KCSE 2024 REPLICA

CHEMISTRY

(PREDICTION EXAMS 1-10)

Confidential set of Possible Questions likely to be examined in the forthcoming Final Examinations. A Projection of what is likely to be tested in the much-awaited KNEC Exams scheduled for November 2024.

The following are Questions to expect in KCSE 2024 EXAMS.

CONFIDENTIAL!

For Marking Schemes

Mr Isaboke 0746 222 000 / 0742 999 000

THE KEY TO SUCCESS!

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 1)

CHEMISTRY

233/1

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

a) *Write your name and Admission 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 below each question.*

d) *Mathematical tables and silent electronic calculators may be used.*

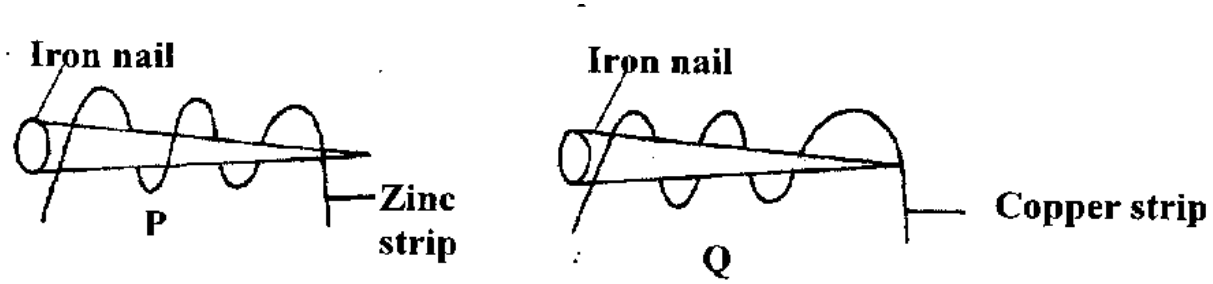
e) *All working **MUST** be clearly shown where necessary.*

For Examiner's Use Only

Questions	Max. Score	Candidate's Score
1 – 27	**80**	

*Answer **ALL** the questions in the spaces provided*

1. Use the diagram below to answer the questions that follow.



a) In which set – up will the iron nail rust? Explain **(2 marks)**

b) State **one** advantage of rusting **(1 mark)**

2. During distillation in a laboratory the distillate can be collected either by a beaker or a conical flask.

(a) Define the term distillate. **(1 mrk)**

(b) Explain why a conical flask is the most preferred apparatus for the collection of the distillate. **(1 mark)**

(c) Draw the diagram of a graduated conical flask. **(1 mark)**

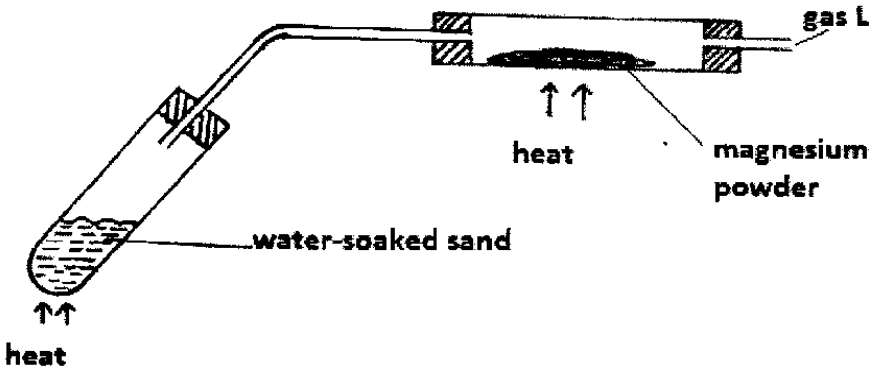
3. Describe how you would test for pH value of plant extract **(3 marks)**

4. During investigation to identify illegal steroids used by three athletes. Urine samples were obtained and labeled as **A**, **B** and **C**. Illegal steroid was labeled as **X**, each urine sample had 2 components each and urine **A** and **C** contain the illegal steroid.

a) Give the name of process used to identify illegal steroids in athletes**.** **(1 mark)**

b) Draw a chromatogram, showing the information given above **(2 marks)**

5. The following set up was used to react steam with Magnesium Powder.



a) Explain why the water-soaked sand was heated before heating the iron powder**.** **(1 mark)**

b) Write an equation for the reaction that took place between steam and magnesium powder.**(1 mk)**

c) State how gas **L** would be collected without using water. **(1 mark)**

6.(a) Using dots(•) and crosses(**x**) ,show bonding in Hydroxonium ion, (H_3O^+) (H =1.0,O = 16.0)

(1mark)

(b) The chloride of Aluminum was added to water and stirred. State and explain the observation made when two drops of methyl orange were added into the solution. **(2 marks)**

7. The data below gives the electronic configuration of some selected atoms and ions

Atom/ion	A^{2+}	B	C^{2-}	D^{2+}	E	F^-	G^+	H
Electronic configuration	2	2.4	2.8	2.8.8	2.8	2.8.8	0	2.8.2

(a) Select an atom that is a noble gas **(1 mark)**

(b) What is the atomic number of**:** **(1 mark)**

A……...

C……..

(c) Select an element that belongs to group II and period 4 **(1 mark)**

8. Use the table below to answer the questions that follow:

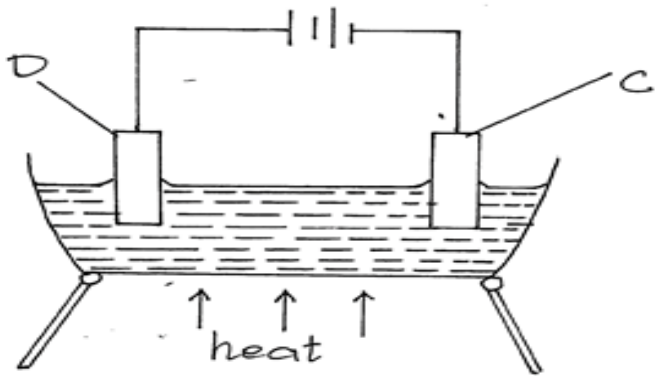
Element	**Atomic number**
A	11
B	13
C	14
D	17
E	19

(a) Write an equation for the reaction between element **A** and water. **(1 mark)**

(b) Compare the atomic radii of elements **A** and **D**. Explain. **(2 marks)**

9. Starting with Copper metal describe how to prepare pure Copper (II) sulphate crystals. **(3 marks)**

10. The diagram below was used to electrolyze molten copper (II) chloride using graphite electrodes.



(a)Explain the role of heat on the above set up. **(1 mark)**

(b) Write an equation for the reaction taking place at electrode: **(2 marks)**

C……

D……..

11. A state of equilibrium between dichromate (VI) and Chromate ions is established as shown below.

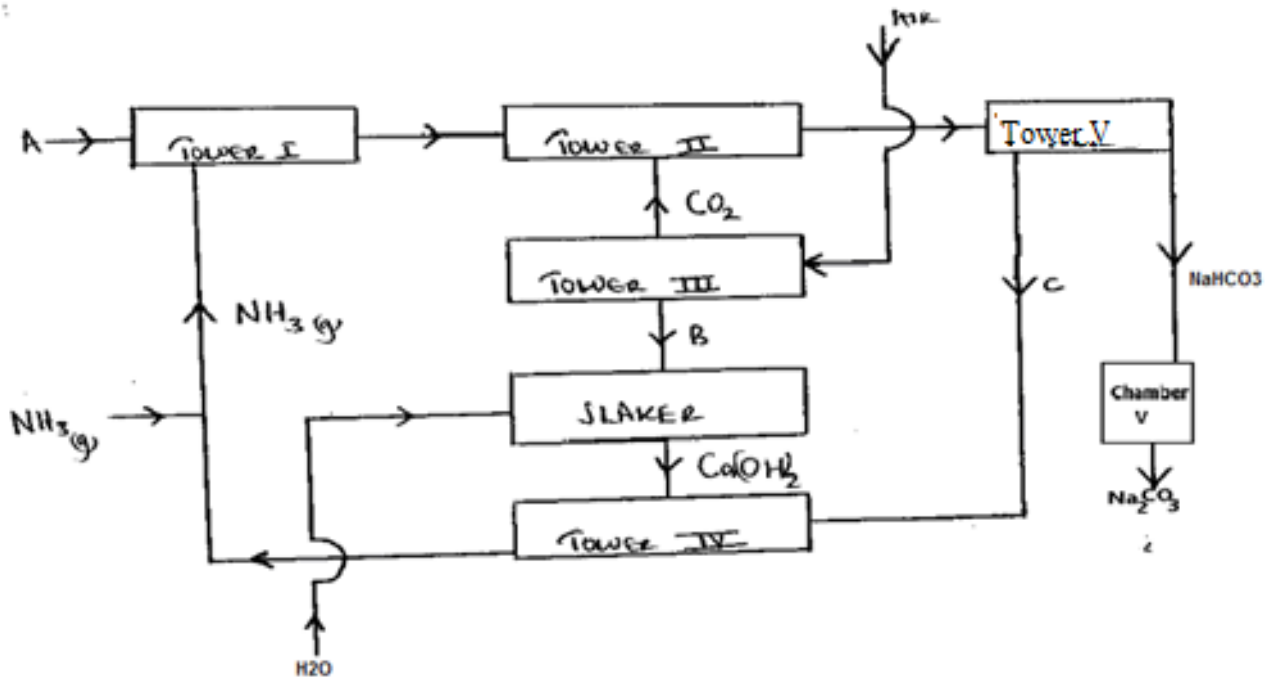
$$Cr_2O_7^{2-}{}_{(aq)} + 2OH^-{}_{(aq)} \rightleftharpoons CrO_4^{2-}{}_{(aq)} + H_2O_{(l}$$

(Orange) (Yellow)

a) What is meant by a dynamic equilibrium? **(1 mark)**

b) State and explain observation made when a few pellets of Potassium hydroxide are added to the equilibrium mixture. **(2 marks)**

12. The figure below shows some steps in the industrial preparation of sodium carbonate. Study it and answer the questions that follow.



(a)Identify substances labelled **B** and **C** **(1 mark)**

b) Name the method that is used to separate sodium hydrogen carbonate and ammonium chloride. **(1 mark)**

(c) Name the most suitable substance used in Tower III to produce Carbon (IV) oxide**.** **(1 mark)**

13.Calculate the relative formula mass of gas **A** given that the time taken for equal volumes of oxygen and gas **A** to diffuse through the same hole is 20 seconds and 24 seconds respectively (O=16.) **(2 marks)**

14. Propane gas was bubbled through bromine liquid in a boiling tube.

(a) State condition required for the reaction to occur. **(1 mark)**

(**b)**Name the type of the reaction above. **(1 mark)**

(c)State one observation made during the reaction. **(1 mark)**

15.Zinc metal and hydrochloric acid react according to the following equation.

$$Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2(aq)} + H_{2(g)}$$

2.0g of zinc were reacted with 100 cm^3 of 0.2M Hydrochloric acid,

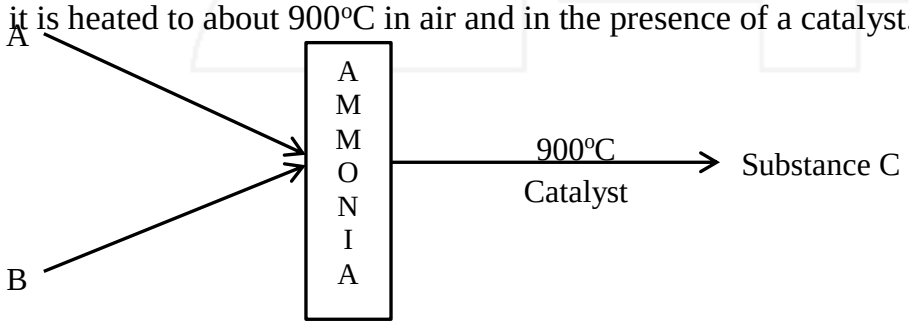
Determine the reagent that was in excess **(3 marks)**

16.a) What is meant by the term allotropy**?** **(1 mark)**

b) Which type of Sulphur is formed under the following conditions?

	Conditions	Type of Sulphur
(i)	Mixing sodium thiosulphate with dilute hydrochloric acid	(½ mark)
(ii)	Saturating distilled with Hydrogen sulphide then exposed to air	(½ mark)
(iii)	Pouring boiling Sulphur into cold water	(½ mark)
(iv)	Below 96^0C	(½ mark)

17. The flow chart below shows the process that can be used to obtain substance C from ammonia gas when it is heated to about 900°C in air and in the presence of a catalyst.



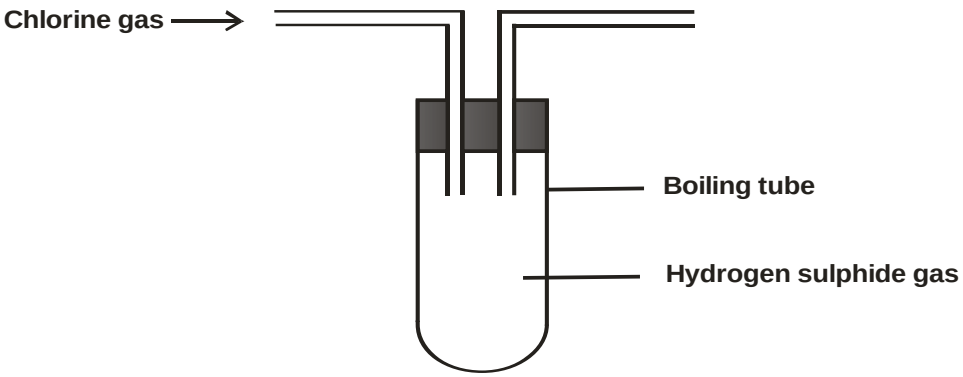
a) Ammonia is obtained on large scale by Haber process. Name the raw materials A and B.

(1 mark)

b) Name the substance C and the catalyst used. **(1 mark)**

c) Write an equation to show the product formed when C is cooled in the presence of air**. (1 mark)**

18. In an experiment, Chlorine gas was passed into moist hydrogen Sulphide gas as shown below



a) What observation was made in the boiling tube? **(1 mark)**

b) Write an equation for the reaction which took place. **(1 mark)**

c) What precaution should be taken in carrying out this experiment? Give a reason. **(1mark)**

19. In an experiment to investigate the enthalpy of displacement of copper(II) ions by Zinc,50cm^3 of copper(II) sulphate solution was placed in a plastic beaker. Excess zinc powder was then added into the beaker and allowed to react. After two minutes the highest change in temperature was noted to be 15 ^{o}C

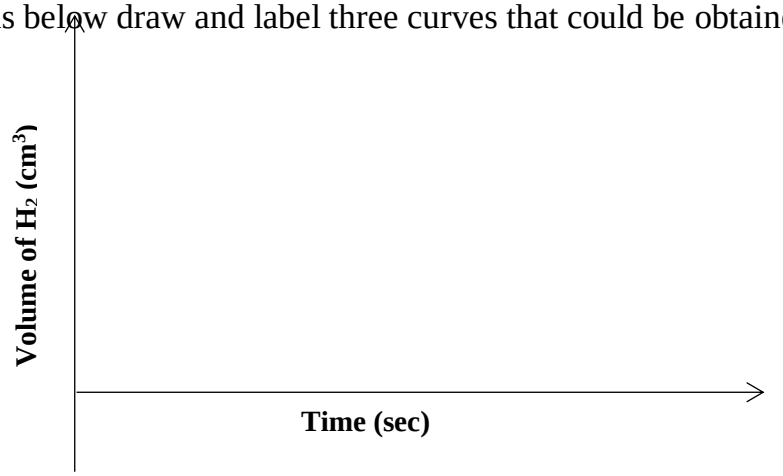
(a) Calculate the amount of heat given out during the reaction (C =4.2kJ/Kg/Density of solution = 1g/cm^3**)** **(1 mark)**

(b) Given that the molar heat of displacement of reaction is -63kJ/mol,calculate the concentration of copper(II)sulphate solution in moles/litre. **(2 marks)**

20. The table below gives three experiments on the reaction of excess hydrochloric acid and 1.5g of zinc done under different conditions. In each the volume of gas was recorded at different time internals

Experiment	Form of Zinc	Hydrochloric acid solution
I	Powder	1.5M
II	Granules	1.0 M
III	Powder	1.0 M

On the axis below draw and label three curves that could be obtained from such results.**(3 marks)**



21. An experiment was carried out where hydrogen chloride gas was bubbled through methylbenzene and water in separate beakers. The resulting solutions were tested with blue litmus papers and sodium carbonate

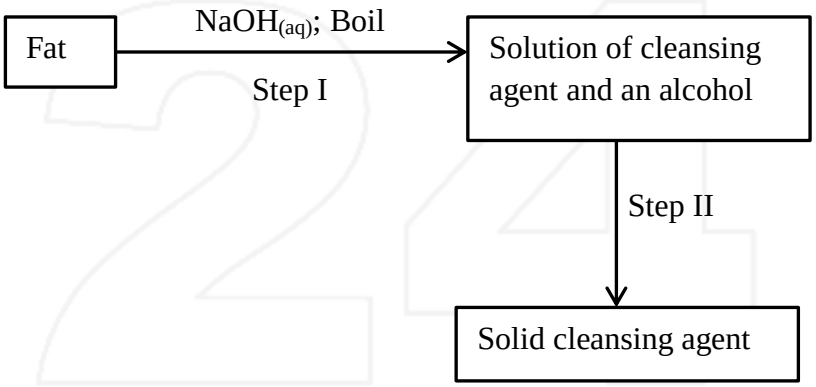
(i) Write the observations made in the following table **(2 marks)**

Solution of hydrogen Chloride gas in:	Blue litmus paper	Sodium carbonate
Water		
Methylbenzene		

(ii) Explain the observations in (i)above **(1 mark)**

22. An element **R** has a relative atomic mass of 88. When a current of 0.5 A were passed through the fused chloride for 32 minutes and 10 seconds, 0.44g were deposited at the cathode. Determine the charge on the ion of **R**. (1 Faraday= 96500 C) **(3 marks)**

23. The scheme below was used to prepare a cleansing agent. Study it and answer the questions that follow.



i) What name is given to the type of cleansing agent prepared by the method shown in the scheme? **(1 mark)**

ii) Name one chemical substance added in step II **(1 mark)**

iii) What is the purpose of adding the chemical substance named in (ii) above? **(1 mark)**

24. In the extraction of zinc, the zinc ore is crushed to a powder, mixed with oil and water and air blown through the mixture.

a) What is the name given to this process? **(1 mark)**

b) Explain how this process works. **(1mark)**

c) Name the chief ore from which zinc is extracted. **(1 mark)**

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

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

b). Given that polonium resulted from Bismuth (Bi) following emission of a beta (β) particle; write a nuclear equation for the decay. **(1 mark)**

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

26. (a) State the Hess's Law **(1 mark)**

(b) Calculate the molar enthalpy of formation of ethyne (C_2H_2) given the following. **(2 marks)**

$C_2H_2 + {}^5/_2O_{2(g)} \rightarrow 2CO_{2(g)} + H_2O_{(l)}$ $\Delta H = -1300kJ/mol$

$C_{(S)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H = -394kJ/mol$

$H_{2(g)} + {}^1/_2O_{2(g)} \rightarrow H_2O_{(l)}$ $\Delta H = -286kJ/mol$

27 (a) Using the oxidation number, identify and explain oxidizing and reducing agent **(2 marks)**

$2\ H_2S_{(g)} + SO_{2(g)} \rightarrow 3S_{(s)} + 2H_2O_{(l)}$

(b) Atomic number of Sulphur is 16. Write the electron configuration of S in SO_3^{2-} **(1 mark)**

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 1)

CHEMISTRY

233/2

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

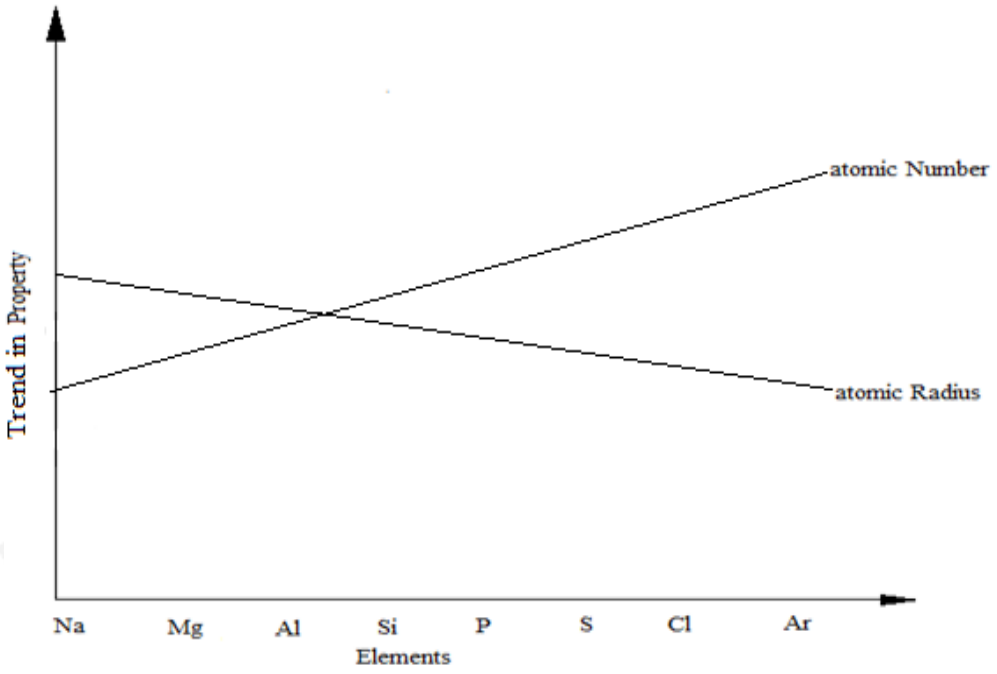
INSTRUCTIONS TO CANDIDATES

1. *Write your name, class and admission number in the spaces provided above.*
2. *Answer all the questions in the spaces provided in the questions paper.*
3. *Mathematical tables and silent electronic calculators may be used.*
4. *All working must be shown where necessary.*

For Examiners Use Only

Question	Maximum score	Candidates score
1	10	
2	11	
3	14	
4	10	
5	12	
6	11	
7	12	
TOTAL	80	

1. The figure below represents trends of some properties of period three elements. Study it answer the questions that follow.



a). Explain the trends shown by the atomic numbers and the atomic radii

i). Atomic number **(1 mark)**

ii). Atomic radii **(2 marks)**

b). On the same axes, sketch the trend of reactivity across the period **(1mark)**

c). Write down the electronic configuration of phosphorous and sulphur in the following compounds

i). H_3PO_4 (P=15) **(1 mark)**

ii). $Na_2S_2O_3$ (S=16) **(1 mark)**

d). i). One of the elements given in the figure above is stored under water.

Identify the element and give a reason as to why it is stored under water **(1 mark)**

ii). State **one** use of aluminium that can be associated with its malleability. **(1mark)**

e). Explain the observation that would be made if the chloride of Phosphorous is exposed to moist air.

(2 marks)

2.a). Sulphur is extracted from sulphur beds below the earth's surface. Super-heated water is pumped down a pipe into the sulphur beds.

i. What is super-heated water and how is it obtained**?** **(2marks)**

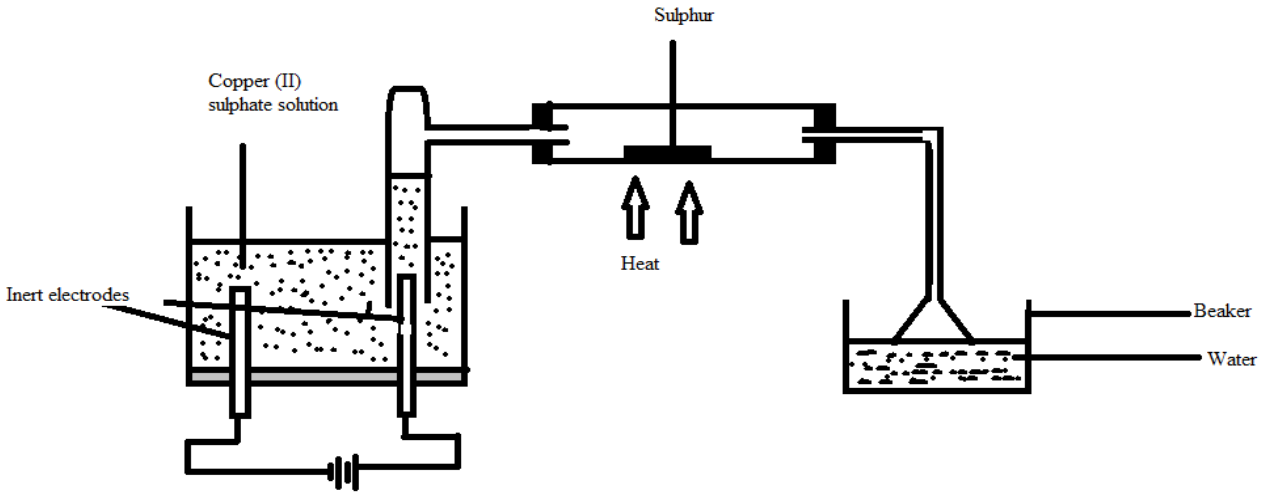
ii. Why does the water used here have to be **superheated**, and **not use boiling** water? **(1mark)**

iii. When molten sulphur is pumped to the surface, it solidifies. Which allotrope of sulphur forms first**?**

(1mark)

iv. Name the form of sulphur obtained when liquid sulphur is poured into a beaker of cold water **(1mark)**

b) The diagram below represents a set up that can be used for electrolysis of aqueous copper (II) sulphate. Use it to answer the questions that follow.



i. What do you understand by the term inert electrode? **(1mark)**

ii. What is the purpose of the filter funnel**?** **(1mark)**

iii. Explain what happens to the pH of the:

I. Water in the beaker**.** **(1mark)**

II. Copper (II) sulphate **solution** **(1mark)**

iv. Write ionic equation for the:

I. Oxidation **reaction** **(1mark)**

II. Reduction reaction, in above set up. **(1mark)**

3. a).(i) Define the term 'molar enthalpy of formation of a compound; **(1mark)**

(ii) Calculate the molar enthalpy of formation of ethane using the following information:

(3marks)

$C_2H_{6(g)} + \frac{7}{2}O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{(l)}$, $\Delta H_f^{\ominus} = -1561$ kJ/mole

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$, $\Delta H_f^{\ominus} = -394$ kJ/mole

$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)}$, $\Delta H_f^{\ominus} = -286$ kJ/mole

b) Study the reactions below and answer the questions that follow:

$NaCl_{(s)} \xrightarrow{\Delta H_1} Na^+_{(g)} + Cl^-_{(g)}$ $\Delta H = +776$kJ/mole

$Na^+_{(g)} \xrightarrow{\Delta H_2} Na^+_{(aq)}$ $\Delta H = -402$kJ/mole

$Cl^-_{(g)} \xrightarrow{\Delta H_3} Cl^-_{(aq)}$ $\Delta H = -371$kJ/mole

$NaCl_{(s)} \xrightarrow{\Delta H_4} NaCl_{(aq)}$

I. State the name given to :

a) ΔH_1 **…….(1mark)**

b) ΔH_2 **……(1mark)**

II. Draw an energy cycle diagram illustrating the reactions above. **(2marks)**

III. Determine the value of H_4 **(2marks)**

IV. Joy placed $100cm^3$ of 0.1M $CuSO_{4(aq)}$ in a plastic beaker , covered it with some cotton wool and recorded its initial temperature. She then added excess zinc powder to the solution and stirred it using a stirrer. She noted down the following data:

Initial temperature 20.5^oC

Final temperature 30.0^oC

Density of solution $1.0g/cm^3$

Specific heat capacity of water 4200J/kg/k

i. Apart from the temperature rise, state one other observation made while she was stirring. **(1mark)**

ii. Calculate the heat change for the reaction **above** **(1mark)**

iii. Determine the number of moles of ions of copper reacting **(1mark)**

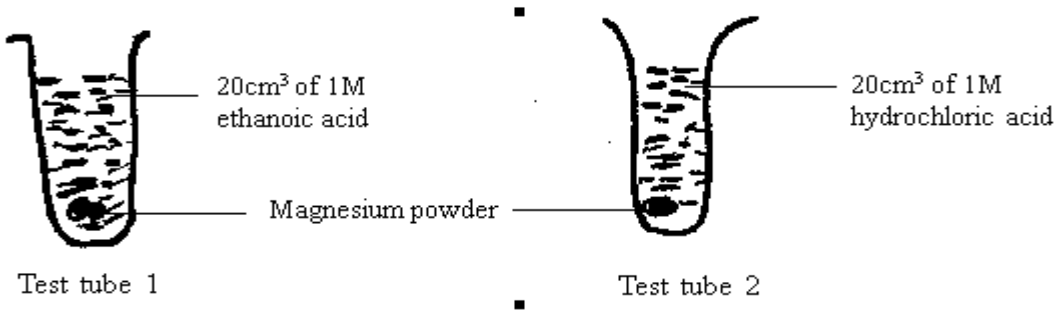
iv. Hence, determine the molar enthalpy of the reaction**.** **(1mark)**

4.a) An experiment was set up to investigate the effect of temperature on the rate of reaction between 1.0g calcium carbonate and excess hydrochloric acid. The temperature was varied from15^0C, 20^0C and 25^0C; and data obtained for the 3 sets of reagents.

i) Sketch a graph of volume of carbon (IV) oxide gas produced against time for each temperature on the axes below. Label each graph with corresponding temperature. Consider all gas volumes measured at same temperature and pressure. **(2 marks)**

ii) Explain the shape of graphs you've drawn in (a) above. **(2marks)**

b) In an experiment, equal amounts of magnesium powder were placed into test tube 1 and 2 as shown below.



i) Explain why the magnesium powder in test tube 2 gets used up faster than that in test tube 1.

(3 marks)

ii) Other than concentration, state one factor that affects the rate of a reaction. **(1 mark)**

c) Consider the equilibrium of the reaction below

$$A_{(g)} + B_{(g)} \rightleftharpoons D_{(I)} + E_{(g)}; \text{ DH = -ve.}$$

In which direction will the equilibrium position shift as a result of each of the following changes? Explain.

i) Raising the temperature **(1 mark)**

ii) Reducing the volume of the container. **(1mark)**

5. (a) Work out the oxidation number of nitrogen in NO_3^- ? **(1 mark)**

(b) Study the standard electrode potentials below and answer the questions that follow. (The letters do not represent the actual symbols of the elements.

$A^+_{(aq)} + e^- \rightarrow A_{(s)} \quad E^\vartheta = -2.92V$

$B^+_{(aq)} + e^- \rightarrow B_{(s)} \quad E^\vartheta = +0.52V$

$C^+_{(aq)} + e^- \rightarrow \frac{1}{2}C_{2(g)} \quad E^\vartheta = 0.00V$

$\frac{1}{2}D_{2(g)} + e^- \rightarrow D^-_{(aq)} \quad E^\vartheta = +1.36V$

$E^{2+}_{(aq)} + 2e^- \rightarrow E_{(s)} \quad E^\vartheta = -0.44V$

(i) With reasons, identify the;

I Strongest reducing agent. **(1 mark)**

II the reference electrode. **(1 mark)**

(ii) Write the overall equation for the reaction that will be obtained when half cells of B and E are connected. **(1 mark)**

(iv) Explain whether the reaction represented below can take place. **(2 marks)**

$$2A^+_{(aq)} + E_{(s)} \rightarrow 2A_{(s)} + E^{2+}_{(aq)}$$

(v) Draw the cell diagram obtained when the half cells in (ii) are combined. **(2 marks)**

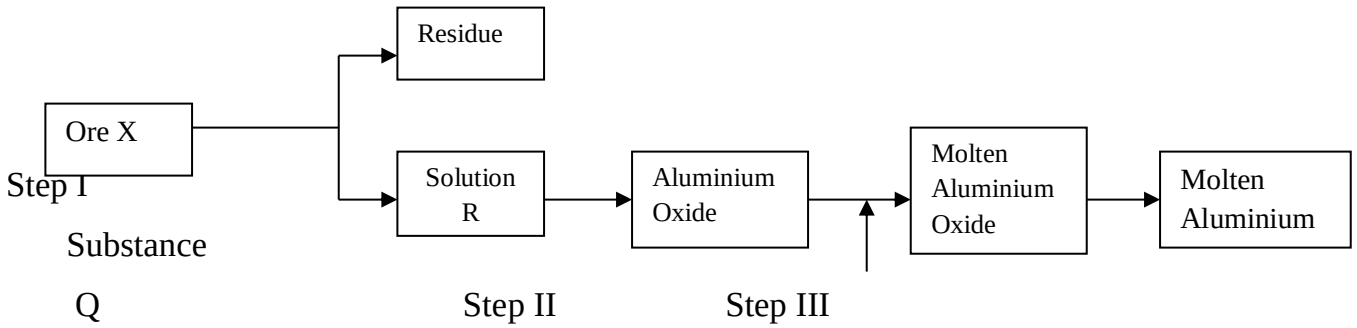
(c) In an experiment to electroplate a copper spoon with silver, a current of 0.5A was passed for 18 minutes.

(i) Sketch a diagram to show how the experiment was carried out. **(2 marks)**

(ii) Calculate the amount of silver deposited on the spoon.

(IF = 96500C, Ag = 108) **(2 marks)**

6. The process of extraction of Aluminium is summarized as below:



(a) (i) Write the formula of the main Ore X which is used in extraction of Aluminium. **(1 mark)**

(ii) Name:

(a) The main residue formed after filtration in step I. **(1 mark)**

(b) Substance Q. **(1 mark)**

(iii) How is the sodium Aluminate in Solution R separated from the impurity silicon (iv) oxide. **(2 marks)**

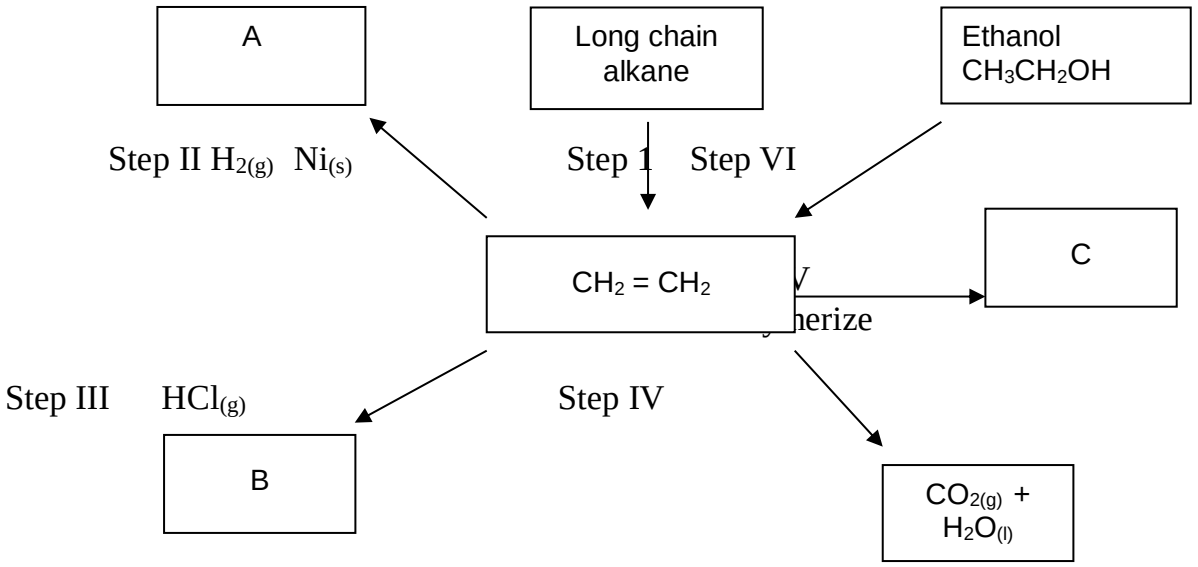
(iv) What is the purpose of addition of substance S in step III. Explain. **(2 marks)**

(b) (i)Explain why the Anode in extraction of Aluminium is replaced periodically **(2 marks)**

(ii) Write an equation for the formation of Aluminium at the cathode. **(1 mark)**

(c) Explain why Duralum an alloy of Aluminium is used in construction of aircraft parts and car window frames. **(1 mark)**

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



(i) Name the process taking place in step (I). **(1mark)**

(ii) Describe a chemical test that can be carried out to show the identity of organic compound A. **(2marks)**

(iii) Give the name of the following: **(2marks)**

I. A:……

II. B:……

(iv) Give the structural formulae of substance C. **(1mark)**

(v) Name the type of reaction that occurs in:

I. Step IV **(2marks)**

II. Step VI:

(vi) Give the reagent and the condition necessary for step VI. **(2marks)**

Reagent:**……**

Condition:**……**

(b) Give the systematic names of the following compounds:

I. $CH_2CHCHCH_2CH_3$ **(1mark)**

II. CH C CH_3 **(1mark)**

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 2)

CHEMISTRY

233/1

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

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

FOR EXAMINER'S USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1-26	80	

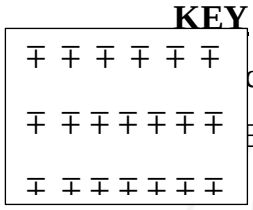
Answer all the questions in the spaces provided.

1(a) State the condition under which a Bunsen burner produces a non-luminous flame. **(1mk)**

(b) Write an equation for the reaction that takes place in a luminous flame assuming the laboratory gas is butane. **(1mk)**

(c) One of the regions in the non-luminous flame is the unburnt gas region. Describe how the presence of this region can be shown using a piece of paper. **(1mk)**

2. The diagram below is a section of a model of the structure of element T.



a) State the type of bonding that exist in T. **(1mk)**

b) In which group of the periodic table does element T belong? Give a reason. **(2mks)**

3. A radioactive isotope of lead undergoes radioactive decay in two stages as shown below:

$^{216}_{85}Pb \xrightarrow{\text{(i)}} {}^{212}_{83}X \xrightarrow{\text{(ii)}} {}^{212}_{84}Y$

(a) Identify the particle emitted at each stage. **(2mks)**

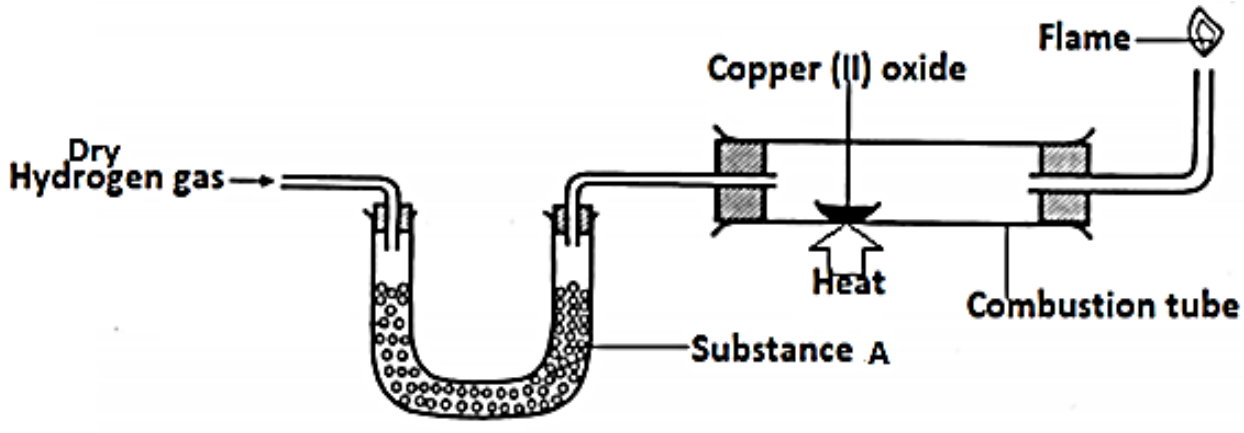
(b) State one use of radioactive isotopes. **(1mk)**

4(i) State the observations made when Hydrogen Sulphide gas is bubbled through aqueous Lead

(II) Nitrate solution. **(1mk)**

(ii) Write an ionic equation for the reaction above. **(1mk)**

5. The set up below was used to investigate the reaction between dry hydrogen gas and Copper (II) Oxide.

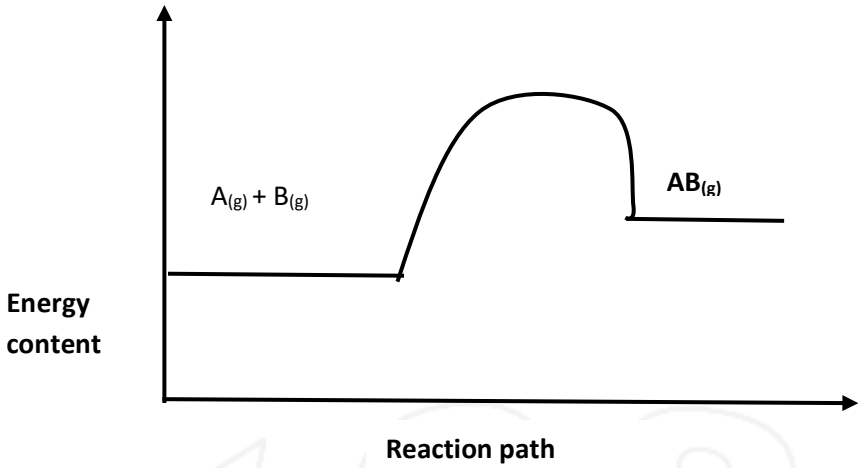


(a) Name substance A. **(1mk)**

(b) State the observation made in the combustion tube. **(1mk)**

(c) Explain the observation in (b) above. **(1mk)**

6(a) Consider the following equation.



On the same axis, sketch the graph when a catalyst is added. **(1mk)**

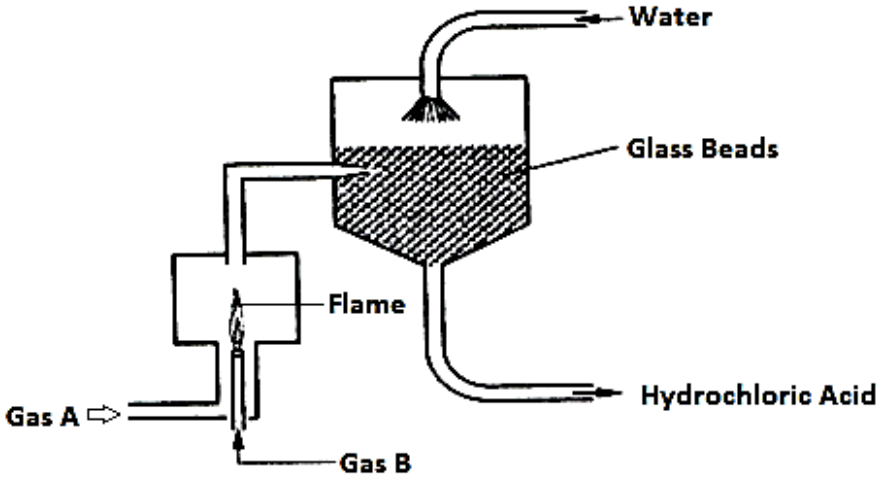


(b) Hydrazine H – N – N – H is used as a fuel in rockets. Using the bond energies in the table below. Calculate the enthalpy change for combustion of hydrazine. **(3mks)**

$N_2H_4(l) + O_2(g) \longrightarrow N_2(g) + 2H_2O(g)$

Bond	Bond energy kJ/mol
N – H	388
N – N	163
O = O	496
N ≡ N	944
O – H	463

7. The diagram below represents large scale manufacture of hydrochloric acid. Study it and answer the questions that follow:



(a) Identify

(i) Gas A **(1mk)**

(ii) Gas B **(1mk)**

(b) Write the chemical equation for the reaction between gas A and gas B. **(1mk)**

(c) State the role of glass beads in the process. **(1mk)**

8. Use the following information on substances S, T, V and Hydrogen to answer the question that follow.

(i) T displaces V from a solution containing V ions.

(ii) Hydrogen reacts with the heated oxide of S but has no effect on heated oxide of F.

a) Arrange substances S, T, V and Hydrogen in order of increasing reactivity. **(2mks)**

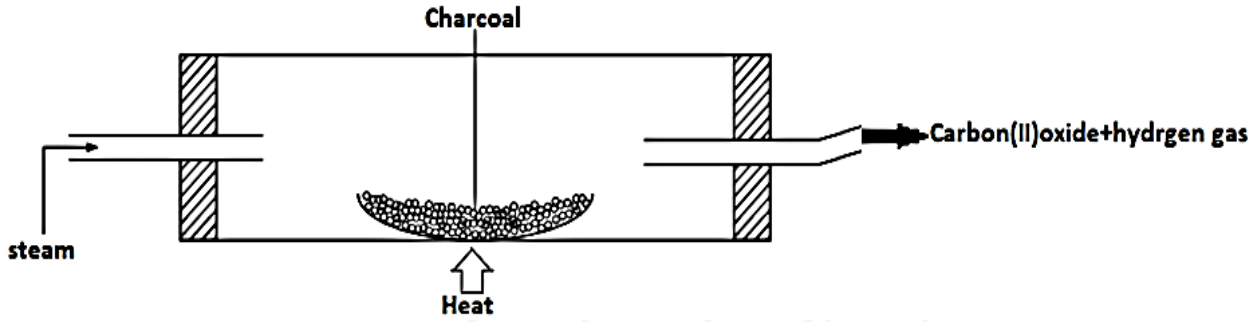
b) If T and V are divalent metals, write an ionic equation for the reaction in (i) above. **(1mk)**

9. Describe how the PH of anti-acid (Actal tablet) can be determined in the laboratory. **(3mks)**

10(a) A student electroplated a spoon with copper metal. Write an equation for the reaction at the cathode. **(1mk)**

(b) Calculate the time in minutes required to deposit 1.184 grams of Copper if a current of 2A was used. (1 Faraday = 96500 coulombs, Cu = 63.5) **(2mks)**

11. When steam was passed over heated charcoal as shown in the diagram below, hydrogen gas and Carbon (II) oxide were formed.



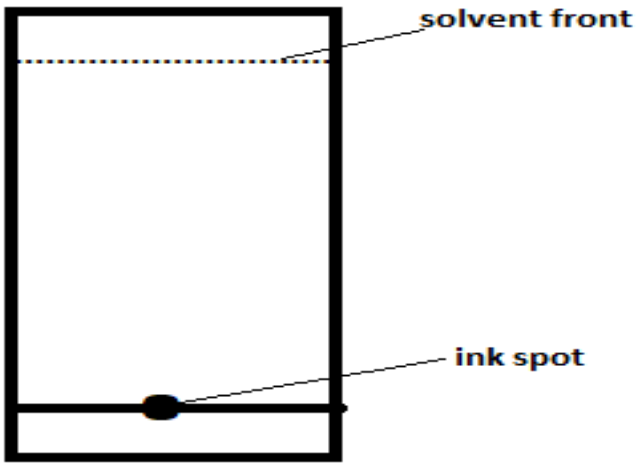
a) Write a balanced equation for the reaction which takes place in the combustion tube. **(1mk)**

b) Name two uses of Carbon (II) oxide gas, which are also the uses of hydrogen gas. **(2mks)**

12. A given sample of ink is a mixture of red dye, blue dye and orange dye. The blue dye is least absorbed than the rest and the red dye is the most sticky.

a) Complete the paper chromatogram below showing their separation.

(1½mks)

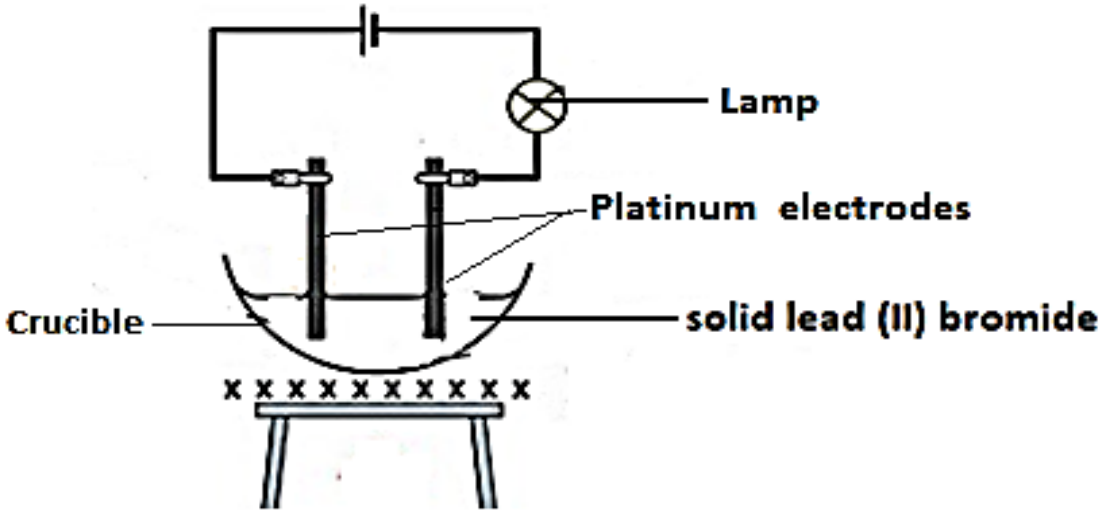


(b) The above dyes are soluble in water. Describe how a pure sample of blue dye can be obtained.

(1mk)

c) Name the solvent used in paper chromatography. **(½ mk)**

13. In an experiment to investigate the conductivity of substances, a student used the set up shown below.



The student noted that the bulb did not light.

a) What had been omitted in the set up. **(1mk)**

b) Explain why the bulb lights when the omission is corrected? **(2mks)**

14. The results of an experiment to determine the solubility of potassium chlorate in water at 30°C were as follows.

Mass of dish = 15.86g

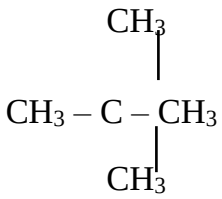
Mass of dish + saturated solution at 30°C = 26.8g

Mass of dish + solid chlorate after evaporation to dryness = 16.68g

Calculate the mass of saturated solution containing 60g of water at 30°C. **(3mks)**

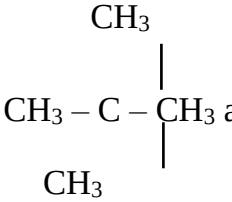
15(a) Give the systematic names of the following compounds. **(2mks)**

(i)



(ii) $CH_3C \equiv CCH_2CH_3$

(b) Describe a chemical test that can be carried out inorder to distinguish between.



and $CH_3C \equiv CCH_2CH_3$ **(2mks)**

16(a) Draw a labelled diagram showing the atomic structure of $^{23}_{11}Na$ **(2mks)**

(b) The atomic number of phosphorous is 15. Draw a dot (·) and cross (x) diagram for the compound formed when phosphorous react with chlorine. **(1mk)**

17(i) State Gay-Lussaic's Law. **(1mk)**

ii) $15cm^3$ of a gaseous hydrocarbon reacted completely with $45cm^3$ of Oxygen gas. $30cm^3$ of carbon (IV) oxide were formed. Determine the formula of the hydrocarbon given that all volume of gases were measured under same conditions of temperature and pressure. **(2mks)**

18. Consider the following reactions

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The enthalpy is -92.4kJ per mole of nitrogen.

a) Give the enthalpy change per mole of ammonia. **(1mk)**

b) State and explain how each of the following affects the yield of ammonia: **(2mks)**

(i) Increase in temperature. **(1mk)**

(ii) Finely divided iron. **(1mk)**

19. Excess iron was allowed to rust in dm^3 of moist air remaining was measured at 1 atmospheric pressure each day. The results were as follows.

Day	0	1	3	4	5	6	7	8
Volume (cm^3)	2000	1900	1720	1660	1620	1600	1600	1600

(i) Write an equation for the formation of rust. **(1mk)**

(ii) On which day was the reaction complete. Explain. **(1mk)**

(iii) What is the percentage volume of oxygen in air. Show your working. **(1mk)**

20. Element P^{3+} and Q^{2-} belong to period three of the periodic table.

(i) Write the electronic arrangement of their atoms. **(2mks)**

ii) Write the formula of the compound formed by P and Q. **(1mk)**

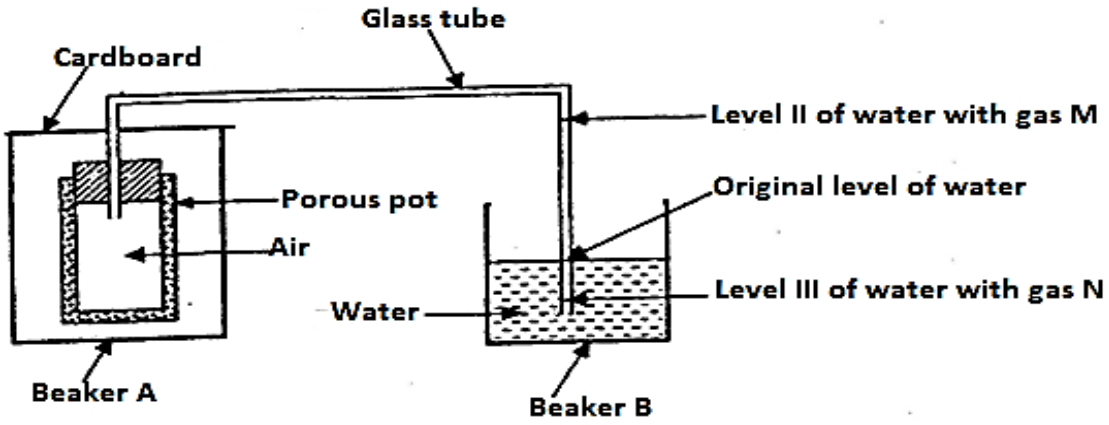
21(i) Give the IUPAC name of the following:

$CH_3CH_2COOCH_2CH_3$ **(1mk)**

ii) Give the chemical name to which the compound you have named in (i) above belongs. **(1mk)**

iii) Name the two substances used in the formation of the compound in (i) above. **(1mk)**

22. The set up below was used to investigate some properties of two gases M and N.



When beaker A was filled with gas M, the level of water in the glass tube rose to point II. When the experiment was repeated using gas M, the level of water dropped to point III. Explain these observations. **(2mks)**

23. Nitric (V) acid may be prepared in the laboratory by the action of concentrated sulphuric (VI) acid on a suitable nitrate and distilling off the nitric V acid.

(a) Why is the apparatus used in the preparation of nitric (V) acid made of glass. **(1mk)**

(b) Pure nitric (V) acid is colourless but the products in the laboratory preparation is usually yellow. Explain. **(2mks)**

24.Starting with copper metal, describe how a pure sample of Copper (II) carbonate can be prepared. **(3mks)**

25. Aluminum is both malleable and ductile.

(a) Differentiate between malleable and ductile. **(2mks)**

(b) State one use of aluminium based on:

(i) Malleability **(1mk)**

(ii) Ductility **(1mk)**

26. Sulphur (IV) oxide and nitrogen (IV) oxide reacts as shown in the equation below.

$$SO_2(g) + NO_2(g) \longrightarrow SO_3(g) + NO(g)$$

(i) Using the oxidation numbers of either sulphur or nitrogen, show that this is redox reaction. **(2mks)**

(ii) Identify the reducing agent. **(1mk)**

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 2)

CHEMISTRY

233/2

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- *-Write your name, class and admission number in the spaces provided above.*
- *-Answer all questions in the spaces provided.*
- *-This paper consists of Question 1 to 7*
- *-Students should check the question paper to ascertain that all the pages are printed as indicated and no questions are missing.*

FOR EXAMINER'S USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	12	
2	12	
3	13	
4	11	
5	11	
6	11	
7	10	
TOTAL	80	

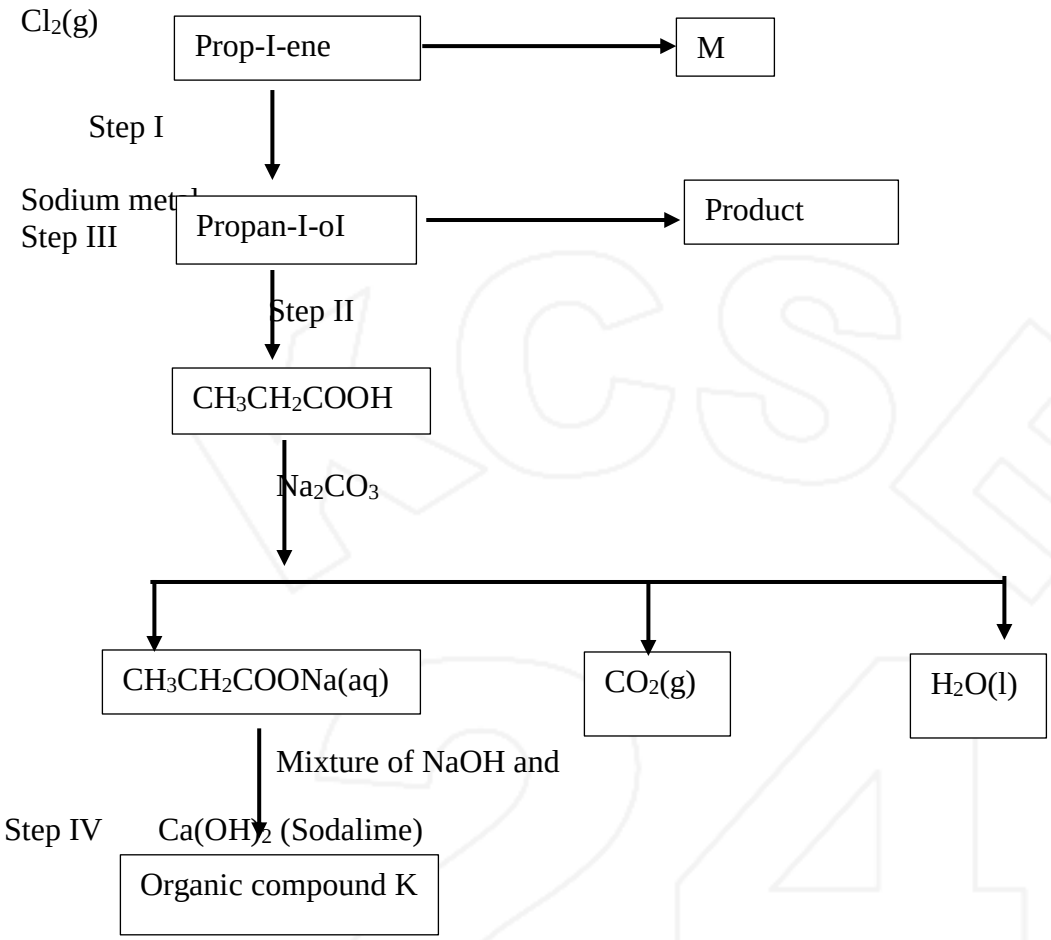
Answer all questions in the spaces provided.

1(a) Draw the structures of the following compounds. **(2mks)**

(i) 2-methylbut-2-ene

(ii) Heptanoic acid

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



(i) Identify the organic compound K. **(1mk)**

(ii) Write the formula of M. **(1mk)**

(iii) Give one reagent that can be used in:

Step I **(1mk)**

Step II **(1mk)**

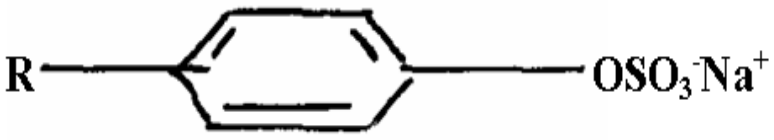
(iv) Write the equation of the reaction in Step III. **(1mk)**

(c) Name the process that occurs in: **(2mks)**

Step II

Step IV

(d) The structure below represents a type of cleansing agent



Describe how the cleansing agent removes grease from a piece of cloth. **(3mks)**

2. Below is part of the periodic table. The letters are not the actual symbols of the elements. Study it and answer the questions that follow.

								Q
C	**E**		**G**			**L**	**N**	
D	**F**							

a(i) State and explain the differences in the melting point of D and F. **(2mks)**

(ii) Explain the difference in the atomic radii of G and N. **(2mks)**

(iii) Select the element that is the strongest reducing agent. Explain. **(2mks)**

(iv) Compare the nature of the aqueous solution of the oxide of C and that of L. Explain. **(2mks)**

(b) Study the table below and answer the questions that follows:

Substance	**MP(k)**	**BP (k)**	**Electrical conductivity**	
			Solid	**Molten**
J	365	463	NIL	NIL
K	1323	2773	Good	Good
L	1046	1680	NIL	Good
M	2156	2776	NIL	NIL

(c) Which of the substance J, K, L and M represents the following:

(i) Silicon (IV) Oxide **(1mk)**

(ii) Barium Sulphate **(1mk)**

a) In terms of structure and bonding, explain why Silicon (IV) Chloride ($SiCl_4$) is a liquid at room temperature while Magnesium chloride ($MgCl_2$) is a solid. **(2mks)**

3(a(i) What is meant by the term 'Enthalpy of formation'. **(1mk)**

(ii) The enthalpies of combustion of Carbon, Methane and Hydrogen are indicated below:

$C(s) + O_2(g) \longrightarrow CO_2(g)$; $\Delta H = -393 kJmol^{-1}$

$H_2(g) + ½ O_2(g) \longrightarrow H_2O(l)$; $\Delta H = -286 kJmol^{-1}$

Enthalpy of combustion of CH4 = -890kJ/mol.

I Draw an energy cycle diagram that links the enthalpy of formation of methane to enthalpies of combustion of carbon, hydrogen and methane. **(2mks)**

II Determine the enthalpy of formation of methane. **(2mks)**

(b) An experiment was carried out where different volumes of dilute hydrochloric acid and aqueous sodium hydroxide both at 25°C were mixed and stirred with a thermometer. The highest temperature reached by each mixture was recorded in the table below.

Volume of Hydrochloric acid (cm^3)	5	10	15	20	25	30	35	40	45
Volume of sodium hydroxide (cm^3)	45	40	35	30	25	20	15	10	5
Highest temperature of mixture (°C)	27.2	29.4	31.6	33.8	33.6	31.8	30.0	28.4	26.6

(i) On the grid provided, plot a graph of highest temperature (vertical axis) against volume of hydrochloric acid (horizontal axis). **(3mks**

(ii) Using your graph, determine the

(a) Highest temperature reached. **(½mk)**

(b) Volume of acid and base reacting when highest temperature is reached. **(1mk)**

(iii) Calculate the amount of heat liberated during the neutralization process. (Specific heat capacity $4.2Jg^{-1}k^{-}$ and the density of solution is $1.0g/cm^3$. **(1½mks)**

(c) The molar enthalpy of neutralization between hydrochloric acid and ammonia solution was found to be $-52.2kJ/mol^{-}$, while that of hydrochloric acid and sodium hydroxide was $-57kJmol^{-1}$.

Explain the difference in these values. **(2mks)**

4(a) What is meant by rate of reaction. **(1mk)**

(b) In the space provided sketch the diagram of a set-up that can be used to determine the rate of reaction between manganese (IV) oxide and hydrogen peroxide. **(3mks)**

(c) A state of equilibrium between dichromate ions is established as shown below:

$Cr_2O_7^{2-}(aq) + 2OH^- \rightleftharpoons 2CrO_4^{2-}(aq) + 4H_2O(l)$

Orange Yellow

(i) What is meant by dynamic equilibrium. **(1mk)**

(ii) State and explain observation made, when a few drops of hydrochloric acid are added to the equilibrium mixture. **(2mks)**

(d) Some plants have seeds that contain vegetable oil.

(i) Describe how the oil can be obtained from the seeds. **(3mks)**

(ii) Explain how it could be confirmed that the liquid obtained from the seeds in oil. **(1mk)**

5. Use the standard electrode potential given below to answer the questions that follows:

Half reaction	**E^{θ} volts**
$Zn2+(aq) + 2e- \longrightarrow Zn_{(s)}$	-0.76
$Pb^{2+}_{(aq)} + 2e^- \longrightarrow Pb_{(s)}$	-0.13
$Ag^+_{(aq)} + e^- \longrightarrow Ag_{(s)}$	+0.80
$Cu^{2+}_{(aq)} + 2e^- \longrightarrow Cu_{(s)}$	+0.34

(a)(i) Choose a pair that will form a cell with the higher E^{θ} value. **(1mk)**

ii) Draw a diagram to represent the cell formed by the pair in (i) above **(3mks)**

(iii) Give a cell representation for the cell in (I) above **(1mk)**

(iv) State two functions of the salt – bridge. **(2mk)**

b(i) Using a well labelled diagram, explain how an iron spoon can be electroplated with silver. **(2mks)**

ii) 2.34g of metal Q were deposited when a current of 4.0 amperes was passed through a salt of Q for 30 minutes. (RAM of Q = 65, 1 Faraday = 96,500C) calculate the amount of electricity in coulomb:

(I) Used to deposit 2.34g of metal Q. **(1mk)**

(II) Needed to deposit one mole of Q. **(1mk)**

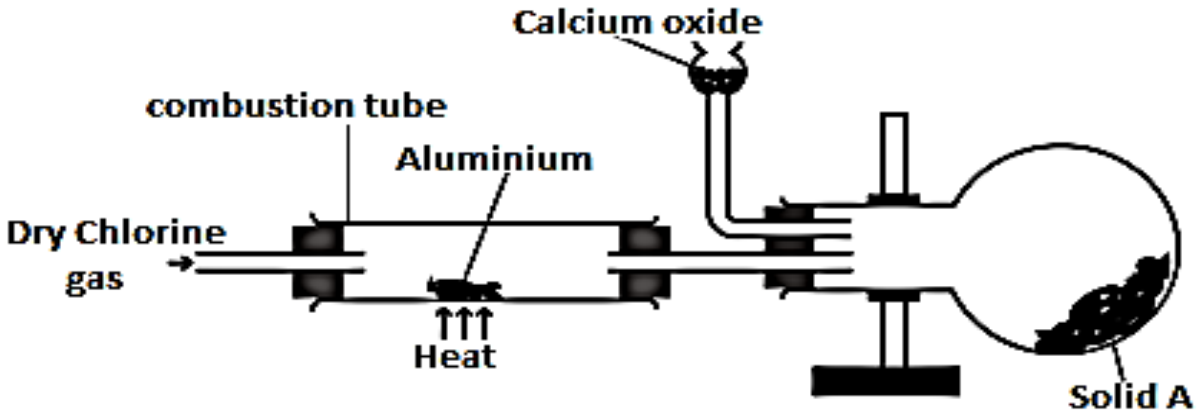
6(a) Two reagents that can be used to prepare chlorine gas are Manganese (IV) oxide and concentrated hydrochloric acid.

(i) Write an equation for reaction. **(1mk)**

(ii) Give the formula of another reagent that can be reacted with concentrated hydrochloric acid to produce chlorine gas. **(1mk)**

(iii) Describe how the chlorine gas would be dried in the laboratory. **(2mks)**

(b) In an experiment, dry chlorine gas was reacted with aluminium as shown in figure below



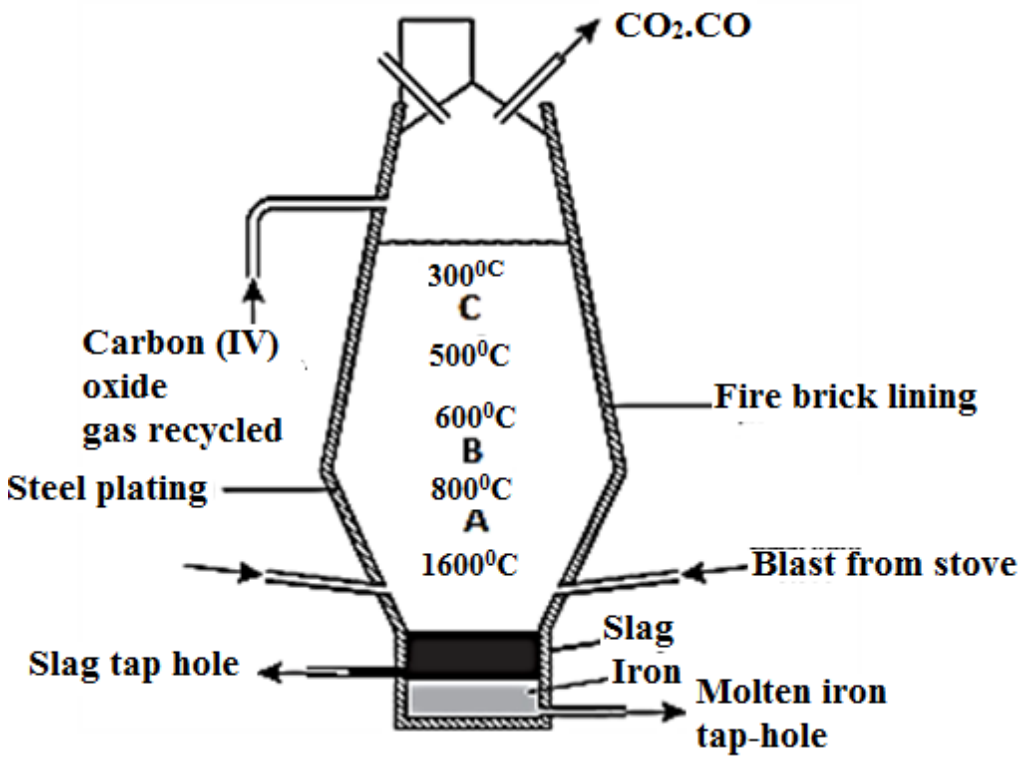
(i) Name substance A. **(1mk)**

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

(iii) 0.84g of aluminium reacted completely with chlorine gas. Calculate the volume of chlorine gas used (Molar gas volume is $24dm^3$ Al=27) **(3mks)**

(iv) Give two reasons why Calcium oxide is used in the set up. **(2mks)**

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) The chief ore is Hamematite. Name one other ore used in extraction iron. **(1mk)**

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

iii) What is the role of the hot air blast in the process. **(1mk)**

(b) Write equations for the reaction that took place of the region marked A, B and C. **(3mks)**

A ……

B ……

C ……

(c) What is the purpose of limestone in the extraction process. **(1mk)**

(d) Write equations to show how impurities are removed from the ore. **(2mks)**

(e) State one environmental effect of the process. **(1mk)**

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 3)

CHEMISTRY

233/1

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

(a) *Write your* ***name*** *and* ***index number*** *in the spaces provided above.*

(b) *Sign and write the date of the examination in the spaces provided above.*

(c) *Answer all the questions in the spaces provided in the question paper.*

(d) ***Non-programmable*** *silent electronic calculators and* ***KNEC*** *mathematical tables may be used.*

(e) *All working must be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-27	80	

Answer all the questions in the spaces provided

1. a) Name the laboratory apparatus below ; **(1 mark)**

A **B**



A…… **B** ……

b) Which laboratory apparatus is used to keep substances free from moisture? **(1 mark)**

2. Describe how to experimentally separate a mixture of Iron (III) chloride and sodium chloride in the laboratory. **(2 marks)**

3. An ion of element Q has 18 electrons,16 neutrons and 15 protons;

a) Write the electron arrangement of an atom of element Q**.** **(1 mark)**

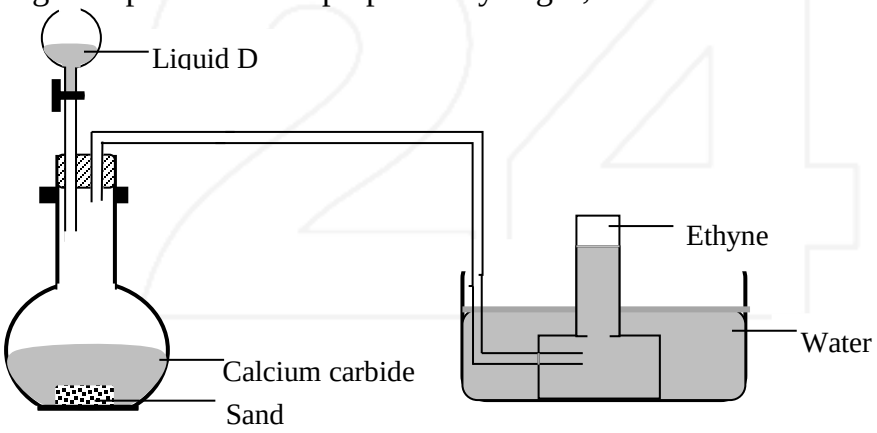
b) What is the mass number of element Q. **(1 mark)**

c) State the period and group of the periodic table where element Q is found**.** **(1 mark)**

Period……

Group……

4. The following set-up was used to prepare ethyne gas;



a) Identify liquid D. **(1 mark)**

b) Write the equation for the reaction in the flask. **(1 mark)**

c) State and explain one precaution to be taken when performing the experiment**.** **(1 mark)**

5. A saturated solution of a salt X at 25^0C weighing 56g yielding 14g of solid when evaporated to dryness.

a) Give one precaution to be taken when performing the experiment**.** **(1 mark)**

b) What is the solubility of the salt at 25^0C **?** **(2 marks)**

6. a)Use the equation below to answer the question that follow;

$$NH_3(g) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

Identify the species that acts as a base and give a reason**.** **(1 mark)**

b) Study the flow chart below carefully.

White precipitat → *Step 1* / Excess → Colourless solution A → $Na_2CO_3(aq)$ / Step II → White precipitat → Heat / Step III → Yellow solid

i) Identify the cation in solution A**.** **(1 mark)**

ii) Write the ionic equation for the reaction in step II. **(1 mark)**

7. a) Some Agriculture students wanted to test the pH of the soil in the school farm. Describe how this can be done in the school's chemistry laboratory. **(2 marks)**

b) The pH of the soil from the school farm was found to be 4.5. What should be done to raise the pH of the soil to 8.0**?** **(1 mark)**

8. Given that:

$C(s) + O_2(g) \longrightarrow CO_2(g)$ $\Delta H = -393\ kJ\ mol^{-1}$
(Graphite)

$C(s) + O_2 \longrightarrow CO_2(g)$ $\Delta H = -395\ kJ\ mol^{-1}$
(Diamond)

a) Determine ΔH for : $C(s) \longrightarrow C(s)$ **(2 marks)**
(Graphite) (Diamond)

b) Represent the information above in an energy level diagram. **(2 marks)**

9. a) State Charles' law **(1 mark)**

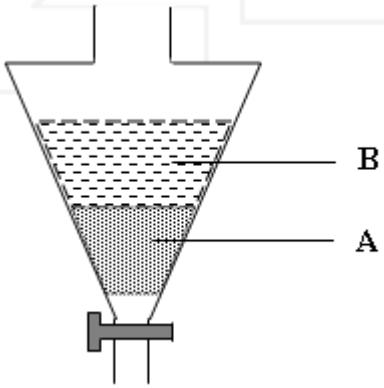
b) The volume of a certain gas was measured at 21^0C. At what temperature will the volume be doubled if pressure remains constant? **(2 marks)**

10.a) Name the chief ore of aluminium. **(1 mark)**

b) Give a reason why aluminium is extracted using electrolysis. **(1 mark)**

c) Give two uses of aluminium metal. **(1 mark)**

11. The figure below shows an apparatus used to separate a mixture of water and hexane



a) Name the apparatus. **(1 mark)**

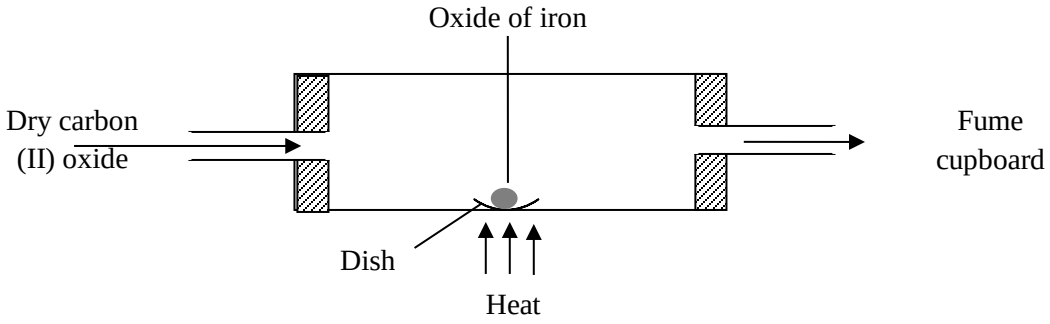
b) State the principle by which the mixture of the two liquids is separated. **(1 mark)**

c) Identify the liquids, A and B if the density of hexane is $0.66g/cm^3$. **(1 mark)**

A……

B……

12. Excess carbon (II) oxide was passed over a heated sample of an oxide of iron as shown in the diagram below. Study the diagram and use the data below to answer the questions that follow:

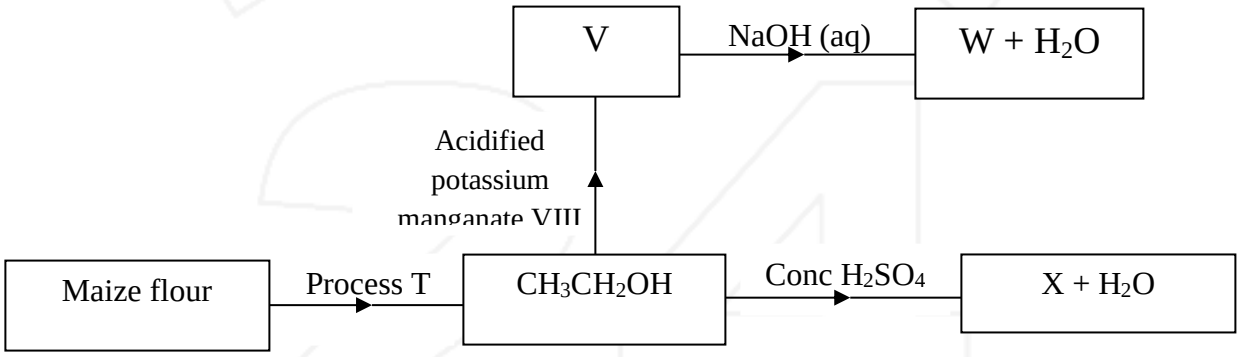


Mass of empty dish = 10.98g
Mass of empty dish and oxide of iron = 13.30g
Mass of empty dish and the residue = 12.66g

a) Determine the formula of the oxide of iron. (Fe = 56, O = 16) **(3 marks)**

b) Write an equation for the reaction which took place in the dish. **(1 mark)**

13. Study the flow chart below and use it to answer the questions that follow;



a) State two conditions required for process T**.** **(1 mark)**

b) Give the formula of **W** **(1 mark)**

c) State one use of X**.** **(1 mark)**

14. When a certain mass of calcium carbonate was reacted with 200cm^3 of 1M HCl, 1440cm^3 of carbon (IV) oxide was produced. Determine the mass of calcium carbonate.

(Ca = 40, C = 12, O = 16, Molar gas volume is 24000 cm^3) **(3 marks)**

15. If you are provided with powdered zinc, distilled water, dilute nitric (V) acid and sodium carbonate crystals; describe how a sample of pure zinc carbonate crystals can be prepared in the laboratory. **(3 marks)**

16. The reaction between nitrogen and hydrogen to manufacture ammonia is a reversible reaction;

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

How would the following changes affect the position of equilibrium?

a) Increase in temperature. **(1 mark)**

b) Increasing concentration of nitrogen gas. **(1 mark)**

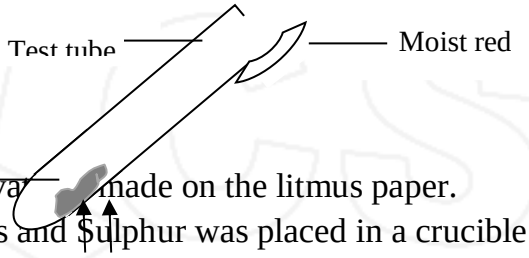
c) Introduction of finely divided Iron catalyst**.** **(1 mark)**

17. A student investigated the effect of electric current on substances by passing current through copper sulphate solution using copper electrodes.

a) State two observations made during the experiment. **(2 marks)**

b) Write the equation for the reaction at the anode . **(1 mark)**

18. The diagram below shows the heating of ammonium chloride in a test tube until there is no further change;



State and observation made on the litmus paper. **(2 marks)**

19. A mixture of iron filings and sulphur was placed in a crucible and heated strongly.

a) Explain the following observations which were made;

i) The mixture continued to glow red even when heating was stopped**.** **(1 mark)**

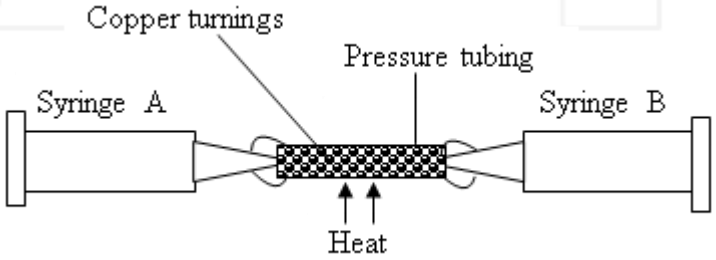
ii) The black solid produced was not attracted by a magnet. **(1 mark)**

b) Write the equation for the reaction which took place. **(1 mark)**

20. A sample of water is suspected to contain chloride ions. Describe an experiment that can be carried out to determine the presence of chloride ions. **(2 marks)**

21. Draw a well labeled diagram to show how to prepare and collect hydrogen sulphide gas using Iron (II) sulphide solid. **(3 marks)**

22. The following set-up was used by Form one students to determine the percentage of oxygen in air. About 200cm^3 of air was passed repeatedly from syringe A to syringe B and back. After sometime, the volume of air was found to be 160 cm^3.



a) Calculate the percentage of oxygen in the initial sample of air**.** **(1 mark)**

b) Write the equation for the reaction that took place**.** **(1 mark)**

c) Why would Magnesium metal not be used in the experiment to replace the Copper metal**?(1 mrk)**

23.a) Define allotropy. **(1 mark)**

b) Name the two allotropes of Sulphur. **(1 mark)**

c) Calculate the oxidation number of Sulphur in H_2SO_3. **(1 mark)**

24. A pea-size of potassium metal is dropped in a trough containing ethanol;

a) State two observations made. **(1 mark)**

b) What is observed when blue litmus paper is dropped in the resultant solution **(1 mark)**

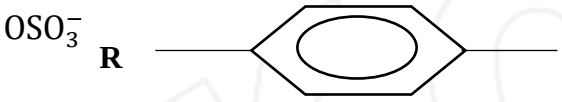
c) Write the equation for the reaction which takes place **(1 mark)**

25. Calculate the volume of gas collected at the anode when a current of 3 amperes is passed through dilute sulphuric (VI) acid solution for 45 minutes and 30 seconds.

(Molar gas volume at r.t.p = 24.0 dm^3, 1F = 96500 coulombs) **(3 marks)**

26. a) Identify the organic compounds below and state their uses; **(3 marks)**

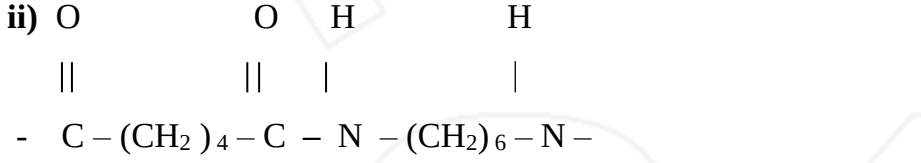
i)



Name **……**

Use **……**

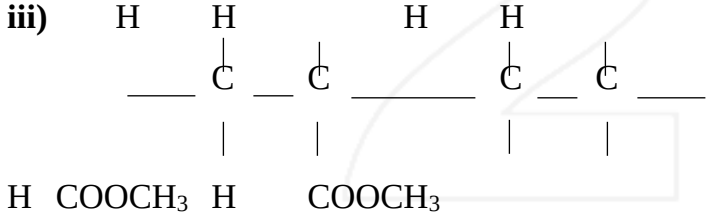
ii)



Name **……**

Use **……**

iii)



Name **……**

Use **……**

27.a) Define half-life. **(1 mark)**

b) It takes 20 days for a certain radioisotope to disintegrate from 400g to 25g. Determine the half-life of the radioisotope. **(2 marks)**

c) State one application of radioactivity in agriculture. **(1 mark)**

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 3)

CHEMISTRY

233/2

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES.

a) *Write your **name** and **index number** in the spaces provided.*
b) ***Sign** and write the **date** of examination in the spaces provided.*
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	14	
2	12	
3	11	
4	14	
5	09	
6	10	
7	10	
Total Score	80	

*Answer **ALL** the questions in the spaces provided.*

1. a) Name the process that takes place when:

i) Ethanol reacts with concentrated sulphuric (VI) acid at 180°C to form ethene. **(1 mark)**

ii) Ammonium chloride is heated and forms a white powder on the cooler parts of the boiling tube. **(1 mark)**

iii) Propanol reacts with propanoic acid is the presence of a catalyst to form propyl propanoate. **(1 mark)**

b) Give the systematic names of the following compounds : **(2 marks)**

i)

$$CH_2CCH_3$$
$$\quad\quad|$$
$$\quad CH_3$$

ii) $CH_3CH_2CH_2C \equiv CH$

c) State the observation made when propan-l-ol reacts with:

i) Acidified potassium dichromate (VI) solutions **(1 mark)**

ii) Sodium metal **(1 mark)**

d) Ethanol obtained from glucose can be converted to ethane as shown below;

$$C_6H_{12}O_6 \xrightarrow{\text{Step I}} C_2H_5OH \xrightarrow{\text{Step II}} CH_2 = CH_2$$

Name and describe the process that takes place in steps I and II **(3 marks)**

Step I

Step II

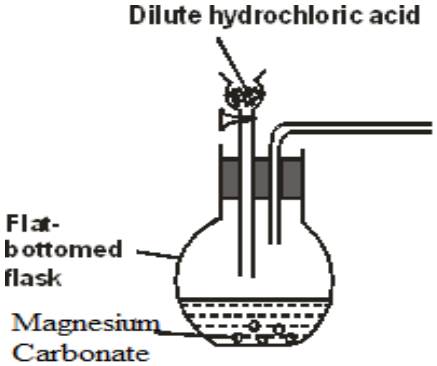
e) Compounds A and B have the same molecular formula $C_3H_6O_2$. Compound A liberates carbon (IV) oxide on addition of aqueous sodium carbonate while compound B does not. Compound B has a sweet smell. Draw the possible structures of:

i) Compounds A **(1 mark)**

ii) Compound B **(1 mark)**

f) Give **two** reasons why the disposal of polymers such as polychloroethene by burning pollutes the environment. **(2 marks)**

2. a) The following diagram represents an incomplete set-up of apparatus used to prepare and collect a dry sample of carbon (IV) oxide gas.



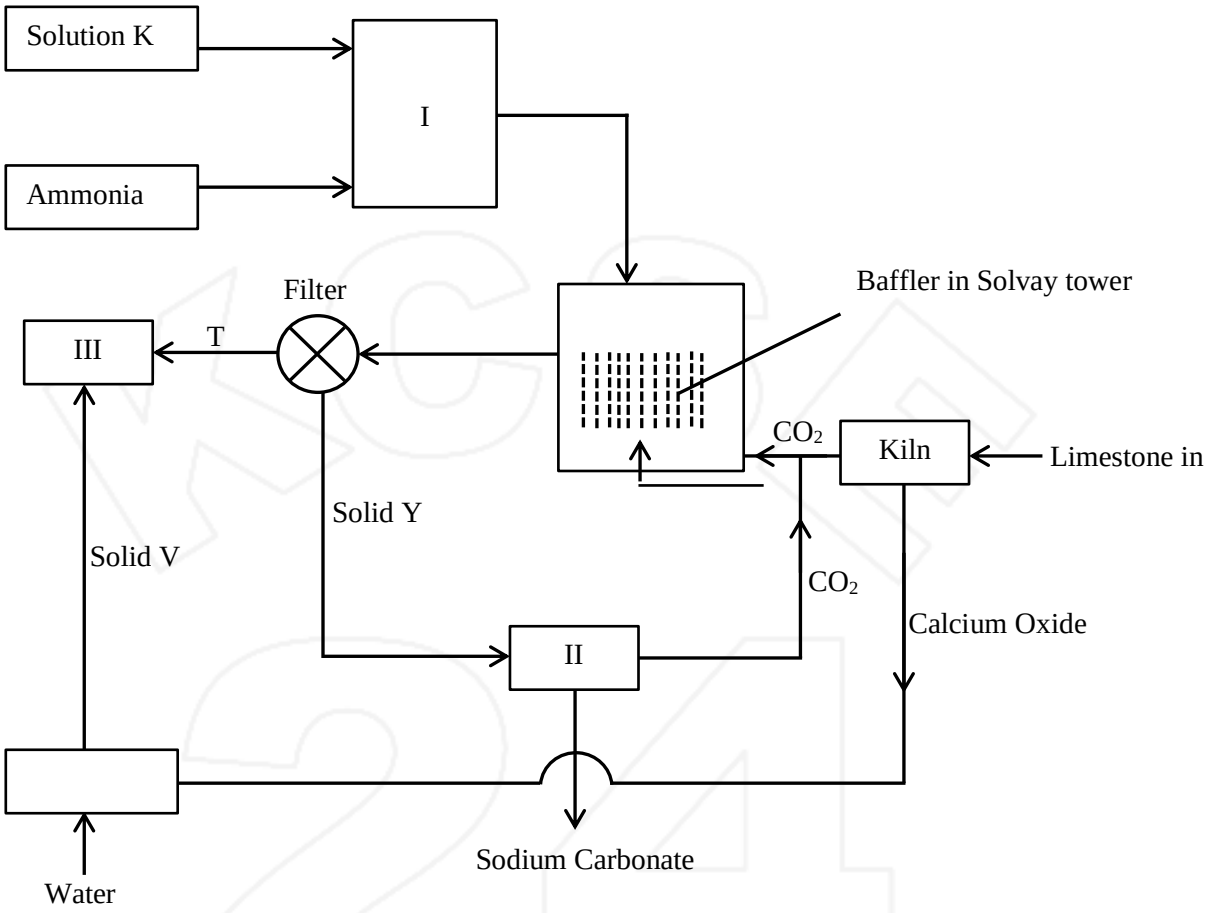
i) Complete the diagram to show how a dry sample of pure carbon (IV) oxide gas is collected. **(2 marks)**

ii) Write an equation for the reaction that takes place in the flat-bottomed flask. **(1 mark)**

iii) Why is it not suitable to use lead (II) carbonate in place of magnesium carbonate in this experiment? **(1 mark)**

iv) State **two** properties of carbon (IV) oxide that makes it suitable for use in fire extinguishers.**(2mk**

b) Study the flowchart below then answer the questions that follow.



i) Identify substances **K, T, V and Y.** **(2 marks)**

ii) Write an equation for the reaction that takes place in the Solvay tower. **(1 mark)**

c) **A** burning magnesium ribbon will continue to burn in a gas jar of carbon IV oxide while a burning wooden splint will be extinguished. Explain. **(3 marks)**

3. 140g of powdered brass (an alloy of Zinc and copper) were added to excess 0.5M hydrochloric acid in a conical flask placed on top of a pan balance. The changes in mass of the flask and its contents with time were recorded in the following table. This experiment was carried out at room temperature.

Time (in seconds)	0	10	20	30	40	50
Mass (mg) of flask and its contents.	255.0	253.0	251.9	251.2	251.0	251.0

a) Write an equation for the reaction that took place. **(1 mark)**

b) State and explain the relationship between the mass of the flask and its content with time.**(2 mks)**

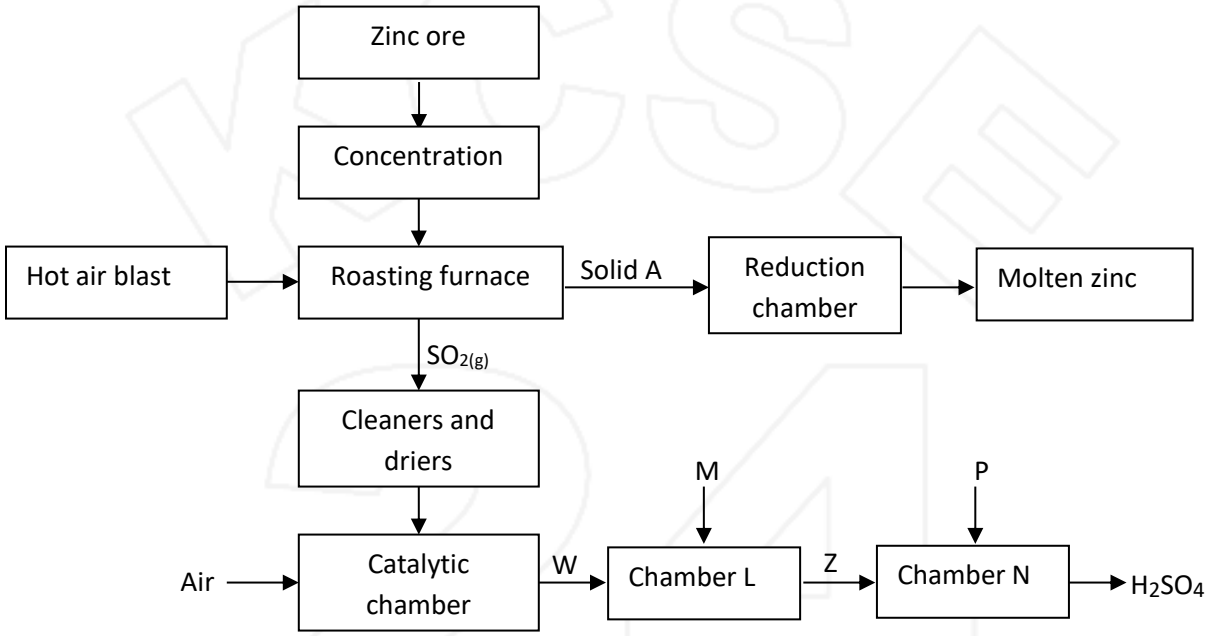
c) i) What observation was made in the flask at the end of the reaction? **(1 mark)**

d) i) Plot a graph of mass of the flask and its content against time. **(3 marks)**

ii) Using the graph, determine rate of the reaction at the 20th second. **(2 marks)**

iii) How would the rate in 4 (d) (ii) above be affected if the reaction was carried out using 0.5M hydrochloric acid at 45°C? Explain. **(2 marks)**

4. The chart below represents the extraction of zinc from its ore and a by-product used in the manufacture of sulphuric (VI) acid. Study it and use it to answer the questions that follow:-



a) Name;

(i) The zinc ore used. **(1 mark)**

(ii) The main impurity in the ore. **(1 mark)**

b) (i) Name the process by which zinc ore is concentrated. **(2 marks)**

(ii) State **one** use of Zinc metal **(1 mark)**

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

d) Describe what happens in the reduction chamber. **(2 marks)**

e) Identify substances:- **(2 marks)**

W……...

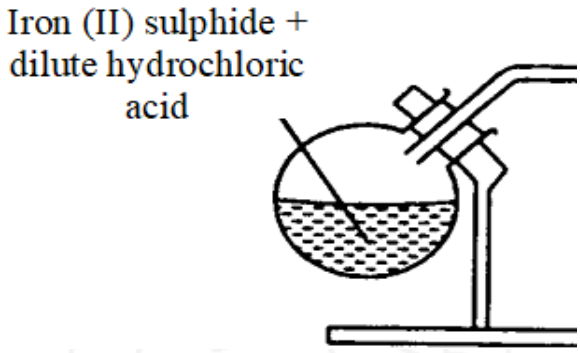
M ……..

f) Write the equation for the reaction that occurs in chamber **N**. **(1 mark)**

g) Explain why sulphur (VI) oxide is not dissolved directly in water. **(2 marks)**

h) Explain the danger caused by this process to the environment. **(2 marks)**

5. Study the set up below which was used by form four students to prepare a gas in the laboratory.



a) Complete the diagram to show how the gas above can be collected. **(2 marks)**

b) Write the equation for the reaction in the flask. **(1 mark)**

c) State a chemical test for the gas prepared. **(1 mark)**

d) When hydrogen sulphide gas was bubbled into an aqueous solution of iron (II) chloride a yellow precipitate was deposited.

(i) State the other observation that was made. **(1 mark)**

(ii) Write the reaction equation for d (i) above. **(1 mark)**

e) When sugar crystals were reacted with concentrated sulphuric (IV) acid, a black substance T was formed which when dried burnt in excess air to form a colourless gas U only. While when concentrated sulphuric (VI) acid is reacted with liquid D at temperature of 170°C, a colourless gas W is formed, this changes yellow bromine water to colourless and also changes colour of substance Y from purple to colourless.

i) Identify;

Substance **T……** **(½ mark)**

Gas U…… **(½ mark)**

Liquid D …… **(½ mark)**

Gas W …… **(½ mark)**

Substance Y……. **(½ mark)**

ii) Which property of concentrated sulphuric (VI) acid is being demonstrated by formation of a black mass**?** **(½ mark)**

6. The grid below is part of the periodic table. Use it to answer the questions that follow.

(The letters do not represent the actual symbols of the elements)

				D		E	G	
			H	J			K	
							L	

a) Which is the most reactive non-metallic element shown in the table? **(1mark)**

b) i) Write the formula of the compound formed when element **D** and **E** react. **(1 mark)**

ii) Name the bond type in the compound formed in b (i) above. **(1 mark)**

c) i) What is the name given to the group of elements where **G, K** and **L** belong? **(1 mark)**

ii) Write the equation for the reaction that occurs when **G** in gaseous form is passed through a solution containing ions of element **L**. **(1 mark)**

d) The melting point of elements **J** and **K** are 1410°C and -101°C respectively. In terms of structure and bonding, explain why there is a large difference in the melting points of J and K. **(2 marks)**

e) **D** forms two oxides. Write the formula of each of the two oxides. **(2 marks)**

f) M is an element that belongs to the 3rd period of the periodic table and is a member of the alkaline earth metals. Show the position of M in the grid. **(1 mark)**

7. a) The standard reduction potentials for five half cells are shown in the table below.

Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

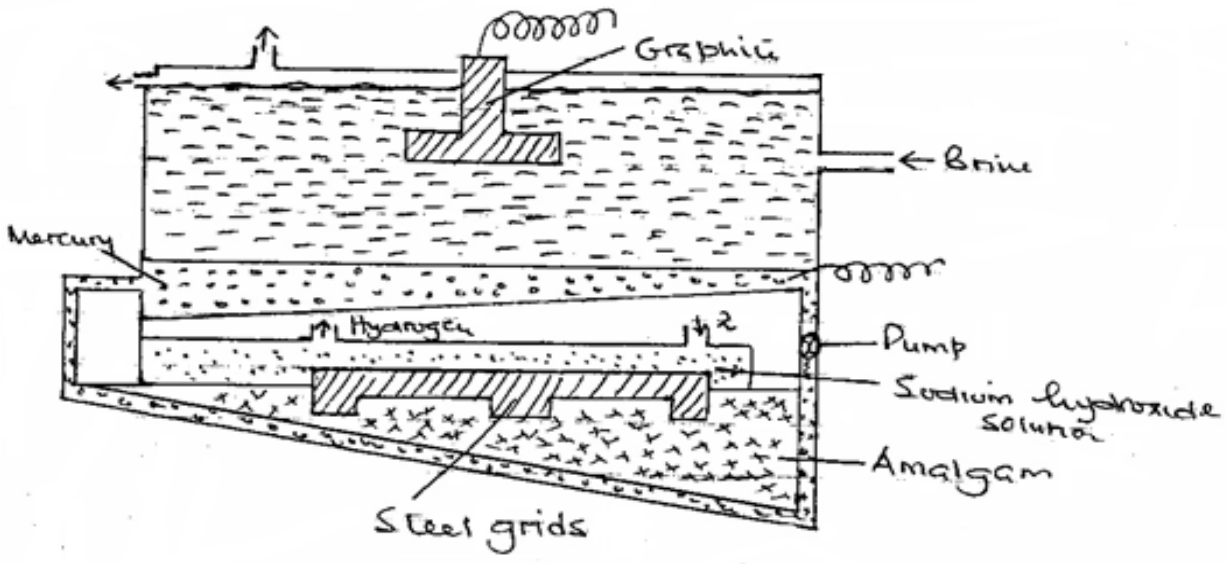
			E^{θ}(V)
$A_{2(aq)} + 2e^-$	$\rightarrow$	$2A^-_{(aq)}$	$+1.09$
$Q^{2+}_{(aq)} + 2e^-$	$\rightarrow$	$Q_{(S)}$	-0.13
$R^{2+}_{(aq)} + 2e^-$	$\rightarrow$	$R_{(S)}$	-2.37
$Y^{2+}_{(aq)} + 2e^-$	$\rightarrow$	$Y_{(S)}$	$+0.34$

(i) With a reason identify the strongest reducing agent. **(1 mark)**

(ii) Write an equation for the cell formed when Q and Y half cells are joined**.** **(1 mark)**

(iii) Calculate the e.m.f of the cell in (iii) above. **(1 mark)**

b) The diagram below represents a mercury cell that can be used in the industrial manufacture of sodium hydroxide. Study it and answer the questions that follow.



(i) Name raw material introduced at **2**. **(½ mark)**

(ii) Name another material that can be used in the cell instead of graphite. **(½ mark)**

(iii) Write an equation for the reaction.

I) that occurs at the anode. **(1 mark)**

II) in which sodium hydroxide is produced. **(1 mark)**

(iv) Give **one** reasons why mercury is recycled. **(1 mark)**

(v) A current of 100 amperes was passed through the cell for five (5) hours. Calculate the mass of sodium hydroxide that was produced. **(3 marks)**

(Na = 23.0, O = 16.0, H = 1.0, 1 Faraday = 96500C).

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 4)

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME…… ADM NO; ……

CLASS…… DATE……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

a) *Write your **Name**, **Index Number** and **School** in the spaces provided above.*

b) *Answer **all** the questions in the spaces provided after each question.*

c) ***KNEC** Mathematical tables and **silent non-programmable** electronic calculators may be used.*

d) ***ALL** working **must** be clearly shown where necessary.*

e) *Candidate should **check** the question paper to ascertain that **all** the pages are printed and that no questions are missing.*

f) *Candidates* should answer the questions in **English**.

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1 – 29	80	

*Answer **all** the questions in the spaces provided*

1 (a) Give the name of the first member of the alkyne homologous series **(1 mark)**

(b) Describe a chemical test that can be used to distinguish ethanol from ethanoic acid. **(2 marks)**

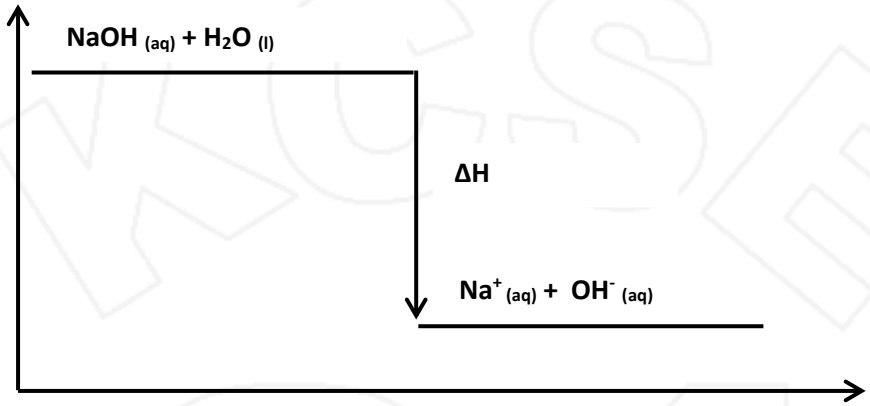
2 (**a)** Name the raw material from which aluminium is extracted **(l mark)**

(b) Give a reason why aluminium is extracted using electrolysis. **(1 mark)**

(c) Give **one** use of aluminium metal. **(l mark)**

3 (a) What is meant by lattice energy? **(1 mark)**

(b) Study the energy level diagram below and answer the question that follows:



What type of reaction is represented by the diagram? **(1 mark)**

4 (a) Sketch a graphical representation of Boyles law on the axes below. **(1 mark)**



(b) A gas occupies 400 cm^3 at 25°C and 100,000 Pa. What will be its volume at 27°C and 101325 Pa? **(2 marks)**

5 **(a)** What is half- life? **(1 mark)**

(b) The half-life of protactinium - 234 is 1.17 minutes. Determine the mass that decays in 5.85 minutes starting with 100 g of the sample. **(2 marks)**

6 State **two** disadvantages of hard water. **(2 marks)**

7 Hydrogen chloride gas can be prepared by reacting sodium chloride with an acid.

(a) Name the acid. **(1 mark)**

(b) Write an equation for the reaction between sodium chloride and the acid. **(1 mark)**

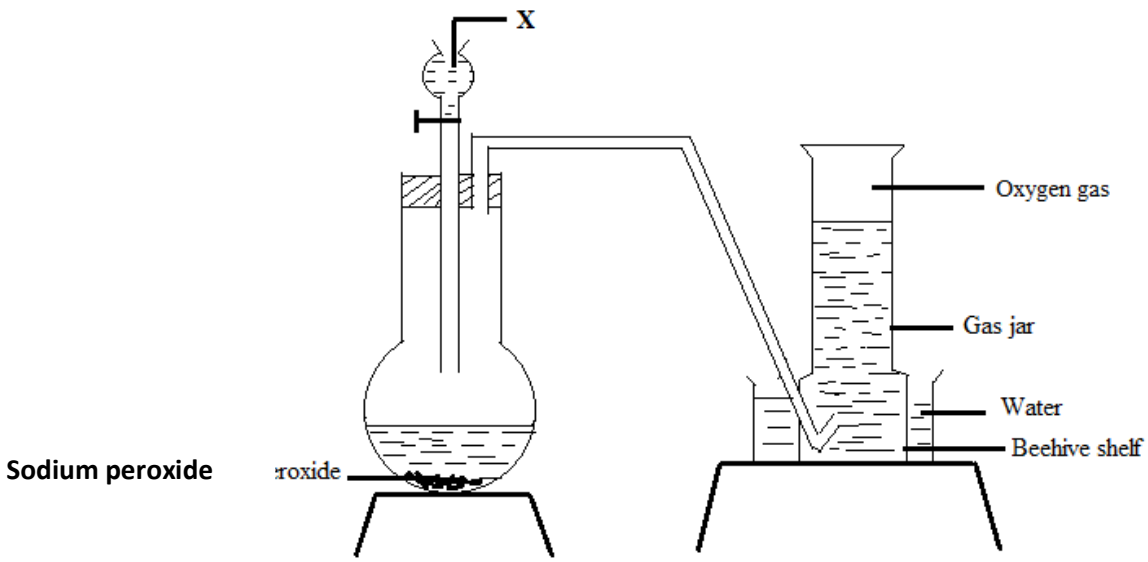
(c) State **two** uses of hydrogen chloride. **(1 mark)**

8 When solid **B** was heated strongly, it gave off water and a solid residue. When water was added to the solid residue, the original solid **B**, was formed.

(a) What name is given to the process described? **(1 mark)**

(b) Give **one** example of solid **A**. **(1 mark)**

9 The set up below can be used to prepare oxygen gas. Study it and answer the questions that follow.



(a) Identify **X**. **(1 mark)**

(b) Write the equation for the reaction which occurs in the flask. **(1 mark)**

(c) State **one** use of oxygen other than in welding **(1 mark)**

10 The atomic number of an element, **M** is 13.

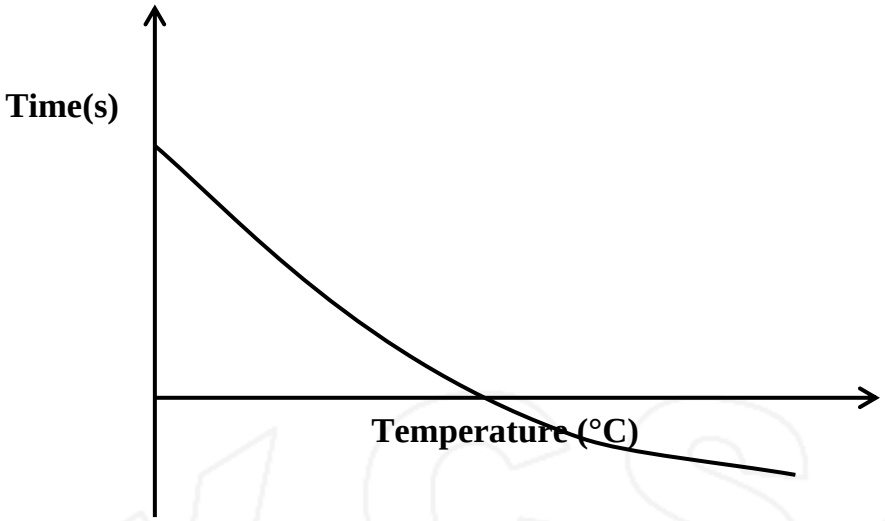
(a) Write the electronic configuration of the ion $\mathbf{M^{3+}}$**.** **(1 mark)**

(b) Write the formula of the chloride of **M**. **(1 mark)**

(c) State the structure of the compound formed in (b) above **(1 mark)**

11 Concentrated sodium chloride was electrolysed using graphite electrodes. Name the product formed at the anode and give a reason for your answer. **(2 marks)**

12 The curve shown below shows the variation of time against temperature for the reaction between sodium thiosulphate and hydrochloric acid.



(a) Explain the shape of the curve. **(2 marks)**

(b) Other than temperature name **one** factor that affects the rate of reaction**.** **(1 mark)**

13 (a) Dry ammonia was passed over heated copper (II) oxide in a combustion tube.

(i) State the observations made in the tube **(1 mark)**

(ii) Write an equation for the reaction that occurs. **(1 mark)**

(b) What products would be formed if red hot platinum is introduced into a mixture of ammonia and oxygen? **(1 mark)**

14 The table below shows behaviour of metals P, Q, R and S. Study it and answer the questions that follow:

Metal	Appearance on exposure to air	Reaction with water	Reaction with dilute sulphuric (VI) acid
P	Remains the same	Doesn't react	Reacts moderately
Q	Remains the same	No reaction	Doesn't react
R	Slowly tarnishes	Slow	Vigorous
S	Slowly turns white	Vigorous	Violent

(a) Arrange the metals in the order of reactivity starting with the most reactive. **(2 marks)**

(b) Name a metal which is likely to be **R** **(1 mark)**

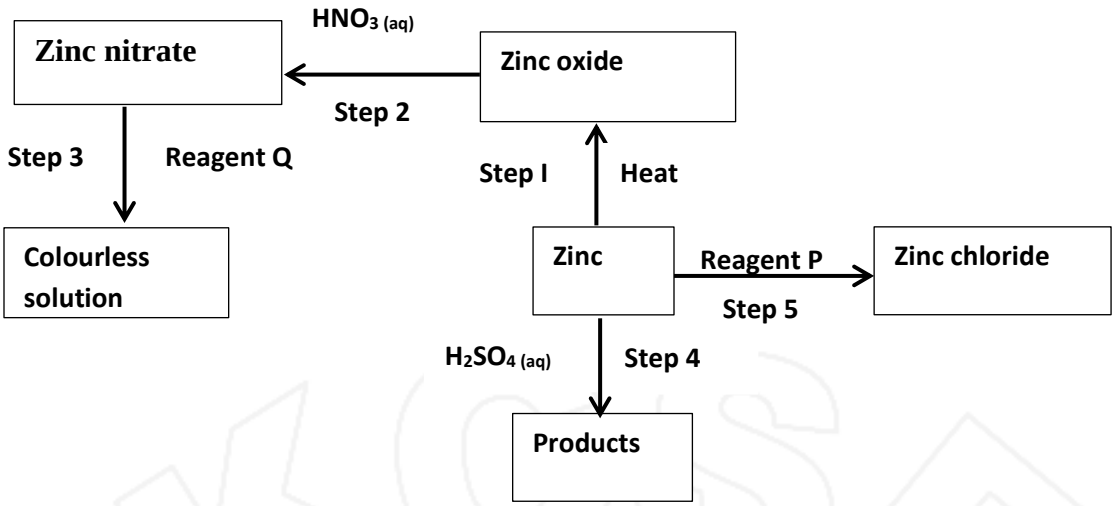
15 Given the following substances: sodium carbonate, orange juice and sodium bromide.

(a) Name **one** commercial indicator that can be used to show whether sodium carbonate, orange juice and sodium bromide are acidic, basic or neutral. **(1 mark)**

(b) Classify the substances in 15 (a) above as acids, bases or neutral**.** **(2 marks)**

Acid	
Base	
Neutral	

16 The flow chart below shows various reactions of zinc metal. Study it and answer the questions that follow:



(a) (i) Other than water, name another reagent that could be **Q**. **(1 mark)**

(ii) Write the formula of reagent **P**. **(1 mark)**

(b) Write an equation for the reaction in **step 4**. **(1 mark)**

17 (a) One of the allotropes of sulphur is monoclinic sulphur, name the other allotrope **(1 mark)**

(b) Concentrated sulphuric (VI) acid reacts with copper and prapanol. State the property of the acid shown in each case. **(2 marks)**

Copper **……..……..…**

Propanol **……**

18 Study the standard electrode potentials in the table below and answer the questions that follow.

Half -reaction	E^{θ}(V)
$Ag^{+}(aq) + e \longrightarrow Ag(s)$	+ 0.80
$Cu^{2+}(aq) + 2e \longrightarrow Cu(s)$	+ 0.34
$Mg^{2+}(aq) + 2e \longrightarrow Mg(s)$	- 2.38
$Ca^{2+}(aq) + 2e \longrightarrow Ca(s)$	- 2.87

(a) Which of the metals is the strongest oxidising agent? **(1 mark)**

(b) What observations will be made if a copper coin was dropped into an aqueous solution of calcium nitrate? Explain. **(2 marks)**

19 Calculate the number of sulphate ions present in 22.5 cm^3 of 2 M aluminium sulphate solution. ($L=6.0 \times 10^{23}$) **(3 marks)**

20 (a) A crystal of iodine, heated gently in a test tube gave off a purple vapour.

(i) Write the formula of the substance responsible for the purple vapour. **(1 mark)**

(b) What type of bond is broken when the iodine crystal is heated gently? **(1 mark)**

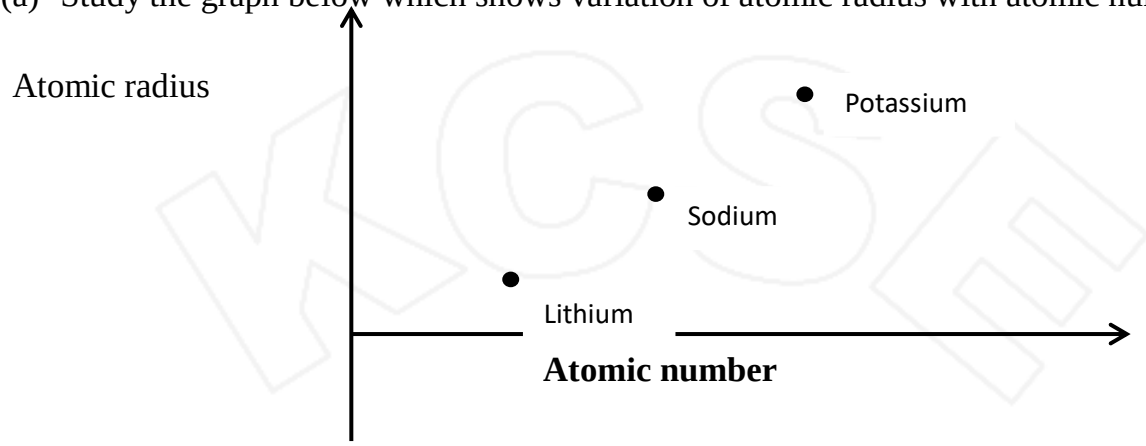
(b) State **one** use of chlorine. **(1 mark)**

21 Describe how samples of barium (II) sulphate, ammonium chloride and common salt can be obtained from a mixture of the three. **(3 marks)**

22 (a) Give the name of the process which takes places place when maize flour is converted to ethanol **(1 mark)**

(b) Write the formula of the compound formed when ethanol reacts with sodium metal. **(1 mark)**

23 (a) Study the graph below which shows variation of atomic radius with atomic number



State and explain the trend shown in the graph above. **(2 marks)**

(b) State **one** use of sodium. **(l mark)**

24 A farmer intended to plant blueberries in her farm. She first tested the pH of the soil and found it to be 10.0. In order to obtain high yield, what advice would be given to the farmer if blueberries do well in acidic solution? **(2 marks)**

25 Starting with calcium nitrate solution, describe how a pure dry sample of calcium carbonate can be prepared in the laboratory. **(3 marks)**

26 A hydrocarbon contains 81.82% of carbon. If the molar mass of the hydrocarbon is 44, determine the molecular formula of the hydrocarbon. **(C = 12.0; H = 1.0)** **(3 marks)**

27 (a) Describe how Carbon (II) Oxide can be distinguished from Carbon (IV) Oxide using calcium hydroxide solution. **(2 marks)**

(b) What is the role of carbon (IV) oxide in fire extinguishing? **(l mark)**

28 (a) Name **one** source of alkanes. **(1 mark)**

(b) Methane gas was reacted with one mole of chlorine gas. State the condition necessary for this reaction. **(1 mark)**

29 (a) What is meant by heating value of a fuel? **(1 mark)**

(b) Other than heating value, name **one** factor to be considered when choosing a fuel. **(1 mark)**

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 4)

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME…… ADM NO; ……

CLASS…… DATE……

Kenya Certificate of Secondary Education.

Instruction to the candidates

a) *Write your Name and Index number, Admission Number and Class in the spaces provided.*

b) *Answer all the questions in the spaces provided in this paper using English.*

c) *KNEC Mathematical tables and silent electronic calculators may be used.*

d) *All working MUST be clearly shown where necessary*

FOR EXAMINER'S USE ONLY

Questions	Maximum score	Candidate's Score
1	10	
2	14	
3	14	
4	10	
5	11	
6	11	
7	10	
	80	

1. (a) Define nuclear fission**.** **(1 mark)**

(b) State two similarities between nuclear fission and nuclear fusion? **(2 marks)**

(c) The following table shows the activity of a sample of protactinium ($^{234}_{91}Pa$), a radioactive element, measured at regular intervals.

Time (sec)	10	30	50	70	90	110	130	150	170	190
Activity(c/s)	33	29	23	17	14	12	10	9	8	6

(i) Plot a graph of activity against time**.** **(3 marks)**

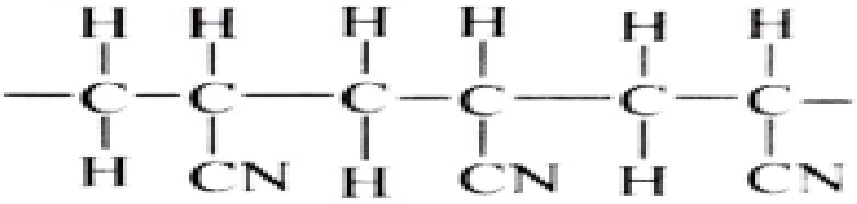
(ii) From the graph:

(I) The initial activity of the element**.** **(1 mark)**

(II) Determine the half-life of the nuclide. **(1 mark)**

(d) State two dangers associated with radioactivity. **(2 marks)**

2. (a)Acrylan and orlon are names of fibers which are made of the polymer.



(i) How many repeat units are shown in this structure**?** **(1 mark)**

(ii) Draw a structural formula of the monomer unit from which the polymer is made. **(1 mark)**

(iii) State two disadvantages of using the above synthetic fiber. **(2 marks)**

(b) Detergents contain additives that enhance their cleaning performance. Name two such additives. **(2 marks)**

(c) Calculate the mass of ethanol that can be made from 56g of ethene. **(2 marks)**

(d) An organic **compound P** is found on analysis to have the empirical formula $\mathbf{C_6H_{14}O}$. Compound P is slightly soluble in water. On oxidation compound P is converted into a **compound Q** of empirical formula $\mathbf{C_3H_6O}$ and relative molecular mass 116. Both compound P and Q react with sodium metal liberating hydrogen gas.

(i) To what class of compounds does compound P belong? **(1 mark)**

(ii) Draw the displayed structural formula of **P.** **(1 mark)**

(iii) Deduce the molecular formula of Q and draw its displayed structural formula. **(2 marks)**

(iv) What other test would you carry out on Q to confirm the presence of the functional group you have indicated? **(2 marks)**

3. (a) During the electrolysis magnesium sulphate a current of 2 amperes was passed through the solution for 4 hours. Calculate the volume of the gas produced at the anode. (1 faraday 96,500 coulombs and volume of a gas at room temperature is 24,000cm^3). **(2 marks)**

(b) Table gives standard reduction potentials for some half cells.

Half-cell	Half-cell equation	E^0 /V
I	$Cr^{3+}(aq) + e^- \rightarrow Cr^{2+}(aq)$	-0.41
II	$Cd^{2+}(aq) + 2e^- \rightarrow Cd(s)$	-0.40
III	$Na^+(aq) + e^- \rightarrow Na(s)$	-2.71
IV	$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$	+0.34
V	$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$	-0.13
VI	$Br_2(aq) + 2e^- \rightarrow 2Br^-(aq)$	+1.07
VII	$2H^+(aq) + 2e^- \rightarrow H_2(g)$	0.00
VIII	$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$	-0.44V
IX	$O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$	+0.40V
X	$H_2O_2(aq) + 2H^+(aq) + 2e^- \rightarrow 2H_2O(l)$	+1.23V

(i) Identify**:** **(1 mark)**

I.The strongest oxidizing agent.

II. The strongest reducing agent.

(ii) Construct an electrochemical cell from half-cells **V** and **VI**. **(3 marks)**

(iii) Write the equation and calculate the electrode potential for the electrochemical cell constructed from half-cells **V** and **VI**. **(2 marks)**

(iv) Explain why it is not advisable to use aqueous sodium sulphate as the salt bridge in the electrochemical cell formed between half-cells **V** and **VI.** **(1 mark)**

(v) Write the cell diagram for an electrochemical cell made using half-cells **V** and **VI**. **(1 mark)**

(vi) Write an equation to show how rusting occurs**.** **(2 marks)**

(vii) Give two reasons why electroplating is necessary. **(2 marks)**

4. Below is a periodic table grid study it and answer the questions. (*The letters does not represent the actual symbols of the elements*)

											B
C	**D**			**E**						**F**	
	G									**H**	
I											

(a) Which element will require the least amount of energy to remove one of the outermost electrons.

(1 mark)

(b) Select the most reactive metal. **(1 mark)**

(c) What name is given to the family of elements to which **elements D** and **G** belong? **(1 mark)**

(d) An **element A** has atomic number 9. Indicate the position of **A** on the grid. **(1 mark)**

(e) Explain why the atomic radius of **D** is smaller than that of **C**. **(1 mark)**

(f) Explain why the atomic radius of **A** is smaller than its ionic radius. **(2 marks)**

(g) Element **C** combines with oxygen to from an oxide. Using dots (•) and crosses(**x**) to represent the outermost electrons, show how the two elements combine. **(1 mark)**

(h) Explain why **chloride of E** has higher melting point than **chloride of D**. **(2 marks)**

5. (a) Describe how you can determine change in mass when magnesium is heated**. (3 marks)**

(b) The table below shows the tests that were carried out on five portions of a compound and the results obtained. Study it and answer the questions that follow.

	Test	**Observation**
1	Addition of few drops of sodium hydroxide to the first portion until in excess.	White precipitate soluble in excess.
2	Addition of few drops of aqueous potassium iodide to the second portion	No yellow precipitate is formed.
3	Addition of few drops of acidified barium nitrate to the third portion.	White precipitate formed.
4	Addition of few drops of Lead (II) nitrate to the fourth portion.	White precipitate formed.
5	Addition of few drops of dilute nitric (V) acid to the fifth portion.	Effervescence of a colorless gas.

(i) Identify the ions likely present in; **(2 marks)**

I. **Step 2**

II. **Step 5**

(ii) Write an ionic equation for the reaction in the fifth portion. **(1 mark)**

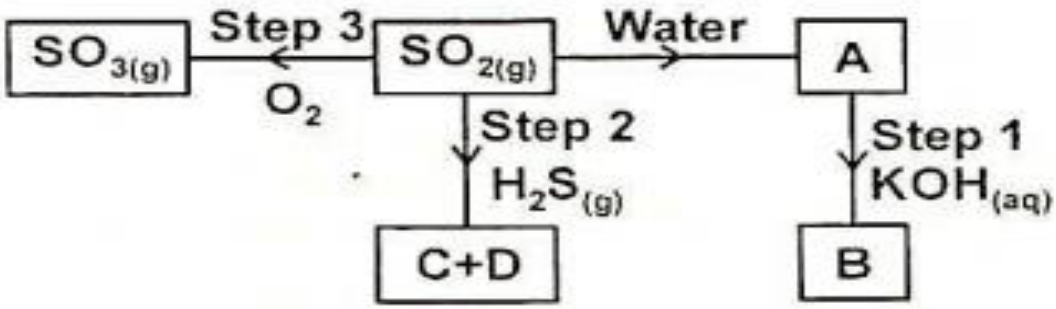
(iii) Dilute nitric (V) acid was added to a solid which is an alloy of copper. The resultant mixture was then filtered. To the filtrate, few drops of sodium hydroxide solution was added till in excess.

I.Sate any two observations made when dilute nitric (V) acid is added to the alloy. **(2 marks)**

II. Name the other metal present in the alloy**.** **(1 mark)**

III. Write an ion equation for the reaction that took place when few and excess sodium hydroxide solution is added**.** **(2 marks)**

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



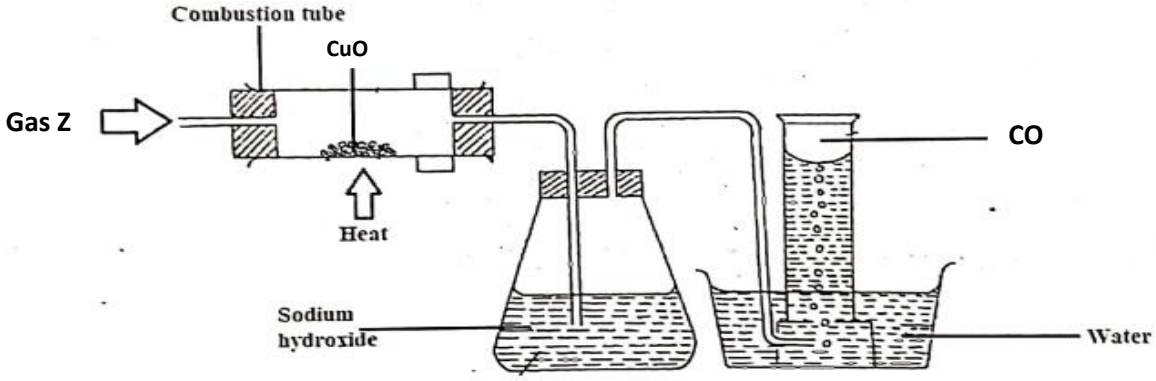
(i) Name a suitable method of gas collection that can used to collect Sulphur (VI) oxide gas in the laboratory**.** **(1mark)**

(ii) Name substances A, B, C and D**.** **(2 marks)**

(iii) State the property of Sulphur (IV) oxide exhibited in step 2. **(1mark)**

(b) (i) Explain the observations made when burning magnesium is lowered into a gas jar containing carbon (IV) oxide**.** **(3 marks)**

(ii) Study the diagram below and answer the questions that follows.

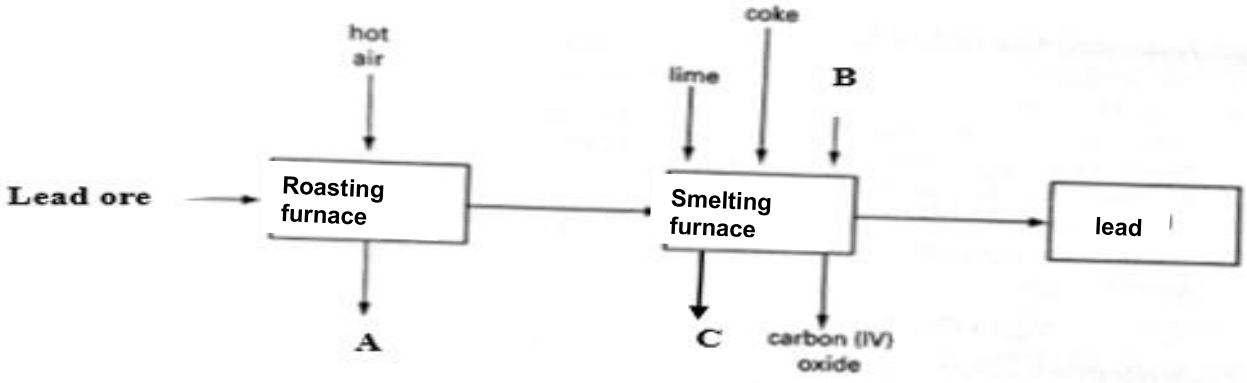


I. Name gas Z. **(1 mark)**

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

III. State and explain the observations made in the combustion tube. **(1 mark)**

7. The flow chart in the figure below represents some stages in the extraction of lead metal. Study it and answer the questions that follow.



(a) Identify:

(i) The lead ore. **(1 mark)**

(ii) Substance A, B and C**.** **(3 marks)**

(b) Write an equation for the reaction that forms **substance C**. **(1 mark)**

(c) Name an impurity resent in the ore. **(1 mark)**

(d) State the process by which the ore is concentrated**.** **(1 mark)**

(e) Write an equation for the reaction which occurs in the roasting chamber**.(1 mark)**

(f) State any one use of lead**.** **(1 mark)**

(g) Give one reason why the extraction of lead causes pollution to the environment.

(1 mark)

KCSE 24

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 5)

CHEMISTRY

233/1

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- *Write your name, admission number, class, date and then sign in the spaces provided.*
- *Answer **all** questions in the spaces provided.*
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*

FOR EXAMINERS USE ONLY

QUESTIONS	MAXIMUM SCORE	STUDENTS SCORE
1-28	80	

*Answer **all** questions in the spaces provided.*

1. a) Name another gas, which is used together with oxygen in welding**.** **(1 mark)**

(b). Explain the change in mass that occurs when the following substances are separately heated in open crucibles.

(i) Copper metal. **(1mark)**

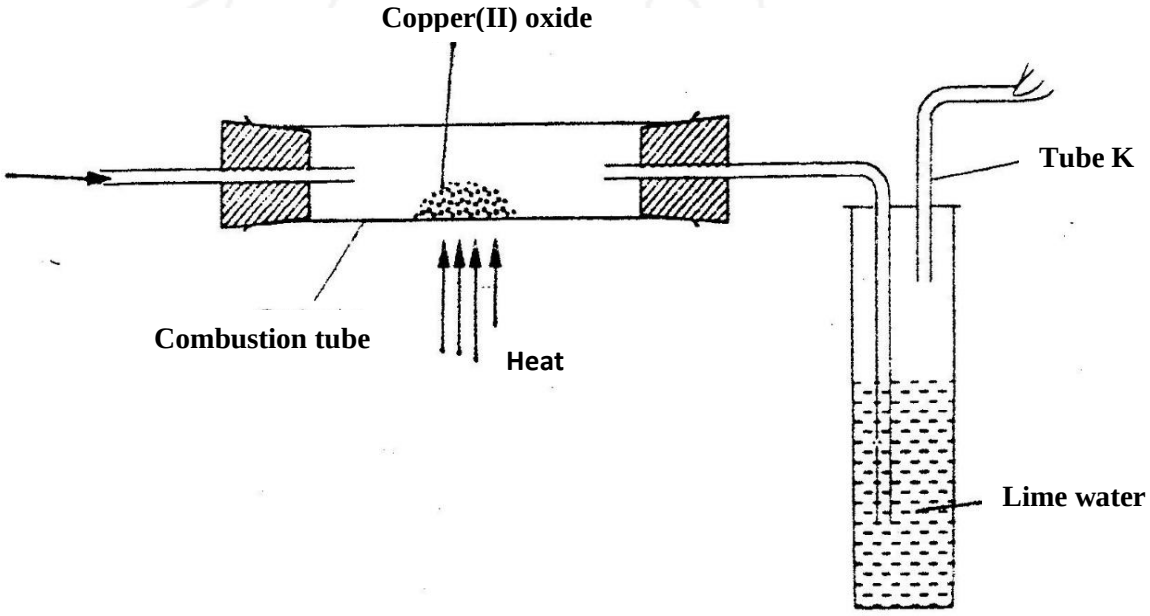
(ii) Copper (II) nitrate**.** **(1mark)**

2. Aluminum metal is a good conductor and is used for overhead cables. State any other two properties that make aluminum suitable for this use**.** **(2marks)**

3. Give **two** reasons why helium is used in weather balloons**.** **(2marks)**

4. Draw two positional isomers of the third member of alkyne series. **(3marks)**

5. The apparatus shown below was used to investigate the effect of carbon (ii) oxide on copper (II) oxide.



a) State the observation that was made in the combustion tube at the end of the experiment. **(1mark)**

b) Write an equation for the reaction that took place in the combustion tube **(1mark)**

C) Why is it necessary to burn the gas coming out of tube K**?** **(1mark)**

6.Give a reason why

(i) Phosphorus is stored under water. **(1mark)**

ii) Chlorine gas is prepared in the fume chamber. **(1mark)**

iii) Concentrated sulphuric acid is not used to dry ammonia gas**.** **(1mark)**

7. A certain matchstick head contains potassium chlorate and Sulphur. On striking, the two substances react to produce Sulphur (iv) oxide and potassium chloride. State the environmental effect of using such matches in large numbers. **(2marks)**

8. When a sample of concentrated sulphuric acid was left in an open beaker in a room for two days, the volume was found to have increased slightly.

a) What property of concentrated sulphuric acid was being investigated. **(1mark)**

b) State one use of concentrated sulphuric acid that depends on the property named above. **(1mk)**

9. The following two tests were carried out on chlorine water contained in two test tubes

a) A piece of colored flower was dropped into the first – tube. Explain why the flower was bleached **(2marks)**

b) The second test- tube was corked and exposed to sunlight after a few days, it was found to contain a gas that rekindled a glowing splint. Write an equation for the reaction which produced the gas. **(1mark)**

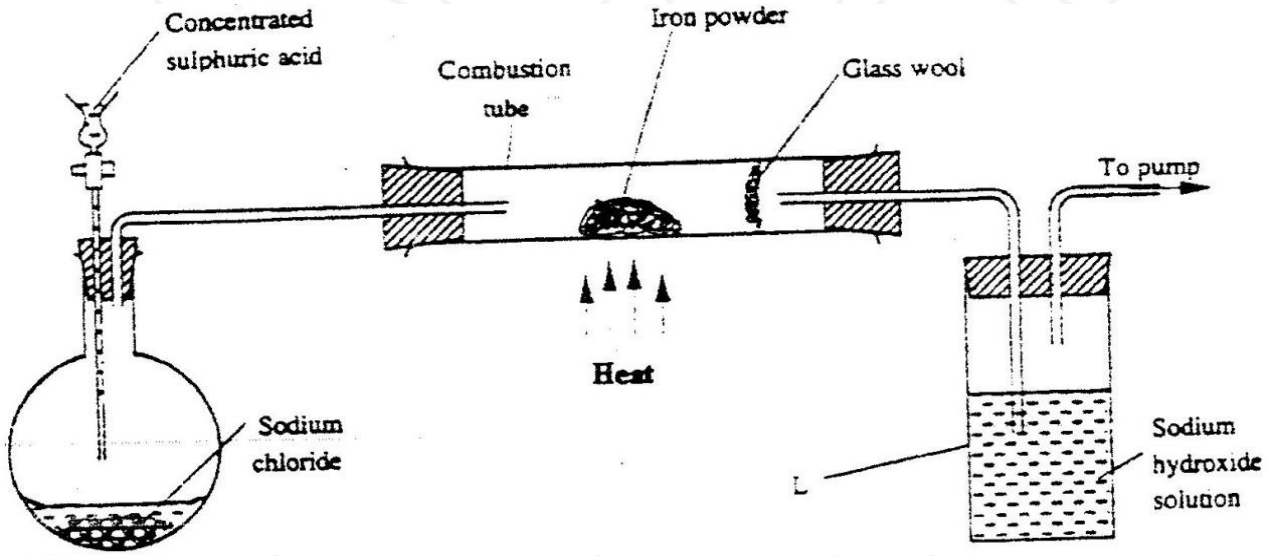
10. In the Haber process, the optimum yield of ammonia is obtained when a temperature of 450^0C, a pressure of 200 atmospheres and iron catalysts are used

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$; $\Delta H = -92kJ$.

a) How would the yield of ammonia be affected if the temperature was raised to 600^0C? Explain. **(2marks)**

b) Give two use of ammonia. **(1mark)**

11. The set – up below was used to prepare hydrogen chloride gas and react it with iron powder. Study it and answer the questions that follow.



At the end of the reaction, the iron powder turned into a light green solid.

a) Identify the light green solid**.** **(1mark)**

b) At the beginning of the experiment, the pH of the solution in container L was about 14. At the end, the pH was found to be 2. Explain**.** **(2marks)**

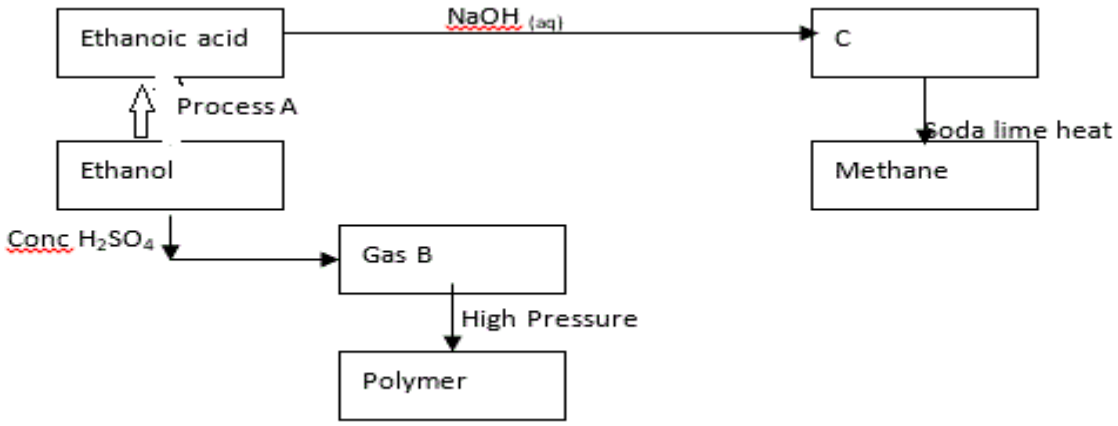
12. Below is part of the Thorium decay series.

$$^{232}_{90}Th \xrightarrow{(i)} {}^{228}_{88}Ra \xrightarrow{(ii)} {}^{228}_{89}Ac \xrightarrow{(iii)} {}^{228}_{90}Th \xrightarrow{(iv)} {}^{224}_{88}Ra$$

(i) Write an overall nuclear equation for the conversion of Th-232 to Ra-224. **(1mark)**

(ii) Give any **two** uses of radio isotopes in medicine. **(2marks)**

13. The flow chart below shows a series of reactions starting with ethanol , Study it and answer the questions that follow.



i) Name:

I. Process **A**…… **(1mark)**

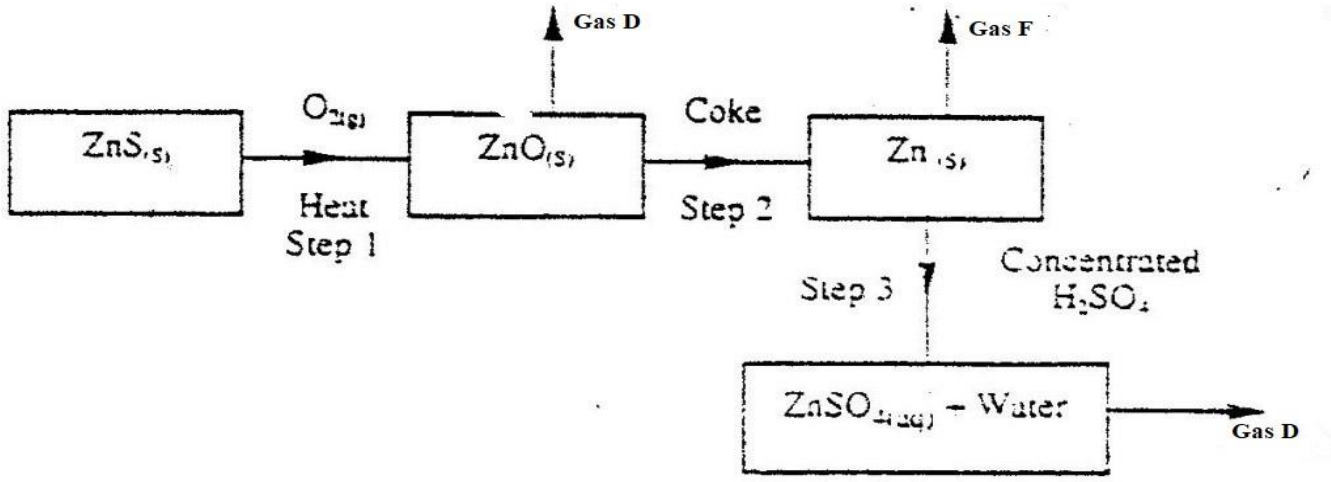
II. Substances B and C

B..... **(½mark)**

C…… **(½mark)**

ii) Write the equation for the reaction leading to formation of methane**.** **(1mark)**

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



a) State the condition necessary for the reaction in step 2 to **occur** **(1mark)**

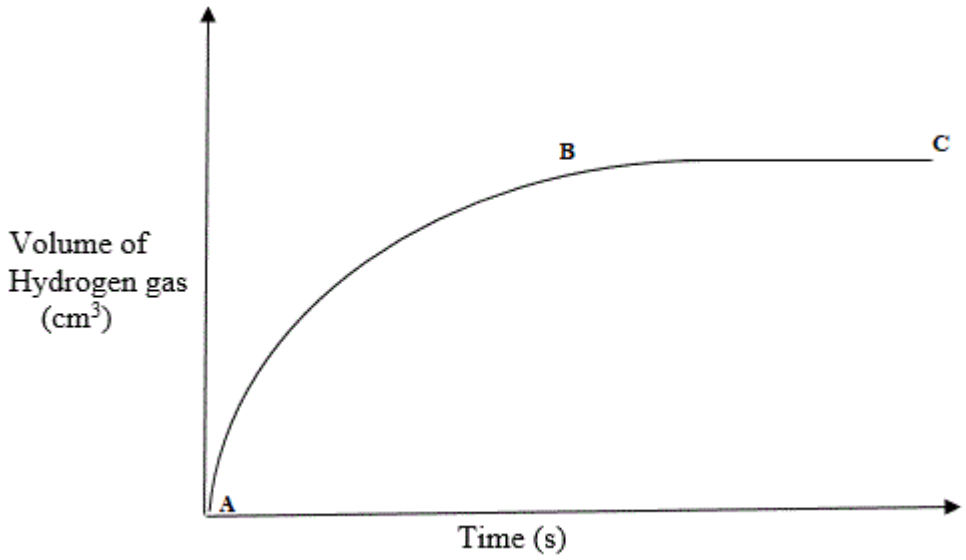
b) Name gases **D and F:** **(1mark)**

i) Gas D……

Gas F ……..

ii) State one use of zinc metal. **(1mark)**

15. The reaction between a piece of magnesium ribbon with excess 2M hydrochloric acid was investigated at 25°C by measuring the volume of hydrogen gas produced as the reaction progressed. The sketch below represents the graph that was obtained.



a) Explain the shape of the curve between B and C. **(1mark)**

b) Suggest another parameter that can be used to determine the rate of the above reaction **(1mark)**

c) On the same diagram, sketch the curve that would be obtained if the experiment is repeated using powdered magnesium metal**.** **(1mark)**

16. Zinc oxide reacts with acids and alkalis.

a) Write the equation for the reaction between zinc oxide and:

i) Dilute sulphuric acid **(1mark)**

ii) **Sodium** hydroxide solution **(1 mark)**

b) What property of zinc oxide is shown by the reactions in (a) above? **(1 mark)**

17. 0.84 g of aluminum reacted completely with chlorine gas. Calculate the volume of chlorine gas used (Molar gas volume is $24dm^3$, al = 27). **(3 marks)**

18. Proper use of soaps in washing hands has proven to control the spread of corona novel virus.

a) Write the formula of the grey insoluble substance left in the washing basin when one uses soap with tap water given that the formula of the soap is $C_{17}H_{35}COONa$. **(1mark)**

b) State two advantages of Soapy detergents over soapless detergents. **(2marks)**

19. a) Use the information given below to draw a labeled diagram of an electrochemical cell that can be constructed to measure the electromotive force between G and J.

$G2+(aq) + 2e \rightarrow G(s)$; $E^{\theta} = -0.74$ V

$J2+(aq)+ 2e \rightarrow J(s)$; $E^{\theta} = -0.14$ V **(2marks)**

b) Calculate the E^{θ} value for the cell constructed in (a) above. **(1mark)**

20. a) Sate Le' Chetelier's principle. **(1mark)**

b) Study the following equilibrium reaction and answer the questions that follow: -

$$\underbrace{HL_{(aq)} + H_2O_{(l)}}_{\text{Red}} \rightleftharpoons \underbrace{H_3O^+(aq)\ L^-(aq)}_{\text{Blue}}$$

Given that in an acid solution, $H_3O^+_{(aq)}$ act in place of hydrogen ions, H^+, according to the equation.

$$H_3O^+_{(aq)} + OH^-_{(aq)} \longrightarrow 2H_2O_{(l)}$$

Explain what would be observed when potassium hydroxide solution is added to the above equilibrium mixture. **(2marks)**

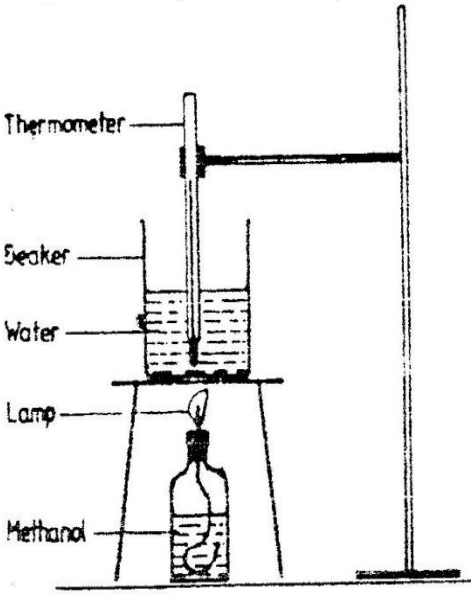
21. The table below gives information on four elements K, L, M and N. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	Electron arrangement	Atomic radius (nm)	Ionic radius(nm)
K	2, 8, 2	0.136	0.065
L	2, 8, 7	0.099	0.181
M	2, 8, 8, 1	0.203	0.133
N	2, 8, 8, 2	0.174	0.099

a) Which two elements have similar chemical properties? Explain. **(2marks)**

b) Which element is a non-metal? Explain. **(1mark)**

22. In an experiment to determine the heat of combustion of methanol, a student used the set-up below.



Volume of water = 500cm^3

Final temperature of water= 27.0^{0}C

Initial temperature of water = 20.0^{0}C

Final mass of lamp + methanol = 22.11g

Initial mass of lamp+ methanol= 22.98g

Density of water = 1.0g/cm^3

Specific heat capacity = 4.2kJ/g/k

Calculate:

(i) The number of moles of methanol used in this experiment given that the R.F.M is 32. **(1mark)**

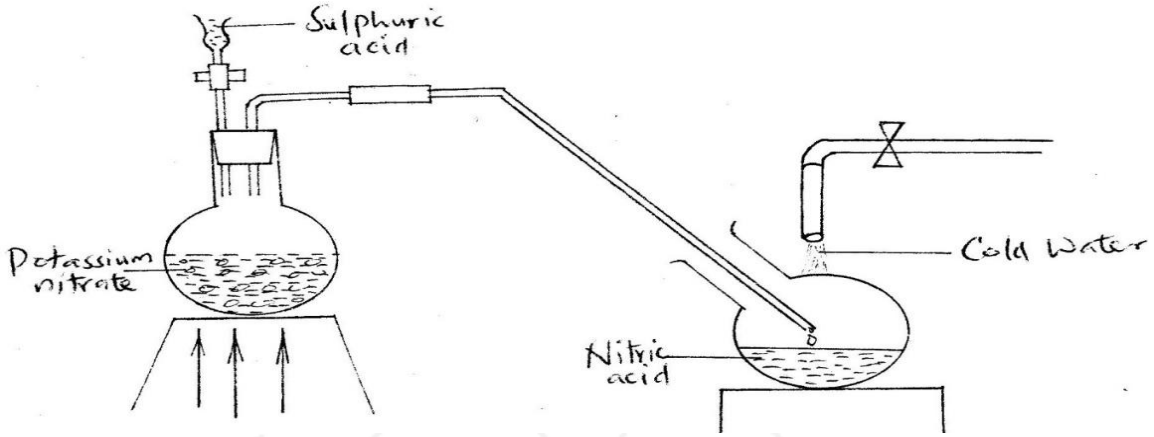
(ii) The heat of combustion per mole of methanol. **(2mark)**

23. Using dots (.) and crosses (x) to represent outermost electrons, draw diagrams to show the bonding in, CO_2 and H_3O^+. (Atomic numbers; H = 1.0,C= 14.0, O = 8)

i) CO_2. **(1mark)**

ii) H_3O^+ **(2marks)**

24. The diagram below shows a set- up that was used to prepare and collect a sample of nitric (v) acid



a)Give a reason why it is possible to generate nitric (v) acid from sulphuric(vi) acid in the set – up. **(1mark)**

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

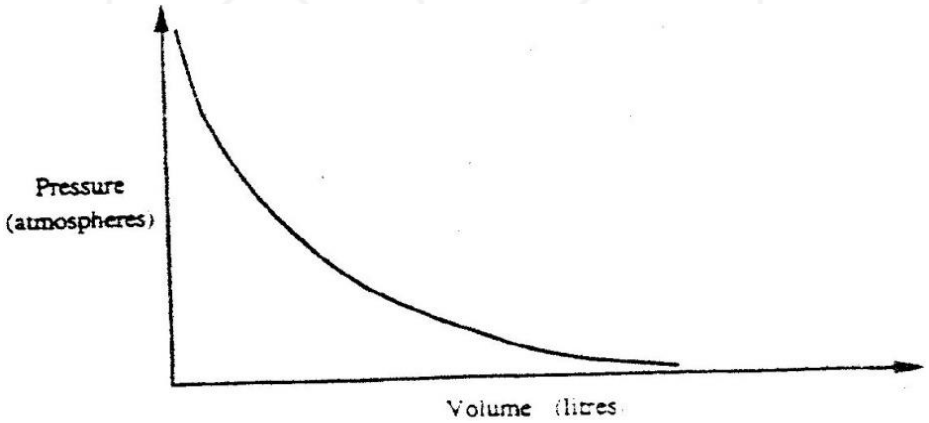
c) Give two use of nitric (v) acid. **(1mark)**

25. When a hydrocarbon was completely burnt in oxygen, 4.2g of carbon (IV) oxide and 1.71 g of water were formed. Determine the empirical formula of the hydrocarbon

(H= 1.0 ; C=12.0 ; 0 = 16.0). **(3marks)**

26. Starting with 50 cm^3 of 2.8M sodium hydroxide describe how a sample of pure sodium sulphate crystals can be prepared. **(3 marks)**

27. The graph below shows the behavior of a fixed mass of a gas at constant temperature.



a) What is the relationship between the volume and the pressure of the gas? **(1mark)**

b) Three litres of oxygen gas at one atmosphere pressure were compressed to two Atmospheres at constant temperature. Calculate the volume occupied by the oxygen gas. **(2marks)**

28. Explain the following observations

i) Very little amount of hydrogen gas is collected when dilute sulphuric acid react with calcium metal. **(1mark)**

ii) When hydrogen chloride gas is dissolved in water, the solution turns blue litmus paper to red, while when hydrogen chloride gas is dissolved in methyl benzene; the resulting solution has no effect on the blue litmus paper. **(2marks)**

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 5)

CHEMISTRY

233/2

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

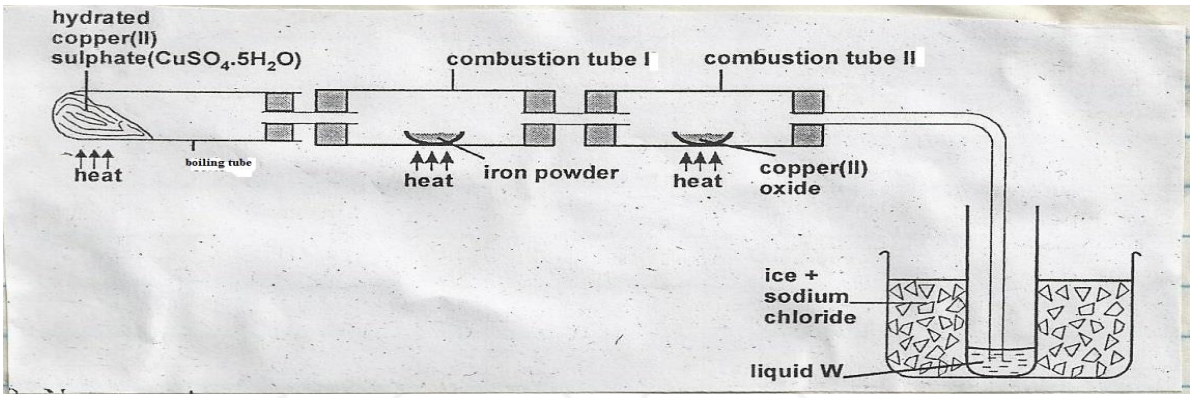
1. *Write your name and index number in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *Answer **all** the questions in the spaces provided.*
4. *Mathematical tables and silent electronic calculators may be used.*
5. *All working must be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

QUESTION	MAXIMUM SCORE	SCORE
1	11	
2	12	
3	12	
4	11	
5	11	
6	12	
7	11	
Total score	**80**	

*Answer **all** the questions in the spaces provided*

1. The diagram below shows the apparatus for the preparation of gas A and investigate on its properties. Study it and answer the questions that follow.



a) (i) Name gas A. **(1mark)**

(ii) Suggest the property of gas A under investigation. **(1mark)**

(iii) Write chemical equations for the reactions in the;

Boiling tube **(1 mark)**

Combustion tube I **(1 mark)**

b) State and explain the observation made in

(i) Boiling tube. **(1mark)**

(ii) Combustion tube II. **(1mark)**

c) What is the use of hydrated copper (II) sulphate in the experiment? **(1mark)**

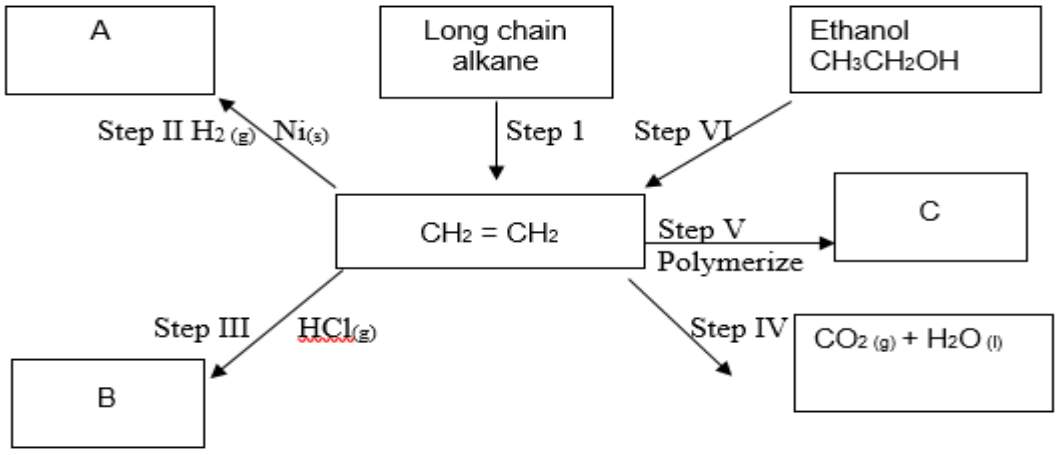
d) (i) Name one other substance that comes out of tube II. **(1mark)**

(ii) Name liquid W. **(1mark)**

(iii) What is the role of sodium chloride in the ice (freezing mixture). **(1mark)**

(iv) Explain why hydrogen gas has been replaced by helium in filling of aereoplane tyres. **(1mark)**

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



(vii) Name the process-taking place in step I. **(1mark)**

Describe a chemical test that can be carried out determine the identity of organic compound A. **(2marks)**

Give the name of the following: **(2marks)**

I. A……..

II. B……..

(viii) Give the structural formulae of substance C. **(1mark)**

(ix) Name the type of reaction that occurs in:

I. Step IV . **(2marks)**

II. Step VI:

(x) Give the reagent and the condition necessary for step VI. **(2marks)**

Reagent……

Condition……

(c) Give the systematic names of the following compounds:

I. $CH_3CHCHCH_2CH_3$ **(1mark)**

II. $CHCCH_3$ **(1mark)**

3. The grid below forms part of the periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

P				T	V	W	Y	M
	Q		S	U		X		
	R						Z	

a) Write the general name given to the group where element P belong. **(1mark)**

b) An element N has an atomic number of 15. Write down its electronic arrangement and hence fix it in its right position on the grid above. **(2marks)**

Electronic arrangement

b) Compare the size of the atom of R and that of its ion. Explain your answer. **(2marks)**

c) Give the formula of the compound formed between. **(1mark)**

i. P and W

ii. T and Y

e) Compare the melting points of element Q and S. Explain. **(2marks)**

f) State the most reactive non-metal from the grid. Give a reason for your answer. **(2marks)**

g) Write chemical equations for the thermal decomposition of nitrates of: **(2marks)**

i) Q

ii) P

4. a) The results below were obtained in an experiment conducted by form three students from MBORANU 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. **(2marks)**

(ii) Determine the empirical formula of magnesium oxide. (Mg=24.0, O=16.0) **(2marks)**

b) Sodium hydroxide pellets 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 neutralised by $20cm^3$ of 0.25M sulphuric acid.

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

(ii) Calculate the:

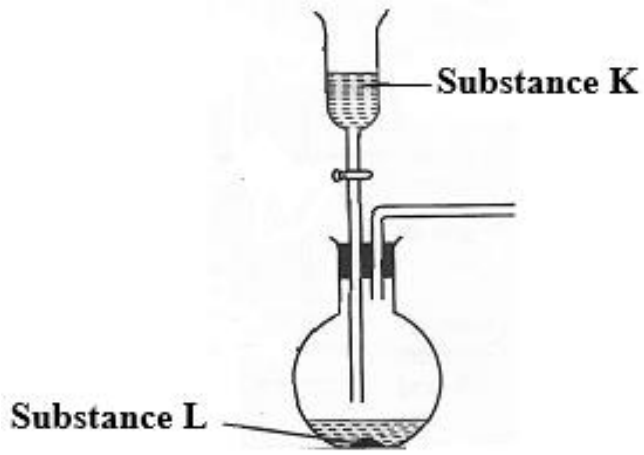
I. Number of moles of the substance that reacted with sulphuric acid. **(2marks)**

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

III. The percentage of sodium chloride in the mixture**.** **(3marks)**

(H=1.0; Na=23.0; Cl=35.5; O=16.0)

6. The set-up below can be used to generate a gas.



(a) (i) Complete the table below giving the names of substance **K** and **L** if the gases generated are carbon (IV) oxide and carbon (II) oxide. **(2marks)**

Substance	Carbon (IV) oxide	Carbon (II) oxide
K		
L		

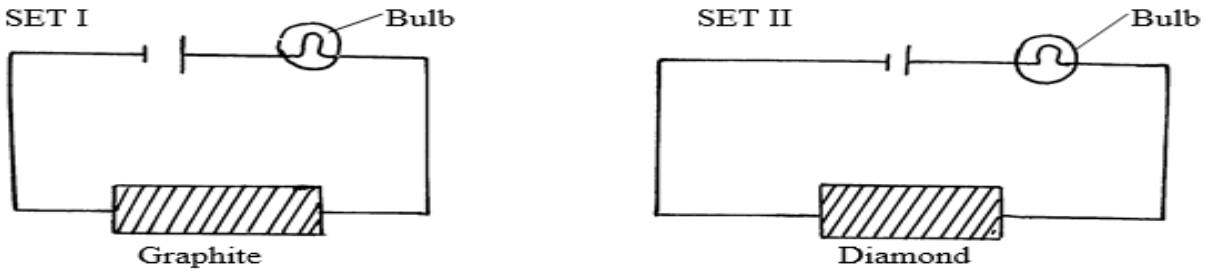
(ii) Complete the diagram to show how a sample of carbon (II) oxide can be collected.**(2mks)**

(iii) State two ways that can be used to distinguish carbon (IV) oxide from carbon (II) oxide? **(2marks)**

(b) (i) In an experiment, carbon (IV) oxide gas was passed over heated charcoal held in a combustion tube. Write a chemical equation for the reaction that took place in the combustion tube. **(1mark)**

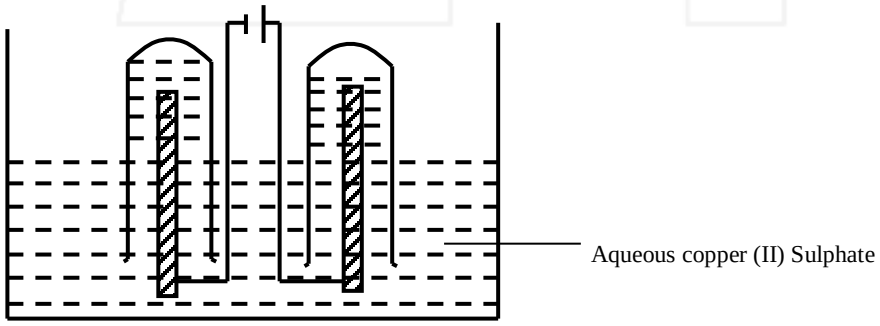
(ii) State one use of carbon (II) oxide. **(1mark)**

(c) The following set ups were used by Form Two students. Study and use them to answer the questions that follow.



State and explain the observations made in set up I and II above. **(3marks)**

6. a) The set up below was used during electrolysis of aqueous copper (II) sulphate using inert electrodes.



i) Name a suitable pair of electrodes for this experiment. **(1 mark)**

ii) Write formula of the anions and cations in the solution**.** **(1 mark)**

iii) On the diagram, label the cathode**.** **(1mark)**

iv) Write ionic equation for the reaction that took place at the anode. **(1 mark)**

v) Explain the observation that occurred to the Copper (II) Sulphate solution during the experiment. **(2 marks)**

vi) During the electrolysis, a current of 2 amperes was passed through the solution for 4 hours. Calculate the volume of the gas produced at the anode. (1 Faraday = 96,500 coulomb. Volume of gas at room temperature = 24,000cm^3). **(3 marks)**

b) i) Draw a diagram to show how an impure copper lump can be refined through electrolysis. **(2marks)**

ii) State one other application of electrolysis other than the one shown in b (i) above. **(1mark)**

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

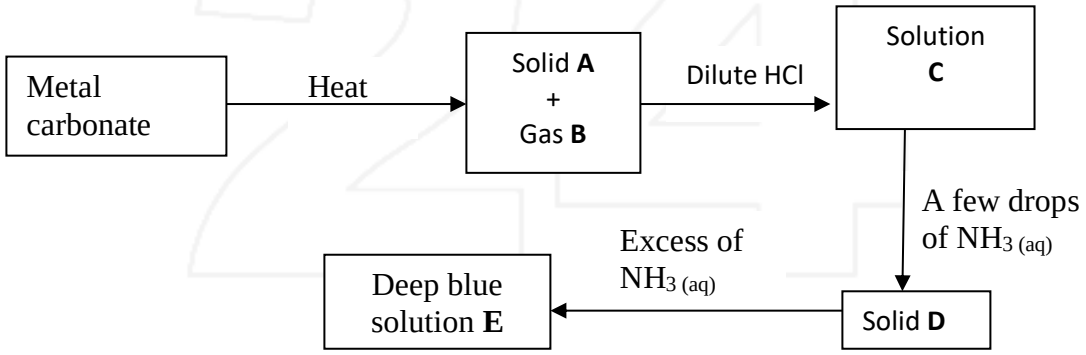
Temperature ^0C		0	10	20	30	40	50	60	70	80
Solubility g/100g H_2O	KNO_3	5	15	26	43	61	83	105	135	165
	KBr	50	55	60	65	70	77	85	90	95

(i) Draw solubility curves for both salts on the same axis. **(3marks)**

(ii) What was the solubility of each salt at 65^0C? **(1mark)**

(iii) 100g of a saturated solution of potassium nitrate at 75^0C was cooled to 25^0C. What mass of the crystals will be formed? **(3marks)**

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

(ii) Name;

Solution **C** **……** **(1mark)**

Solid D **…..……** **(1mark)**

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

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 6)

CHEMISTRY

233/1

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

a) *Write your name and index number in the spaces provided above*

b) *Sign and write date of examination in the space provided.*

c) *All working must be clearly shown where necessary.*

d) *Mathematical tables and silent electronic calculations may be used*

e) *Answer all questions in English.*

For examiners use only

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1-29	80	

1. The following are atomic and ionic radii of elements in the same group of the periodic table. The letters are not actual symbols of the elements

Elements	Atomic radius	Ionic radius
A	0.133	0.216
B	0.114	0.195
C	0.099	0.181

a) Identify the strongest oxidizing agent. **(1 mark)**

b) Give reasons for answer in (a) above? **(1mark)**

c) Which element has the highest atomic number? Explain? **(1mark)**

2. P, Q and S are solutions with pH values

Solutions	pH value
P	7.0
Q	6.5
S	5.0

a) Which solution is likely to be:

i. Water obtained from location near greenhouse? **(1mk)**

ii. Water collected near a contact process plant. **(1mk)**

iii. Distilled water **(1mk)**

3. Write a balanced ionic equation to:

a) Explain how temporary hardness in water is removed using soda ash. **(1mk)**

b) Give one disadvantage of using hard water in washing. **(1mk)**

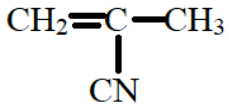
4. Draw a simplified diagram of a common Liebig condenser and show direction of water using arrows. **(2mks)**

5. Draw structures of the following compounds

i. 2-chloro-4-methylpent-1-ene. **(1mk)**

ii. 3-methylheptanoic acid. **(1mk)**

6. Study the monomer below



a) Draw the structure of its polymer. **(1mk)**

b) A sample of polymer formed from the monomer above has a molecular mass of 4020. Determine the number of monomers making up the polymer. (H=1, C=12, N=14). **(2mks)**

7. Nitric (V) acid is a major product of Ostwald process with 65% purity.

a) State how its concentration is increased. **(1mk)**

b) What gives a yellow colour of the acid? How is it removed? **(2mks)**

8. Name the type of artificial Name the type of artificial radioactivity represented by each of the following nuclear equations.

a)

i. $3H + 2H \rightarrow 4He + In + energy$
$1 \quad 1 \quad 1 \quad 0$ **($\frac{1}{2}$mk)**

ii. $^{235}_{92}u + In \rightarrow ^{141}_{56}Ba + ^{92}_{36}K + 3In + energy$ **($\frac{1}{2}$mk)**
$0 \qquad\qquad\qquad\qquad\qquad\qquad 0$

b) Give two differences between nuclear reactions and chemical reactions. **(2mks)**

9. Complete the table below.

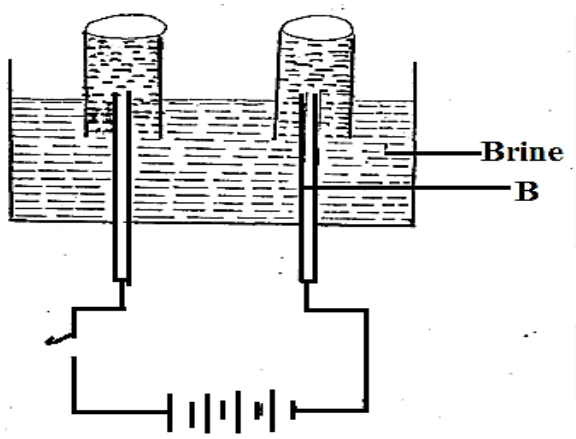
Species	Number of electrons	Number of neutrons
$^{108}_{47}Ag^{+}$		

10. A given volume of ozone (O_3) diffused through a porous hole in 144 seconds. How long would it take equal volume of Sulphur (IV) oxide to pass through same hole? (O = 16, S =32) **(3mks)**

11. One way to increase the yield of methanol from hydrogen and carbon (II) oxide is to lower the temperature of the system. Why is it not advisable to lower the temperature below the optimum 250^0c. **(2mks)**

$2H_{2(g)} + CO_{(g)} \rightleftharpoons CH_3OH_{(g)} \qquad \Delta H = -90vJ/mole$

12. The apparatus below was used to investigate products formed during electrolysis of brine (concentrated sodium chloride).



a) Write equation at electrode B. **(1mk)**

b) If electrode B was replaced with mercury electrode. Name product formed? Explain**.** **(2mks)**

13. A solution contains 7.5g of solute X in $20cm^3$ of water. When the solution is cooled, crystals of X begin to appear at 10^0c. Determine solubility of solute X at 10^0c. **(2mks)**

14. Explain the difference in melting point of magnesium oxide 3080^0c and phosphorous (V) oxide 563^0c. **(2mks)**

15. How would you confirm presence of lead in an ore? **(3mks)**

16. Why do latent heat of fusion and latent heat of vaporization increase from sodium to aluminum in third period. **(2mks)**

17. a) Write an equation for reaction between chlorine and hot concentrated sodium hydroxide. **(1mk)**

b) Explain how chlorine is used in water treatment. **(1mk)**

18. A fixed mass of a gas occupies $300cm^3$ at 15^0c and 740mmHg. At what temperature will the gas occupy 450^0c at pressure of 780mmHg? **(3mks)**

19. When a sample of hydrated Iron (II) sulphate ($FeSO_4.nH_2O$) was heated until a constant was obtained the following data was recorded.

a) Mass of evaporating dish = 50.00

b) Mass of evaporating dish + hydrated salt = 55.20

c) Mass of evaporating dish + residue = 52.84.

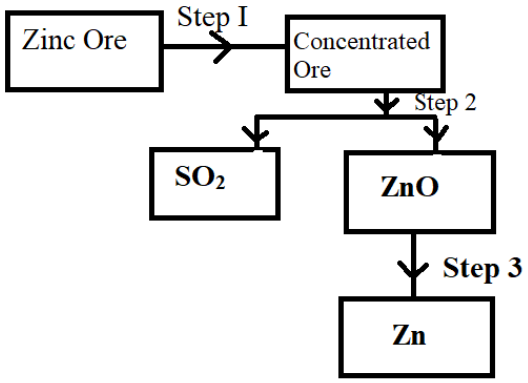
Calculate value of n. (Fe = 56, S = 32, O=16, H=1). **(3mks)**

20. a) Define the term standard molar heat of formation. **(1mk)**

b) Draw an energy cycle diagram to show how the standard heat of formation of ethane (C_2H_6) can be determined from standard heat of combustion of its elements. **(2mks)**

21. When a piece of potassium metal is placed in water, it becomes "ball like" and darts on the surface of water as it gets diminished. Explain why the metal become "ball like**".** **(2mks)**

22. The flow chart below shows steps in extraction of Zinc study it and use it to answer questions that follows.



i. Name the process in Step I. **(1mk)**

ii. Write a balanced chemical equation in Step 2. **(1mk)**

iii. Name the ore used in extraction of Zinc in above flow chart. **(1mk)**

23. A mass of 3.2g of XOH reacts completely with $20cm^3$ of 2.0M $H_2SO_{4(aq)}$

i. Write an equation for the reaction. **(1mk)**

ii. Calculate the relative atomic mass of X in the formula XOH. (O=16, H=1). **(3mks)**

24. A Compound whose general formula is $M(OH)_3$ reacts as shown below:

a) $M(OH)_{3(s)} + OH^-_{(aq)} \rightarrow M(OH)^-_{4(aq)}$

b) $M(OH)_{3(s)} + 3H^+_{aq} \rightarrow M^{3+}_{(aq)} + 3H_2O_{(l)}$

i. What name is given to compounds which behave like M (OH) in the two equations above? **(1mk)**

ii. Name two elements whose hydroxide behave like that of M. **(2mks)**

25. Diamond and graphite are allotropes of carbon.

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

b) Explain why graphite conducts electricity while diamond does not? **(2mks)**

26. A piece of blue and red litmus paper were placed in a beaker containing water into which aluminum chloride had been dissolved.

i. Is dissolving aluminum chloride in water physical or chemical process. **(1mk)**

ii. State and explain the observation. **(1mk)**

27. Consider electrochemical cell below

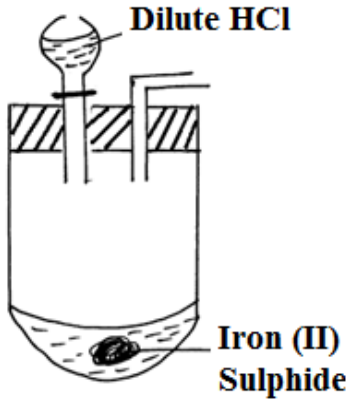
$$Zn_{(s)} / Zn^{2+}_{(aq)} // Pb^{2+}_{(aq)} / Pb_{(s)}$$

i. Name the electrode in above cell. **(1mk)**

ii. Write half ionic equation involving oxidation in above electrochemical cell**.** **(1mk)**

iii. Name the possible salt bridge. **(1mk)**

28. The diagram below is a part of a set up used in preparation of a particular gas in the laboratory.



a) Complete the diagram to show how dry sample of gas can be collected. **(3mks)**

b) Write a balanced chemical equation for the reaction in the diagram. **(1mk)**

29. When SO_2 sulphur (IV) oxide gas is bubbled through acidified $KMnO_4$ solution the reaction takes place according to the following equation.

$$2MnO^{-}_{4(aq)} + SO^{2-}_{2(aq)} + 6H^{+}_{(aq)} \rightarrow 2MnO_{4(aq)} + SO^{2-}_{4} + 3H_2O_{(l)}$$

a) Calculate the oxidation number of manganese in:

i. MnO_4^- **(1mk)**

ii. MnO_4 **(1mk)**

b) During the reaction was manganese oxidized or reduced? Explain. **(1mk)**

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 6)

CHEMISTRY

233/2

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

a) *Write your name and index number in the spaces provided above*

b) *Sign and write date of examination in the space provided.*

c) *All working must be clearly shown where necessary.*

d) *Mathematical tables and silent electronic calculations may be used*

e) *Answer all questions in English.*

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1-7	80	

QUESTIONS

1. (a) Study the table below and answer the questions that follows. The symbols are not the actual symbols of the elements

Element	A	B	C	D	E	F
Electronic configuration of the ion	2.8	2.8.8	2.8	2.8.8.	2.8	2.8.8
Valency and type of ion	Divalent cation	Divalent anion	Monovalent cation	Monovalent anion	Trivalent cation	Trivalent anion

i) Arrange the elements A,B,C,D,E and F in terms of increasing atomic sizes **(1mk)**

ii) Name the period of the periodic table to which these elements belongs? **(1mk)**

iii) Write an equation for the reaction between elements C and D **(1mk)**

iv) Compare the electrical conductivity of elements A and E. Explain **(2mks)**

v) Compare the first ionization energies of elements A and C. Explain. **(2mks)**

vi) Which element sit re strongest oxidizing agent **(1mk)**

b.) Study the information below and answer the question that follow

Formula of oxide	NaCl	$MgCl_2$	$AlCl_3$	$SiCl_4$	PCl_3	SCl_2
Melting point ^oC	801	714	_	-70	-91	-80
Formula of oxide	Na_2O	MgO	AlO_3	SiO_2	P_4O_{10}	SO_2
Melting point ^oC	1190	3080	2050	1730	560	-73

b. Aluminum chloride($AlCl_3$) has an unexpected bond type and structure

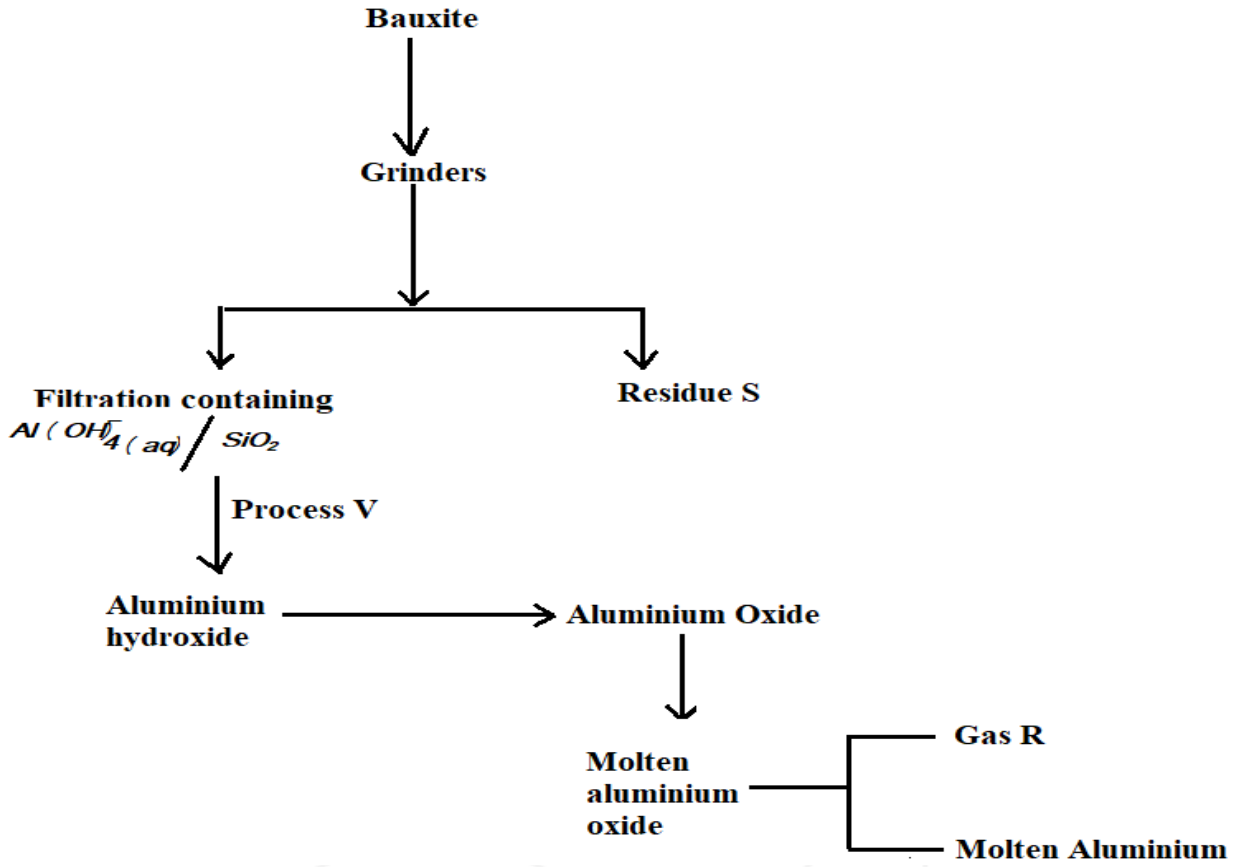
i.) State the type of bond and the structure in $AlCl_3$ **(1mk)**

ii.) What type of bond would $AlCl_3$ be expected to have? Give a reason **(1mk)**

iii.) Why is the melting point of $AlCl_3$ not indicted in the table above **(1mk)**

iv.) Silicon (iv) chloride get hydrolyzed by water. Write a balanced equation for this reaction **(1mk)**

2.) The following flow chart is an illustration of the extraction of aluminum from its ores



i) Give the formula of bauxite **(1mk)**

ii.) Name the two main impurities in bauxite **(2mks)**

iii.) Write the chemical equation for the reaction taking place during process V **(1mk)**

(iv) The melting point of aluminum oxide is quite high. Explain what is done to make the process cost effective. **(1mk)**

(v) Name residue S

(vi) Write down the half equations for the reaction at the **(2mks)**

(vii) In the electrolysis stage the graphite electrode used at the anode is periodically replaced anode at regular intervals **(1mk)**

(viii) Give two properties that makes aluminum and alloys suitable for making aircraft bodies **(2mks)**

(3a.) A form four students carried out an experiment to extract oil from sim sim seeds. **(1mk)**

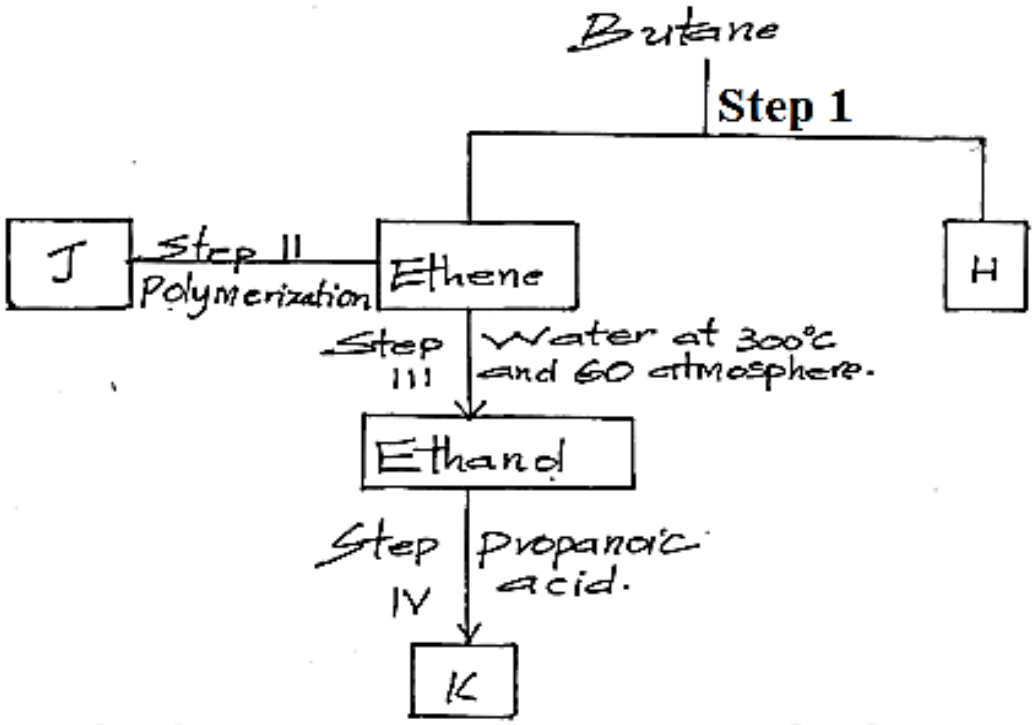
i.) Name two apparatus he used to crush the simsim seeds **(1mk)**

ii.) Name suitable solvent used **(1mk)**

iii.) Name the class or organ compounds in which vegetable oil belongs to **(1mk)**

(iv) Describe the process of preparing soapy detergents using vegetable oil **(3mks)**

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



(i) State the conditions for the reaction in step 1 to occur **(1mk)**

(ii) Identify substance H **(1mk)**

(iii) Give one disadvantage of the continued use of substances such as J **(1mk)**

(iv) The relative molecular mass of J is 16800. Calculate the number of monomers that make up J **(2mks)**

4. Study the standard electrode potentials of the half – cells given below and answer the questions that follow. The letters do not represent the actual symbols of the elements)

	E^{Θ} Volts
$N^{+}_{(aq)} + e^{-} \rightleftharpoons N_{(S)}$	-2.92
$J^{+}_{(aq)} + e^{-} \rightleftharpoons J_{(s)}$	+0.52
$K^{+}_{(aq)} + e^{-} \rightleftharpoons \frac{1}{2}K_{2(g)}$	0.00
$G^{+}_{(aq)} + e^{-} \rightleftharpoons G_{(s)}$	+0.80
$M^{2+}_{(aq)} + 2e^{-} \rightleftharpoons M_{(s)}$	-.0.44

i) Identify the strongest oxidizing agent. Give a reason for your answer **(2mks)**

ii) Which two half- cells would produce the highest potential difference when combined **(1mk)**

iii) Draw an electrochemical cell for the above. Show on the diagram flow of electrons **(3mks)**

iv) Write the cell notation representation for the above cell **(1mk)**

v.) Calculate the e.m.f of the cell above **(1mk)**

vi.) Give two functions of the salt bridge **(2mks)**

(vii) Determine the oxidation number of the halogen in $I0_4^-$ **(1mk)**

viii) Give on use f electrolysis **(1mk)**

5. The table below shows the observations made when aqueous ammonia and sodium hydroxide solutions were added to cations of A,B,C and D

Cation of	Sodium hydroxide in excess	Ammonia solution in excess
A	Blue precipitate	Blue precipitate dissolves to form a deep blue solution
B	White precipitate dissolve to form a colourless solution	White precipitate dissolve to form a colourless solutuion
C	White precipitate dissolved to form a colourless solution	White precipitate
D		

(i) Identify the cations present in **(2mks)**

B-

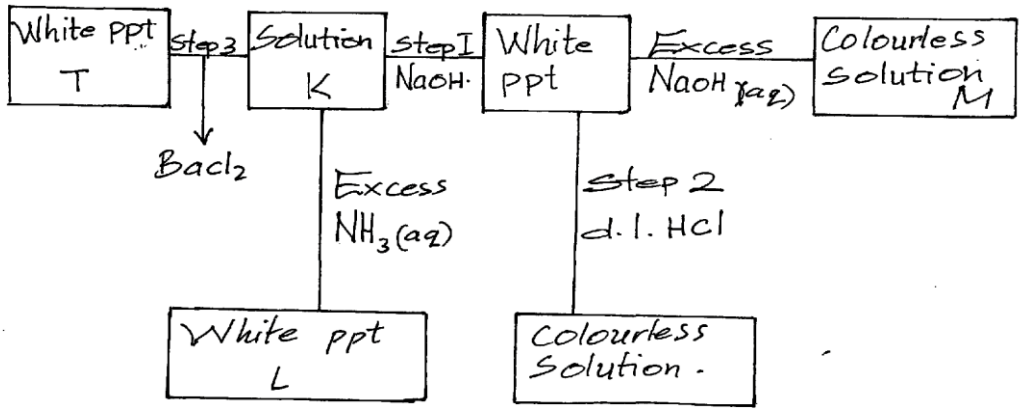
C-

(ii) Write the formula of the complex ion present in the deep blue solution of cation A **(1mk)**

iii.) Given that the cation of D have Na + ions complete the table above **(1mk)**

iv.) State any one use of complex ions **(1mk)**

5(b)



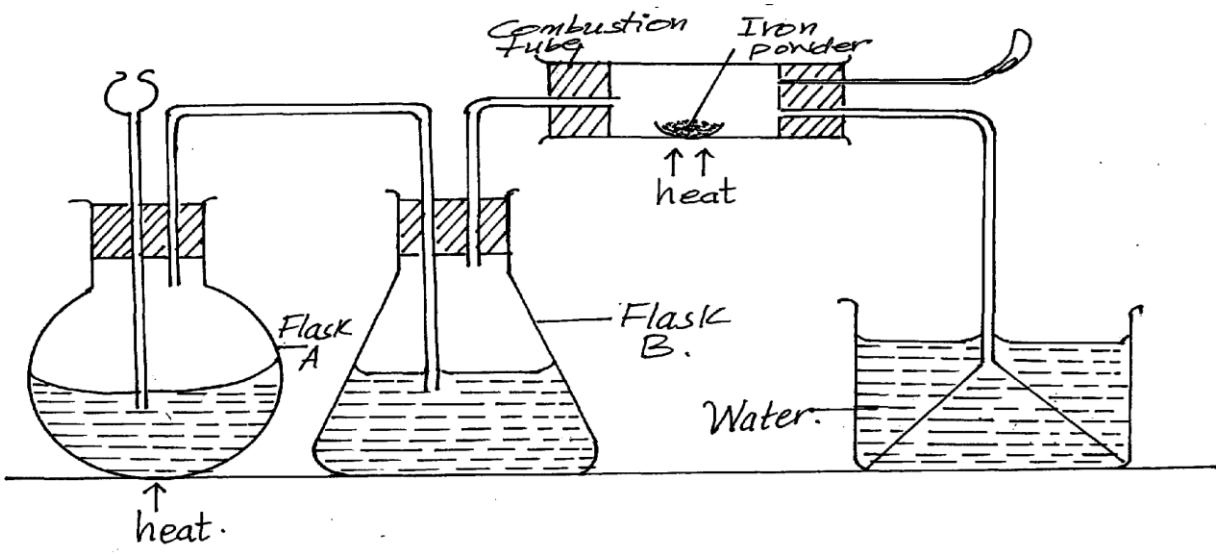
i.) Name precipitate L **(1mk)**

ii.) Write the ionic equation for the formation of L **(1mk)**

iii.) Name the type of reaction in step 2 **(1mk)**

iv.) Name any other solution that can be used in step 2 above **(1mk)**

6. The diagram below was used to prepare hydrogen chloride gas which was passed over heated iron powder



a.i.) State a pair of reagents that will produce hydrogen chloride gas in flask A **(1mk)**

ii.) Name the substances in flask B **(1mk)**

iii.) State the observations made in the combustion tube **(2mk)**

iv.) Write the equation for the reaction in the combustion tube **(1mk)**

v.) Describe a chemical test for hydrogen chloride gas **(2mks)**

b i.) Identify the gas that burns at the jet **(1mk)**

ii.) Explain why the gas in (b) is burnt **(1mk)**

c.) Another experiment was carried out where hydrogen chloride gas was bubbled through methylbene and water in separate beakers the resulting solutions were tested with blue litmus paper and marble chips **(2mks)**

Solution of hydrogen chloride gas	Blue litmus paper	Marble chips
Water		
Methylbenzene		

The thermodynamic equation for the formation of ammonia in the Harber process is as follows.

$$\mathbf{N}_{2g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \qquad \Delta H = -92KJ/mol$$

i.) **I**f the system is allowed to attain equilibrium. State and explain how the following factors would affect the yield of ammonia

a.) Increase in temperature **(1mk)**

b.) Increase in pressure **(1mk)**

c.) Using a more efficient catalyst **(1mk)**

ii.) In an experiment to study the rate of reaction 1g of Magnesium ribbon was reacted with excess 2M hydrochloric acid. The results obtained were recorded as shown in the table below.

Time(s)	0	20	40	60	80	100	120	140	160	180
Volume of gas produced (cm^3)	0	11	20	26	31	35	38	39	40	40

(a) Give a reason why Magnesium ribbon is normally cleaned with sand paper before being put into the acid **(1mk)**

b.) Write a balanced chemical equation for the reaction **(1mk)**

c.) On the grid provided plot a graph of volume of the gas produced against the time taken **(3mk)**

iii.) From the graph determine the rate of reaction at

a.) 30 seconds

b.) At 120 seconds

c.) Give a reason for the difference between the two values

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 7)

CHEMISTRY

233/1

PAPER 1 (THEORY)

TIME: 2 HRS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

a) *Write your name and index number in the spaces provided above*

b) *Sign and write date of examination in the space provided.*

c) *All working must be clearly shown where necessary.*

d) *Mathematical tables and silent electronic calculations may be used*

e) *Answer all questions in English.*

For examiners use only

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1-29	80	

Answer all questions

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

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

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

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

CH_2CHCl

Name _____ **(1 Mark)**

Structure **(1 Mark)**

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

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

$$\mathbf{^{232}_{92}X \rightarrow {}^{m}_{n}Y + 2\ {}^{0}_{-1}e^{-} + {}^{4}_{2}He}$$

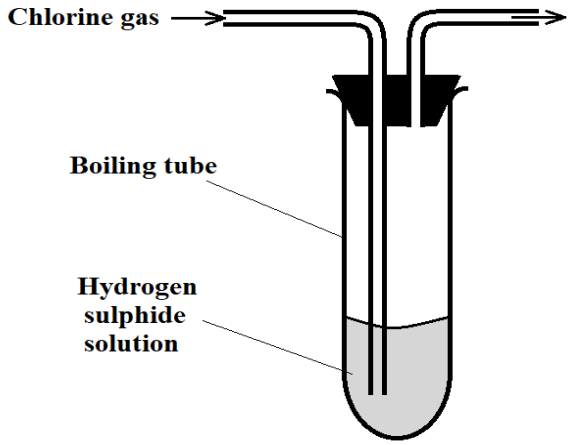
m _____ **(1 Mark)** **n** _____ **(1 Mark)**

5.

a) State Charles' Law **(1 Mark)**

b) A certain mass of carbon (IV) oxide gas occupied 200cm^3 as 25°C and 750mmHg pressure. Calculate the volume occupied by the same mass of gas if pressure is lowered to 300mmHg and the temperature raised to 30°C. **(2 Marks)**

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



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

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

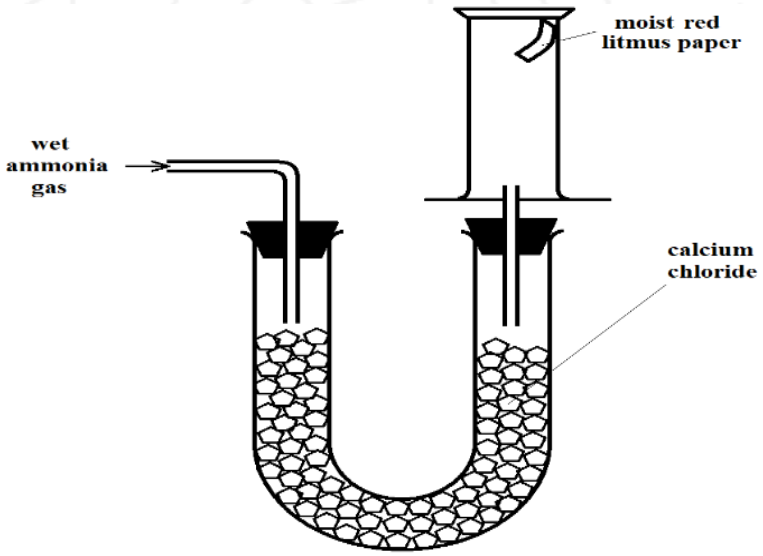
c) Distinguish between the bleaching action of chlorine and that of sulphur (IV) oxide**.** **(1 Mark)**

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

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

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

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



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

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

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

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

Salt	**Solubility at**	
	70°C	**35°C**
$CuSO_4$	38	28
$Pb(NO_3)_2$	78	79

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

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

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

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

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

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

$$CH_4\ (g) + 2O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (g)$$

Given the following bond energies:

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

a) Calculate the heat change for the reaction. **(2 Marks)**

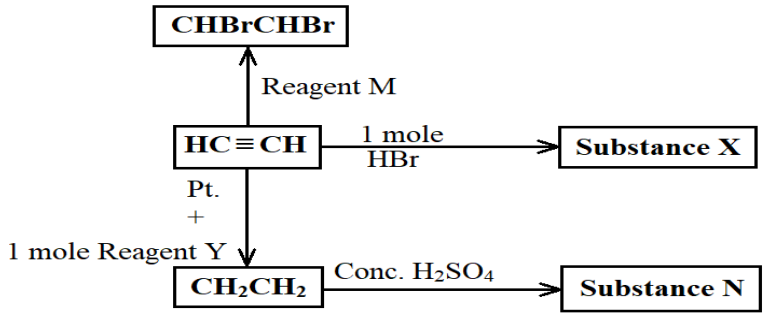
b) Define molar heat of combustion. **(1 Mark)**

12. Given solid sodium carbonate, lead (II) nitrate crystals and water, explain how you can obtain a solid sample of lead (II) carbonate. **(3 Marks)**

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

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

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



a) Name substance

i) X _____ **(½ Mark)**

ii) N _____ **(½ Mark)**

iii) M _____ **(½ Mark)**

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

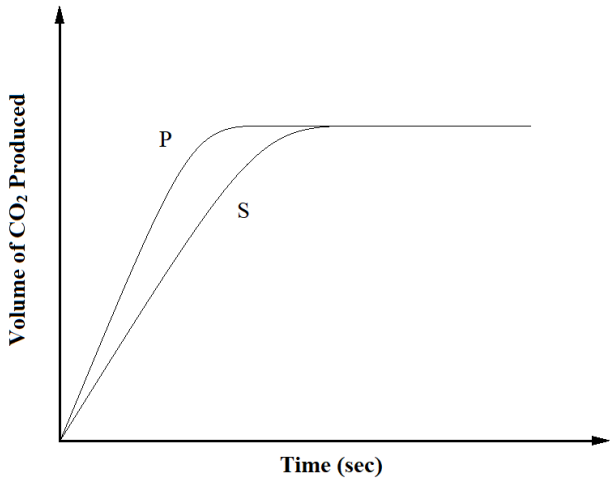
16. When 16g of ammonium nitrate was dissolved in $100cm^3$ of water at 25^oC, the temperature of the solution drops to 19^oC.

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

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

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

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



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

b) Why do the two curves flatten at the same level of production of CO_2? **(1 Mark)**

18. The electron arrangement of ions $\mathbf{X^{3+}}$ and $\mathbf{Y^{2-}}$ are **2.8**, and **2.8.8** respectively.

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

X_____ **Y**_____

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

19.

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

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

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

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

$S(s) + O_2(g) \rightarrow SO_2(g)$ $\Delta H = -294kJ/mole$

$CS_2(g) + 3O_2(g) \rightarrow CO_2(g) + 2SO_2(g)$ $\Delta H = -1072kj/mole$

$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393kJ/mole$

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

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

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

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

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

$Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)$ **$E^\theta = -0.14V$**

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ **$E^\theta = +0.34V$**

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

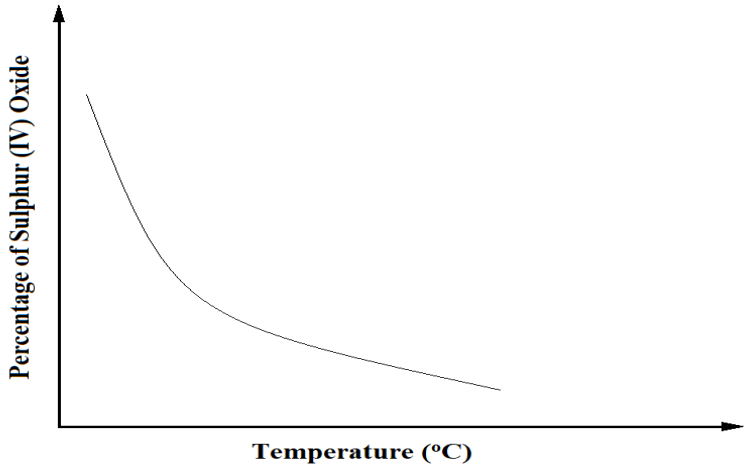
b) Identify the reducing species **(1 Mark)**

c) Calculate the E^θ value for the cell **(1 Mark)**

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

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

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



a) How does the percentage of sulphur (VI) oxide in the equilibrium mixture vary as the temperature increases? Explain. **(1½ Mark)**

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

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

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

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

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

25. Name and give the formula of:

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

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

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

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

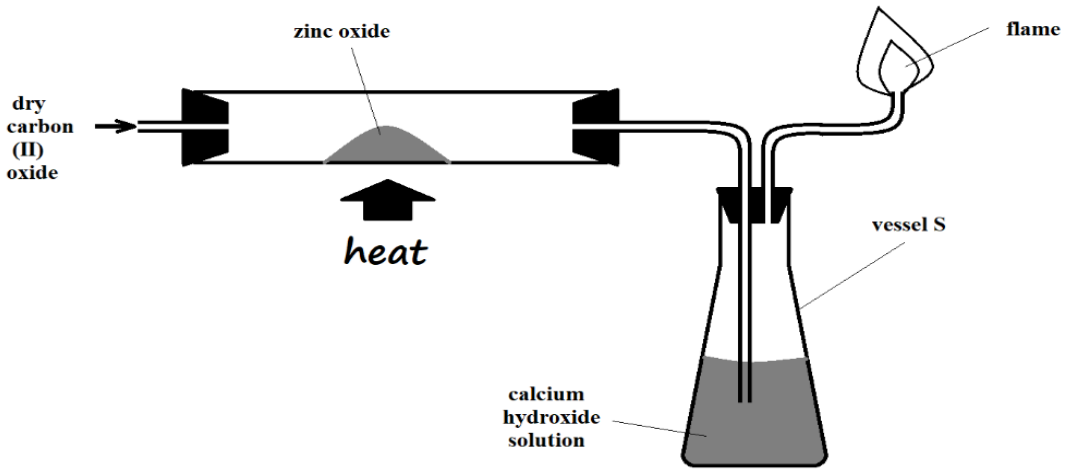
a) H_2S _____ **(1 Mark)**

b) SO_3^{2-} _____ **(1 Mark)**

27. For the reaction: **Cl_2 (g) + $2I^-$ (aq) → $2Cl^-$ (aq) + I_2 (s)**

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

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



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

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

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 7)

CHEMISTRY

233/2

PAPER 2 (THEORY)

TIME: 2 HRS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

a) *Write your name and index number in the spaces provided above*

b) *Sign and write date of examination in the space provided.*

c) *All working must be clearly shown where necessary.*

d) *Mathematical tables and silent electronic calculations may be used*

e) *Answer all questions in English.*

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1-7	80	

Answer all questions

1.

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

C				**F**	**G**		**I**	
						H		**K**
D	**E**							
							J	

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

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

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

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

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

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

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

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

Structure _____ Bond _____

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

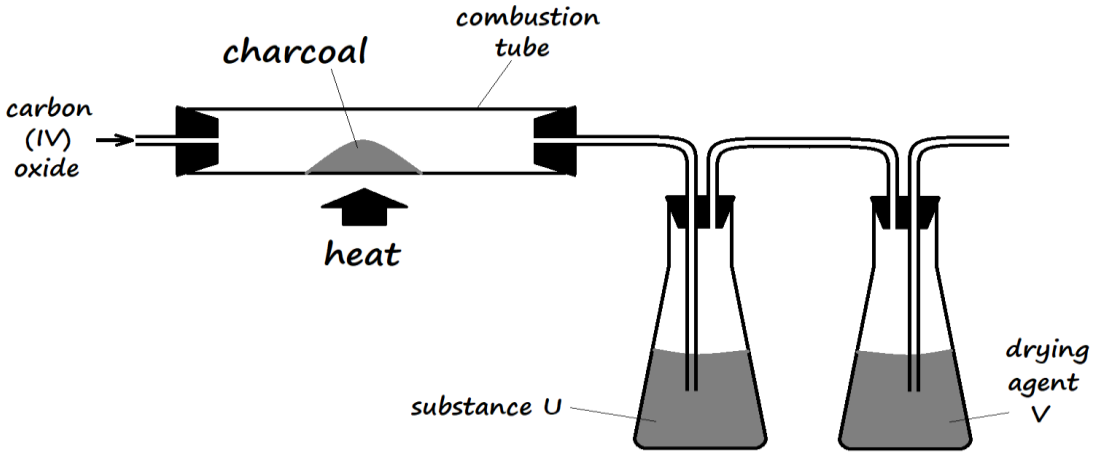
2.

a)

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

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

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



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

ii) Identify:

- Substance **U** and state its use
- Drying agent **Y**

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

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

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

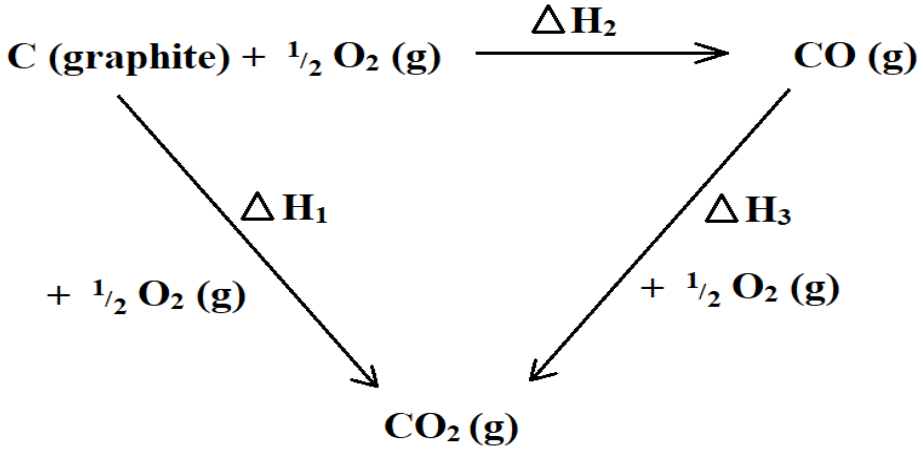
c) State **one** use of carbon (II) oxide **(1 Mark)**

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

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

3.

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



i) Name the enthalpy change represented by ΔH_2. **(1 Mark)**

ii) Use the following information to calculate the value of ΔH_1 for 144g of graphite. **(2 Marks)**

ΔH_2 = -110 kJ/mole ΔH_3 = -283kJ/mole

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

$C_4H_{10}\ (g) + \frac{13}{2}O_2\ (g) \rightarrow 4CO_2\ (g) + 5H_2O$ $\quad \Delta H^{\theta}_c = -2877kJ/mole$

$C\ (s) + O_2\ (g) \rightarrow CO_2\ (g)$ $\quad \Delta H^{\theta}_c = -399kJ/mole$

$H_2\ (g) + \frac{1}{2}O_2\ (g) \rightarrow H_2O\ (l)$ $\quad \Delta H^{\theta}_c = -286kJ/mole$

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

ii) Calculate the molar enthalpy of formation of butane (C_4H_{10}) using the information given above. **(3 Marks)**

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

Initial temperature of acid = 25.0^oC

Initial temperature of alkali = 26.0^oC

Final temperature of mixture of acid + alkali = 38.5^oC

Density of solution = $1g/cm^3$

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

i) Define molar heat of neutralization **(1 Mark)**

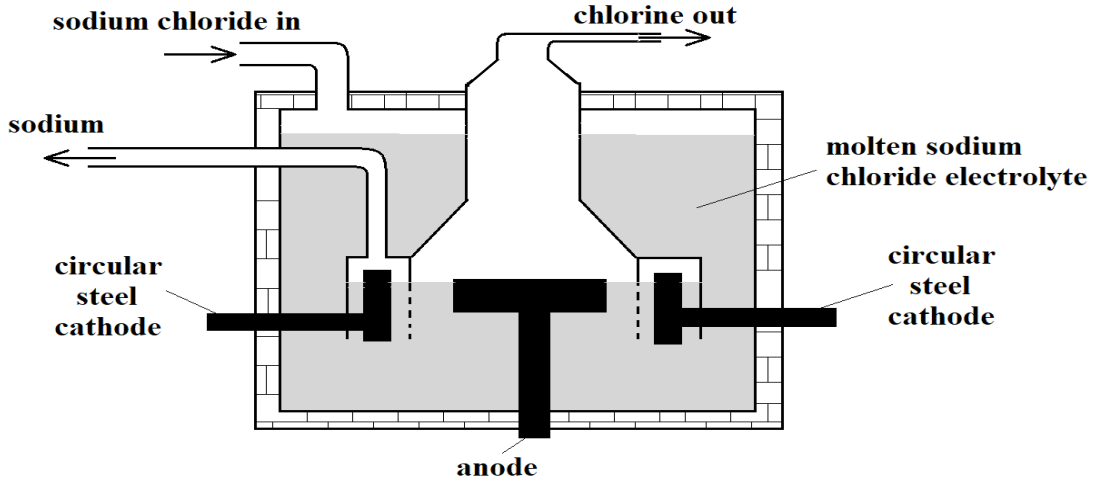
ii) Write an **ionic equation** for the neutralization reaction involving hydrochloric acid and sodium hydroxide solution. **(1 Mark)**

iii) Calculate:

- The enthalpy change during this experiment. **(2 Marks)**
- The molar enthalpy of neutralization for this reaction **(2 Marks)**

4.

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



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

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

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

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

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

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

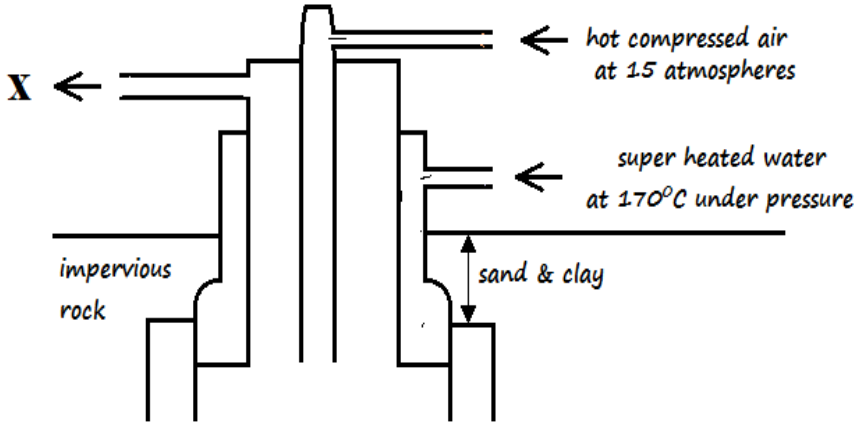
c) Explain why aqueous sodium chloride is not suitable as an electrolyte for the manufacture of sodium in the Down's Process. **(2 Marks)**

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

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

5.

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

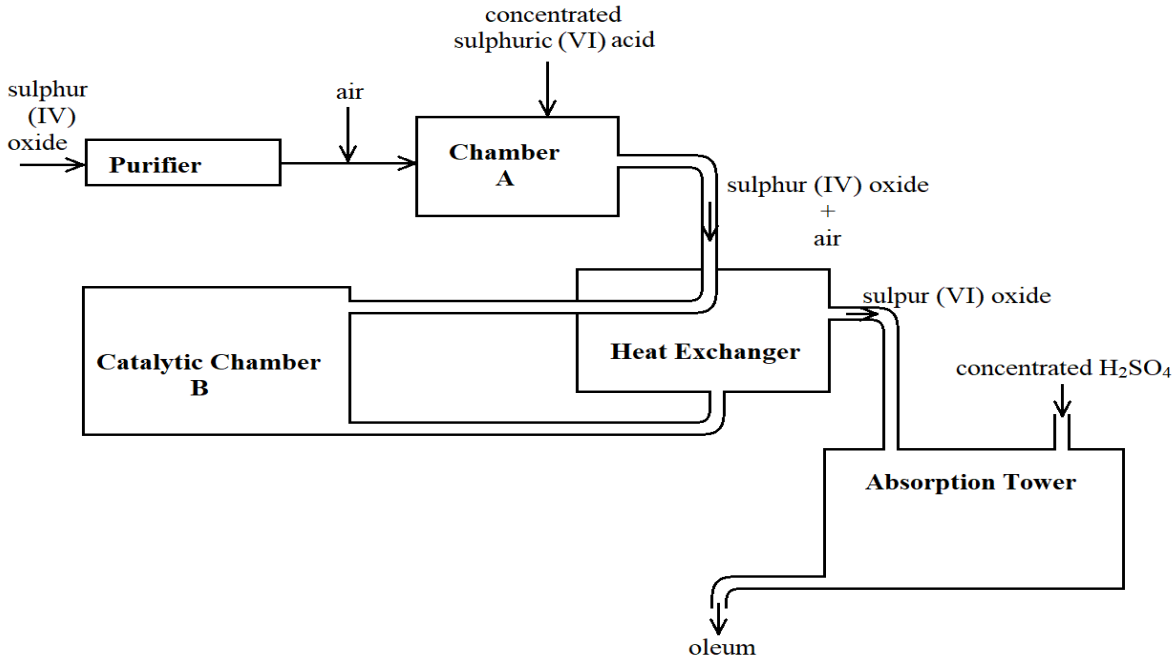


i) Identify **X** **(1 Mark)**

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

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

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



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

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

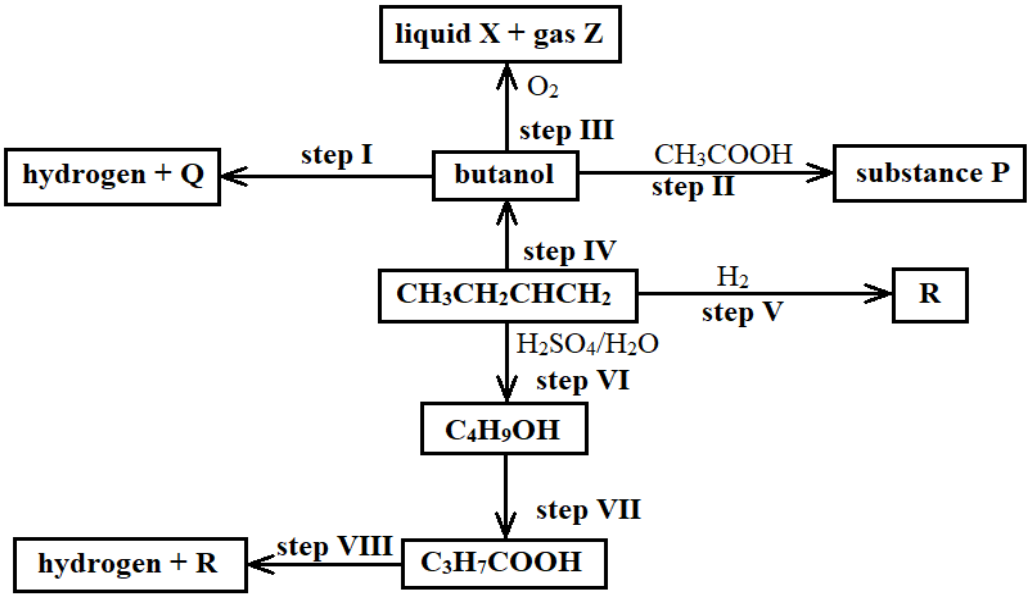
iii) Name **two** catalysts that can be used in the Catalytic **Chamber B**. **(2 Marks)**

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

v) Describe the test for sulphite anion, SO_3^{2-} **(2 Marks)**

vi) Explain the observation made when a few drops of concentrated sulphuric (VI) acid are added to crystals of hydrated copper (II) sulphate. Explain your answer. **(2 Marks)**

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



i) What is the distinguishing physical property of **Substance P**? **(1 Mark)**

ii) Identify a suitable reagent that can be used in **Step I**. **(1 Mark)**

iii) Describe a chemical test on how **C_3H_7COOH** can be distinguished from **C_4H_9OH**. **(2 Marks)**

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

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

vi) If 7.4g of butanol completely underwent Step III, determine the volume of gas Z produced at s.t.p.

(MGV = 22.4 litres, C = 12, H = 1, O = 16) **(3 Marks)**

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

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

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 8)

CHEMISTRY

233/1

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- *Write your name, admission number, class, date and then sign in the spaces provided.*
- *Answer **all** questions in the spaces provided.*
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*

FOR EXAMINERS USE ONLY

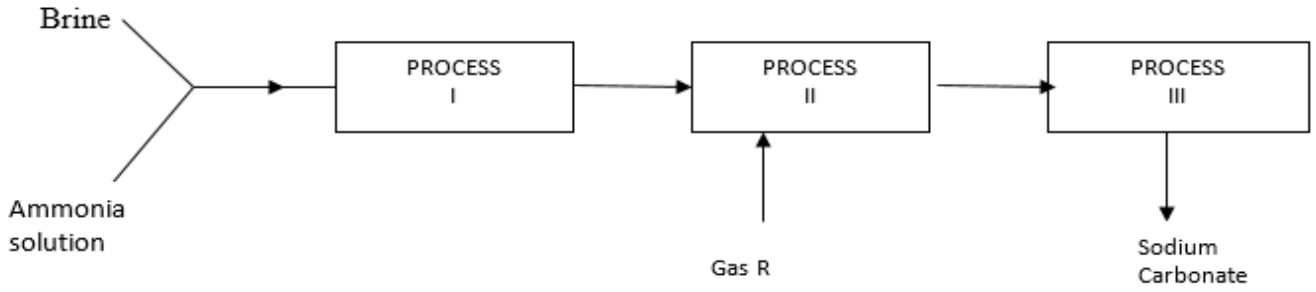
QUESTIONS	MAXIMUM SCORE	STUDENTS SCORE
1-29	80	

1. When magnesium metal is burnt in air, a white ash is formed. Write the formula of the two components of the white ash. **(2marks)**

2. What type of bond is formed when sodium and chlorine react? Explain. **(2marks)**
(Atomic numbers: Na = 11 and Cl = 17)

3. When solid Sodium carbonate was added to a solution of hydrogen chloride in methylbenzene, there was no apparent reaction. On addition of water to the resulting mixture, there was vigorous effervescence. Explain these observations. **(3marks)**

4. Below is a simplified scheme of Solvay process. Study it and answer the questions that follow:



a) Identify gas R. **(1mark)**

b) Write an equation for the process III. **(1mark)**

c) Give **two** use of sodium carbonate. **(1mark)**

5. When potassium nitrate is heated, it produces potassium nitrite and gas C.

(a) Identify gas **C** **(1mark)**

(b) Name the type of reaction undergone by the potassium nitrate **(1mark)**

6. When a few drops of aqueous ammonia were added to copper (II) nitrate solution, a light blue precipitate was formed. On addition of more aqueous ammonia, a deep blue solution was formed. Identify the substance responsible for the:

a. Light blue precipitate. **(1mark)**

b. Deep blue solution. **(1mark)**

7. The first step in the industrial manufacture of nitric (v) acid is the catalytic oxidation of ammonia gas.

(a) What is the name of the catalyst used? **(1 mark)**

(b) Write the equation for the catalytic oxidation of ammonia gas. **(1mark)**

(c) Nitric acid is used to manufacture ammonium nitrate, state two uses of ammonium nitrate. **(1mark)**

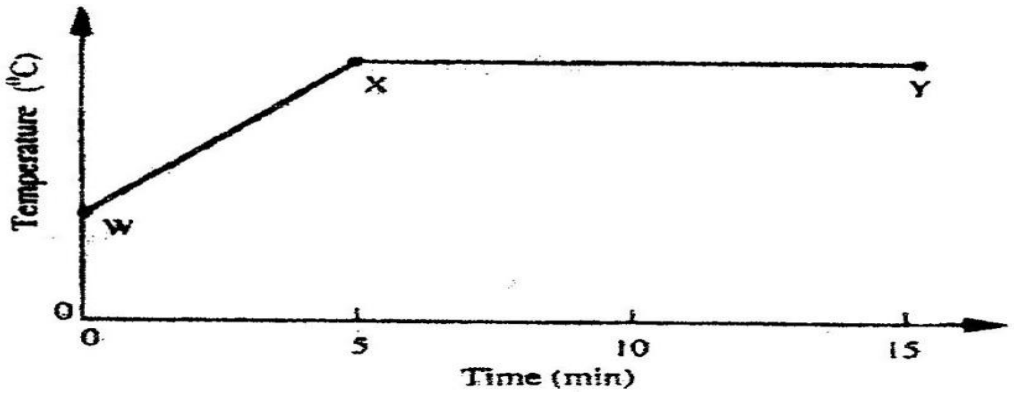
8. a) Complete the table below to show the colour of the given indicator in**.** **(1mark)**

Indicator	Colour in	
	Acid solution	Basic solution
Methyl orange	…….	Yellow
Phenolphthalein	Colorless	……

b) How does the pH value of 0.1 M potassium hydroxide solution compare with that of 0.1M aqueous ammonia? Explain. **(2marks)**

9. Sketch and label a graph to show activation energy in an endothermic reaction. **(3marks)**

10. The graph below shows a curve obtained when water at 20°C was heated for 15 minutes.



a) What happens to the water molecules between points W and x? **(1mark)**

b) In which part of the curve does a change of state occur? **(1mark)**

c)State one application of the effect of impurities on melting point of substances**.** **(1mark)**

11. In an experiment, magnesium reacted with copper (ii) sulphate solution.

a) What type of reaction is illustrated**.** **(1mark)**

b) state two observations made. **(2marks)**

12. 15.0cm^3 of ethanoic acid (CH_3COOH) was dissolved in water to make 500cm^3 of solution. Calculate the concentration of the solution in moles per litre. (C=12.0; H=1.0; O=16.0; density of ethanoic acid is 1.05 g/cm^3). **(3marks)**

13. In an experiment, a few drops of concentrated nitric (v) acid were added to aqueous iron (II) sulphate in a test tube. Excess sodium hydroxide solution was then added to the mixture.

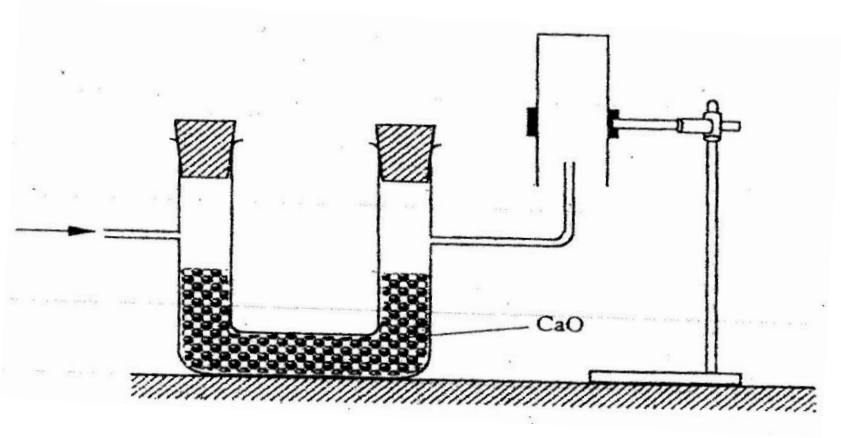
a) State the observations that were made when:

i)Concentrated nitric (v) acid was added to aqueous iron (II) sulphate**.** **(1mark)**

ii) Excess sodium hydroxide was added to the mixture. **(1mark)**

b) Write the ionic equation for the reaction which occurred in (a) (ii) above. **(1mark)**

14. The set-up below was used to collect a dry sample of a gas.



a) Give two reasons why the set-up cannot be used to collect carbon (iv) oxide gas. **(2marks)**

b) Name a gas that can be collected by the above set up**.** **(1mark)**

15 The basic raw material for extraction of aluminium is bauxite

a) Name the method that is used to extract aluminium from bauxite. **(1mark)**

b) Write the chemical formula of the major component of bauxite. **(1mark)**

c) Name two major impurities in bauxite. **(1mark)**

16. During the electrolysis of aqueous silver nitrate, a current of 5.0A was passed through the electrolysis for 3 hours.

a) Write the equation for reaction which took place at the cathode. **(1mark)**

b) Calculate the mass of silver deposited at the cathode. (Ag = 108; IF=96500C). **(2marks)**

17. A compound whose general formula is $M(OH)_3$ reacts as shown by the equation below.

$M(OH)_{3(s)} + OH_{(aq)} \longrightarrow M(OH)_{4(aq)}$

$M(OH)_{3(s)} + 3H^+_{(aq)} \longrightarrow M^{3+}_{(aq)} + 3H_2O_{(i)}$

(a) What name is given to compounds which behave like $M(OH)_3$ in the two Reactions **(1 mark)**

(b) Name two elements whose hydroxides behave like that of **M** **(2 marks)**

18. a) State the Graham's law of diffusion. **(1mark)**

b) The molar masses of gases W and X are 16.0 and 44.0 respectively. If the rate of diffusion of W through a porous material is $12cm^3s^{-1}$, calculate the rate of diffusion of X through the same material. **(2marks)**

19. In a closed system, aqueous iron (III) chloride reacts with sulphide gas as shown in the equation below.

$$2FeCl_{3(aq)} + H_2S_{(g)} \rightleftharpoons 2FeCl_{2(aq)}\ 2HCl_{(aq)} + S_{(s)}$$

State and explain the effects on the position of equilibrium point when dilute hydrochloric acid is added to the system at equilibrium. **(2marks)**

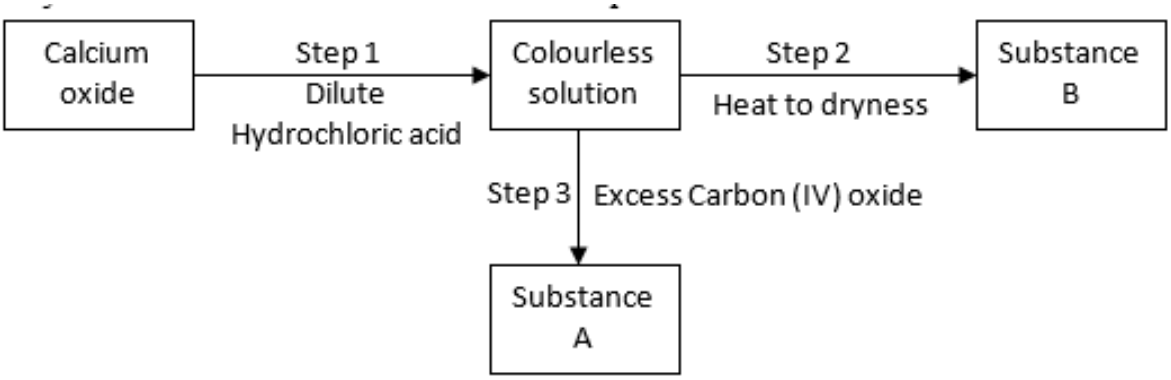
20.In an experiment to determine the percentage of magnesium hydroxide in an anti-acid, a solution containing 0.50 g of the anti-acid was neutralized by 23.0 cm^3 of 0.1M hydrochloric acid (Relative formula mass of magnesium hydroxide =58)

Determine the,

a) Mass of magnesium hydroxide in the anti-acid. **2marks)**

b) Percentage of magnesium hydroxide in the anti-acid . **(1mark)**

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



a) Give the name of the process that takes place in step 1. **(1mark)**

b) Give;

(i) The name of substance A**.** **(1mark)**

(ii) One use of substance B**.** **(1mark)**

22. Starting with 50 cm^3 of 2.8M sodium hydroxide, describe how a sample of pure sodium sulphate crystals can be prepared. **(3 marks)**

23. Use the information below to answer the questions that follow:

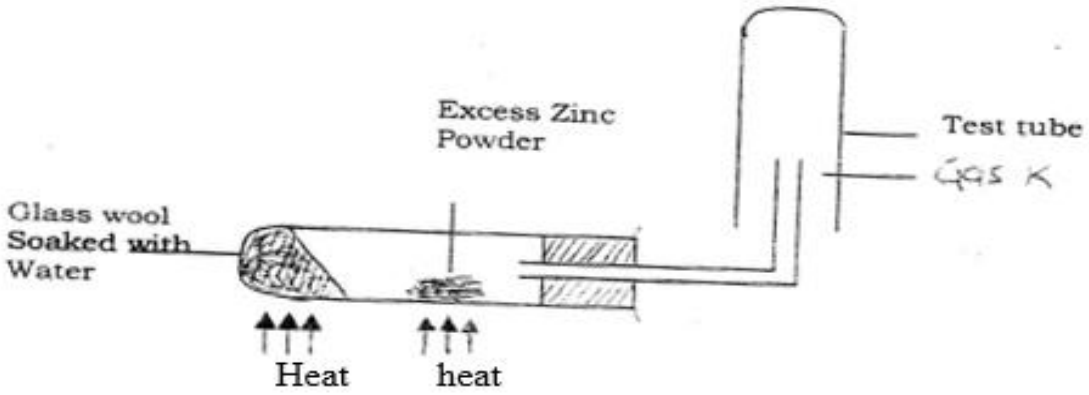
Equation	Enthalpy of formation
$H_2(g) + ½ O_2(g) \rightarrow H_2O(l)$	$\triangle H = -286\ kjmol^{-1}$
$C(s) + O_2(g) \rightarrow CO_2(g)$	$\triangle H = -394 kjmol^{-1}$
$2C(s) + 3H_2(g) + ½ O_2 \rightarrow C_2H_5OH(i)$;	$\triangle H = 277 kjmol^{-1}$

a) Define the term "enthalpy of formation of a compound **(1mark)**

b) Calculate the molar enthalpy of combustion, $\triangle H_c$ of ethanol:

$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ **(2marks)**

24. A student set up the experiment below to collect gas K, the glass wool was heated before heating the Zinc powder.



a) Explain why was it necessary to heat the moist glass wool before heating zinc powder. **(2mks)**

b) Identify gas K. **(1mark)**

25. Compound W (not its actual symbol) is a solid with a giant ionic structure. In what form would the compound conduct an electric current, explain. **(2marks)**

26.Pentane and ethanol are miscible. Describe how water could be used to separate a mixture of pentane and ethanol. **(3marks)**

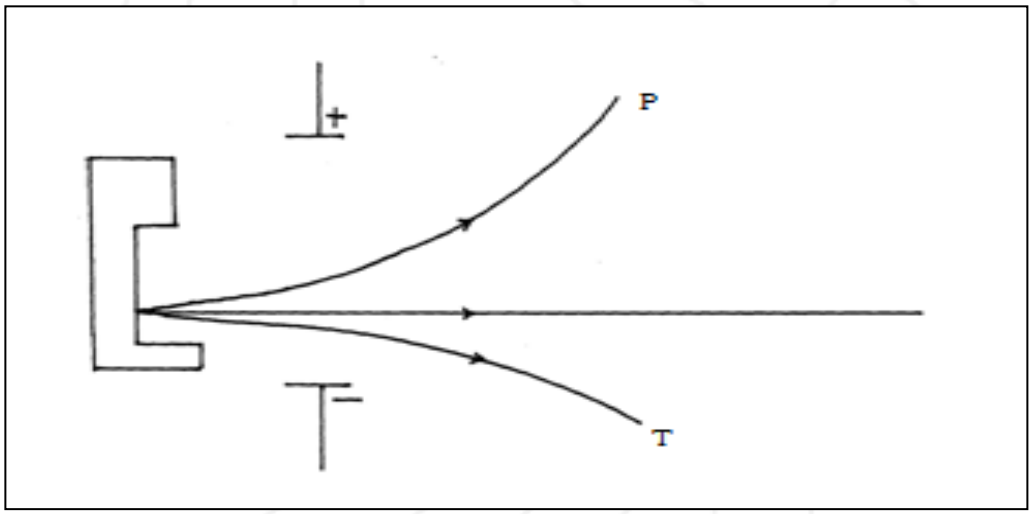
27. But -2- ene undergoes hydrogenation according to the equation given below

$CH_3CH = CHCH_3$ (g) + H_2 (g) $\rightarrow CH_3CH_2CH_2CH_3$ (g)

(a) Name the product formed when but -2 – ene reacts with hydrogen gas. **(1mark)**

(b) State one industrial use of hydrogenation. **(1mark)**

28. The figure below shows the behaviour of emissions by a radioactive isotope x. Use it to answer the question follow



(a) Why does isotope **X** emits radiations. **(1mark)**

(b) Name the radiation labelled **T** **(1mark)**

c)What is half-life **(1mark)**

29.a) State two reasons why cars are **painted** **(1mark)**

b) Explain why electric cars are better than ordinary fuel cars. **(2marks)**

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 8)

CHEMISTRY

233/2

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

(a) *Write your name and admission number in the spaces provided above.*
(b) *Answer **all** the questions in the spaces provided in the question paper.*
(c) *Non-programmable silent electronic calculators and KNEC mathematical tables may be used.*
(d) *All working **must** be clearly shown where necessary.*
(e) *Candidates should answer the questions in English.*

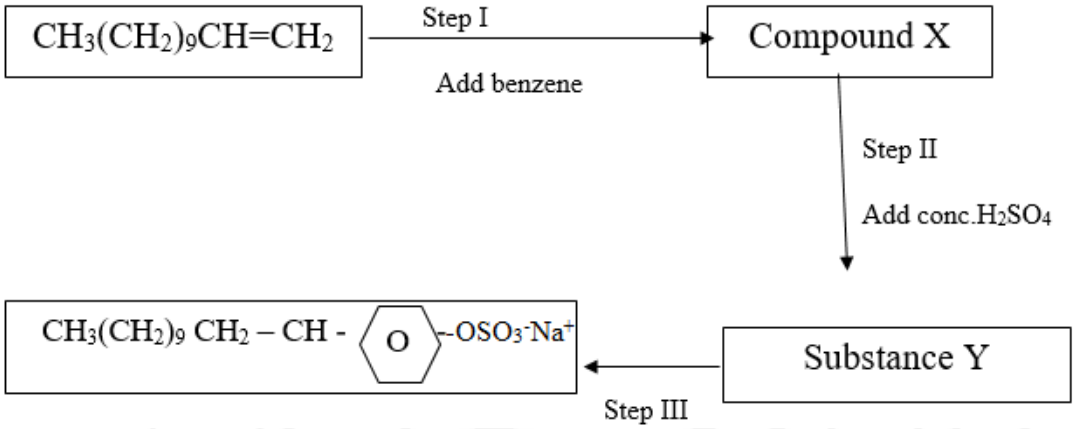
FOR EXAMINER'S USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	12	
2	13	
3	11	
4	11	
5	12	
6	10	
7	11	
Total score	80	

*Answer **all** the questions*

1. (a) Detergents are substances that improves cleansing properties of what. Name two substances that are added to detergents to make them more effective in cleansings. **(1mark)**

(b) The flow chart below shows steps in the manufacture of soapless detergent. Study it and answer the questions that follow.



(i) State the condition necessary for Step I. **(1mark)**

(ii) Write an equation for the reaction in step I (benzene, C_6H_6 is represented as O —). **(1 mark)**

(c) (i) Name the process in step III. **(1mark)**

(ii) Give the reagent in step III. **(1mark)**

(iii) Give the name of the product of step III. **(1mark)**

(d) Explain:

(i) One advantage of soapless detergents over soaps. **(1mark)**

(ii) One disadvantage of soapless detergents over soaps. **(1mark)**

(e) Pentanoic acid reacts with butan-1-ol to form an organic compound.

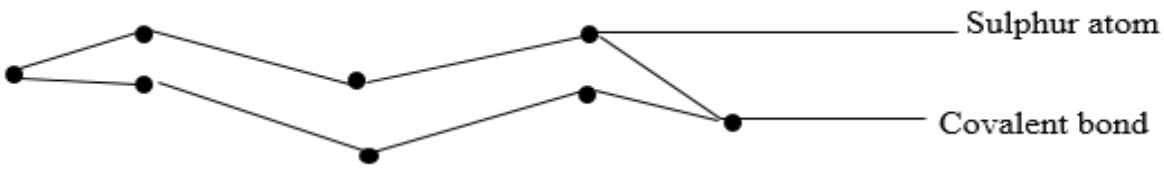
(i) What is the name given to the above type of reaction? **(1mark)**

(ii) A certain catalyst must be added to the mixture to increase the rate of reaction.

Name the catalyst. **(1mark)**

Explain the role of the catalyst in the above reaction. **(1 mark)**

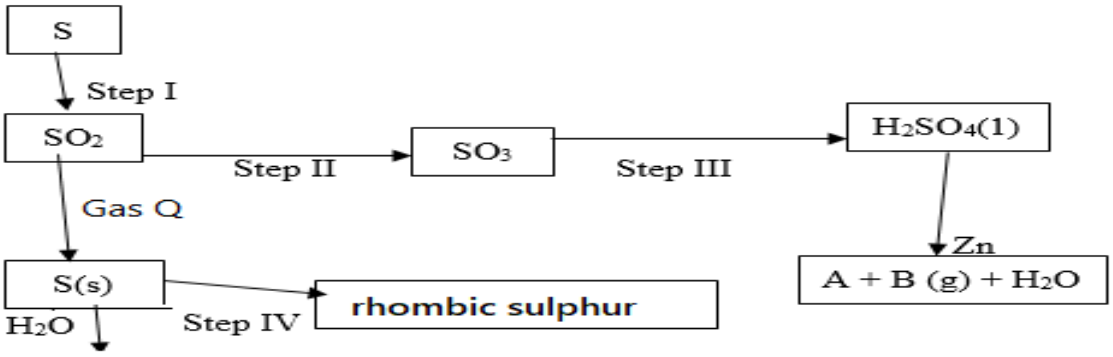
2. Study the structure below and use it to answer the questions that follows



(a) State two observations made when the molecule is heated to a temperature of 113°c. **(2 marks)**

(b) Write an equation of the reaction between sulphur atom with hydrogen gas. **(1mark)**

(c) Below is a flow chart. Use it to answer the questions that follow.



Name: **(2 marks)**

(i) Gas Q……(ii) Gas B …….

(d) (i) State the observations made in step I. **(2marks)**

(ii) Step I and Step II occur in the Contact process. State the optimum conditions necessary for Step II to occur. **(2marks)**

(iii) Name the reagent used in Step IV. **(1 mark)**

(iv) Explain why water is not used in Step III. **(1 mark)**

(e) Sulphur (iv) oxide is a major environmental pollutant and should not be emitted into the atmosphere. Name the reagent used to achieve this. **(1 mark)**

(f) Explain the role of Sulphur in vulcanization of rubber. **(1 mark)**

3. Study the Standard electrode potential for the half-cell given below and use it to answer the questions that follow. The letters do not represent the actual symbols of elements. **Eθ (volts)**

$P^{+}_{(aq)} + e^{-} \longrightarrow P(s)$	-2.92
$Q^{+}_{(aq)} + e^{-} \longrightarrow Q(s)$	+0.52
$R^{+}_{(aq)} + e^{-} \longrightarrow \frac{1}{2}R_2(g)$	0.00
$S^{2+}_{(aq)} + 2e^{-} \longrightarrow S(s)$	-0.44
$\frac{1}{2}T_{2(g)} + e^{-} \longrightarrow T^{-}_{(aq)}$	+1.36

(a) Identify the strongest oxidizing agent. Give a reason for your answer. **(2 marks)**

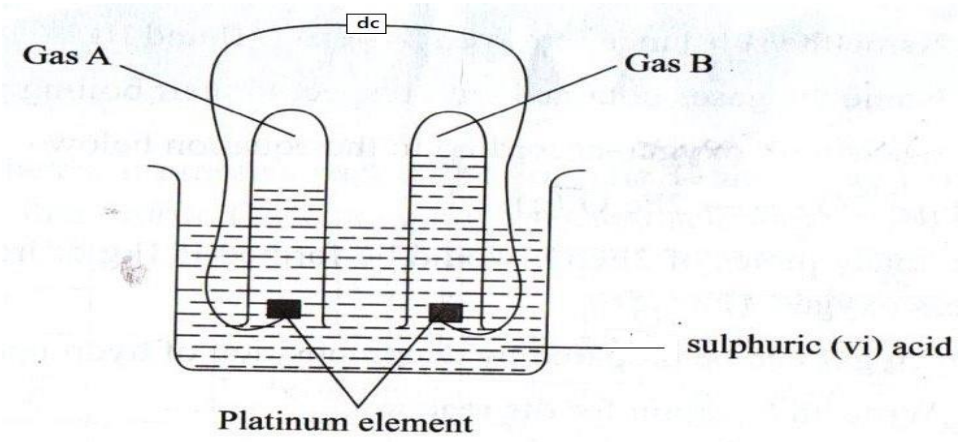
(b) Which half cells would produce the highest potential difference when combined? **(1 mark)**

(c) Predict whether the reaction represented below can take place. **(2 marks)**

$$S_{(s)} + P^{+}_{(aq)} \longrightarrow S^{2+}_{(aq)} + P_{(s)}$$

(d) Write a cell representation for the cell that would be constructed by combining P and Q.**(2 mks)**

(e) 100 cm^3 of 2M sulphuric acid was electrolyzed using the set up represented by the following diagram.



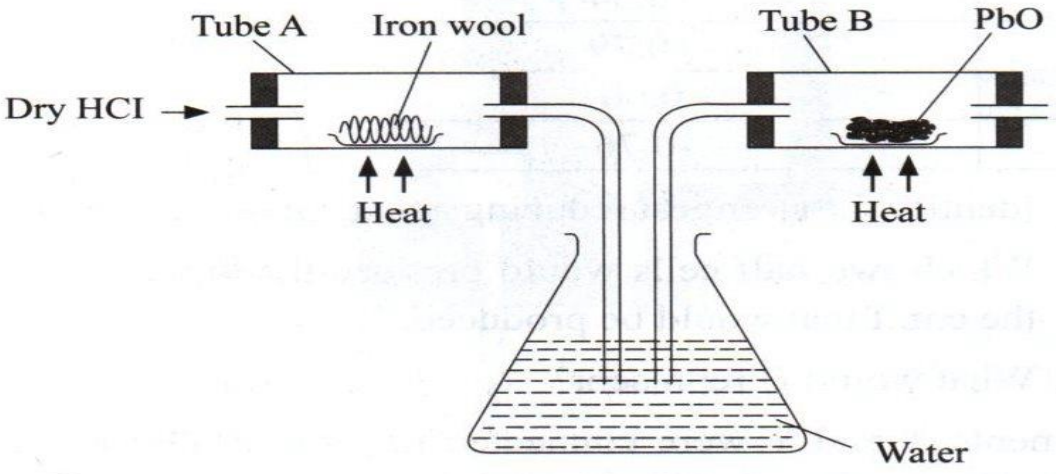
(i) Write an equation for the reaction that produces gas B.

(ii) Describe how gas A can be identified. **(1 mark)**

(iii) Explain the differences in the volumes of gases produced at the electrodes. **(2 marks)**

(f) An electric current is passed through a solution for 18 minutes. The volume of gas produced at the cathode is 480 cm3.Calculate the current used. (Molar gas volume at rtp = 24 dm3 IF = 96500 C) **(2 marks)**

4. In an experiment, dry hydrogen chloride gas was passed through heated iron wool as shown in the diagram below. The gas produced was then passed through heated lead (II) oxide.



(a) (i) State the function of water in the flask. **(1 mark)**

(ii) Write the equation for the reactions that took place in tubes labeled A and B**.** **(2 marks)**

Tube A

Tube B

(iii) Explain how the total mass of tube B and its contents would compare before and after the experiment. **(2 marks)**

(b) Chlorine gas and hydrogen chloride gas can be prepared using the following reagents: sodium chloride, concentrated Sulphuric (VI) acid and potassium manganate (VII) and hydrochloric acid.

(i) State the role of each of the following in the reaction. **(1 mark)**

Concentrated Sulphuric (vi) acid

Potassium manganate VII. **(1 mark)**

(ii) Name the bleaching agent formed when chlorine gas is passed through cold dilute sodium hydroxide solution. **(1 mark)**

(iii) Apart from bleaching action, state the other use of compound formed in (ii) above**. (1 mark)**

(c) 1.9 g of magnesium chloride were dissolved in water. Silver nitrate solution was then added until in excess. Calculate the mass of $AgNO_3$ that was needed for the complete reaction.**(2 mks)**

(Ag = 108, O = 16, N = 1, Mg = 24, Cl = 35.5)

5. Use the grid below to answer the questions that follow (the letters do not represent the actual symbols of the elements)

A								
F	J				M		O	
G			K	L		N	P	Q
H								

(a) Give the family name to which elements in the shaded area belong. **(1 mark)**

(b) State and explain the difference in reactivity between G and J. **(2 marks)**

(c) How does the atomic radius of K compare to that of L? Explain. **(2 marks)**

(d) Element R forms an oxide of formula RO_2 and it belongs to period 2.

Indicate on the grid the position of R. **(1mark)**

(e) Give the formula of the compound formed between K and P. **(1mark)**

(f) Give the type of bond formed when F reacts with O. Explain. **(2 marks)**

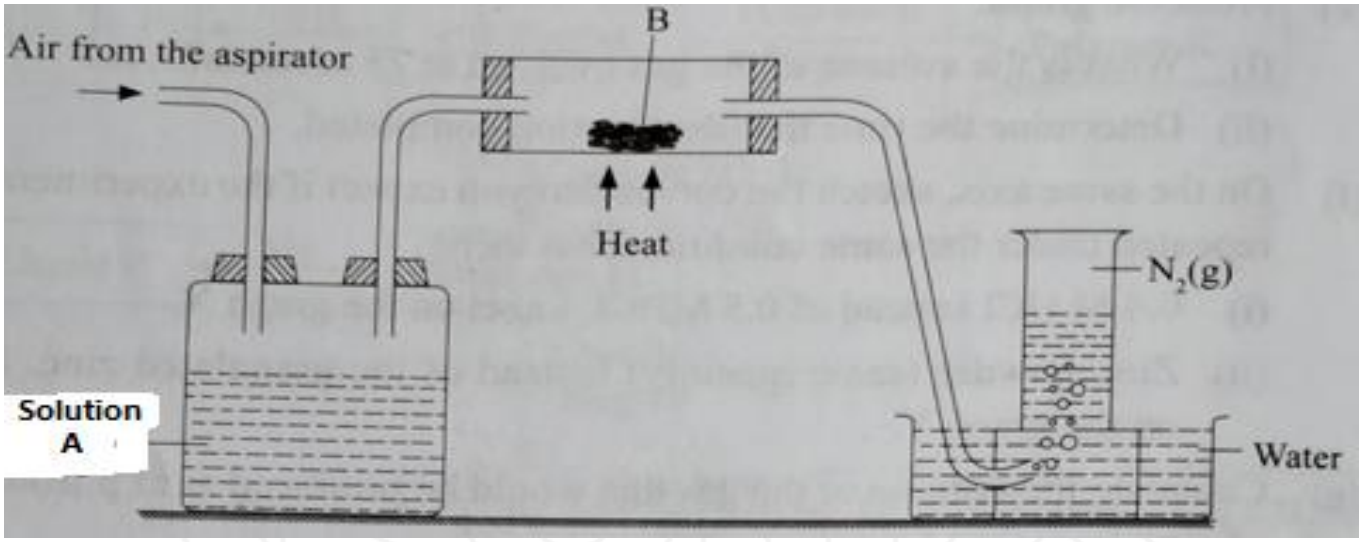
(g) Give the electronic arrangements of the ions of G and M. **(1mark)**

G……

M……

h) Element A can fit in two groups. Name the two groups and explain**.** **(2 marks)**

6. An experiment was carried out using the apparatus as shown below to prepare a sample of nitrogen gas from air.



(a) Identify one mistake in the setup. **(1mark)**

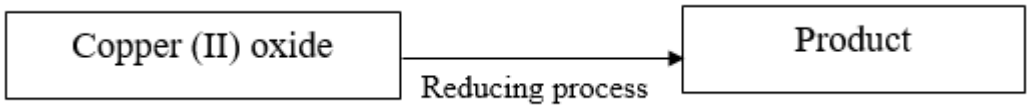
(b) Name what is contained in: **(2marks)**

(i) Bottle A ……..

(ii) Tube B ……

(c) The nitrogen prepared by his method is denser than nitrogen prepared by fractional distillation of liquid air. Explain. **(1mark)**

(d) Use the flow diagram to answer the questions



(i) Give the formulae of three gases which can reduce hot copper (II) oxide. **(3 marks)**

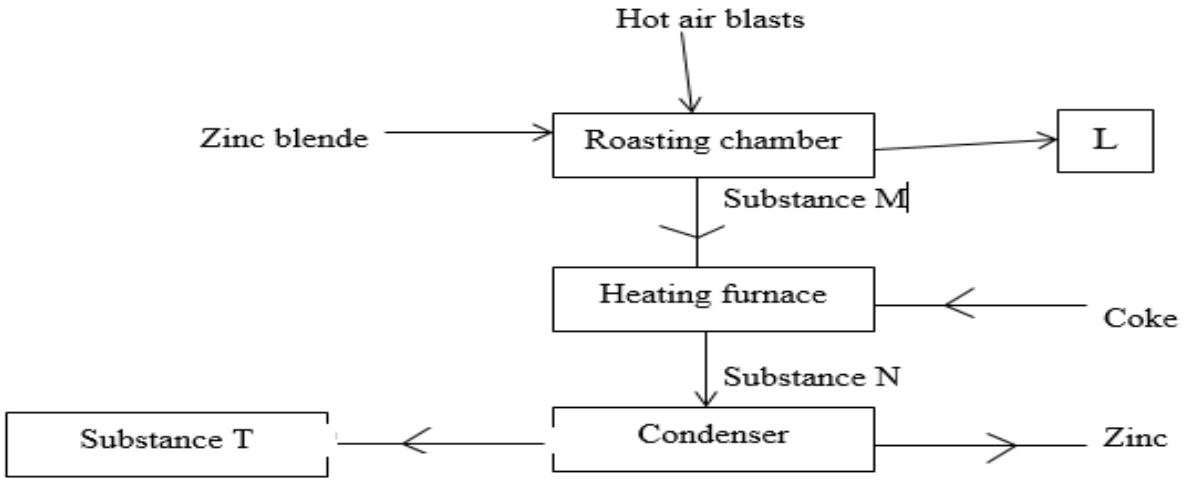
(ii) Explain what will be observed when the above reaction takes place**.** **(1 mark)**

(e) In the Haber process, the optimum yield of ammonia is obtained when a temperature of 450°c,a pressure of 200 atmospheres and an iron catalyst are used.

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

How is the yield of ammonia affected if the temperature is raised to 600° C. Give a reason? **(2mks)**

7. The flow chart below illustrates extraction of Zinc from zinc blende. Study it and answer the questions that follow



(a) Give an equation for the reaction in roasting furnace. **(1 mark)**

(b) Name each of the substances marked L and N. **(2 marks)**

(c) Why is it necessary to condense substance N? **(1 mark)**

(d) Which other factory can be set up near the zinc extraction plant. Explain. **(2marks)**

(e) Give one use of zinc metal. **(1 mark)**

(f) (i) Zinc sulphide and sulphuric acid react according to the following equation.:

$$ZnS_{(s)} + H_2SO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + H_2S_{(g)}$$

2.91g of zinc sulphide reacted with 100cm^3 of 0.2M Sulphuric acid. Determine the reagent that was in excess. (Zn = 65.0, S = 32.0). **(2 marks)**

(ii) Calculate the volume of hydrogen sulphide H_2S) gas produced in the reaction above at rtp. Molar gas volume 24 dm^3**)** **(2 marks)**

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KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 9)

CHEMISTRY

233/1

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

Instructions to candidates

(a) *Write your name and index number in the spaces provide above.*

(b) *Sign and write the date of examination in the spaces provided above.*

(c) *Answer ALL the questions in the spaces provided in the question paper*

(d) *KNEC Mathematical tables and electronic calculators may be used for calculations.*

(e) *All working MUST be clearly shown where necessary.*

(f) *Candidates should answer the questions in English.*

FOR EXAMINERS' USE ONLY

Question	Maximum Score	Candidates' Score
1 – 32	80	

Answer ALL the questions

1. What is the difference between chromatography and chromatology? **(1mark)**

2. When dilute Sulphuric (VI) acid is connected in a circuit to test conduction of electricity, the bulb lights while when concentrated Sulphuric (VI) acid is used in the same set-up, the bulb does not light. Explain this observation. **(2marks)**

3. Explain why Aluminium Chloride has **PH 3** when dissolved in water? **(2marks)**

4. Below is a list of substances.

Soap solution, common salt, urine, lemon juice and baking powder.

Select:

(a) A substance that is likely to give a PH of 3.0 when tested? **(1mark)**

(b) A substance (s) which is likely to resemble sodium hydrogen carbonate**.** **(1mark)**

(c) Two substances when reacted are likely to give the product with same **PH** as that of common salt. **(1mark)**

5. Briefly explain the observation made when a small piece of sodium metal is dropped into a bowl of water. **(3marks)**

6. (a) Define Le Chatelier's principle. **(1mark)**

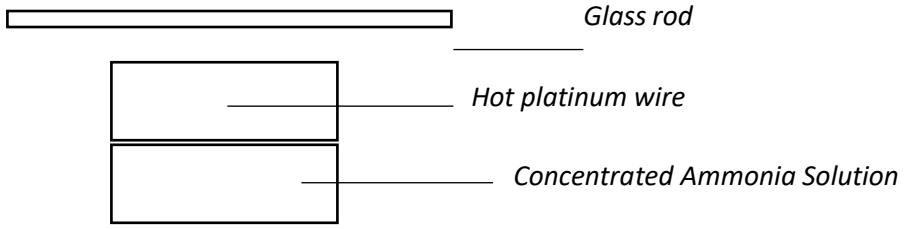
(b)A fixed mass of a gas has a volume of **400cm^2** at **20°C,** what temperature rise would produce a 10% increase in volume if the pressure remains constant. **(3marks)**

7. Using Dots (.) and (x) diagram, show the number of electrons used in bonding of H_3O^+**(2marks)**

8. Explain why a luminous flame appears yellow. **(2marks)**

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

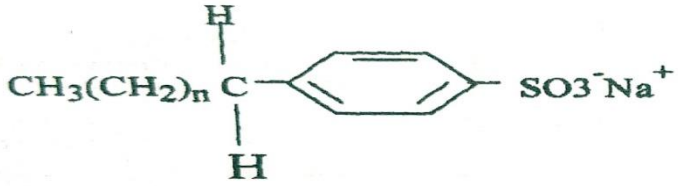
10. Hot platinum wire was lowered into a flask containing concentrated ammonia solutions shown below.



State and explain observations made **(3marks)**

11. Give three characteristics of gases according to Kinetic theory of matter. **(3marks)**

12. The formula below represents active ingredients of two cleansing agents **A** and **B**

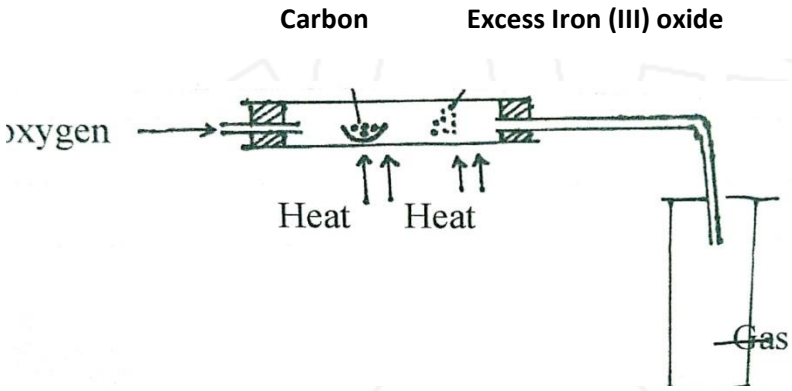


$CH_3(CH_2)_6COO^-Na^+$

Agent A **Agent B**

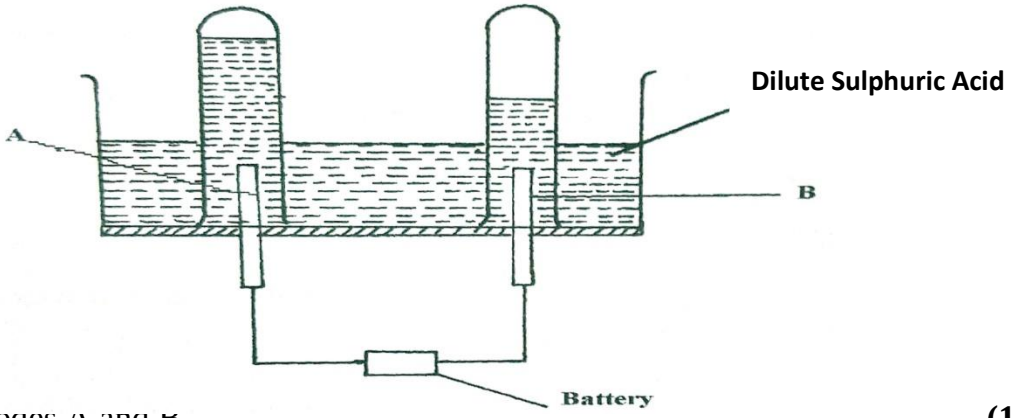
Which one of the cleansing agents would be suitable to be used in water containing magnesium hydrogen carbonate? Explain. **(2marks)**

13. The set-up below was used to obtain a sample of iron



Write **two** equations for the reactions which occur in the combustion tube. **(2marks)**

14. The diagram below represents a set-up that can be used for the electrolysis of dilute Sulphuric acid.



(a) Name the electrodes A and B **(1mark)**

(b) Write an equation for the reaction taking place at electrode B. **(1mark)**

(c) What happens to the concentration of dilute sulphuric acid as the reaction continues? **(1mark)**

15. Describe one physical and one chemical test that can be used to identify Ethane gas. **(2marks)**

16. 15$cm^3$of a solution containing 2.88g/dm^3 of an alkali XOH completely reacts with 20cm^3 of 0.045M sulphuric acid. Calculate the reactive atomic mass of X present in the alkali. **(3marks)**

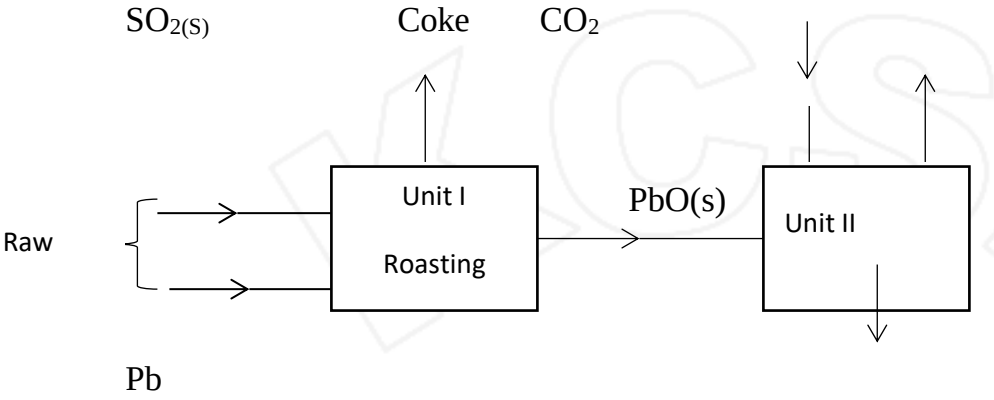
17. Using equations, state and explain the changes in mass that occur when the following are heated separately in open crucible. **(3marks)**

(a) Magnesium metal

(ii) Zinc carbonate

18. In the space provided below, draw a set-up that can be used to show the reaction between nitrogen (I) oxide with copper to give Nitrogen gas. **(3marks)**

19. The flow chart below shows some process in extraction of lead metal. Study it and answer the questions that follow;



(a) Name two raw materials that were fed into Unit I **(1mark)**

(b) State one environment hazard associated with the process in Unit I. **(1mark)**

(c) What is the function of Coke in Unit II **(1mark)**

20. Sulphur exhibits as an allotropy.

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

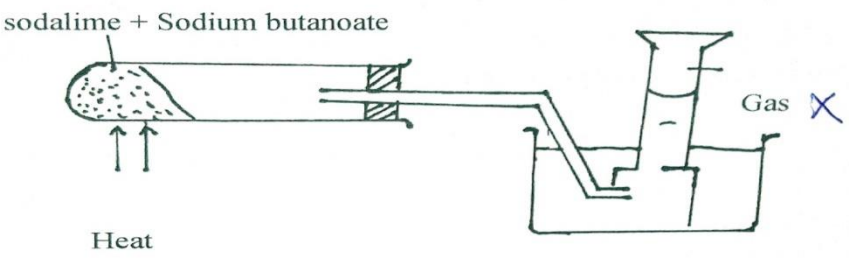
(b) Name the two allotropes of sulphur. **(1mark)**

(c) Sulphur powder was placed in a deflagrating spoon and heated on a Bunsen burner.

(i) State the observation made. **(1mark)**

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

21. The set-up below was used to prepare a sample of an organic compound X.



(a) Identify gas X **(1mark)**

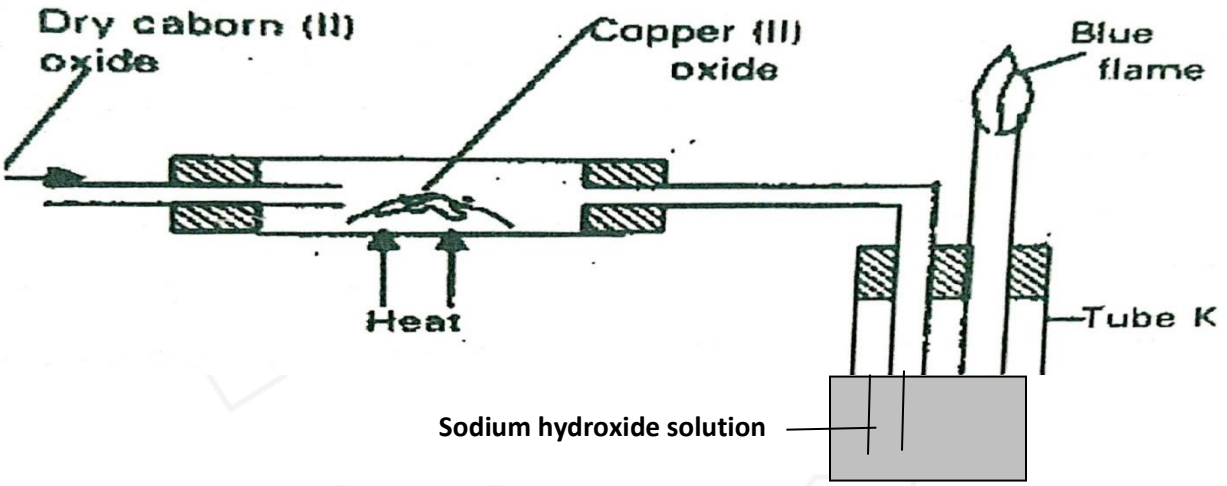
(b) Write the equation for the reaction that produces gas X. **(1mark)**

(c) 1 Mole of chlorine was reacted with gas X in presence of sunlight.

(i) State one observation made. **(½ mark)**

(ii) Name the major product formed. **(½ mark)**

22. The apparatus shown below was used to investigate the effect of carbon (II) oxide on Copper (II) oxide.



(a) State the observation that was made in the combustion tube at the end of the experiment. **(1mark)**

(b) Write an equation for the reaction that took place in the combustion tube. **(1mark)**

(c) Why is it necessary to burn the gas coming out of tube K? **(1mark)**

23. The equation below represents changes in the physical state of ions metal:

$Fe_{(s)} \longrightarrow Fe_{(I)} \quad \Delta H = +15.4 Kjmol^{-1}$

$Fe_{(1)} \longrightarrow Fe_{(g)} \quad \Delta H = +354 Kjmol^{-1}$

Calculate the amount of heat energy required to change 10kg of solid iron to gaseous iron. (Fe = 56) **(3marks)**

24. The section below represents part of the periodic table. Study it and answer the questions that follow; the letters are not the actual symbol of the elements.

				Q				
X			**B**	**H**		**M**	**T**	
Y		**A**					**V**	
Z							**S**	

(a) Explain why the atomic radius of T is smaller than that of M **(1mark)**

(b) Compare the electrical conductivity of element X and B. **(2marks)**

25. Read the following passage and answer the questions.

A salt X was heated with slaked lime (calcium hydroxide). A colorless gas R with a characteristic smell that turns red litmus paper blue was evolved. A large quantity of this gas was passed through an inverted filter funnel into Copper (II) sulphate solution, and a deep blue solution M was obtained.

(a) Identify gas R **(1mark)**

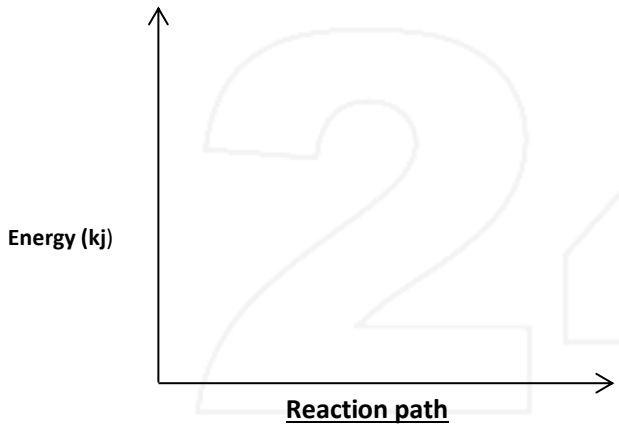
(b) What is X most likely to be? **(1mark)**

(c) Write an equation for the reaction between X and slaked lime. **(1mark)**

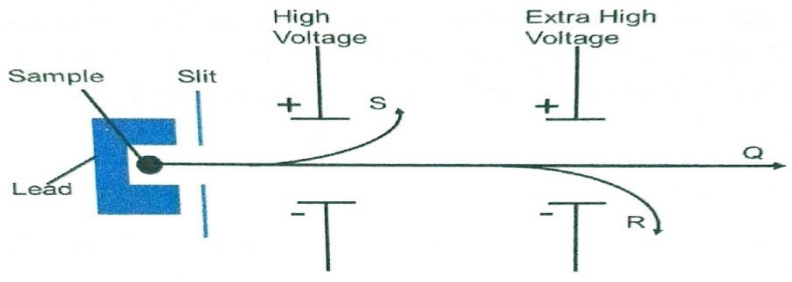
26. Consider the following reaction:

$$A_{2(g)} + B_{2(g)} \rightleftharpoons 2AB_{(g)}, \Delta \quad H = +75kj$$

Sketch an energy level diagram showing the relative activation energies for the catalyzed and uncatalyzed reactions using the axes below. **(2marks)**



27. The diagram below shows the radiations emitted by a radioactive sample.



(i) Identify radiation particles S and R **(2marks)**

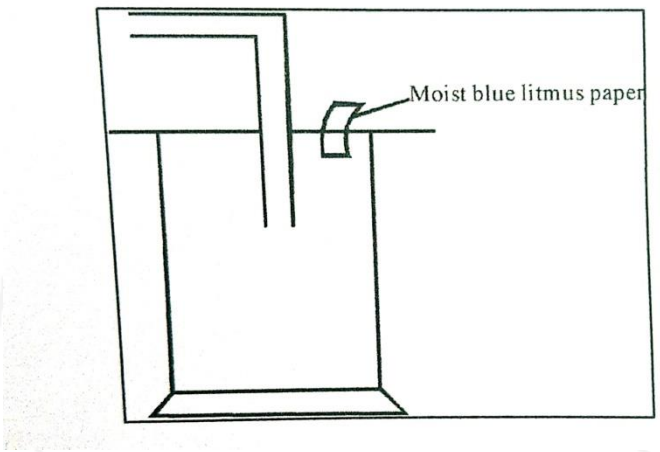
28. (a) Starting with red roses, describe how a solution containing the red pigments may be prepared? **(2marks)**

(c) How can the solution be used as an indicator? **(1mark)**

29. (a) Give one reason why some of the laboratory apparatus are made of ceramics. **1mark)**

(b) Name the two apparatus that can be used to measure approximately $75cm^3$ of dilute sulphuric (VI acid. **(2marks)**

30. Dry chlorine was collected using the set-up below.



(a) Name a suitable drying agent for chlorine gas? **(1mark)**

(b) State one property of chlorine gas which facilitates this method of collection. **(1mark)**

(c) State one observation made on the moist blue litmus paper. **(1mark)**

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 9)

CHEMISTRY

233/2

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

Instructions to Candidates

a) *Write your name and index 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 in the question paper.*

d) *KNEC Mathematical tables and silent non-programmable electronic calculators may be used.*

e) *All working **MUST** be clearly shown where necessary*

For Examiner's Use Only

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

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

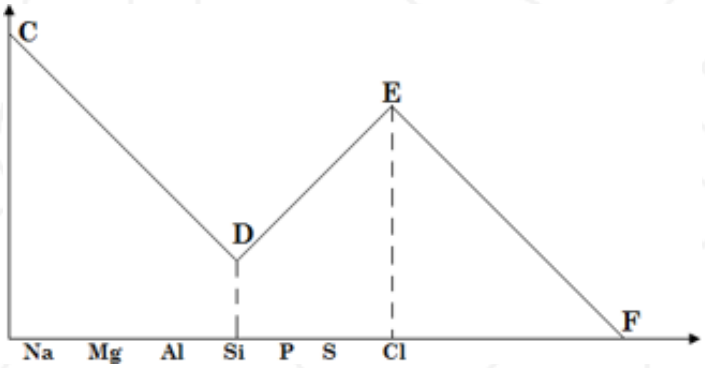
J							**M**				
	K		**N**	**O**					**P**		
L											
								H			

i) Write the formula of the compound formed by element J and M. **(1mk)**

ii) Identify the least reactive element. Give a reason for your answer. **(1mk)**

iii) Compare the atomic size of K and O. Explain. **(2mks)**

b)The following graph shows the reactivity of elements in period 3.



Explain the Trend at D and E **(1mks)**

c)The table below gives information on the Melting Points of compounds of period 3 elements. The letters do not represent the actual symbols.

Elements	R	S	T	U	V	W
Atomic number	11	12	13	14	15	16
M.pt of chloride ^{0}C	801	714	-	-70	-90	-80
M.pt of oxide ^{0}C	1190	3080	2050	2750	560	-73

a. Write the formula of

(i) Chloride of T **(1mk)**

(ii) Oxide of U **(1mk)**

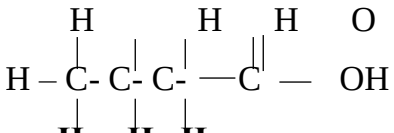
b. (a) Using the information above, suggest the type of bonding present in the chloride of V. Explain. **(2mks)**

(ii) The difference in melting point of chloride and oxide of U in terms of structure and bonding. **(2mks)**

(iii) Why there is no melting point in the chloride of T. **(1mk)**

2.(a) Give the systematic names of the compounds whose structural formulae are given below.

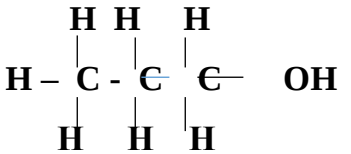
i.



(½ mark)

…….

ii.



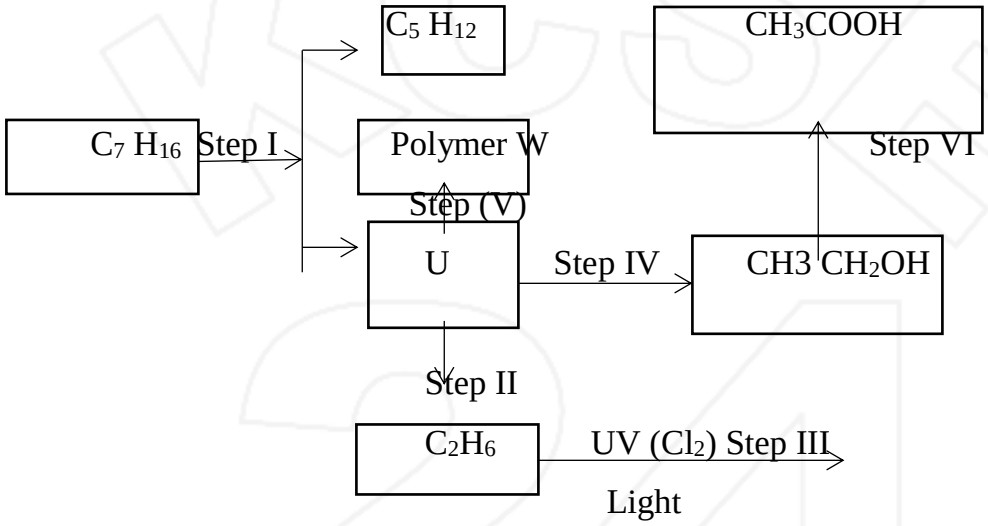
(½ mark)

……

(b) Draw and name the structural formulae of the compound obtained when compounds in (a) react.

(1 mark)

c). Study the reaction scheme below and answer the questions that follow.



(i) Name the process labeled Step I **(½ mark)**

(ii) Identify substance U **(½ mark)**

(iii) State the name of the fifth member of the homologous series to which U belongs. **(1 mark)**

(iv) Explain how acidified potassium manganite (VII) can be used to distinguish U from C_2H_6.

(2 marks)

(v) State one industrial application of the process in step II. **(1 mark)**

(vi) Write the equation for the reaction in step III. **(1 mark)**

(vii) Identify the reagent and condition required in step (IV) **(1 mark)**

(viii) State **one** use of the polymer W. **(1 mark)**

(c) $R - COO^- Na^+$ (A) and R  $OSO_3^- Na^+$ (B) represent two types of cleaning agents

(i) Name the class of the cleaning agent to which A belongs. **(1 mark)**

(ii) Which cleaning agent would be suitable to use with water containing Magnesium Chloride? Explain **(2 marks)**

3.a) In an experiment $50cm^3$ 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 recorded. The procedure was repeated using powders of metal B and C. The results obtained were given in the table below.

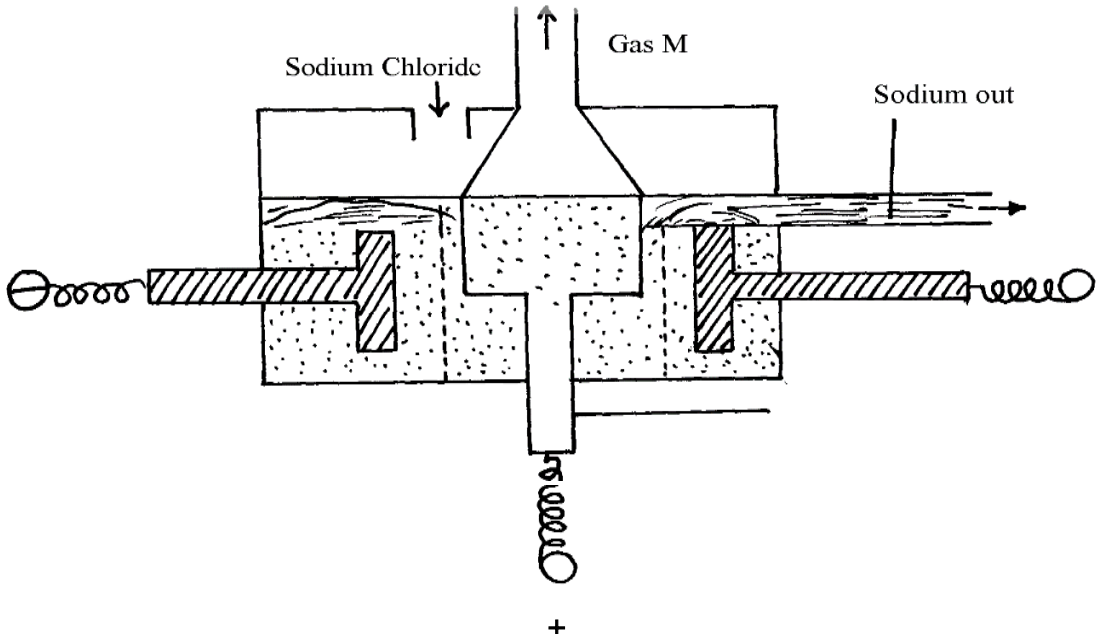
Metal	**A**	**B**	**C**
Maximum temperature(^{0}C)	26.3	31.7	22.0
Initial temperature (^{o}C)	22.0	22.0	22.0

(i) Arrange the metal A, B, C and Copper in ascending order of reactivity. **(1mark)**

(ii) State one observation that was made when the most reactive metal than copper was added to the copper (II) Sulphate solution**.** **(1mk)**

iii) Other than temperature state two factors that affect rate of reaction **1mk**

b). The diagram below shows the extraction of sodium metal using the Down's cell. Study it and answer the questions that follow.



(i) Explain why in this process sodium chloride is mixed with calcium chloride. **(1 marks)**

(ii) Why is the anode made of graphite and not iron? **(1 mark)**

(iii) State **two** properties of sodium metal that make it possible for it to be collected as shown in the diagram. **(2 marks)**

(iv) What is the function of the steel gauze cylinder? **(1 mark)**

(v) Write ionic equations for the reactions which take place at;

ICathode **(1 mark)**

II Anode **(1 mark)**

(v) Why is sodium metal stored under kerosene? **(1 mark)**

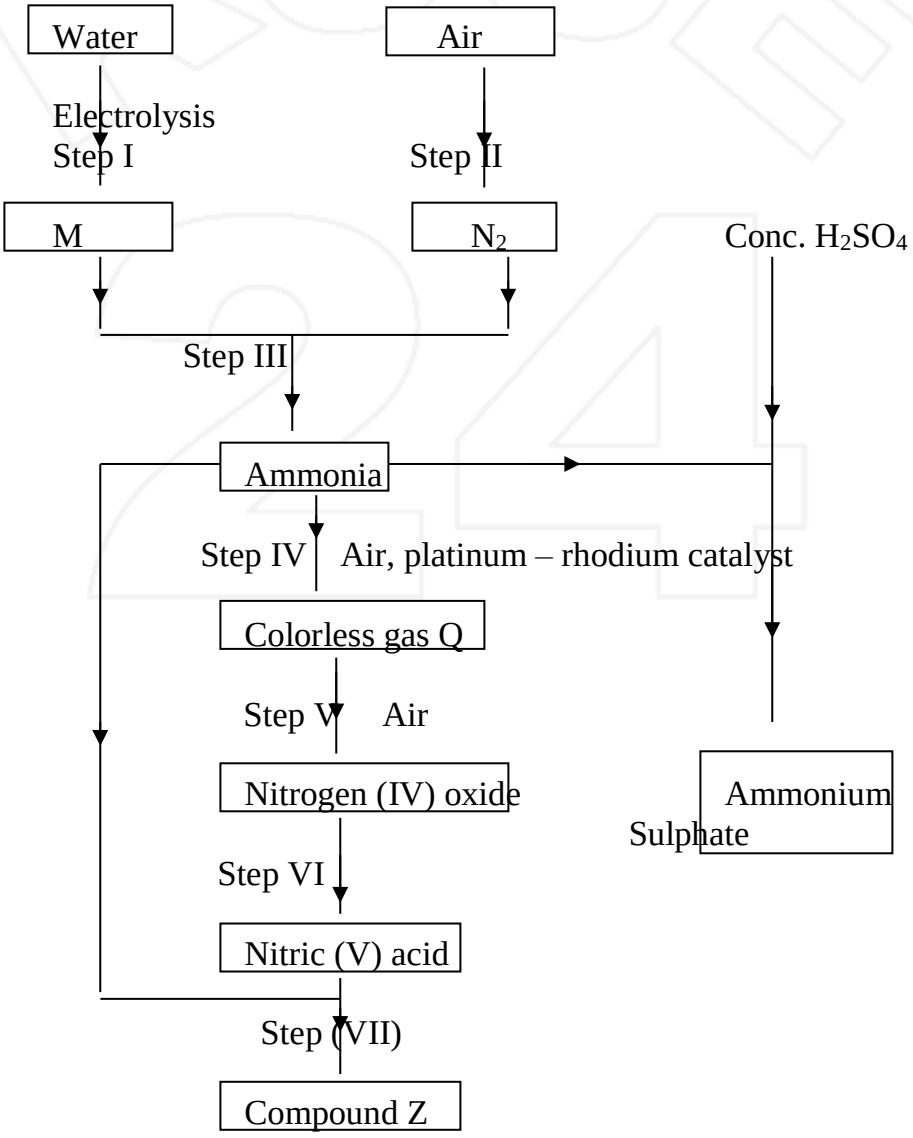
4.(a) Fractional distillation of liquid air is mainly used to obtain nitrogen and oxygen.

(i) Name one substance other than sodium hydroxide that is used to remove carbon (IV) oxide from the air before it is changed into liquid. **(1 mark)**

(ii) Describe how nitrogen gas is obtained from the liquid air.

(Boiling points nitrogen = -196^0C, Oxygen = -183^0C) **(3 marks)**

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



(i) Name substance M …… **(1 mark)**

(ii) Identify gas Q …… **(1 mark)**

(iii) State one use of compound Z …….. **(1 mark)**

(iv) A fertilizer manufacturing industry uses 1400dm^3 of ammonia gas per hour to produce ammonium sulphate. Calculate the amount of ammonium sulphate produced in kg for one day if the factory operates for 18 hours.

(N = 14, H = 1, S = 32, O = 16, 1 mole of gas = 24dm^3) **(3 marks)**

5.. a) Define the term Half -life **(1mk)**

(b) **Table 2** contains information from the measurements made of the radioactivity in counts per minutes from a radioisotope iodine – 128.

Counts per min	240	204	180	156	138	122	108
Time (min)	0	5	10	15	20	25	30

Table 2

(i) Plot a graph of counts per minute against time. **(3marks)**

(ii) Use the graph to determine the half-life of iodine – 128. **(1mark)**

(iii) What is the counts rate after 22 minutes? **(½ mark)**

(iv) After how many minutes were the counts rate 160 counts per minute? **(½ mark)**

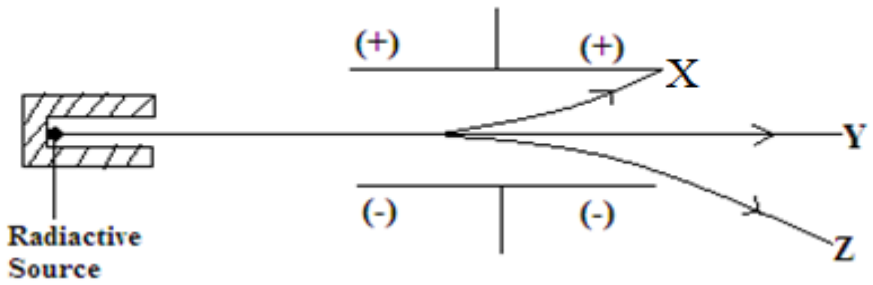
c) Potassium has two isotopes $^{39}_{19}K$ and radioactive $^{40}_{19}K$.

(i) State how the two isotopes differ. **(1mark)**

(ii) The half-life of $^{40}_{19}K$ is 1.3 x 10^{9}years. Determine how long it would take for 4g of the isotope to decay to 1g. **(1mark)**

(iii) $^{39}_{19}K$ undergoes beta decay to form an isotope of calcium. Write the nuclear equation for this decay. **(1mark)**

d) **Fig 2** shows how a radioactive material emitted radiations from its source. Study it and answer the questions that follow as shown below.



I) Identify the radiation that: **(2 marks)**

i. Has no mass?

ii. Contains Helium particles?

II) State two applications of radioactivity in medicine **(2 mks)**

(6.a) State the Hess's law **(1 mark)**

a) Use the information below to answer the questions that follow.

$C_{(s)} + O_{2(g)} \xrightarrow{CO_2} \quad H = -394KJmol^{-1}$

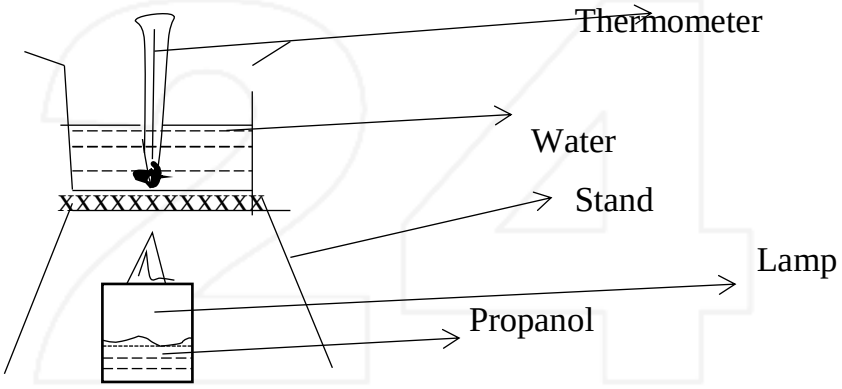
$H_{2(g)} + \frac{1}{2} O_{2(g)} \longrightarrow H_2O_{(l)} \quad H = -286KJmol^{-1}$

$C_2H_{2(g)} + 5O_{2(g)} \longrightarrow 2CO_2 + H_2O \quad H = -1300KJmol^{-1}$

(i) Draw an energy cycle diagram that links the heat of formation of ethyne with its heat of combustion and the heats of combustion of carbon and hydrogen. **(2marks)**

(ii) Calculate the standard 'enthalpy of formation' of ethyne. **(2mark)**

(b) The diagram below represents a set-up that was used in determining the molar heat of combustion of propanol. (C_3H_7OH)



During the experiment the data given below was recorded.

Volume of water = $100cm^3$

Final temperature of water = 43.5^0c

Initial temperature of water = 20.5^0c

Mass of propanol + lamp before burning = 126.5g

Mass of propanol + lamp after burning = 124.7g

Calculate

(i) The molar heat of combustion of propanol **(3marks)**

(Density of water = $1g/cm^3$, specific heat capacity of water = 4.2 kJ/kg/k, C=12.0, O = 16.0, H = 1.0)

(ii) The heating value of propanol. **(1 mark)**

(iii) Give **two** disadvantages of using hydrogen as a source of fuel. **(1 mark)**

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

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

Calculate the enthalpy change for the reaction. **(2mks)**

$$CH_{4(g)} + 4Cl_{2(g)} \longrightarrow CCl_{4(g)} + 4HCl_{(g)}$$

7(a) Explain the meaning of the following in terms of oxidation numbers: **(2mks)**

i) Reduction

ii) Oxidation

iii)Determine the oxidation number of chlorine in the ion. **(1mk)**

ClO_3^-

b) The standard electrode potentials (E^{θ}) of elements Dand G are-2.38Volts and -2.87 Volts respectively.

i) Identify the strongest oxidizing agent **1mk**

ii) Draw a labeled diagram of the cell formed when the two are connected. **(3mks)**

iii) Determine the e.m.f of the cell formed above. **(2mks)**

c) During electrolysis of aqueous Copper(II) Sulphate using carbon electrodes a current of 2.0A was passed for 3 hours.

i) Find the mass of copper metal deposited at the cathode (Cu=64;1F=96500) **(3mks)**

ii) State two factors that determine preferential discharge in electrolysis. **(1 mark)**

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 10)

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME…… ADM NO; ……

CLASS…… DATE……

SIGN: ……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

1. *Write your name and index number in the spaces provided above.*
2. *Answer all the questions in the spaces provided.*
3. *All working must be clearly shown.*
4. *Non-programmable silent electronic calculators and KNEC mathematical tables may be used.*

FOR EXAMINER'S USE ONLY

Questions	Maximum score	Candidates score
1 - 25	80	

ANSWER ALL QUESTIONS

1. The pH values of some solutions labeled **E** to I are given in the table **below**. Use the information to answer the questions that follow.

pH	14.0	1.0	9.0	6.5	5.0
Solution	E	F	G	H	I

(a) Identify the solution with the highest concentration of hydroxide ions. Explain **(1mk)**

(b). Which solution can be used as a remedy for acid indigestion in the stomach? Explai**n (1mk)**

(c) Which solution would react explosively with Potassium metal? **(1mk)**

2. a) Distinguish between ionization energy and electron affinity **(2mks)**

b) The table below shows first ionization energies of metals represented by letters A, B, C and D. The metals are in the same group of the periodic table.

Metal	A	B	C	D
1st ionization energy (kJ/mole	402	496	520	419

Which of the metals has the largest atomic radius? Explain. **(2mks)**

3. An element: $^{23}_{11}M$

(a) To which chemical family does it belong? **(½mk)**

(b) Write the electron arrangement of the atom. **(½mk)**

(c) Draw the structure of its ion. **(1mk)**

4. (a) Define electrolysis. **(1mk)**

(b) During the electrolysis of molten aluminium oxide, write the equations at the;

Anode -**……** **(1mk)**

Cathode -**……** **(1mk)**

5. In an experiment to determine the percentage purity of Sodium carbonate produced in the Solvay process , 2.15g of the sample reacted with exactly 40.0cm^3 of 0.5M Sulphuric(VI)acid. Determine the percentage purity of sodium carbonate in the sample.

6. **Y** is a product of gaseous reaction which results in an equilibrium mixture being formed.

Reactants **Y** $\rightleftharpoons$

The percentage of **Y** in equilibrium at various temperatures and pressure is shown in the following table.

Temperature (^{0}C)	1 atm	100 atm	200 atm
550	**0.77**	**6.70**	**11.9**
650	**0.032**	**3.02**	**5.71**
750	**0.016**	**1.54**	**2.99**
850	**0.09**	**0.87**	**1.68**

Use this data to deduce, giving a reason for each case;

a) Whether production of Y is exothermic or endothermic. **(2mks)**

b) Whether production of Y **involves** an increase or a decrease in number of moles of gas present. **(2mks)**

7. State and explain what is observed when moist red flowers are dropped in a gas jar containing Sulphur (IV) oxide. **(3mks)**

8. A sample of water collected from **River Nzoia** is suspected to contain chloride ions. Describe an experiment that can be carried out to determine the presence of the chloride ions. **(2mks)**

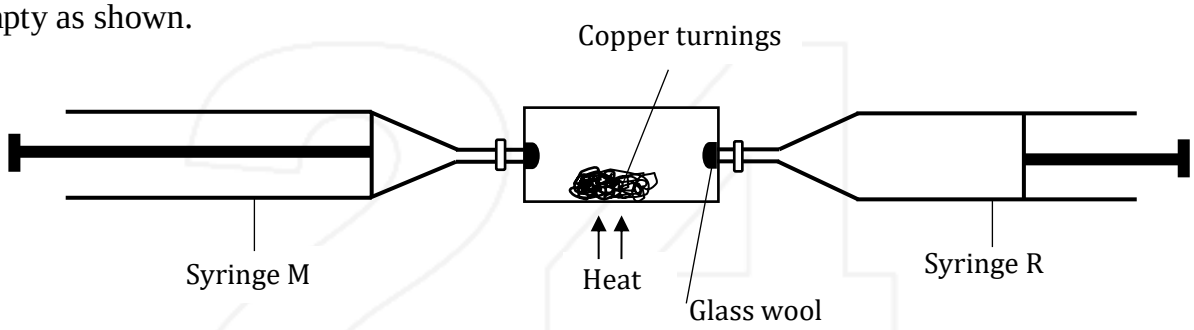
9. During distillation in a laboratory the distillate can be collected either by a beaker or a conical flask.

(a) Define the term distillate. **(1mk)**

(b) Explain why a conical flask is the most preferred apparatus for the collection of the distillate. **(1mk)**

(c) Draw the diagram of a graduated conical flask. **(1mk)**

10. In an experiment to determine the proportion of oxygen in air, copper turnings were packed in excess in a long combustion tube connected to two syringes of $110cm^3$ each in volume. At the beginning of the experiment, syringe R contained $110cm^3$ of air while syringe **M** was closed and empty as shown.

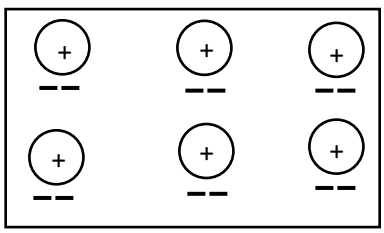


Air was passed over the heated copper slowly and repeatedly until there was no further change in volume. $97.5cm^3$ of air remained in syringe M.

(a) State and explain the observation made in the combustion tube. **(2mks)**

(b) If the volume of air in the **combustion tube** at the beginning of the experiment was $23.8cm^3$ and at the end of the experiment reduced to $10cm^3$, calculate the percentage of the active part of air. **(2mks)**

11. Below is a structure of an element X. Use it to answer the questions that follow.



(a) Name the chemical family to which element X belongs. Give a reason. **(2mks)**

(b) (i) Define covalent bond. **(1mk)**

(ii) Using dots (●) of cross (**x**) diagram, show bonding in Carbon (II) Oxide. **(1mk)**

12. (a) (i) State ***two*** allotropes of Carbon. **(1mk)**

(ii) Explain the differences in their densities. **(2mks)**

(b) (i) Name the process used for large scale production of Sodium Carbonate using brine as raw material. **(1mk)**

(ii) Write the overall chemical equation for the reaction in the carbonator. **(1mk)**

(c) Name two gases recycled in the above process **(1mk)**

13. Name the following compounds using the IUPAC system. **(3mks)**

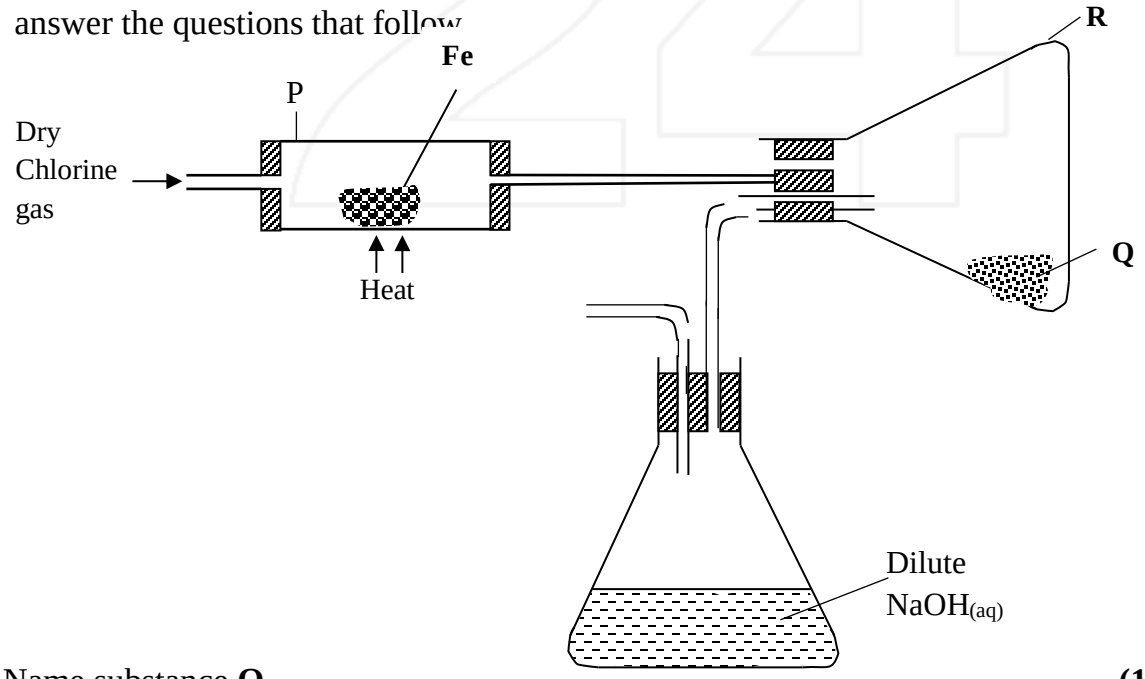
(i) $CH_3\,CH_2\,CH_2\,CH_2\,C(Br)=CH(CH_3)$

(ii) $CH_3CH_2CH_2COOCH_2CH_2CH_3$

(iii) $CH_3CH(CH_3)CH(Cl)CH(Cl)CH_3$

14. Describe how to prepare Ethane gas starting with soda lime **(3mks)**

15. The diagram below shows how chlorine reacts with metals in the laboratory. Study it and answer the questions that follow



(a) Name substance **Q**. **(1mk)**

(b) Give a reason why substance Q is not collected in the combustion tube P. **(1mk)**

(c) Write chemical equation for the reaction that occurs in the conical flask containing Sodium hydroxide. **(1mk)**

16. (a) Water sample is found to contain Mg^{2+},Cl^{-}, SO_4^{2-} , and Ca^{2+}. Identify the type of water hardness **(1mk)**

(b) Which type of detergent is more suitable with the water sample above. Give a reason **(2mks)**

(c) Permanent water hardness cannot be removed by boiling. Explain **(1mk)**

17. Starting with lead metal, write procedure on preparation of lead(II) nitrate crystals **(3mks)**

18. The following chemical equations show the effects of heat on nitrates.

$2B(NO_3)_{2(s)} \longrightarrow 2BO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

$2ANO_{3\,(s)} \longrightarrow 2ANO_{2(s)} + O_{2(g)}$

$2CNO_{3(s)} \longrightarrow 2C_{(s)} + 2NO_{2(s)} + O_{2(g)}$

a. Arrange elements A, B and C from the most reactive to the least reactive. **($1^1/_2$mks)**

Give one example of element A, B and C. **($1^1/_2$mks)**

19. Copper (II) sulphate crystals, a boiling tube, a test-tube, a beaker and other necessary requirements were used in an experiment to determine the type of change that occurred when the crystals were heated.

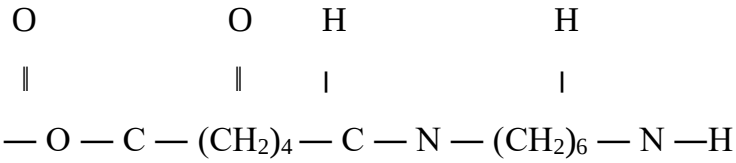
(a) Draw a labelled diagram to represent the set-up at the end of the first part of the experiment. **(3mks)**

(b) After the second part of the experiment was done, state the conclusion that was made about the type of change undergone by copper (II) sulphate crystals when heated. **(1mk)**

20. (a). Distinguish between chromatography and a chromatogram. **(1mk)**

(b) State the role of chromatography in the administration of international athletics competitions. **(1mk)**

21. Study the polymer shown below.



a) Name the polymer. **(1mk)**

b) Identify two monomers that make up the polymer. **(2mks)**

c) Give one use of the **polymer** **(1mark)**

22. (a) State Charles law. **(1mk)**

(b) A gas occupies $450cm^3$ at 27^0C. What volume would the gas occupy at 177^0C if its pressure remains constant? **(2mks)**

23. A colourless liquid was suspected to be water. State two ways to confirm.

(i) Purity of the water. **(1mk)**

(ii) That the liquid was water. **(2mks)**

24. Use the following information to answer the questions that follow

$\Delta H_{lattice}$ $MgCl_2$ = **+2489 kJ/ mol**

$\Delta H_{hydration}$ Mg^{2+} = **- 1891 kJ/ mol**

$\Delta H_{hydration}$ Cl^- = **-384 kJ/ mol**

a) Calculate the heat of solution of magnesium chloride. **(2mks)**

b) Draw an energy level diagram for the dissolving of magnesium chloride **(2mks)**

25. i) A solution of aqueous sodium hydroxide is added to a gas jar of nitrogen (IV) oxide and shaken. State and explain the observation made **(2mks)**

ii) Write the chemical equation for the reaction above **(1mk)**

KCSE 2024 REPLICA PREDICTION

(POSSIBLE TRIAL 10)

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME…… ADM NO; ……

CLASS…… DATE……

SIGN: ……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

(a) *Write your* ***name*** *and* ***index number*** *in the spaces provided above.*

(b) *Sign and write the date of the examination in the spaces provided above.*

(c) *Answer all the questions in the spaces provided in the question paper.*

(d) ***Non-programmable*** *silent electronic calculators and* ***KNEC*** *mathematical tables may be used.*

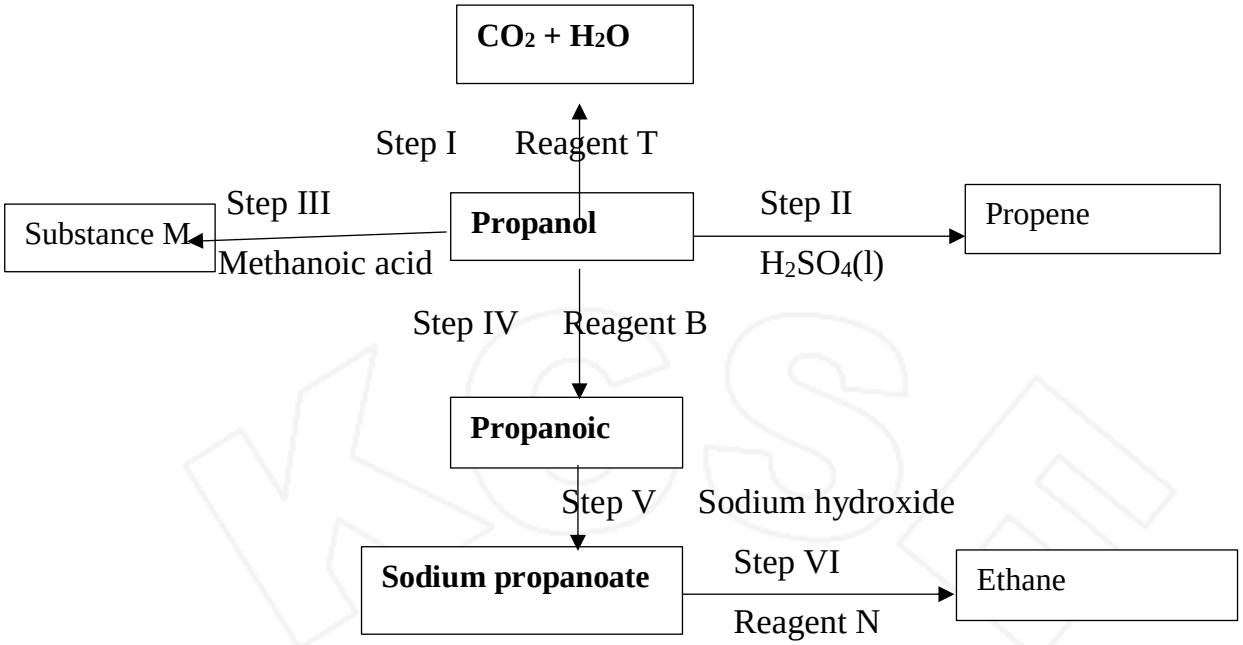
(e) *All working must be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-27	80	

Answer all the questions in the spaces provided

1. The flow diagram below shows some reactions starting with propanol. Study it and use it to answer the questions that follow.



a. Name the process in step; **(3 marks)**

I …….

III ……...

IV ……..

b. Write an equation for the reaction in step **(2 marks)**

I …….

V ……

c. Give the name and structural formula of substance M **(2 marks)**

Name ……

Structural formula

d. Name the reagent; **(2 marks)**

B ……

N ……

e. State the condition necessary for reaction in step II **(1 mark)**

……

f. The diagram below shows the structure of a detergent.



i. Identify the detergent **(1 mark)**

ii. A sample of water was found to contain magnesium ions. Explain why the detergent above is a suitable reagent to be used in the water. **(1 mark)**

2. a.The table below shows properties of four substances. Study it and use it to answer the questions that follow.

Substance	Melting point (^{0}C)	Electrical conductivity	
		Solid	Molten
A	– 33	Poor	Poor
B	801	Poor	Good
C	1083	Good	Good
D	1417	Poor	Poor

i. Identify the structure in the following: **(2 marks)**

A …….

C …….

ii. Explain the conductivity in substance B **(2 marks)**

iii. Give a reason why substance D has a h-igh melting point. **(1 mark)**

b.Draw dot and cross diagram showing bonding in the following; **(2 marks)**

i. Ammonia gas (N=7, H=1)

ii. Sodium sulphide (Na=11, S=16)

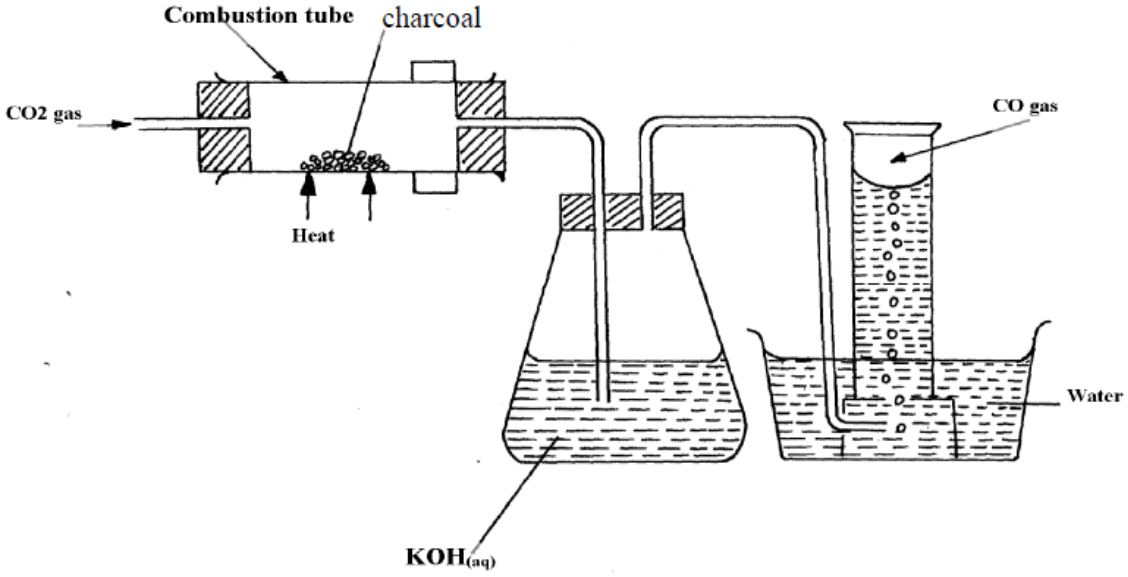
c. Explain the following; **(3 marks)**

i. Magnesium and sulphur are in the same period of the periodic table. However, magnesium oxide is a solid while sulphur (IV) oxide is a gas at room temperature (**Mg = 12, S=16, O=8)**

ii. Ethanol is molecular but it dissolves in water

iii. Solid copper metal is a better electrical conductor than molten copper

3. a.The diagram below shows the set-up used to test a property of carbon in the laboratory. Study it and use it to answer the questions that follow.

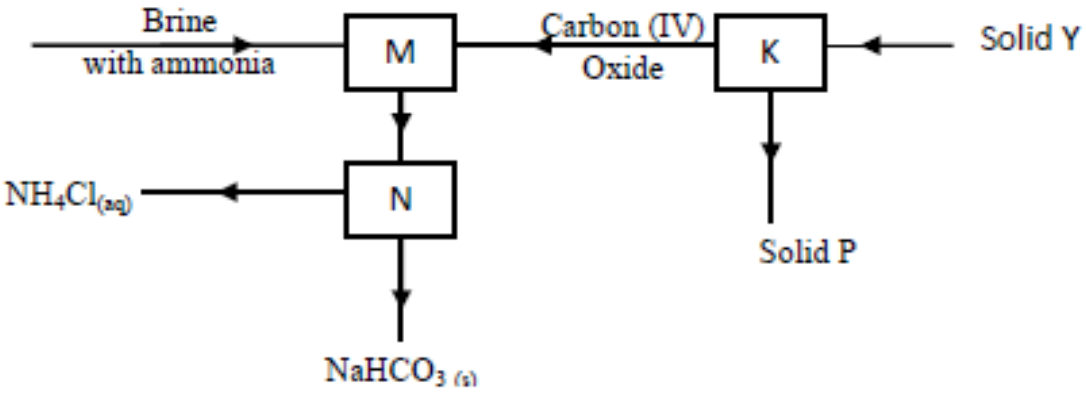


i. State the role of potassium hydroxide solution **(1 mark)**

ii. Write an equation for the reaction in the combustion tube **(1 mark)**

iii. State the property of carbon being investigated. **(1 mark)**

b. Sodium carbonate is prepared industrially using Solvay process. The flow diagram below shows some of the reactions in the process. Study it and use it to answer the questions that follow.



i. Identify; **(2 marks)**

Solid Y ……

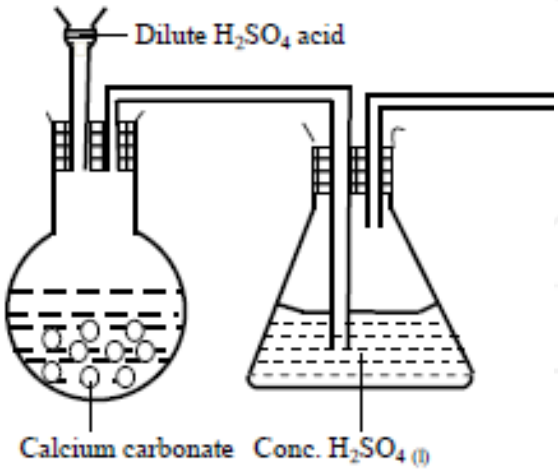
Solid P ……

ii. Write an equation for the reaction taking place in chamber M **(1 mark)**

iii. Name the process taking place in chamber N. **(1 mark)**

iv. State two uses of sodium carbonate **(2 marks)**

c. The set-up below was used to prepare carbon (IV) oxide gas in the laboratory. Study it and answer the questions that follow.



i. Identify the mistake in the set-up and suggest a possible correction. **(2 marks)**

ii. Complete the diagram showing how the gas can be collected **(1 mark)**

4. The list below shows reduction potentials of element M, N, P and Q

	E^{θ}(volts)
$M^{2+}_{(aq)} + 2e \rightarrow M_{(s)}$	; -0.76
$N^{2+}_{(aq)} + 2e \rightarrow N_{(s)}$	;-2.37
$P^{+}_{(aq)} + 2e \rightarrow P_{(s)}$	; +0.80
$Q^{2+}_{(aq)} + 2e \rightarrow Q_{(s)}$	;-0.14

a. Identify the element that is strongest reducing agent **(1 mark)**

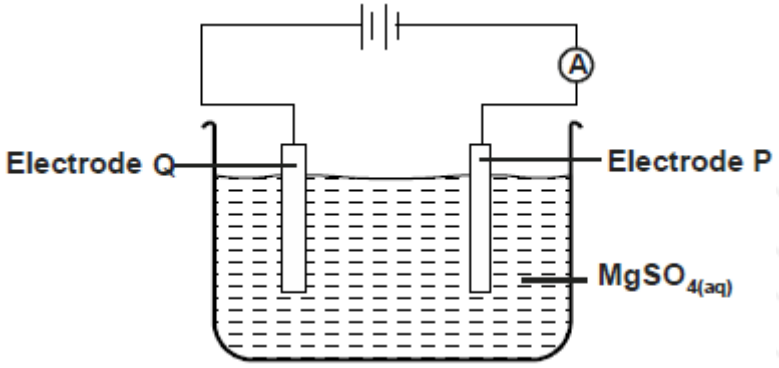
b. Which elements would form an electrochemical cell with the highest e.m.f**. (1 mark)**

c. The half cells of M and P were combined to form an electrochemical cell.

i. Draw the electrochemical cell formed **(3 marks)**

ii. Calculate the e. m. f of the cell formed **(1 mark)**

d. The set-up below was used during the electrolysis of a solution of Magnesium sulphate using inert electrodes.



i. State the observation made in electrode Q. Explain **(2 marks)**

Write an equation for the reaction in electrode P **(1mark)**

ii. A current of 0.5 Amperes was passed through the cell for 16 minutes and 5 seconds. Calculate the volume of product at the anode at RTP (1M= 24l ,I F=96500C) **(3 marks)**

e. Give one application of electrolysis **(1 mark)**

5. a) Define molar heat of neutralization **(1mark)**

b) The table below shows temperature reached when equal volumes of an alkaline solution of 1.5M concentration was reacted with 0.95M sulphuric (VI) acid.

Total volume of Sulphuric VI acid added	0	5	10	15	20	25	30	35	40
Volume of alkaline solution	30	30	30	30	30	30	30	30	30
Highest temperature reached	23	24	25	26	27	28	28	27	26

Plot a graph of temperature against volume of acid used **(3mks)**

c. From the graph determine

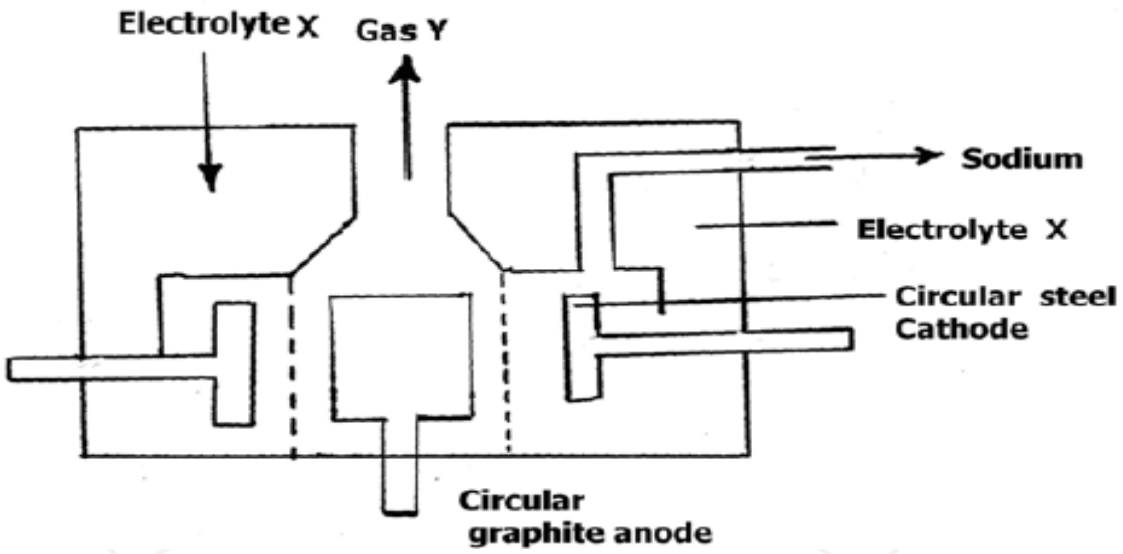
i. the volume of sulphuric VI acid needed to completely neutralize $30cm^3$ of the alkali solution **(1mk)**

ii)the temperature change **(1mk)**

d. Calculate the heat change for the above reaction density of solution 1g/cm^3, Specific Heat Capacity 4.2g/J/K **(2mks)**

e. Calculate the molar heat of neutralization for the reaction **(2mks)**

6. The diagram below shows the set-up used to extract sodium metal.



a. Identify; **(2 marks)**

i. Electrolyte X

ii. Gas Y

b. During extraction of sodium using the down's process, calcium chloride is added to the ore. Give a reason for the addition of calcium chloride. **(1 mark)**

c. State two uses of sodium **(2 marks)**

d. Give a reason why sodium is extracted using electrolysis **(1 mark)**

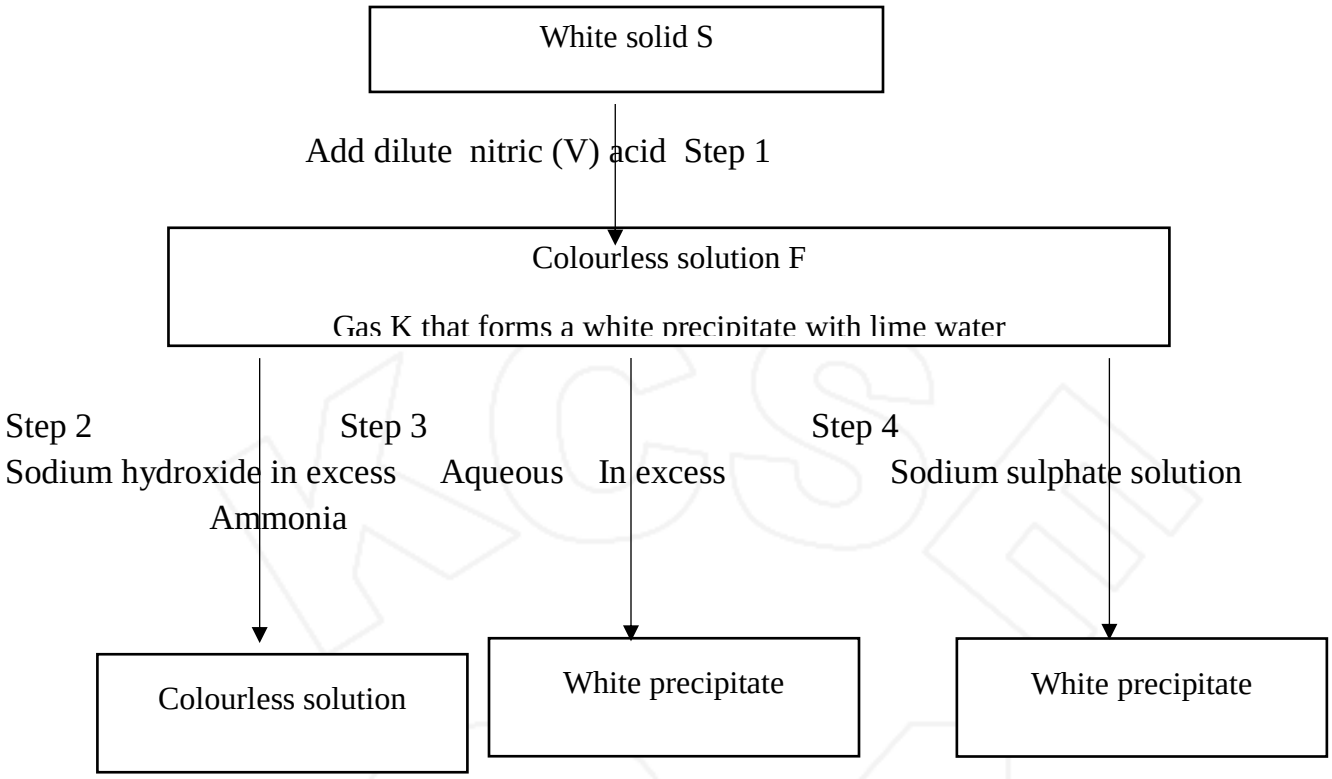
e. Why is the anode made of graphite and not steel? **(1 mark)**

f. On the diagram, label the steel diaphragm. **(1 mark)**

g. State the role of the steel diaphragm **(1 mark)**

h. State and explain two observations made when sodium metal is placed in a trough of cold water. **(3 marks)**

7. a. The figure below shows some properties and reactions starting with solid S. Study it and answer the questions that follow.



i. Identify; **(2 marks)**

Solid S

Gas K

ii. Write an equation for the reaction in step 1 **(1 mark)**

iii. State the property of solution F that makes the reaction in step 2 possible. **(1mark)**

iv. Write an **ionic equation** for the reaction in step 2 **(1 mark)**

b. Starting with Zinc oxide, describe how a dray sample of zinc carbonate can be prepared in the laboratory **(3 marks)**

c. Name the process taking place when the following reactions take place **(3 marks)**

i. Calcium chloride placed on a watch glass overnight forms a solution

ii. Sodium hydroxide reacts with sulphuric (VI) acid to form a colourless solution

iii. Silver nitrate and potassium chloride react to form a white solid

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