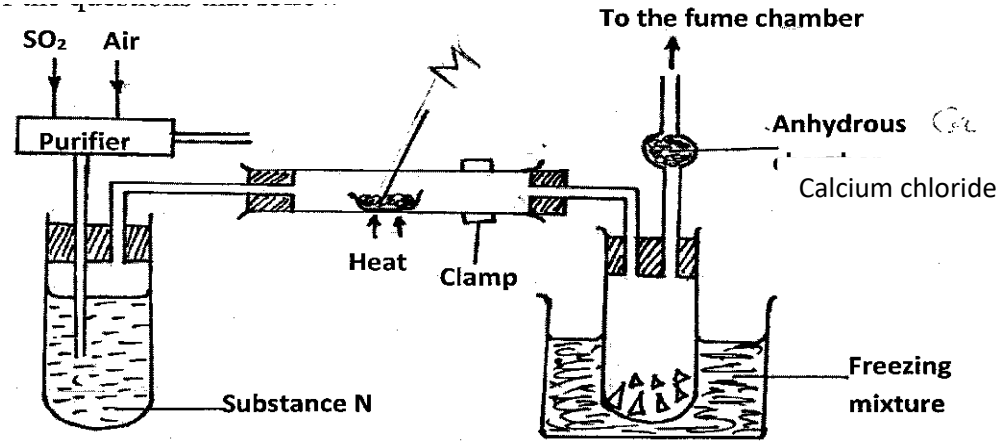
ii. Give a possible reason why $AlCl_2$ has much lower boiling point $MgCl_2$ although both Aluminium and Magnesium are metals. (2mks)

_____

_____

_____

2. The figure below represents a set up that can be used to prepare sulphur (VI) oxide. Study it and answer the questions that follow.



a. Name substance **M** and **N** (1mk)

M_____

N_____

b. State the function of substance **N**. (1mk)

_____

c. Given that the equation for the reaction that occurs is

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \Delta H=-197kJ$

What information about the reaction is provided by ΔH=-197kJ? (1mk)

d. Give the name of the method of gas collection shown above. (1mk)

_____

e. What is the advantage of using calcium oxide instead of anhydrous calcium chloride in the experiment above? (1mk)

_____

II. Concentrated sulphuric (VI) acid is manufactured in large scale through contact process

i. Identify **two** substances that are recycled during contact process.

(1mk)

_____

_____

ii. Why is recycling necessary? Give **two** reasons (1mk)

_____

_____

(b)(i) Sulphur (IV) oxide gas is removed by scrubbing in the contact process. What is meant by scrubbing? (1mk)

_____

(ii) Write an equation showing how sulphur (IV) oxide is scrubbed. (1mk)

(c) Explain why sulphur (VI) oxide is dissolved in concentrated sulphuric (VI) acid and not in water during contact process. (1mk)

_____

_____

III. Given that a concentrated solution of suhuric (VI) acid is 18.2M, determine the volume of the concentrated sulphuric (VI) acid that can be mixed with distilled water to make one litre of 2M sulphuric (VI) acid solution. (2mks)

3. Use the standard electrode potential for the elements A, B, C and D given below to answer the questions that follow. The letters do not represent the actual symbols of the elements.

		E^{θ} (volts)
$A^{+2}_{(aq)} + 2e^- \longrightarrow$	$A_{(s)}$	-0.76
$B^{+2}_{(aq)} + 2e^- \longrightarrow$	$B_{(s)}$	-0.44
$C_{2(g)} + 2e^- \longrightarrow$	$2C^-_{(aq)}$	+0.54
$D^{+4}_{(aq)} + e^- \longrightarrow$	$D^{+3}_{(aq)}$	+1.61

a. Which element is the:

i. Strongest oxidizing agent. (1mk)

_____

ii. Strongest reducing agent (1mk)

_____

b. (i) Draw a labeled diagram of the electro chemical cell that would be obtained when half cell of element A and B are combined.

(ii) Calculate the E^{θ} value of the electrochemical cell constructed in 3b (i) above (1mk)

(iv) Which **two** elements if used together in a cell would produce the largest e.m.f. (1mk)

_____

_____

c. Calculate the number of faradays required to completely reduce 0.1 mole of Fe^{+3} to Fe (2mks)

d. One of the major application of electrolysis is electroplating. In chromium plating the steel article is usually plated first with nickel or copper then chromium in a plating both which contain chromium compounds in sulphuric (VI) acid water. Chromium deposits on the article.

i. Give a reason why steel parts are chromium plated. (1mk)

_____

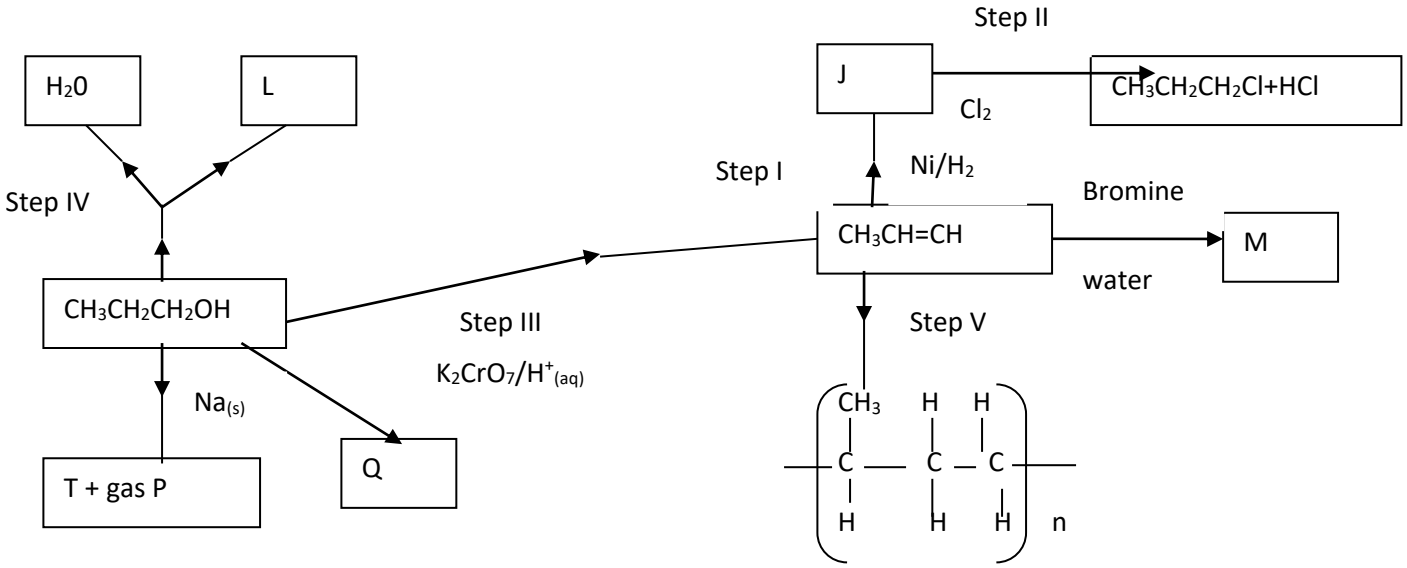
ii. Why is it necessary for the steel to be mated first with nickel or copper before chromium is applied. (1mk)

_____

iii. Give an ionic equation for the process responsible for chromium plating. (1mk)

iv. If an electrical current of 4.5 amperes is passed through the chromium plating for 20 hours, what would be the mass of steel article? (Cr=52.0, 1 faraday = 96,500 coulombs) (3mks)
(Oxidation state of chromium = +2)

4. Study the flow chart below and answer questions that follow.



a. Name substance J and draw its structural formula. (2mks)

Name _____

Structuralformula_____

b. What reagent and conditions are necessary for: (2mks)

(I) Step III_____

Reagent_____

Condition_____

(II) Step II_____

Condition_____

c. Name the following

i. L _____(1mk)

ii. Gas P _____(1mk)

iii. Q _____(1mk)

iv. M _____(1mk)

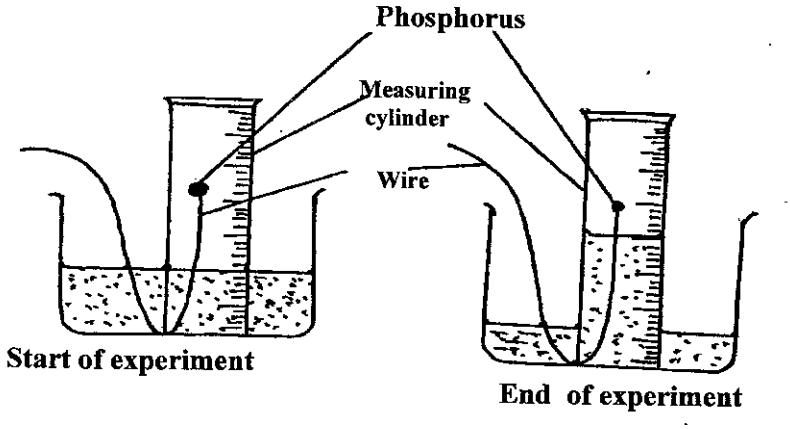
d. Write the equation of the reaction that occur in step P (1mk)

e. Give the name of process in step V (1mk)

_____

f. If the relative molecular mass of R is 21,000. Determine the value of n (C=12.0, H =1.0) (2mks)

5. A student set up the apparatus shown below in order to determine the percentage by volume of oxygen in the air. Study it and answer the questions that follow.



a. (i)State one observation made in the measuring cylinder at the start of the experiment. Explain (2mks)

_____

_____

(ii) The pH of the contents of the beaker at the end of the experiment was found to be 4. Explain the observation (2mks)

_____

_____

(iii) The volume of air in the measuring cylinder at the end of the experiment was measured study the data given below and answer the questions that follow.

Volume of air at start of the experiment =36.65cm^3

Volume of air at the end of the experiment =24.28cm^3

Determine the percentage volume of oxygen in the air (1mk)

b. State and explain the observation made when a mixture of magnesium powder and copper (II) oxide is heated in a crucible. (2mks)

_____

_____

c. State **two** air pollutants produced by motor vehicles. (1mk)

_____

_____

6. (a) The results below were obtained in an experiment conducted by form 3 students from Ratansi secondary school using magnesium.

Mass of the crucible + Lid =19.52g

Mass of the crucible + Lid + Magnesium ribbon =20.36g

Mass of the crucible + Lid + magnesium oxide = 20.92g

(i) Use the results to find the percentage mass of magnesium and oxygen in magnesium oxide. (2mks)

(ii) Determine the empirical formula of magnesium oxide. (Mg=24, O= 16.0)

(b) Sodium hydroxide pellet were accidentally mixed with sodium chloride, 8.8g of the mixture were dissolved in water to make one litre of solution. 50cm^3 of the solution was neutralized by 20.0cm^3 and 0.25M sulphuric (VI) acid

i. Write an equation for the reaction that took place. (1mk)

ii. Calculate the:

I. Number of moles of the substance that reacted with sulphuric (VI) acid. (2mks)

II. Number of moles of the substance that would react with sulphuric (VI) acid in the one litre solution. (1mk)

iii. The percentage of sodium chloride in the mixture. (2mks)

7. (a) Use the bond energies given in the table below to calculate the enthalpy change for the reaction.

(2mks)

$C2H_{6(g)} + Br_{2(g)} \longrightarrow C_2H_5Br_{(g)} + HBr_{(g)}$

Bond	C – H	C - Br	Br – Br	H- Br
Bond energy KJ/mol	413	280	193	635

(b) On the space provided below, sketch the cooling curve that would be obtained when a boiling tube

Containing water at 80^0C is immersed in a freezing mixture maintained at 10^0C.

(2mks)

(c) Butane C_4H_{10} cannot be prepared directly from its elements but its standard heat of formation (ΔH_f^θ) can be obtained indirectly.

The following heats of combustion are given.

ΔH_C^θ (Carbon) = -393kJ/mol

ΔH_C^θ (Hydrogen) = -286kJ/mol

ΔH_C^θ (Butane) =-2877kJ/mol

(i) Draw an energy cycle diagram linking the heat of formation of butane with its heat of combustion and the heat of combustion of its constituents elements.

(2mks)

(ii) Calculate the heat of formation of butane ΔH_f^θ (C_4H_{10}) (2mks)

(d) Given that the lattice enthalpy of potassium chloride is +690kJ/mol and hydration enthalpies of K^+ and Cl^- are -322kJ and -364kJ respectively. Calculate the enthalpy of solution of potassium chloride. (2mks)

233/3

CHEMISTRY

PAPER 3 PRACTICAL

CLASS OF KCSE 2024

TIME: 2 HOURS

THE NYANZA & WESTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

CONFIDENTIAL INSTRUCTIONS

In addition to the apparatus and reagents found in a Chemistry laboratory each candidate will require the following :

1. About $50cm^3$ of solution B
2. About $150cm^3$ of solution C
3. One pipette 25ml
4. One pipette filler
5. One burette 0 - 50ml
6. Two conical flasks - 250ml
7. One 10ml measuring cylinder
8. One 100ml measuring cylinder
9. 100ml empty beaker
10. 250ml volumetric flask
11. Six test tubes
12. One thermometer -10^oC to 110^oC
13. One boiling tube
14. About $500cm^3$ of distilled water supplied in a wash bottle
15. Two labels
16. About 1g of solid F in a stoppered container
17. About 0.2g of solid sodium hydrogen carbonate
18. One blue and one red litmus paper
19. About $6cm^3$ of liquid P
20. Test tube holder

Access solution

1) Acidified lead (II) nitrate supplied with a dropper.

2) Aqueous Barium (II) chloride supplied with a dropper.
3) Phenolphthalein supplied with a dropper.
4) Acidified potassium dichromate (VI) supplied with a dropper
5) Bunsen burner
6) Sodium hydroxide solution
7) Hydrogen peroxide

Solutions preparations

1. Solution C is prepared by dissolving 6.87cm^3 of concentrated sulphuric (VI) acid in 200cm^3 of distilled water and made up to 1000cm^3 of solution with distilled water. Label this as solution C.
2. Solution B is prepared by dissolving 80g of NaOH in about 600cm^3 of distilled water and diluting to
one litre of solution. Label this as solution B.

3. Barium chloride is prepared by dissolving 30g of solid Barium chloride in about 600cm^3 of distilled
water and diluting to one litre of solution. Label thin as aqueous barium nitrate.
4. Acidified potassium dichromate (VI) is prepared by dissolving 25g of potassium dichromate (VI)
crystals in about 200cm^3 of 2M sulphuric (VI) and diluting with distilled water to one litre of solution.
5. Liquid P : Ethanol
6. Solid F: iron (II) Sulphate

NAME_____**ADMNNO**_____**CLASS**_____

SCHOOL_____**DATE**_____**SIGN**_____

233/3

CHEMISTRY

PAPER 3 PRACTICAL

CLASS OF KCSE 2024

TIME: 2 HOURS 15 MINUTES

THE NYANZA & WESTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

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.
- Answer ALL the questions in the spaces provided in the question paper
- Mathematical tables and electronic calculators may be used.
- All working MUST be clearly shown where necessary.

FOR EXAMINER'S USE ONLY

Questio	Maximum marks	Candidate's score
1	22	
2	12	
3	6	
Total	40	

1.a) You are provided with

- 2.0M sodium hydroxide solution labelled solution B
- Solution C containing 12.25 g per litre of a mineral acid C

You are required to

i) Prepare a dilute solution of sodium hydroxide, solution B.

ii) Determine the

Relative Formula mass of the acid C

Molar Enthalpy change of reaction between acid C and sodium hydroxide solution B.

Procedure 1.

Using a pipette and a pipette filler place 25.0cm³ of solution B in a 250.0ml volumetric flask. Add to

it about 150cm³ of distilled water. Shake well. Add more distilled water to make upto the mark. Label this solution D.

Fill a burette with solution C. Using a clean pipette and a pipette filler, place 25.0cm³ of solution D into a 250ml conical flask. Add two drops of phenolphthalein indicator and titrate with solution C. Record your results in table 1. Repeat the titration two more times and complete the table. (4 marks)

	1	2	3
Final burette reading (cm³)			
Initial burette reading (cm³)			
Volume of solution C used (cm³)			

Calculate:

i) Average volume of solution C used. (1 mark)

ii) Moles of solution D used. (2 marks)

iii) Concentration in moles per litre of acid in solution C given that the number of moles of acid C used are half the moles of D used. (2 marks)

vi) Relative formula mass (RFM) of solution C. (1 mark)

b) PROCEDURE II.

i) Using a clean burette, place 5.0cm^3 of solution C into each of six (6) test-tubes.

ii) Using a 100ml measuring cylinder, place 20cm^3 of solution D, sodium hydroxide solution in a 100ml plastic beaker. Measure the temperature of solution D and record it in table 2 below.

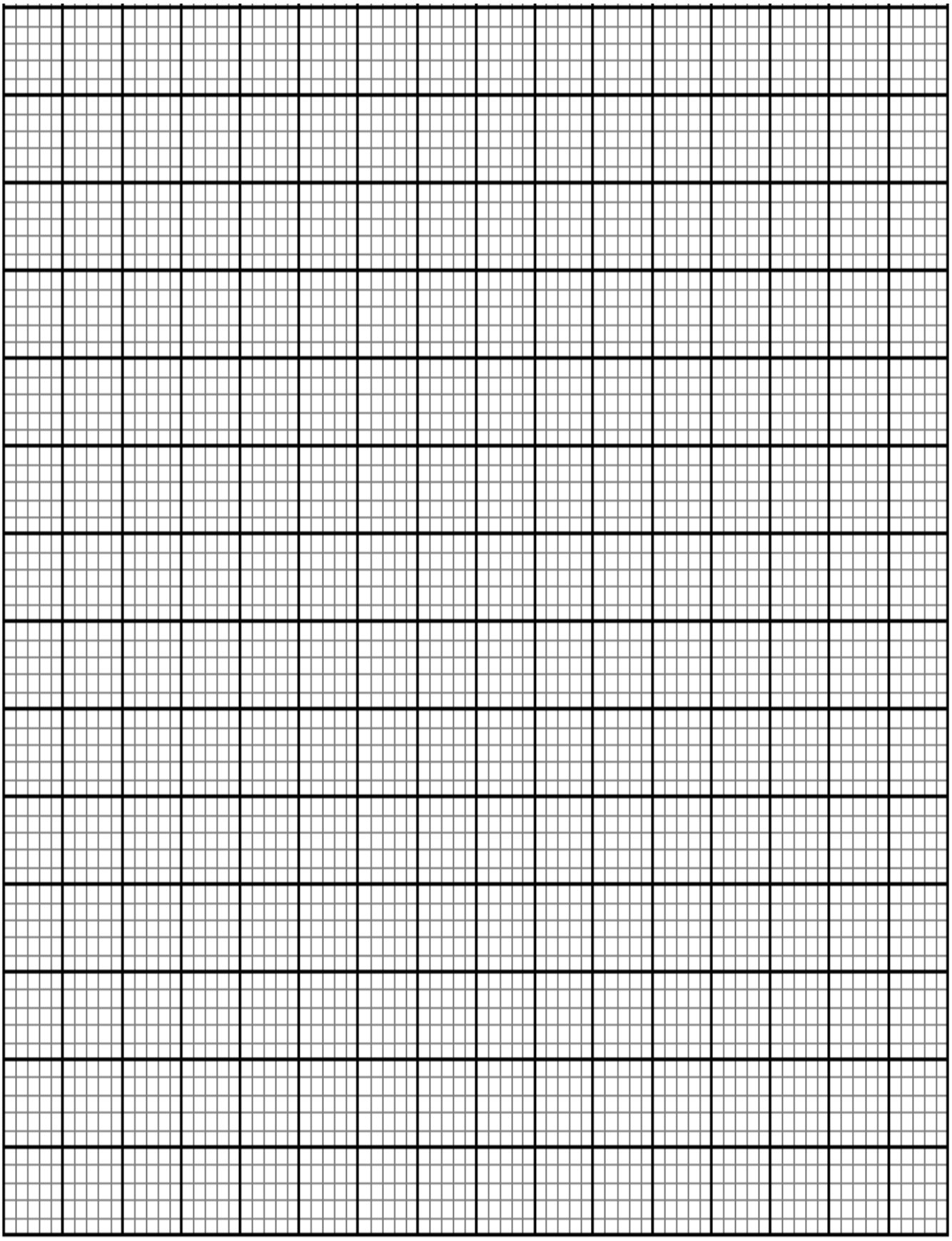
iii) To solution D in the beaker, add acid C, solution C from one of the test-tubes. Stir the mixture with the thermometer and record in Table 2, the maximum temperature reached. Continue with step (iv) IMMEDIATE

iv) Add the acid C, solution C from another test-tube to the mixture obtained in (iii) above, stir and record the maximum temperature reached in Table 2. Continue adding the acid C, solution C from each of the other four test-tubes, stirring the mixture and recording the maximum temperature each time and complete Table 2.

TABLE 2 (4 marks)

Volume of solution C acid C added (cm^3)	0	5	10	15	20	25	30
Maximum temperature (°C)							

c) On the grid provided, plot a graph of temperature (vertical axis) against volume of acid C solution C added. (3 marks)



d) Using the graph

i) Determine the volume of solution C which gave the maximum change in temperature.

(1 mark)

ii) Determine the temperature change for the reaction. (1 mark)

e) Using your answer in parts d (i) and d(ii), calculate the molar enthalpy change of the neutralisation reaction between acid C and sodium hydroxide solution.
(Heat capacity = 4.2J g^{-1} k^{-1}; density of the mixture = 1.0gcm^{-3}) (3 marks)

2. a) You are provided with solid **F** carry out the following tests write your observations and inferences in the spaces provided.

i) Place a half spatula and full of solid **F** in a dry test tube and heat strongly. Test the gases produced with litmus paper

Observations	Inferences
(1mark)	(1 mark)

ii) Place the remaining solid **F** in a boiling tube and add 10cm^3 of distilled water. Divide the resulting solution into five portions

Observations	Inferences
(1 mark)	(1 mark)

iii) To the first portion, add sodium hydroxide solution drop wise until in excess.

Observations	Inferences
(1mark)	(1 mark)

iv) To the second portion, add 5 drops of the hydrogen peroxide and then add ammonia solution drop wise until in excess.

Observations	Inferences
(1 ½ mark)	(½ mark)

v) To the third portion, add three drops of acidified lead (II) nitrate solution.

Observations	**Inferences**
(1 mark)	(1mark)

vi) To the fourth portion, add three drops of barium nitrate solution.

Observations	**Inferences**
(1 mark)	(1 mark)

3. You are provided with an organic liquid P. Carry out the following tests and record you observations and inferences in the space provided.

a) Place about 4cm³ of liquid P in a boiling tube. Add to it 10cm³ of distilled water and shake well.

Label this solution G.

Observations	Inferences
(1 mark)	(1 mark)

b) Place 2cm³ of solution G in a test-tube. Add to it solid sodium hydrogen carbonate provided.

Observations	Inferences
(1 mark)	(1 mark)

c) To a second 2cm³ portion of solution G in a test-tube, add 2 to 3 drops of acidified potassium dichromate (VI) and warm.

Observations	Inferences
(1 mark)	(1 mark)

MINISTRY OF EDUCATION (KNEC COMPLIANT)

Name.....Index No...../.....

Adm No.....Stream.....Date.....

233/1
CHEMISTRY
Paper 1
(THEORY)
CLASS OF KCSE 2024
TIME: 2 HOURS

THE COASTAL & EASTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (K.C.S.E)

INSTRUCTIONS TO CANDIDATES

a) Write your **NAME** and **INDEX NUMBER** in the space provided above
b) Sign and write the date of examination in the spaces providedabove
c) Answer **ALL** the questions in the spaces provided
d) **ALL** working must be clearly shown where necessary.
e) Mathematical tables and silent electronic calculators may be used.

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1 –31	80	
Total score	80	

This paper consists of 9 printed pages.
Candidates should check to ensure that all pages are printed as indicated and no questions are missing

1. An element K has atomic number 20 while element M has atomic number 8.

a) Write the electronic configuration for K and M

K

……..

1mark

M

……

1mark

b) Write the symbol of the most stable ion of K and M

K

……

1mark

M

……

1mark

2. Molten Lead (II) bromide is electrolyzed using carbon electrodes. Write the half equations of the reactions that occur at the anode and the cathode.

a) Anode

……

1mark

b) Cathode

……

1mark

3. Explain why the conductivity of metals decreases with increase in temperature.

2marks

.....

.....

.....

.....

4. Three metal oxides XO, YO, and ZO are heated with powdered metal Y. Hot powdered Y will remove oxygen from XO but not from ZO. Arrange the metals in order of reactivity, starting with the most reactive. **1mark**

.....

.....

.....

5. Some sodium chloride was found to be contaminated with copper (II) oxide. Describe how a sample of sodium chloride can be separated from the mixture. **2marks**

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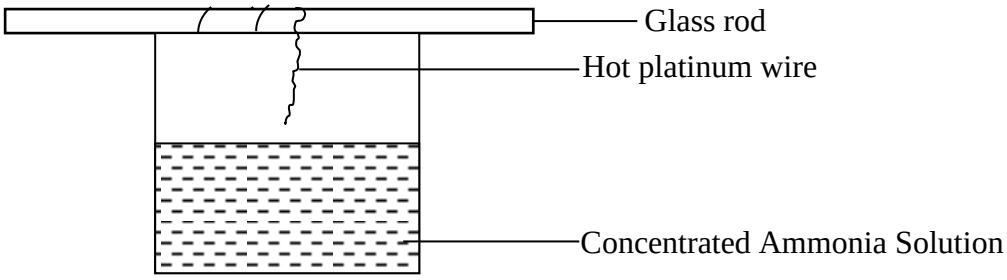
……

6. Hot platinum wire was lowered into a flask containing concentrated ammonia solution as shown below.



State and explain the observations made. **3marks**

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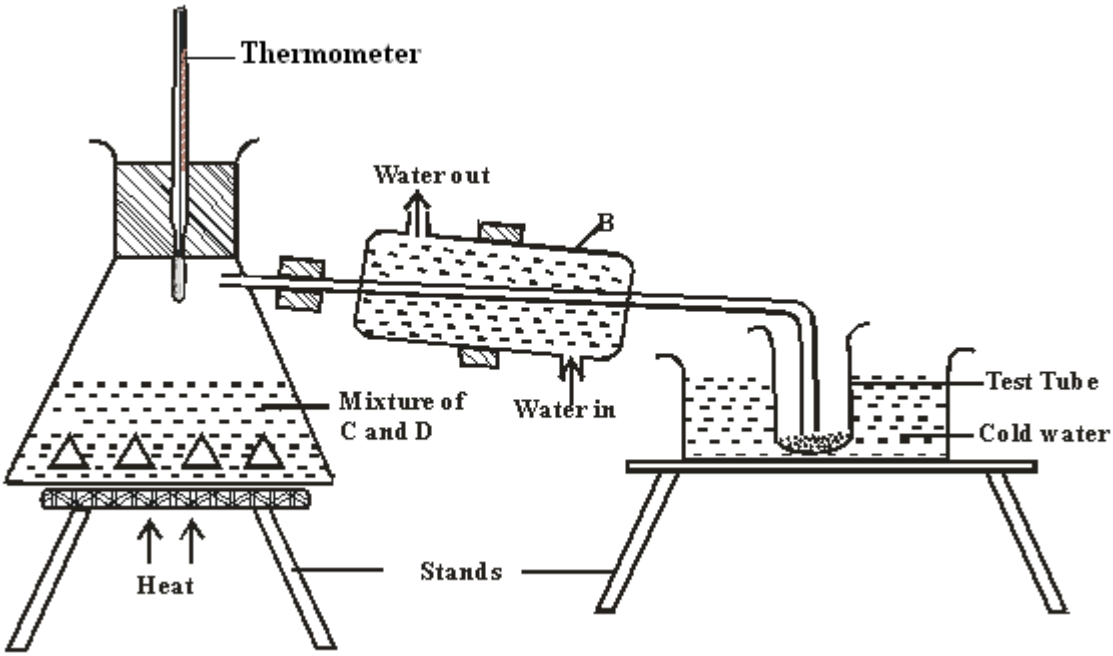
7. The set up below represents the apparatus that may be used to separate a mixture of two miscible liquids C and D whose boiling points are 80^0C and 110^0C.



a) Name B

…… **1mark**

b) What is the purpose of the thermometer **1mark**

……

……

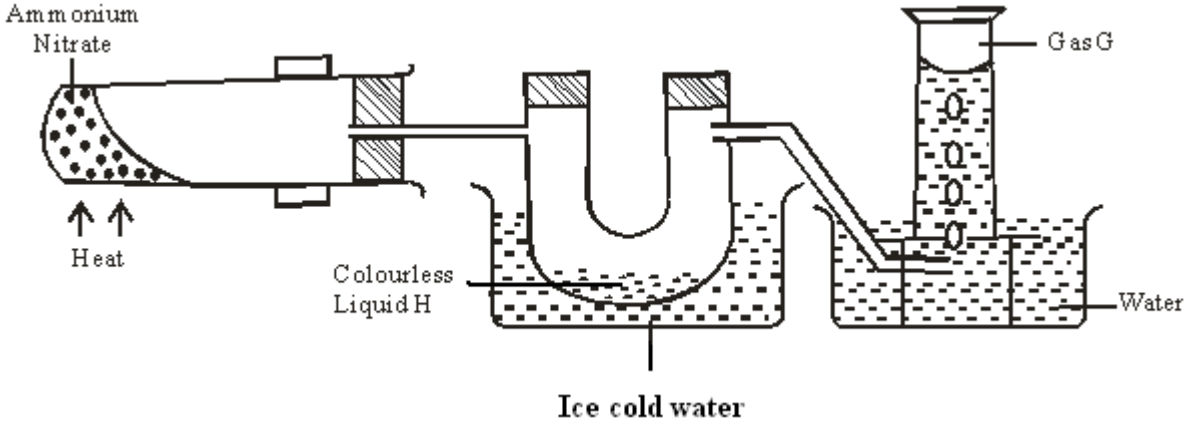
c) Which liquid was collected in the test tube? **1mark**

……

……

8. Draw a dot (.) and cross (x) diagram to show bonding in carbon (II) oxide.**2marks**

9. Ammonium nitrate was gently heated and the products collected as shown in the diagram.



a) Identify:
   i. Colourless liquid H

   ……

   1mark

   ii. Gas G

   ……

   1mark

b) Describe one physical and one chemical test that can be used to identify gas G.

   2marks

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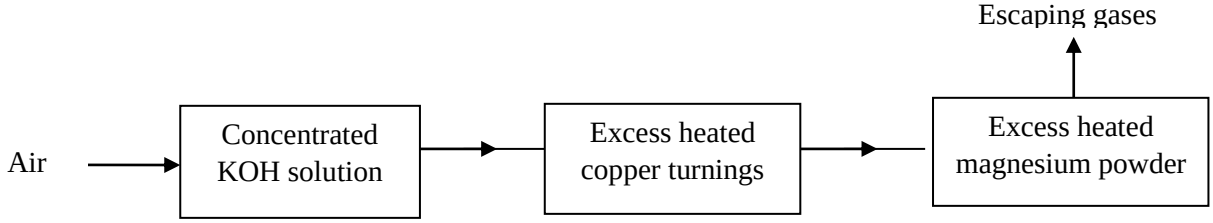
10. Air was passed through several reagents as shown in the flow chart below.



a) What is the purpose of concentrated potassium hydroxide solution? **1mark**

……

……

b) Write an equation for the reaction which takes place in the chamber with magnesium powder. **1mark**

……

……

c) Name one gas which escapes from the chamber containing magnesium powder.

……

Give a reason for your answer **2marks**

……

……

11. Name the following substances.

a) $CH_2\,CH\,CH_2\,CH_3$ **1mark**

……

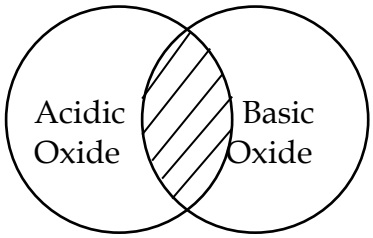
……

b) $CH_3\,CH\,CH\,CH_2\,CH_3$ **1mark**

……

……

12. The diagram below shows the acidic and basic oxides fit into the general family of oxides.



a) State the name given to the type of oxide that would be placed in the shaded area. **1mark**

……

……

b) Give the name of any oxide that would be placed in the shaded area. **1mark**

……

……

13. Study the information in the table below and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Substance	**Solubility in water**	**Electrical conductivity**	
		Solid	**Molten**
A	Insoluble	Good	Good
B	Soluble	Poor	Good
C	Insoluble	Poor	Poor

i) Which of the substances is highly likely to be sodium chloride? Explain **2marks**

……

……

……

……

ii) What type of bond exists in substance A? **1mark**

……

……

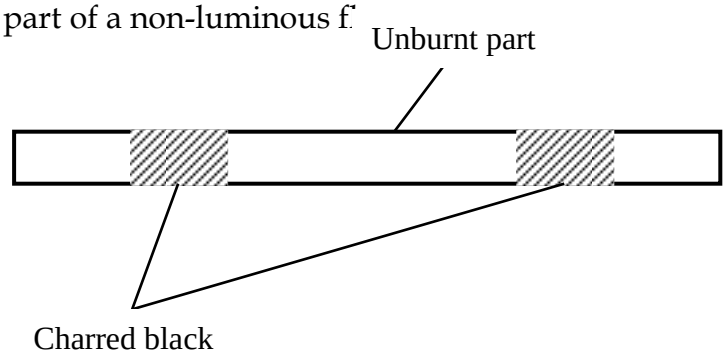
iii) State a possible structure in substance C? **1mark**

……

……

14. Laboratory results showed the composition of a compound to be 58.81% barium, 13.72%, sulphur and 27.47% Oxygen. Calculate the empirical formula of the compound. Ba=137, S = 32, O = 16. **2marks**

15. The diagram below shows a wooden splint that was placed horizontally across the middle part of a non-luminous f



a) Explain the observation made **2marks**

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……

b) Explain why non-luminous flame is preferred for heating than the luminous flame.

2marks

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……

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16. 200cm^3 of oxygen gas took 60 seconds to diffuse through a porous plug. Determine the time taken by 300cm^3 of sulphur (IV) oxide to diffuse through the same plug under the same conditions.
(O=16, S = 32) **3marks**

17. Explain why?

i) Both methane and diamond are covalently bonded. Methane is a gas but diamond is a solid with very high melting point. **2marks**

……

……

……

ii) Ammonia is dissolved in water using an inverted funnel. **1mark**

……

……

18. Explain giving reasons why?

a) Sulphuric acid is not used with marble in the preparation of carbon (IV) oxide **2marks**

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……

b) Water cannot be used to distinguish oil fire. **1mark**

……

……

19. A gas occupies $4dm^3$ at -23^0C and 152 mmHg. At what pressure will its volume be halved, if the temperature then is 227^0C.? **2marks**

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20. a) Sodium, Magnesium and Aluminium are elements in the periodic table. Explain why aluminium has a higher melting and boiling point than sodium and magnesium. **2marks**

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b) The ionization energy of an atom is strongly influenced by three atomic parameters. State two of these parameters. **2marks**

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21. 15cm^3 of a solution containing 2.88g/dm^3 of an alkali XOH completely reacts with 20cm^3 of 0.045M sulphuric acid. Calculate the molarity and relative atomic mass of X present in the alkali. **3marks**

22. Describe how a solid sample of calcium sulphate can be prepared using the following reagents; dilute nitric (v)acid, dilute sulphuric (vi) acid and solid calcium carbonate **4marks**

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23. Crude oil is the main source of organic compounds such as hydrocarbons. The hydrocarbons in the crude oil have to be separated.

a) Name two important hydrocarbons obtained from crude oil.

2marks

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b) Give the uses of the two hydrocarbons named in (a) above.

2marks

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24. A hydrocarbon Q was found to decolourise potassium manganate (vii) solution. When two moles of Q were burnt completely six moles of carbon (iv) oxide and six moles of water were formed.

a) Write the structural formula of Q.

1mark

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……

……

……

b) Name the homologous series to which Q belongs

1mark

……

……

……

25. Dilute sulphuric acid was added to a compound X, of magnesium. The solid reacted with the acid to form a colourless solution, Y and a colourless gas Z which formed a white precipitate when bubbled through lime water.

Name:-

(i) Compound X

1mark

……

……

(ii) Solution Y

1mark

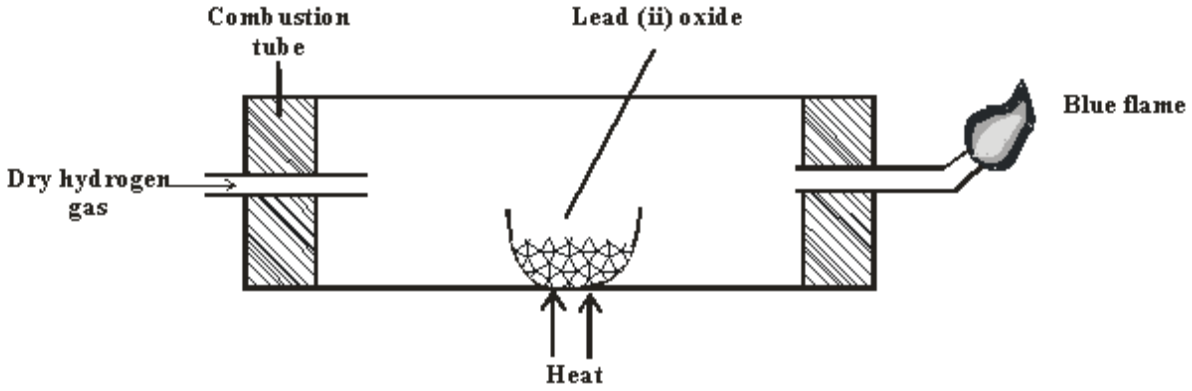
……

(iii) Colourless gas Z

1mark

……

26. When dry hydrogen gas passed over heated Lead (II) oxide in combustion tube, a grey solid was formed.



a) Identify the grey solid.

1mark

……

……

b) Write the equation of the reaction taking place in the combustion tube.

1mark

……

……

.....

c) Write the equation involving the blue flame.

2marks

……

……

……

27. What do (C F C′ S) mean?

1mark

……

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……

……

28.

a) What is meant by the term allotrophy?

1mark

……

……

……

b) Explain in terms of structure and bonding why graphite is soft with greasy feeling.
2marks

……

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……

MINISTRY OF EDUCATION (KNEC COMPLIANT)

NAME_____**ADMNNO**_____**CLASS**_____

SCHOOL_____**DATE**_____**SIGN**_____

233/2

CHEMISTRY

PAPER 2 THEORY

CLASS OF KCSE 2024

TIME: 2 HOURS

THE COASTAL & EASTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

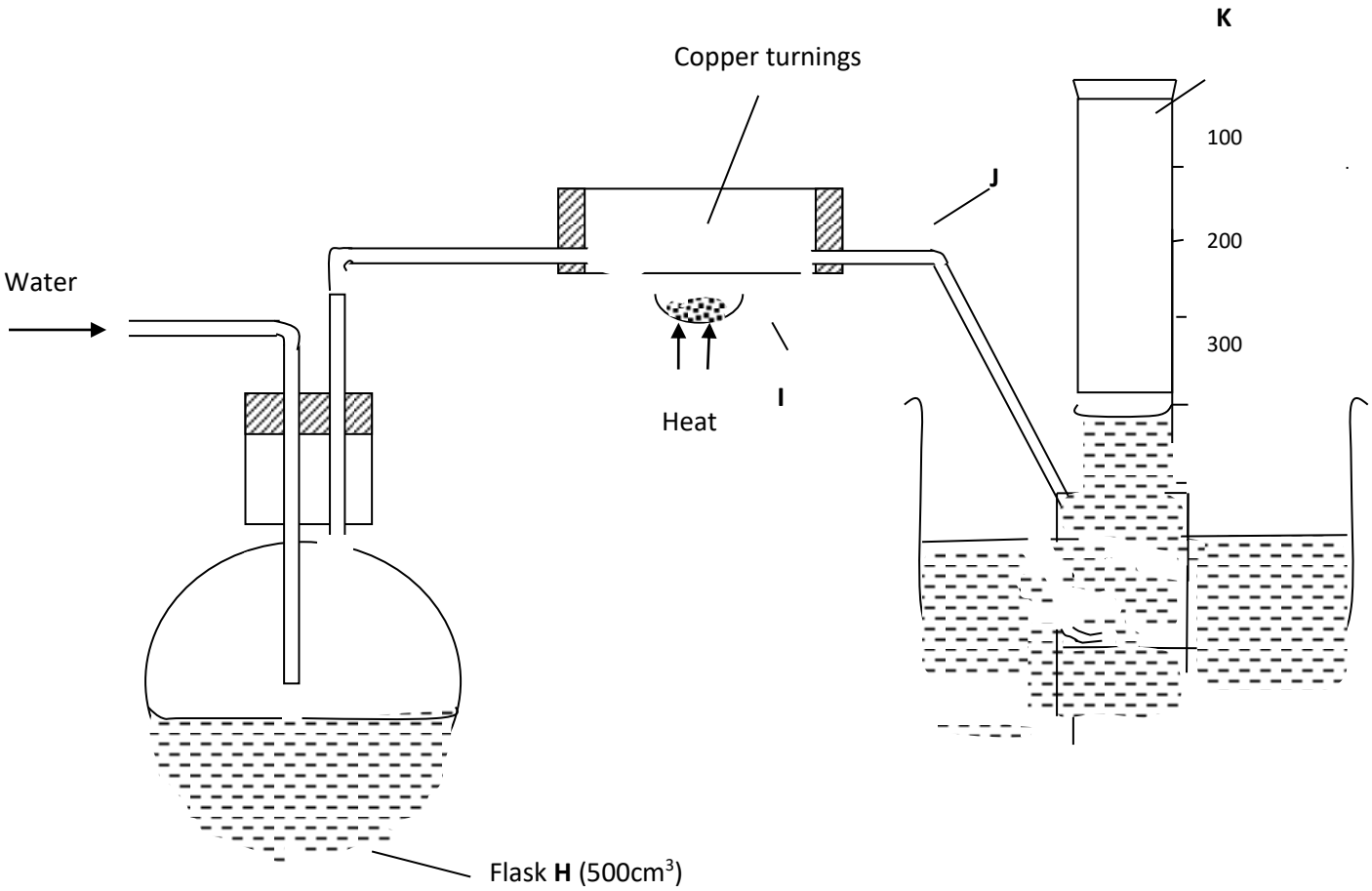
INSTRUCTIONS TO CANDIDATES

- *Write your name, admission number, date and school in the spaces provided.*
- *Answer **all** the questions in the spaces provided.*
- *All working must be clearly shown where necessary.*
- *Scientific calculators may be used.*

FOR EXAMINERS' USE ONLY

Questions	Maximum Score	Candidate's Score
1	10	
2	12	
3	10	
4	12	
5	13	
6	12	
7	11	
TOTAL	**80**	

1. A. In an experiment to determine the percentage of oxygen in air, the apparatus below were set up. Study the set up and the information provided to answer the questions that follow.



A 500cm³ measuring cylinder **K** was filled with water and assembled for gas collection. Copper turnings were heated red hot and water was slowly passed into 500cm³ flask **H** until it reached the 500cm³ mark. A colourless gas was collected in **K**.

(i) What was the purpose of passing water into flask **H**? **(1 mark)**

……

(ii) What observations were made in the tube **I**? **(1 mark)**

……

(iii) Name one of the gases that is likely to be found in **J**. **(1 mark)**

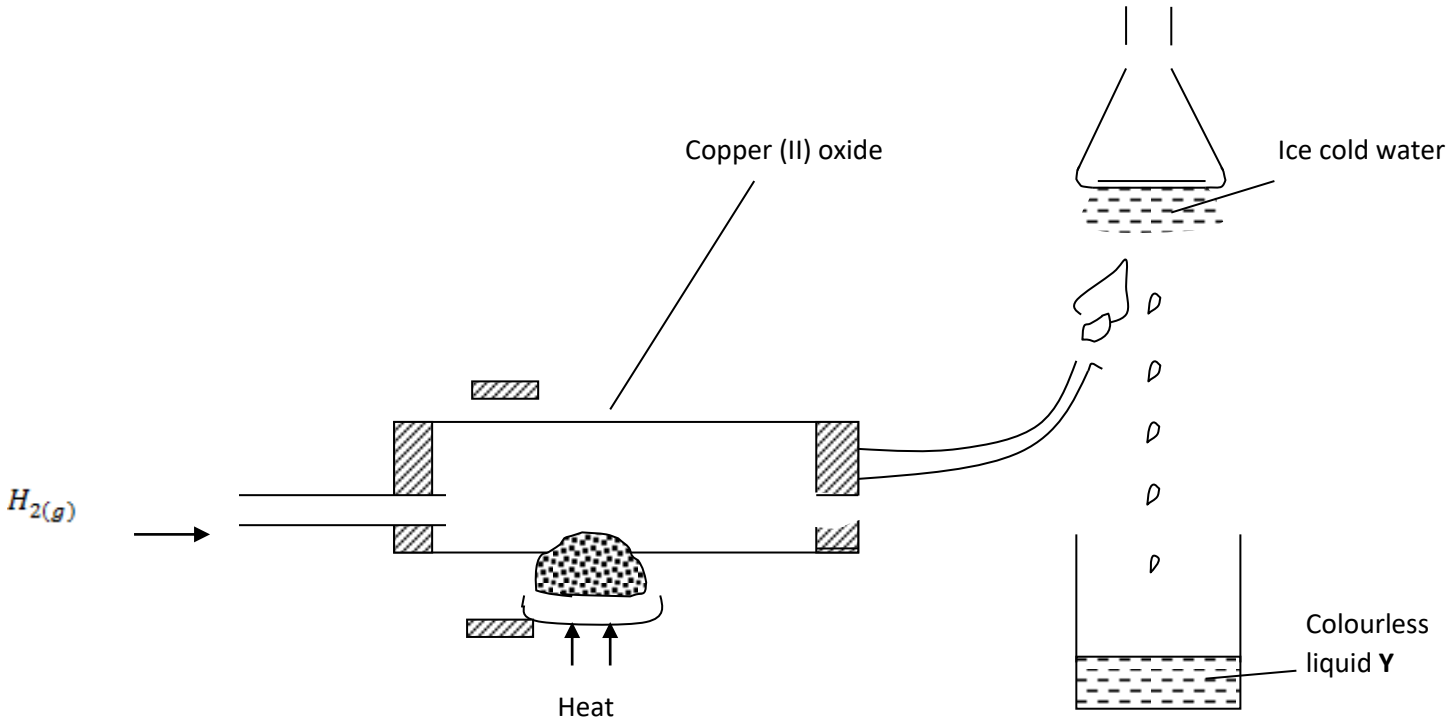
……

(iv) What was the volume of the gas collected in the measuring cylinder at the end of the experiment? **(1 mark)**

……

(v) Calculate the percentage of oxygen in air using the above results. **(2 marks)**

B. Study the diagram below and answer the questions that follow.



(a) Give *one* observation made in the combustion tube after some time. **(1 mark)**

……

(b) Write an equation for the formation of the colourless liquid **Y**. **(1 mark)**

……

(d) What was the aim of the above experiment as demonstrated in the combustion tube? Explain. **(2 marks)**

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……

2. Use the information below to answer the questions that follow. The letters are not the actual symbols of the elements.

Element	Atomic No.	M.P^{0}C	B.P^{0}C	Ionic radius (nm)
P	11	98	890	0.095
Q	12	650	1110	0.065
R	13	660	2470	0.050
S	14	1410	2360	0.041
T	15	44.2 & 590	280	0.034
U	16	113 & 119	445	0.184
V	17	-101	-35	0.181
W	18	-189	-186	-

(a) (i) Write the electronic configuration of the atoms represented by letters **T** and **W**. **(1 mark)**

(ii) State the nature of the oxides of the elements represented by **Q** and **(2 marks)**

……

……..

(b) Why does the elements represented by the letters **T** and **U** have two values of melting points? **(1 mark)**

……

(c) Explain the following observations in terms of structure and bonding.

(i) There is an increase in boiling point from **P** to **R**. **(2 marks)**

……

……

……

(ii) Element **S** has a high boiling point. **(2 marks)**

……

……

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(iii) There is a decrease in boiling points from **U** to **W**. **(2 marks)**

……

……

……

……

(d) (i) Compare the atomic radius of **U** and **V**. **(1 mark)**

……

……

……

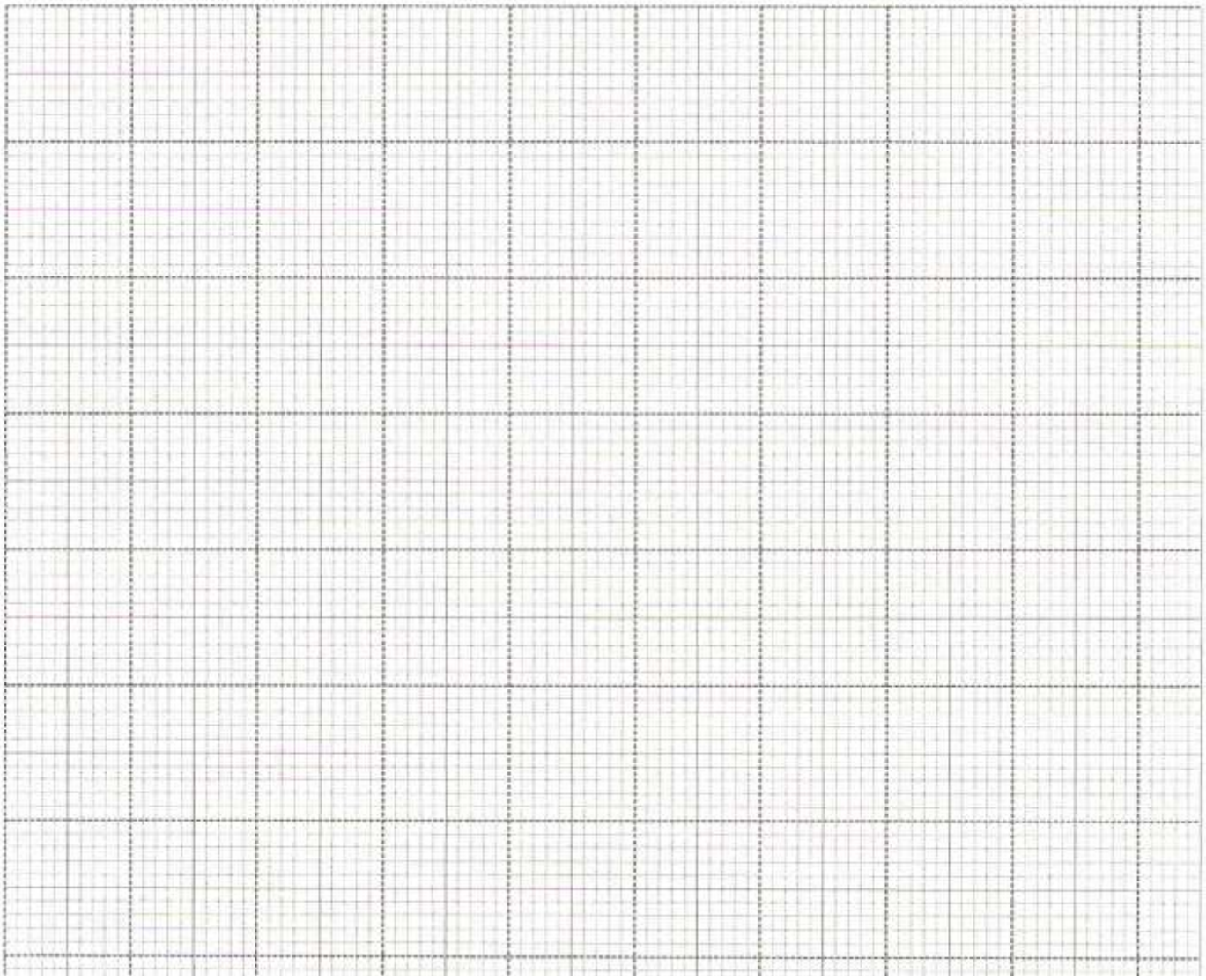
(ii) Why is there no ionic radius for **W** reported in the table? **(1 mark)**

……

……

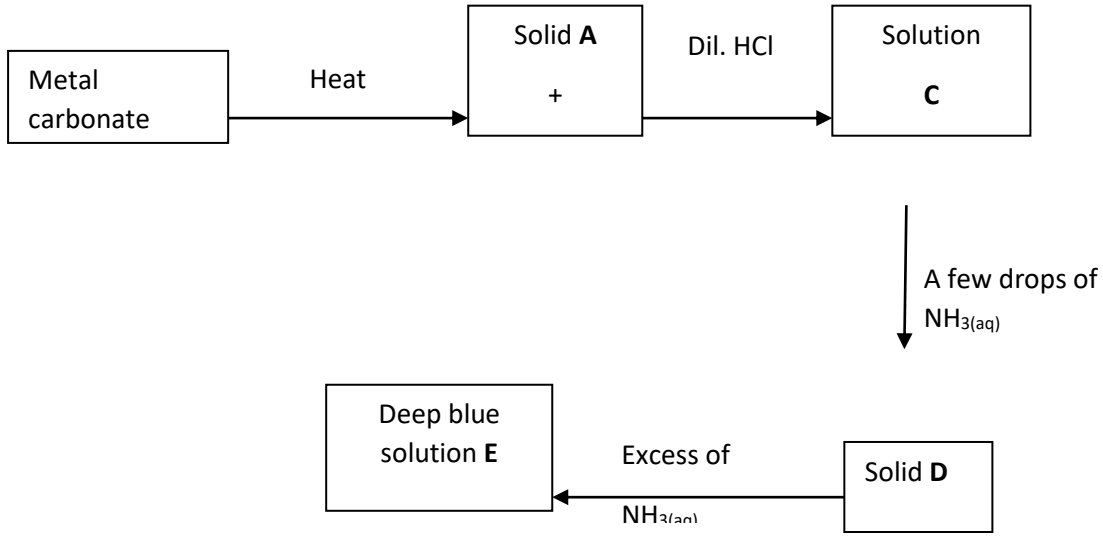
3. (a) The solubilities of potassium nitrate and potassium bromide at different temperatures was determined. The following data was obtained.

Temperature ^0C		0	10	20	30	40	50	60	70	80
Solubility g/100g H_2O	KNO_3	5	15	26	43	61	83	105	135	165
	KB_r	50	55	60	65	70	77	85	90	95



(iii) 100g of a saturated solution of potassium nitrate at 70^0C was cooled to 20^0C. What mass of the crystals will be crystallized? **(2 marks)**

(b) Study the flow chart below and answer the questions that follow.



(i) Write an equation for the formation of solid **A** and gas **B**. **(1 mark)**

……

(ii) Name;

Solution **C** - ……..

(1 mark)

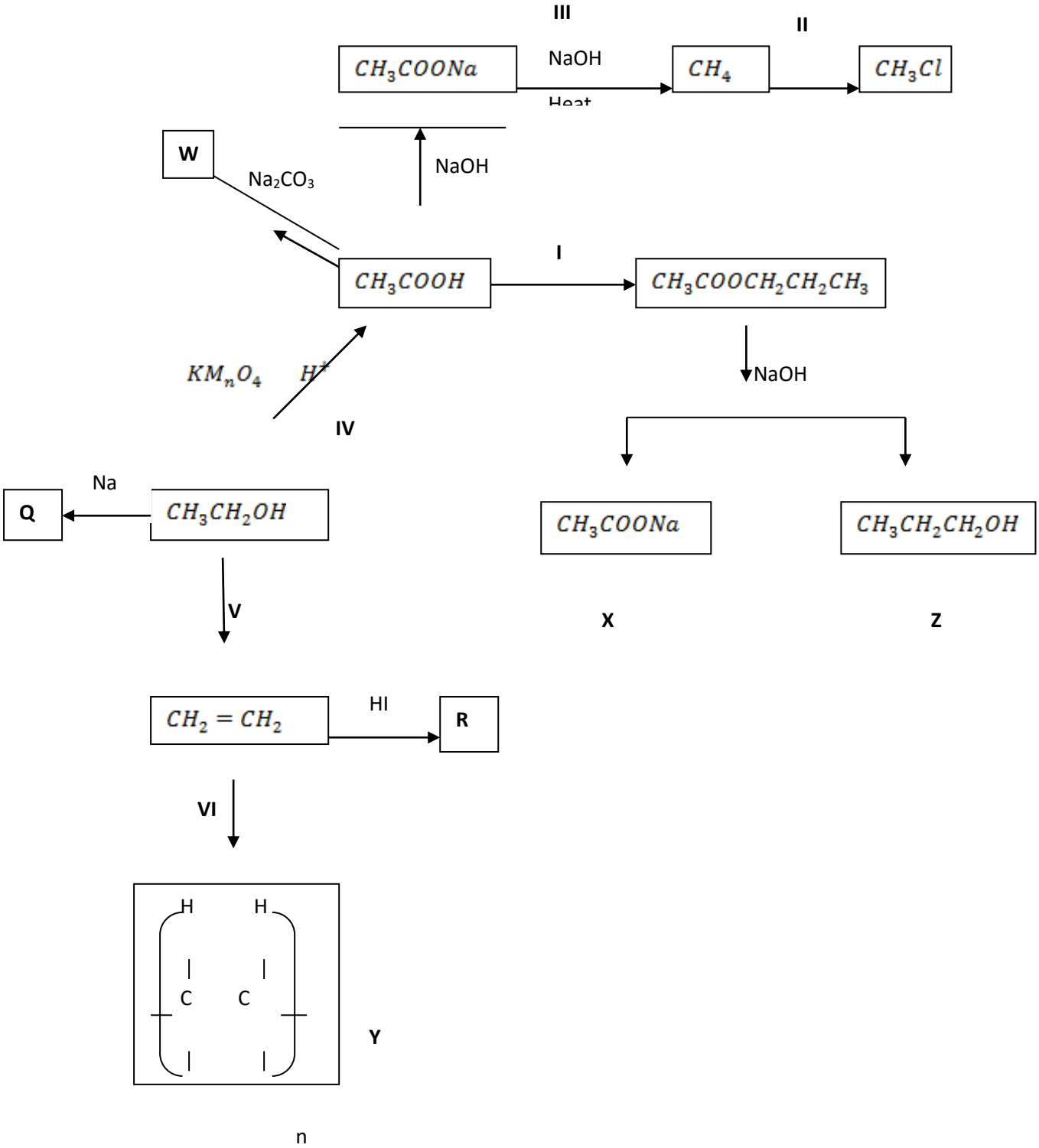
Solid **D** - ……..

(1 mark)

(c) Write the formula of the complex ion in solution **E**. **(1 mark)**

……

4. Study the flow chart below and answer the questions that follow.



(a) Name substance. **(3 marks)**

X - ……

Q - ……

R - ……

(b) Write down an equation for the reaction represented by step III. **(1 mark)**

……

(c) What are the conditions and reagent required for steps?

(i) **I** **(2 marks)**

Reagent -

……

Condition -

……..

(ii) **IV** **(2 marks)**

Reagent -

……

Condition -

……

(b) Name the process represented by: **(4 marks)**

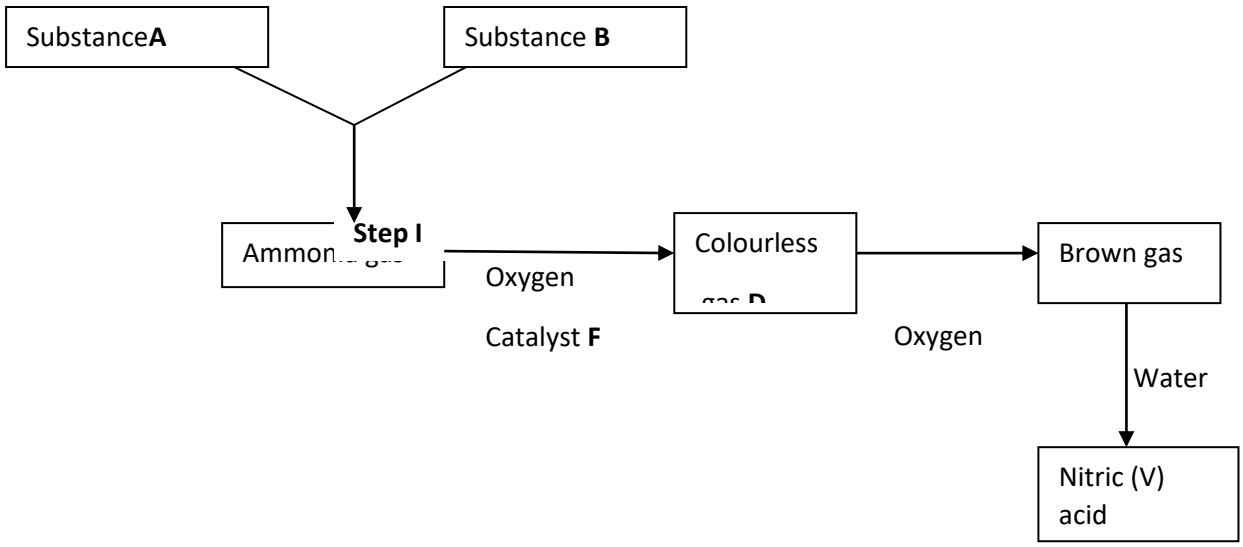
I - ……

II - ……

IV - ……

V - ……

5. **I.** Study the scheme below and answer the questions that follow.



(a) Identify substances. **(3 marks)**

A -

……..

B -

……..

D -

……..

(b) State the catalyst necessary for; **(2 marks)**

Step **I** -

……

Step **II** -

……

(c) Write an equation for the reaction taking place in step **II**. **(1 mark)**

……

(e) Write two balanced chemical equations for the reaction between chlorine gas and;

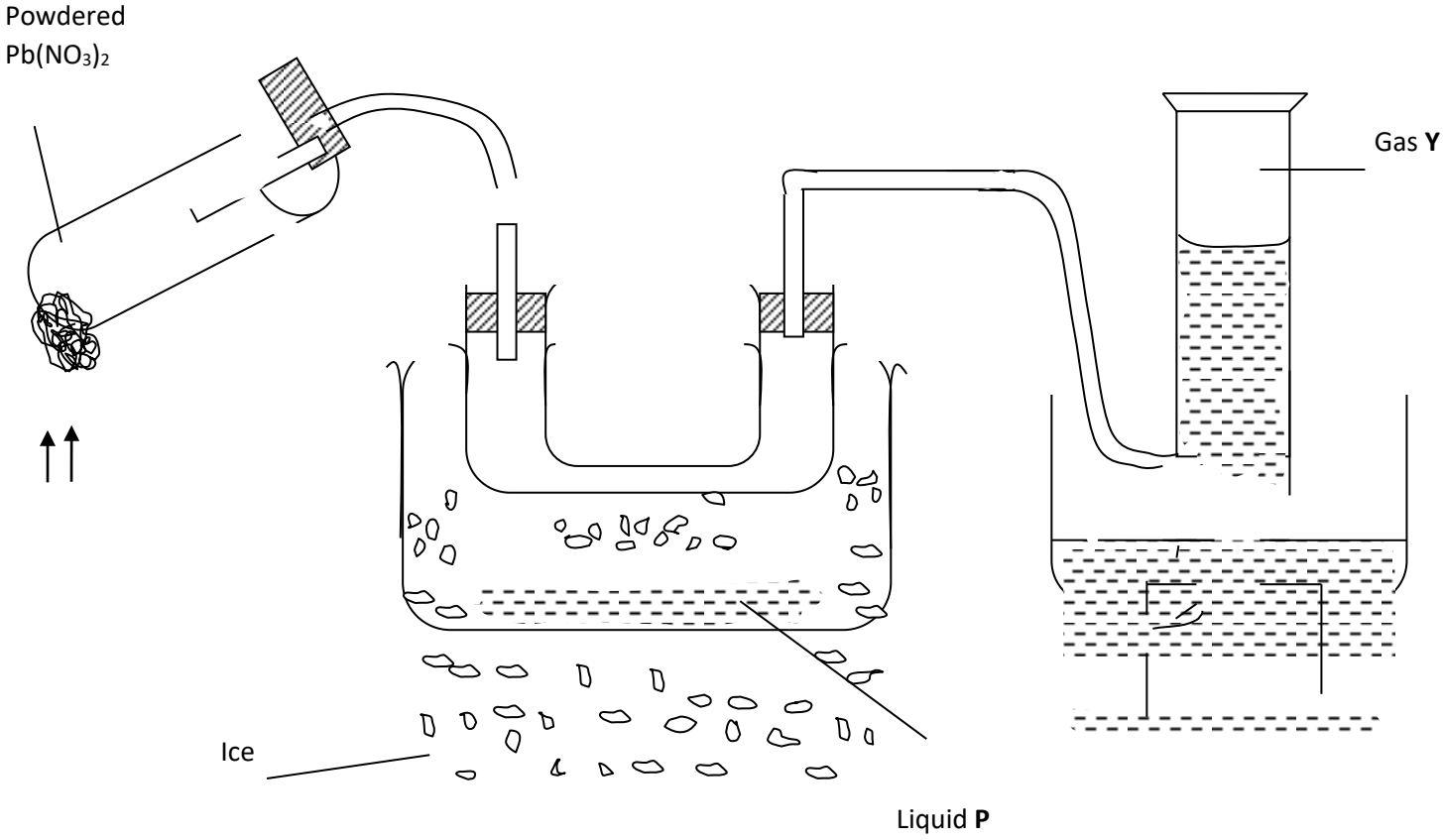
(i) Hot and concentrated sodium hydroxide. **(1 mark)**

……

(ii) Dilute and cold sodium hydroxide. **(1 mark)**

……

II. The diagram below shows an experiment in which the Lead (II) nitrate crystals are heated.



(a) Name; **(2 marks)**

(i) Liquid **P** -

……

(ii) Gas **Y** -

……

(b) Write a balanced chemical equation for the decomposition of Lead (II) nitrate. **(1 mark)**

……

(c) Explain how you can distinguish between nitrogen (II) oxide and nitrogen (I) oxide.

(2 marks)

……

……

……

……

……

6. **I.** Study the standard electrode potentials given below and answer the questions that

follow.

$D^{2+}_{(aq)} + 2e^- \rightleftharpoons D_{(s)} \quad E^\theta = -2.92V$

$G^{2+}_{(aq)} + 2e^- \rightleftharpoons G_{(s)} \quad E^\theta = -2.36V$

$\frac{1}{2}J^{2+}_{(g)} + e^- \rightleftharpoons J_{(s)} \quad E^\theta = 0.00V$

$M^{2+}_{(aq)} + 2e^- \rightleftharpoons M_{(s)} \quad E^\theta = +0.34V$

$\frac{1}{2}R^{2+}_{(aq)} + e^- \rightleftharpoons R_{(s)} \quad E^\theta = 2.87V$

(a) Identify the strongest:

(i) Reducing agent …….. **(1 mark)**

(ii) Oxidizing agent …….. **(1 mark)**

(b) Calculate the e.m.f of a cell made of G and M. **(2 marks)**

(c) Write the cell representation for the above cell in (b). **(1 mark)**

(d) Draw a cell diagram for the cell in (b) above. **(2 marks)**

(e) Write the cell reaction for the drawn cell diagram in (d) above. **(1 mark)**

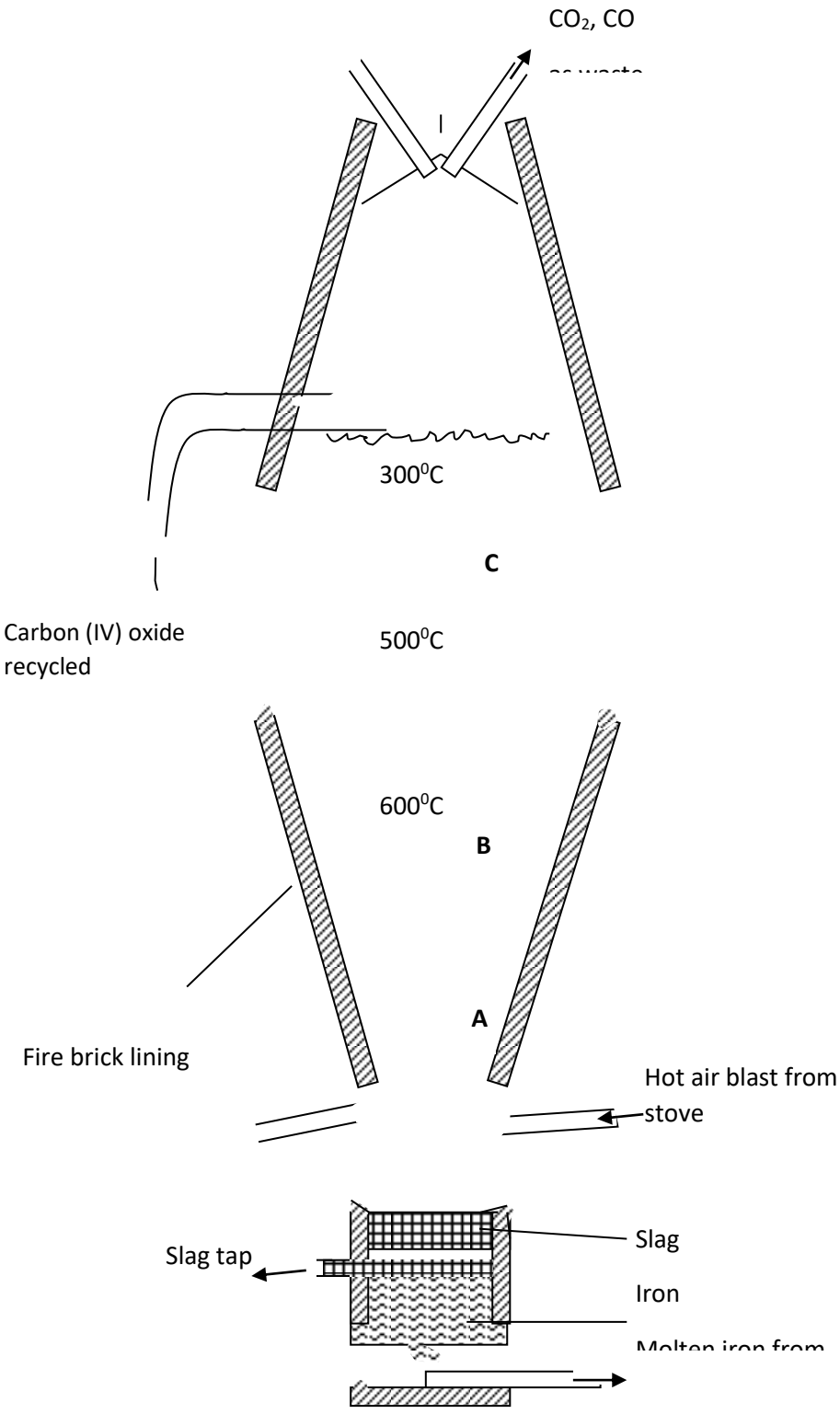
II. Electrolysis of aqueous solution of metal M resulted in the deposition of 1.07g of metal upon passage of a current of 1.32 amperes for 75 minutes.

(M = 52, 1F = 96500C)

(i) Calculate the quantity of electricity passed through the cell. **(1 mark)**

(ii) Calculate the charge on the metal ion. **(3 marks)**

7. Extraction of iron involves two main processes, smelting and refining. Below is the blast furnace which is used to smelt iron from its ore.



(a) (i) What does the word smelt mean? **(1 mark)**

……

……

……

(ii) Name the reducing agent in the process. **(1 mark)**

……

……

(iii) What is the role of the hot air blast in the process? **(2 marks)**

……

……

……

……

(b) Write equations for the reactions that take place at the region marked A, B and C. **(3 marks)**

A -

……

B -

……

C -

……

(c) What is the purpose of limestone in the extraction process? **(1 mark)**

……

(f) Write equations to show how impurities are removed from the ore.
(3 marks)

……

……

……

……

233/3

CHEMISTRY

PAPER 3 PRACTICAL

CLASS OF KCSE 2024

TIME: 2 HOURS 15 MINUTES

THE COASTAL & EASTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

CONFIDENTIAL

Per Student

1. Solution A (100ml)
2. Solution B (100ml)
3. Phenolphthalein indicator
4. 3 conical flasks
5. Funnel
6. Burette
7. Pipette
8. Clamp
9. Stand
10. CBI (g) – $NaHCO_{3(s)}$
11. Clean spatula
12. Test- tubes (5)
13. Litmus papers (2 blue and 2 red)
14. Distilled water
15. Solid Q – 1g $(NH4)_2 SO_4.FeSO_4. 6H_2O$ and NaCl (ration 1:1)

16. 1 boiling tube

Access to;

17. 2M ammonia solution
18. 2M Sodium hydroxide solution
19. Source of heat
20. Silver nitrate solution (0.05M)
21. Dilute nitric acid (0.1M)
22. Dilute hydrochloric acid (0.1M)
23. Dilute Barium nitrate solution (0.1M)
24. Conc. Nitric acid in dropper bottles
25. White tile
26. Test tube holder

- Solution A is prepared by dissolving 6.3g of $H_2C_2O_4.2H_2O$ in $400cm^3$ of water and topped upto one litre of solution.
- Solution B is prepared by dissolving 4g of Sodium hydroxide in $400cm^3$ of water and topped upto one litre of solution.

MINISTRY OF EDUCATION (KNEC COMPLIANT)

NAME_____**ADMNNO**_____**CLASS**_____

SCHOOL_____**DATE**_____**SIGN**_____

233/3

CHEMISTRY

PAPER 2 PRACTICAL

CLASS OF KCSE 2024

TIME: 2 HOURS

THE COASTAL & EASTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

INSTRUCTIONS TO CANDIDATES

- Write your name and index number in the spaces provided above.
- Answer **ALL** the questions in the spaces provided.
- You are not allowed to start working with the apparatus for the first 15 minutes of the 2¼ hours allowed time for the paper.
- Use the 15 minutes to read through the question paper and note the chemicals you require
- Mathematical tables and electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.

FOR EXAMINER'S USE ONLY.

Question	Maximum score	Candidate's score
1	17	
2	8	
3	15	
Total score	40	

This paper consists of 6 printed pages.

1. Solution A is prepared by dissolving 6.3g of the organic acid $H_2C_2O_4.nH_2O$ in water to make a litre of the solution.
   Solution B: 0.1M NaOH solution
   Phenolphthalein indicator
   Clamp and stand
   Burette and pipette.

   You are required to determine the value of n in the organic acid $H_2C_2O_4.nH_2O$
   Procedure.
   Fill the burette with solution A and adjust the volume to zero mark.

   Add 2 to 3 drops of phenolphthalein indicator and titrate solution A against solution B until thecolour just permanently changes. Record your results in the table below. Repeat the procedure two more times to obtain concordant results.
   a)

Titration	**1**	**2**	**3**
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution A used (cm^3)			

4marks

b) Calculate the average volume of solution A used. **1mark**

c) Calculate the moles of sodium hydroxide in the volume of solution B used. **2marks**

d) Given that solution B - Sodium hydroxide and solution A organic acid react in the ration of 2:1, calculate the number of moles of the organic acid –solution A used? **2marks**

e) Calculate the moles of organic acid solution A used per litre of solution **2marks**

f) Calculate the relative formula masses of the organic acid solution A **3marks**

g) Calculate the value of n in $H_2C_2O_4.nH_2O$(H=1, C=12, O=16) **3marks**

2. You are provided with CBI. Carry out the test below. Write your observation and inferences in the spaces provided.
   a) Using a clean spatula, heat about one third of the solid CBI in a non-luminous Bunsen burner flame.

Observation	Inferences

1mark **1mark**

   b) Put a half spatula endful of CBI in a test tube. Heat gently and then strongly. Test for any gas produced using litmus papers.

Observation	Inferences

1mark **1mark**

c) Put 2cm^3 of dilute hydrochloric acid into a test tube. Add ¼ endful of CBI into the test tube.
Test for any gas procedure.

Observation	Inferences
2marks	**2marks**

3. You are provided with solid Q, carry out the test below. Record your observations and inferences in the table. Identify any gas (es) evolved.

Place all the solid Q provided into boiling tube and add distilled water until the tube is ¼ full. Divide it into five portions.

a) To the 1st portion add ammonia solution drop wise until excess.

Observation	Inferences
1mark	**1mark**

b) (i) To the 2nd portion add sodium hydroxide solution dropwise until in excess. Keep the resulting mixture for the next test.

Observation	Inferences
1mark	**1mark**

ii) Warm the preserved mixture from b (i) above

Observation	Inferences
1mark	**1mark**

c) i) To the 3rd portion add silver nitrate solution. Preserve the mixture for the next test.

Observation	Inferences
1mark	**1mark**

ii) To the preserved mixture in c (i) above add diluted nitric acid.

Observation	Inferences
1mark	**1mark**

d) To the 4th portion add dilute Barium nitrate solution followed by dilute nitric acid.

Observation	Inferences
1mark	**1mark**

e) To the 5th portion add 2-3 drops of conc. Nitric acid.
Warm the mixture and allow to cool. Add sodium hydroxide solution dropwise until in excess.

Observation	Inferences
1mark	**1mark**

MINISTRY OF EDUCATION (KNEC COMPLIANT)

Name .....Index No.....

Candidate signature.....Date: .....

233/1

CHEMISTRY

Paper 1(THEORY)

CLASS OF KCSE 2024

Time: 2 Hours

THE RIFT VALLEY & NORTH EASTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

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.
- Answer **all** the questions in the spaces provided.
- KNEC mathematical tables and non-programmable electronic calculators may be used.
- All working **must** be clearly shown where necessary
- Candidates should check whether the question paper to ascertain that all the pages are printed and that no questions are missing.
- Candidates should answer the questions in **English**

FOR EXAMINER'S USE ONLY

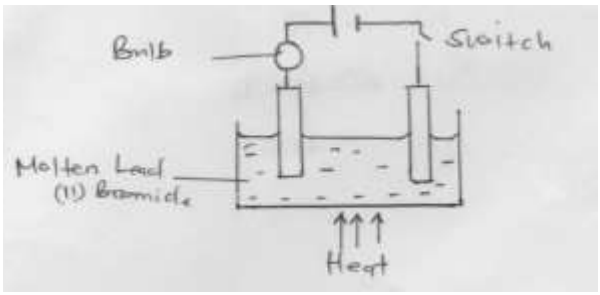
Questions	Maximum Score	Candidates Score
1 – 30	80	

1. a) When the air hole is fully opened, the Bunsen burner produces a non-luminous flame. Explain (1mks)

   b) Draw a labeled diagram of a non-luminous flame (2mks)

2. Describe an experimental procedure that can be used to extract oil from nuts seeds (2mks)

3. Study the diagram below and use it to answer the questions that follow



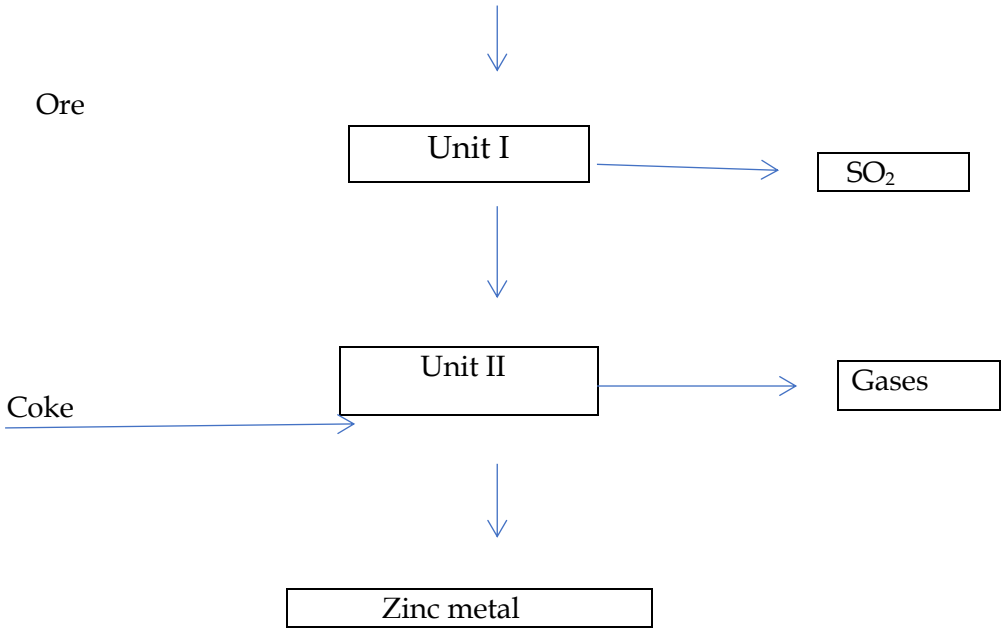
   a) Write the equations for the reactions taking place at the;
      I. Anode (1mks)

II. Cathode (1mks)

b) Name one application of electrolysis (1mks)

4. In a titration experiment, 25cm^3 of a solution of sodium hydroxide containing 8 g per litre was required for complete neutralization of 0.245 g of a dibasic acid. Calculate the relative molecular mass of the acid (Na = 23.0, O = 16.0, H = 1) (3mks)

5. The flow chart below shows processes involved in the industrial extraction of Zinc metal



a) Name **one** ore from which zinc is extracted (1mks)

b) Write the equation of the reaction taking place in unit II (1mks)

c) Name **two** uses of zinc metal (1mks)

6. The table below shows the pH values of solutions P, R, Q and S

Solution	P	R	Q	S
pH	2	7	6.5	13.5

a) Which solution represents:
   i) Strong base (1mks)

   ii) Weak acid (1mks)

b) Give an example of solution S (1mks)

7. The electron arrangement of ions of a certain elements represented by letters P, Q, R and S are:
   P^{2-} -2.8.8
   Q^{2+} -2.8

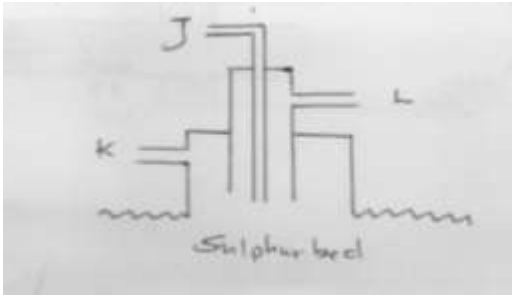
   R^{+} - 2.8

   S -2.8.8

   a) Explain why S is not represented as an ion (1mks)

b) Which element has the largest atomic radius? Explain. (2mks)

8. Sulphur is extracted from underground deposits by a process in which three concentric pipes are sunk down to the deposits as shown



a) Name the process represented above (1mks)

b) What is passed down through pipe J? (1mk)

c) Name the **two** allotropes of sulphur (1mk)

9. Element **A** has atomic mass 23 and element **B** has atomic mass 7 and also have 12 neutrons and 4 neutrons respectively.

a) Write the electronic arrangement of **A** and **B**. (1mk)

b) Which element has higher ionization energy? Explain (2mks)

10. W grammes of a radioactive isotope decayed to 5 grammes in 100 days. The half life of the isotope is 25 days.

a) What is meant by half life? (1mk)

b) Calculate the initial mass W of the radioactive isotope (3mks)

11. Haber process (the manufacture of ammonia gas) is given by the following equation

$N_{2\,(g)} + 3H_{2\,(g)} \rightleftharpoons 2NH_{3\,(g)} \quad \Delta H = -92kJ/mole$

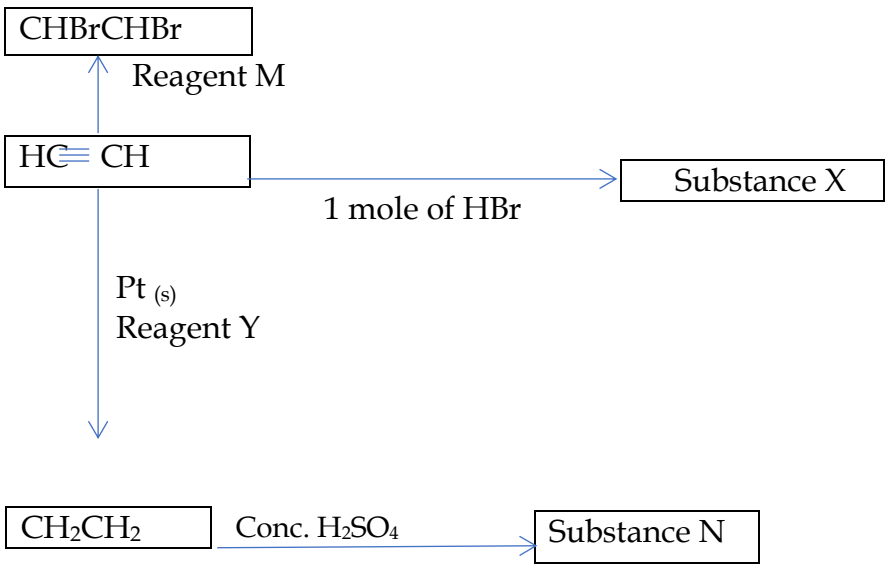
State and explain the effect of

a) Introducing some drops of water to the equilibrium (1mk)

b) Pumping nitrogen gas to the equilibrium mixture (1mk)

c) Lowering the temperature of the reaction (1mk)

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



a) Name substance
   i) X (½mk)

   ii) N (½mk)

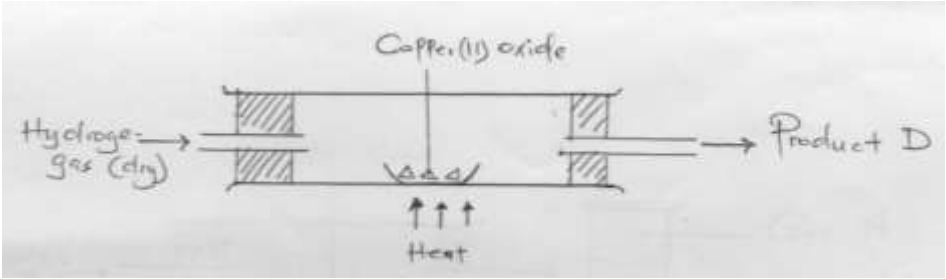
b) Name the reagent M (½mk)

c) Ethene undergoes polymerization to form a polymer. Write an equation for the reaction and name the product (1½mks)

13. a) State Graham's law of diffusion (1mk)

c) $30cm^3$ of hydrogen chloride gas diffuses through a porous in 20 seconds. How long would it take $42cm^3$ of sulphur (IV) gas to diffuse through the same pot under the same conditions? (H = 1, Cl = 35.5, S = 32, O = 16) (2mks)

14. In the laboratory experiment, hydrogen gas was passed over heated copper (II) oxide as shown in the diagram below



a) Write equation for the reaction taking place in the combustion tube (1mk)

b) Describe a chemical test that can be used to identify the product D (2mks)

15. The scheme below represents the manufacture of a cleaning agent X

a) Draw the structure of X and state the type of clearing agent to which X belong (1mk)

b) State **one** disadvantage of using X as a cleaning agent (1mk)

16. Diamond and graphite are allotrope of carbon.

a) What are **allotropes**? (1mk)

b) Explain why graphite can be used as a lubricant while diamond cannot? (1mk)

c) Give another element which exhibit allotropy (1mk)

17. Given sodium carbonate solid, lead II nitrate solid and water, Explain how you can obtain a solid sample of lead II carbonate
(3mks)

18. Given the following bond energies:

C - C	347kJ/mol
C - H	413kJ/mol
C = C	612 kJ/mol
H - H	435.9kJ/mol

Calculate the enthalpy change of hydrogenation of ethane (3mks)

19. Excess magnesium ribbon sample was heated in equal volumes of:

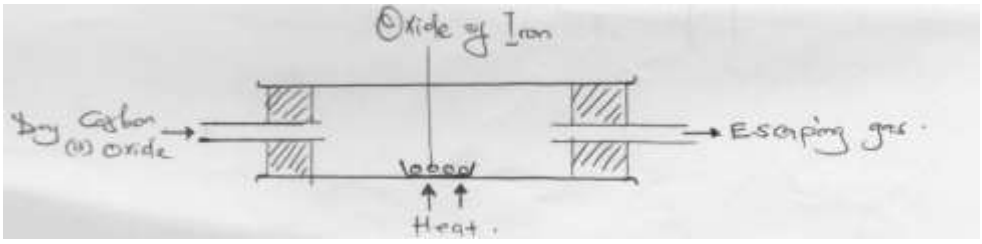
i) Pure oxygen gas

ii) Air

a) Why was the mass of the resulting product in (ii) more than in (i)? (1mk)

b) Write the equations for the reactions in part (ii) (2mks)

20. Excess carbon (II) oxude was passed over heated sample of an oxide of ironas shown in the diagram below. Study it and answer the questions that follow.



Data collected as follows:

Mass of empty crucible	10.98 g
Mass of empty crucible + oxide of iron	13.30 g
Mass of crucible + residue	12.66 g

Determine;

i) The mass of the iron (½mk)

ii) The mass of oxygen (½mk)

iii) The empirical formula of the oxide of iron (2mks)

21. The table below gives some properties of three elements in groups (VII) of the periodic table. Study it and answer the questions that follow

Element	Atomic No.	Melting point (^{0}C)	Boiling point(^{0}C)
Chlorine	17	-101	-34.7
Bromine	35	-7	58.8
iodine	53	114	185

a) Which element is a gas at room temperature (25^0C)? Explain. (1mk)

b) Explain why the boiling point of bromine is higher than that of chlorine (1mk)

c) Identify the element which has the highest electron affinity. Give a reason (1mk)

22. An element X has relative atomic mass of 88. When a current of 0.5 Ampheres was passed through the fused chloride of X for 32 minutes 10 seconds, 0.44 g of X was deposited at the cathode. (IF = 96500C)

a) Calculate the number of Faradays needed to liberate 1 mole of X (2mks)

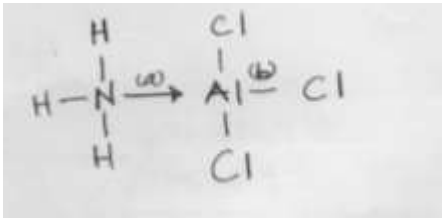
b) Write the formula of the chloride of X (1mk)

23. Aqueous ammonia was added to copper (II) sulphate solution dropwise until in excess.

a) What observations were made? (1½ mks)

b) Write down the ionic equations representing the observations mentioned in (a) above. (1½mks)

24. The diagram below shows the bonding between aluminium chloride and ammonia

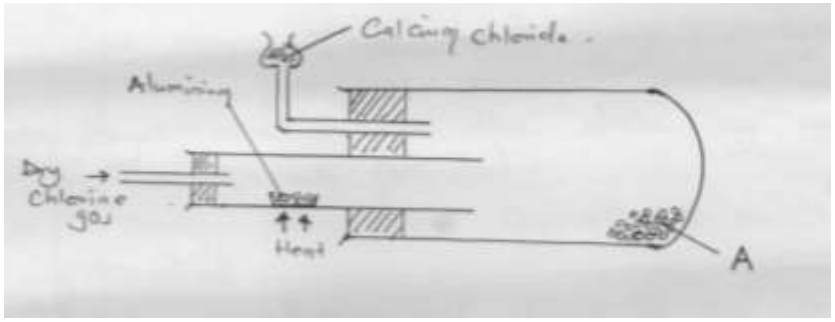


i) Name the type of bond labeled
a) (1mk)

b) (1mk)

ii) How many electrons are used for bonding in the molecule? (1mk)

25. In an experiment, dry chlorine gas reacted with aluminium as shown in the diagram below.



i) Name substance A (1mk)

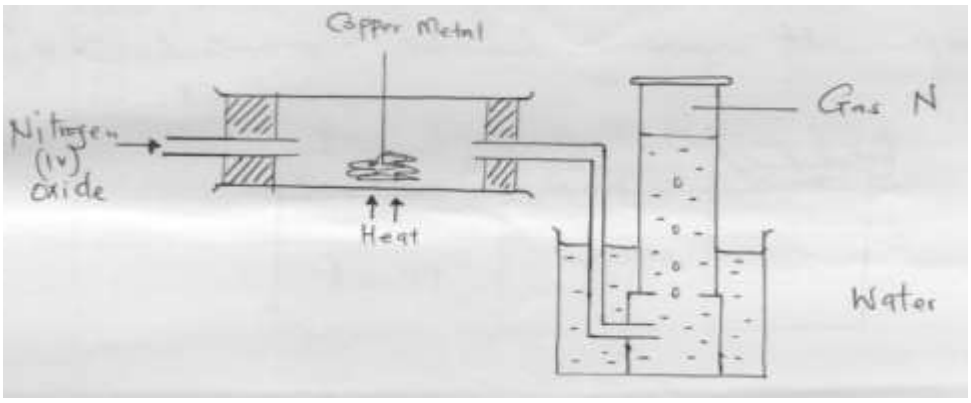
ii) Write an equation for the reaction that took place in the combustion tube (1mk)

iii) State the function of the calcium chloride in the set up above (1mk)

26. a) State the **Gay Lussaic's** law (1mk)

c) $10cm^3$ of gaseous hydrocarbon C_2H_X required $30cm^3$ of oxygen for combustion. If 1 mole of steam and $20cm^3$ of carbon (IV) oxide were produced, what is the value of X? (2mks)

27. The set up below is an arrangement showing how metals react with nitrogen (IV) oxide. Study it and answer the questions that follow.



a) Nitrogen (IV) oxide is passed through the combustion tube before copper is heated. Give a reason. (1mk)

b) State the observations that would be made at the end of the experiment in the combustion tube (1mk)

c) Name gas N (1mk)

MINISTRY OF EDUCATION (KNEC COMPLIANT)

NAME_____**ADMNNO**_____**CLASS**_____

SCHOOL_____**DATE**_____**SIGN**_____

233/2

CHEMISTRY

PAPER 2 THEORY

CLASS OF KCSE 2024

TIME: 2 HOURS

THE RIFT VALLEY & NORTH EASTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

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.
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- Candidates should check whether the question paper to ascertain that all the pages are printed and that no questions are missing.
- Candidates should answer the questions in **English**

FOR EXAMINER'S USE ONLY

Q	MARKS	CANDITATE SCORE
1	12	
2	9	
3	13	
4	11	
5	12	
6	12	
7	11	
TOTAL	80	

1. Use the information below on standard electrode potentials to answer the questions that follow

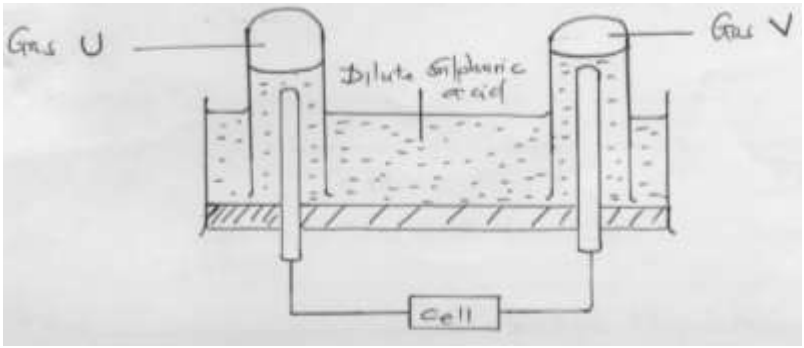
Electronic reaction		E^{θ} volts
$C^{2+}_{(aq)} + 2e^-$	$C_{(s)}$	+0.34
$D^{2+}_{(aq)} + 2e^-$	$D_{(s)}$	+0.44
$E^{+}_{(aq)} + e^-$	$E_{(s)}$	-2.92
$F^{2+}_{(aq)} + 2e^-$	$F_{(s)}$	-2.71
$G^{2+}_{(aq)} + 2e^-$	$G_{(s)}$	-0.14
$\frac{1}{2}H_{2(g)} + e^-$	$H^-_{(aq)}$	+2.87
$\frac{1}{2}K_{2(g)} + e^-$	$K^-_{(aq)}$	+1.09
$L^{+}_{(aq)} + e^-$	$\frac{1}{2}L_{2(aq)}$	0.00

a) i) Identify the strongest reducing agent and oxidizing half cells. Give reasons (2mks)

iii) Calculate the emf of the cell obtained by connecting half cells **C** and **D** (1mk)

b) Draw a well labeled diagram of a cell formed by connecting half cells **E** and **D**. on the diagram indicate the flow of electrons (3mks)

c) The figure below shows the electrolysis of dilute sulphuric (VI) acid



i) On the diagram label the cathode and anode (1mk)

ii) Name the gases **U** and **V** (1mk)

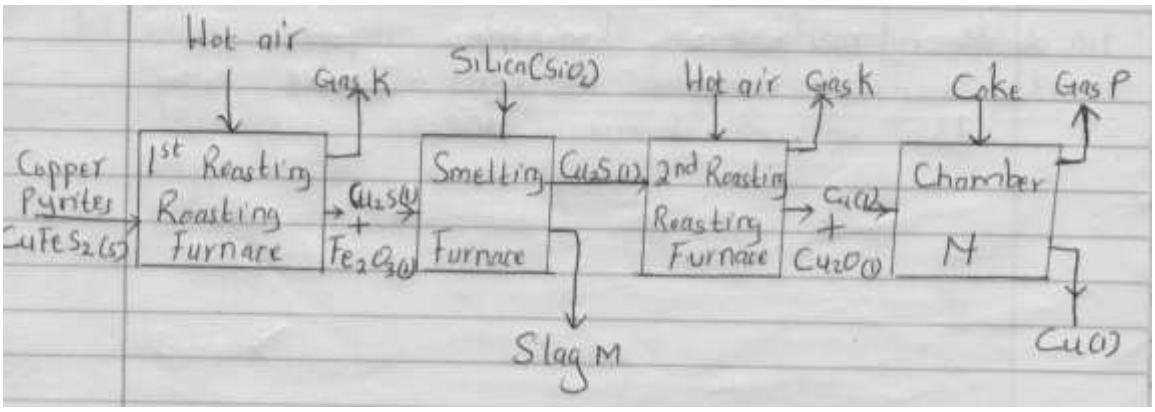
Gas **U**

Gas **V**

iii) Write the equation taking place at the anode (1mk)

d) Define electrolysis and state any **two** applications of electrolysis (3mks)

2. a) The flow chart below outlines some of the processes involved during extraction of copper from copper pyrites. Study it and answer the questions that follow.



i) Name gas K (1mk)

ii) Write an equation for the reaction that takes place in the 1st roasting furnace (1mk)

iii) Write the formula of the cation present in slag **M** (1mk)

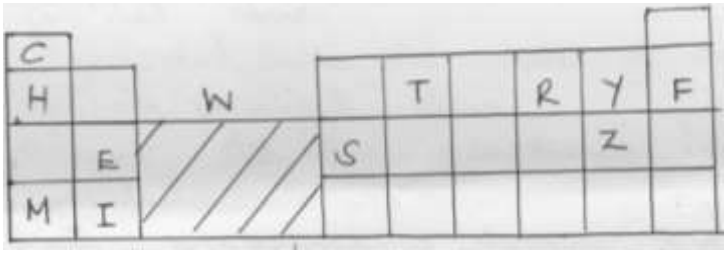
iv) Identify gas **P** (1mk)

v) What name is given to the reaction that takes place in chamber **N**? Give a reason for the answer (1mk)

c) The copper obtained from chamber **N** is not pure. Draw a labeled diagram to show the set up you would use to refine the copper by electrolysis (2mks)

c) Give two effects that this process could have on the environment (2mks)

3. a) The grid below represents part of the periodic table. Study the information and answer the questions that follow. The letters do not represent the actual symbol of the elements.



i) Which element would form a trivalent cation?
(1mk)

ii) Write the equation for the reaction that would occur between **E** and **Y**
(1mk)

iii) Which elements belong to the region labeled W?
(1mk)

iv) Which is the most reactive non-metallic element in the table above? Explain (2mks)

v) How does the atomic radius of **T** compare with that of **Y**
(2mks)

b) The table below shows some properties and electronic arrangements of common ions of elements represented by letters **D** to **K**. Study the information and answer the questions that follow>

Element	Formula of ion	Ionic electronic arrangement	Atomic radius (nm)	Ionic radius (nm)
D	D^-	2.8	0.072	0.136
E	E^+	2.8.8	0.231	0.133
F	F^{3+}	2.8	0.143	0.050
G	G^{2+}	2.8.8	0.133	0.074
H	H^{2+}	2.8	0.160	0.064
I	I^+	2.8	0.186	0.095
J	J^{3-}	2.8.8	0.110	0.190
K	K^-	2.8.8	0.099	0.181

i) State the atomic numbers of elements **F** and **G**
(1mk)

F
G

ii) Select two metals that belong to period 3
(1mk)

iii) Element **I** reacts violently with water. Write the equation for the reaction.
(1mk)

iv) Why is the ionic radius of **G** smaller than its atomic radius
(1mk)

v) Compare and explain the reactivity of **G** and **H**
(2mks)

4. In an experiment to study the rate of reaction between duralumin (an alloy of aluminum, magnesium and copper) and hydrochloric acid, **0.5 g** of the alloy

were reacted with excess **4M** hydrochloric acid. The data in the table below was recorded. Use it to answer the questions that follow.

Time (minutes)	Total volume of gas (cm^3)
1	0
2	220
3	410
4	540
5	620
6	640
7	640

a) i) on the graph paper provided plot a graph of total volume of a gas produced against time (3mks)

ii) From the graph determine the volume of gas produced at the end of 2½ minutes (1mk)

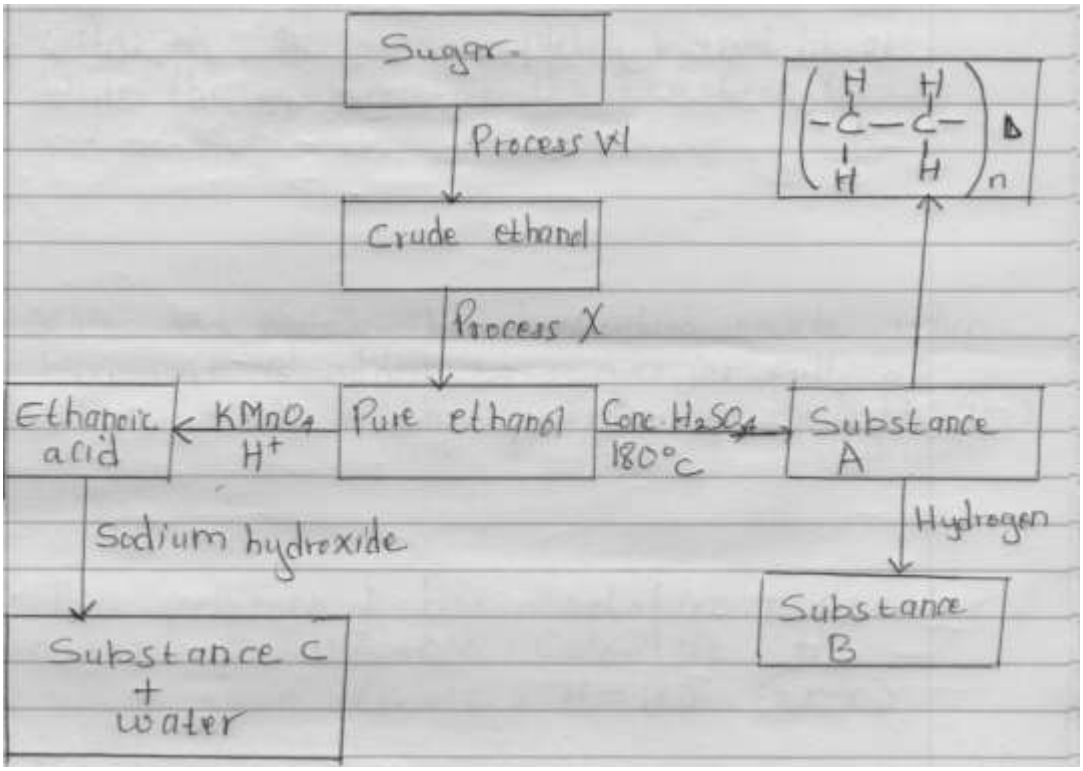
b) Determine the rate of reaction between the 3^{rd} and 4^{th} minute (1mk)

c) Give a reason why some solid remained at the end of the experiment (1mk)

d) Given that 2.5cm^3 of the total volume of the gas was from the reaction between magnesium and aqueous hydrochloric acid, calculate the percentage mass of aluminium present in 0.5 g of the alloy. (Al = 27, and molar gas volume = 24000cm^3 at 298K)
(3mks)

e) State **two** properties of duralumin that makes it more suitable than aluminum in aero plane construction
(2mks)

5. The flow chart below is for the manufacture of sodium carbonate using Solvay process. Use it to answer the questions that follow



a) Name :

i) Gas **W**
(1mk)

ii) Solution **H**
(1mk)

iii) Solid **X**
(1mk)

iv) The product **J**
(1mk)

b) Write an equation for the reaction in chamber B
(1mk)

c) Name **two** raw materials used in Solvay process
(2mks)

d) i) Name **one** substance recycled in Solvay process
(1mk)

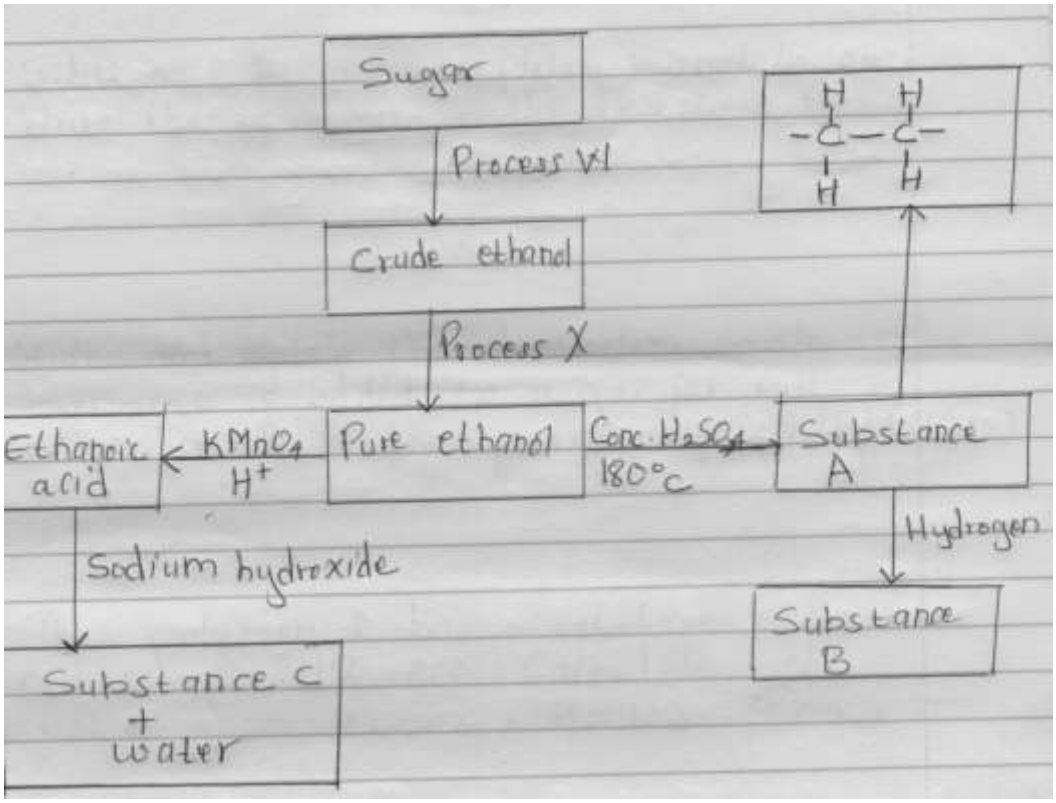
ii) Give **two** reasons why CO_2 is used as fire extinguisher
(2mks)

iii) Explain why lead carbonate is not reacted with dilute H_2SO_4 in preparation of CO_2 in the laboratory
(2mks)

6. a) Name four components of crude oil
(2mks)

b) What is the difference between thermal cracking and catalytic cracking?
(2mks)

c) Study the flow chart below and answer the questions that follow.



i) identify process **W** and **X**
(1mk)

ii) Name substances **B** and **C**
(1mks)

iii) Write the equation for the reaction leading to production of substance **A** (1mk)

iv) Substance **B** was completely burned in air. Write the equation for the reaction (1mk)

v) State and explain the observations made when bromine is added to a das jar full of substance **B** in the presence of sunlight.
(2mks)

vi) The polymer **D** has a relative molecular mass of 112,000. Calculate the value of n (C=12, H = 1)
(2mks)

7. a) What is meant by molar heat of combustion?
(1mk)

b) State the Hess's law
(1mk)

c) Use the following standard enthalpies of combustion of graphite, hydrogen and enthalpy of formation of propane.

$$\Delta H^{\theta}_{C}\ \textbf{(Graphite) = -393kJ/mol}$$
$$\Delta H^{\theta}_{C}\ (H_{2\,(g)}) = \textbf{-286kJ/mol}$$
$$\Delta H^{\theta}_{f}\ (C_3H_8) = \textbf{-104kJ/mol}$$

i) Write the equation for the formation of propane
(1mk)

ii) Draw an energy cycle diagram that links the heat of formation of propane with its heat of combustion and the heats of combustion of graphite and hydrogen (3mks)

iii) Calculate the standard heat of combustion of propane
(1mk)

iv) Other than the enthalpy of combustion, state one factor which should be considered when choosing a fuel
(1mk)

v) The molar enthalpies of neutralization for dilute hydrochloric acid and dilute nitric (V) acid are -57.2kJ/mole while that of ethanoic acid is -55.2kJ/mol. Explain this observations.
(2mks)

NAME_____**ADMNNO**_____**CLASS**_____

SCHOOL_____**DATE**_____**SIGN**_____

233/3

CHEMISTRY

PAPER 3 PRACTICAL

CLASS OF KCSE 2024

TIME: 2 HOURS

THE RIFT VALLEY & NORTH EASTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

CONFIDENTIAL TO SCHOOLS

Each candidate will require

1. Solution B about 60 cm^3 of 1.1 M hydrochloric acid solution.
2. Solution C about 100 cm^3 of 0.2M sodium hydroxide solution.
3. One 250 ml volumetric flask.
4. One 100 ml measuring cylinder
5. 50 ml Burette
6. 25ml pipette.
7. 2 conical flasks
8. Retort stand
9. Filter funnel
10. 2.5g of solid F
11. 500ml of distilled water
12. 100ml plastic beaker
13. Thermometer
14. 1 spatula-ful of solid D
15. ½ spatula of solid E
16. Six test tubes in a rack
17. Red litmus paper
18. Blue litmus paper
19. Metallic spatula
20. 1 lable

ACCESS TO

- 1M NaOH
- 1M NH_4OH
- Barium chloride soln. ($BaCl_2$)
- 0.5M NaCl
- Universal indicator soln.(pH 4 to 11)
- Sodium carbonate solid
- $KmnO_4$.
- Phenolphthalein indicator
- Source of heating

NOTES

1. Solid A – Exactly 0.31 of Zinc carbonate.
2. Solid D-AluminiumSulphate
3. Solid E-Maleic acid
4. Solid F-anhydrous sodium carbonate
5. $BaCl_2$-dissolve 4g of solid in $1dm^3$ of solution.

MINISTRY OF EDUCATION (KNEC COMPLIANT)

NAME_____**ADMNNO**_____**CLASS**_____

SCHOOL_____**DATE**_____**SIGN**_____

233/3

CHEMISTRY

PAPER 3 PRACTICAL

CLASS OF KCSE 2024

TIME: 2 HOURS

THE RIFT VALLEY & NORTH EASTERN REGIONS KCSE JOINT NATIONAL MOCK 2024

Kenya Certificate of Secondary Education (KCSE)

INSTRUCTIONS TO CANDIDATES:

- *Answer all the questions in the spaces provided in the question paper.*
- *You are **NOT** allowed to start working with 2 ¼ 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.*
- *All working **MUST** be clearly shown.*
- *Mathematical tables and calculators may be used.*

For Examiner's Use Only:

Question	Maximum score	Candidates score
1	13	
2	10	
3	17	
Total score	40	

This paper consists of 8 printed pages. Candidates should check to ascertain that all papers are printed as indicated and that no questions areMissing

1 **You are provided with**

- Solid **A**: 0.31 g of a carbonate (MCO_3).
- Solution **B**: l.1M hydrochloric acid
- Solution **C:** 0.2M sodium hydroxide.
- Phenolphthalein indicator.

You are required to:

(i) Determine the molar mass of the carbonate

(ii) Determine the relative formula mass and hence formula of the carbonate.

PROCEDURE

- Measure 50 cm^3 of solution **B** using a measuring cylinder. Transfer the entire solid A provided into a 250cm^3 volumetric flask. Transfer 50 cm^3solutions B into 250cm^3volumetric flask containing solid **A** and swirl the contents until the entire Solid dissolves and no more effervescence occurs. Add more distilled water up to the 250cm^3 mark and label this solution **D**.
- Pipette 25.0cm^3 of solution **D** and transfer to a conical flask. Add two drops of phenophthalein indicator and titrate with solution **C**from the burette. Record your results in table I below.
- Repeat the titration to get two more concordant values.

TABLE 1

	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of C used (cm^3)			

(4 mks)

(a) Calculate;

(i) The average volume of solution **C** used.
(1mk)

(ii) The moles of solution **C** in the volume in (i) above.
(1mk)

(iii) The moles of **D** that reacted with **C**.
(1mk)

(iv) The moles of hydrochloric acid in 250 cm^3 of solution D (1mk)

(v) The moles of hydrochloric acid in 25cm^3 of B. (1mk)

(vi) Calculate the moles of HCl which reacted with the carbonate (1mk.. (1mk)

(vii) Calculate the moles of the carbonate that reacted with the acid (1mk)

(viii) Determine the relative formula mass of the carbonate and the value of M. (1mks)

2) You are provided with 2.5g of a hydrous sodium carbonate labeled F. You are required to determine the enthalpy of solution of solid F.

Procedure

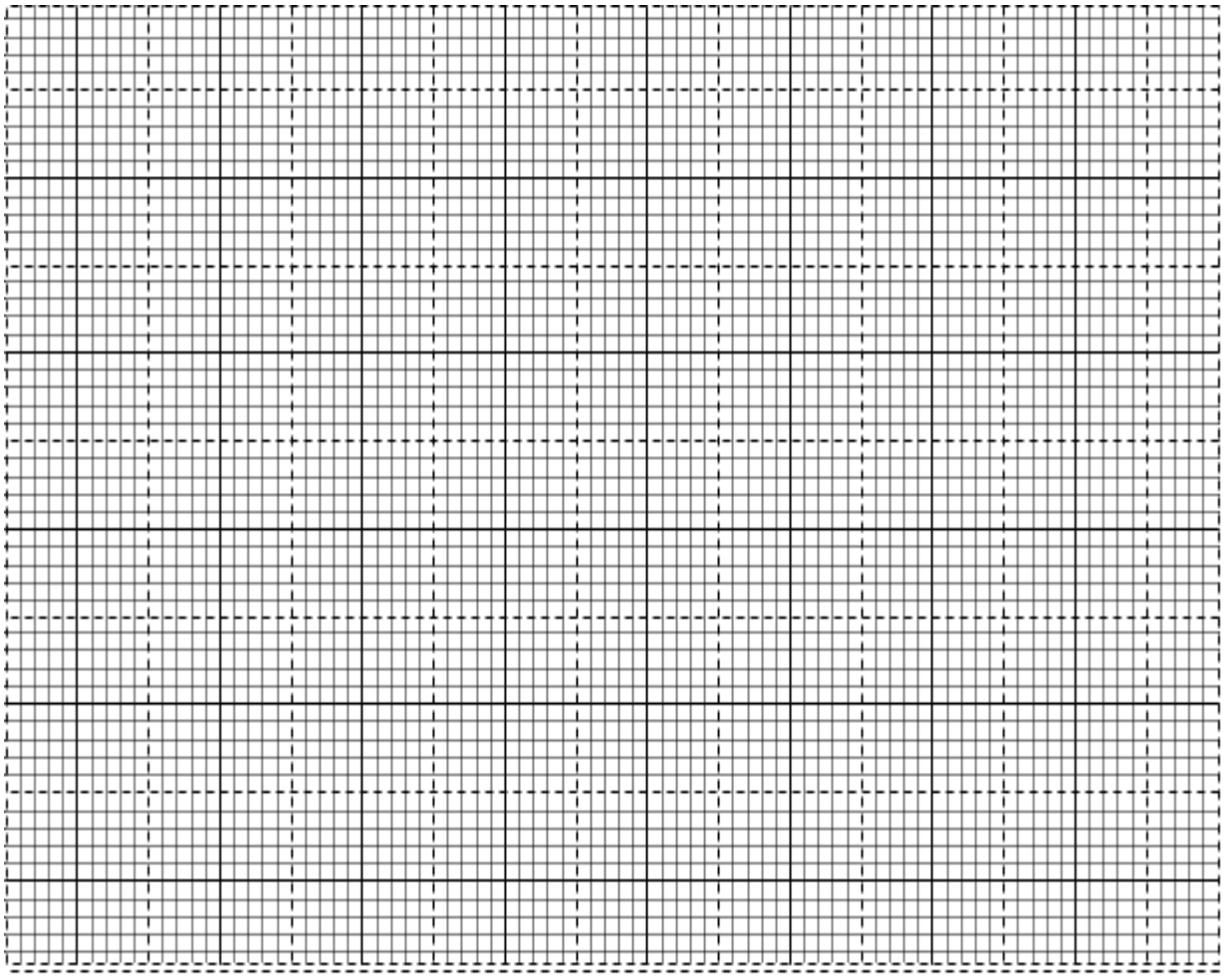
Using 50m1 measuring cylinder place 25cm^3 of water into l00ml plastic beaker. Stir the water gently with a thermometer and take its temp after every half-minute. Record the reading in the table below. At exactly 2 minutes add all solid F to the water at once. Stir well with the thermometer as you take the temperature ofto the mixture after every half- minute upto the 4thminute.

Table III

Time (min)	**0**	**½**	**1**	**1 ½**	**2**	**2 ½**	**3**	**3 ½**	**4**
Temp ^{o}C									

3mks

(a) On the grid provided plot a graph of temp against time.
(3mks



(b) From the graph determine the change in temp (ΔT) (1mk)

(c) (i) Calculate the number of moles of solid F used in the experiment (Na= 23,C=12, 0=16) (1mk)

(ii) Calculate the molar enthalpy of solution. (Density of solution lgcm^{-3}, specific heat capacity of solution is 4.2Jg^{-1}K^{-1} (2mks)

3). You are provided with solid D. Carry out the following tests and write down all the observations and Inferences.

(a) Place a half spatulafull of solid in a dry test tube and heat gently then strongly.Test any gas produced using red and blue litmus papers.

Observations	**Inferences**
(1mk)	(1mk)

(b) Place the remaining solid D in a boiling tube and add about 10cm^3 of water shake Vigorously then divide the mixture into four portions.

Observations	**Inferences**
(1mk)	(1mk)

(c) To the 1st portion add four drops of barium chloride solution

Observations	Inferences
(1mk)	(1mk)

(d) To the 2nd portion add sodium hydroxide solution drop wise till in excess.

Observations	Inferences
(1mk)	(1 mk)

(e) To the third portion add aqueous ammonia solution drop wise till excess about $1cm^3$

Observations	Inferences
(1mk)	(1 mk)

(f) To the fourth portion add 3 drops of sodium chloride

Observations	Inferences
(1mk)	(1mk)

II. You are provided with substance E. Carry out tests on it.

(i) Place about one thirdof solid E on a metallic spatulaand ignite it in a flame.

Observations	**Inferences**
(1mk)	(1mk)

(ii) Place the remaining solid E boiling tube add about 5 cm^3 of distilled water. Shake the contents and divide into 3 portions.

(a) To portion one add 3 drops of Universal indicator

Observations	**Inferences**

(½ mk)	(½ mk)

(b) To second portion all sodium carbonate provided

Observations	**Inferences**
(½ mk)	(½ mk)

(c) To third portion add 2 drops of acidified potassium manganate (VII) solution. Warm the mixture

Observations	**Inferences**
(½ mk)	(½ mk)