NAME: ..... MARKING SCHEME ..... INDEX NO:.....

CANDIDATES SIGN: ..... DATE: .....

233/2
CHEMISTRY
Paper 1
Mock Exams
March/April, 2015
2 hours

MOKASA JOINT EVALUATION EXAMINATION

Kenya Certificate of Secondary Education
Mock Examination – March/April 2015
Form 4
Chemistry Paper 1
Time: 2 Hours

INSTRUCTION TO CANDIDATES:

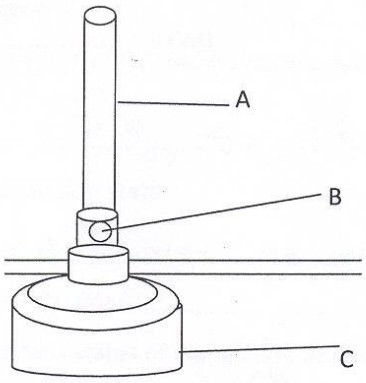
1. Answer ALL the questions in the spaces provided.
2. Mathematical tables and silent electronic calculators may be used.
3. All working must be clearly shown where necessary.

For Examiner's Use Only.

Question	Maximum Score	Candidate's Score
1-27	80	

This paper consist of 15 printed pages. Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.

1. The diagram below shows parts of a Bunsen burner.



a) Name the parts labelled (½ mark)

A Chimney

B Air hole

b) Give one use of the part labelled B (1 mark)

Allows air to enter the chimney

2. Hydrated copper (II) sulphate exists as blue crystals while anhydrous copper (II) sulphate is a white powder. Describe a laboratory experiment that can be used to show that the action of heat on hydrated copper (II) sulphate is a reversible reaction (2 marks)

- Heat the crystals in a corked boiling tube, blue crystals turn white. Condense the vapour produced in a test-tube to form water. Add back the water to the white solid and it will turn blue.

3. A piece of burning magnesium ribbon was placed in a gas jar full of Nitrogen gas. The product Q formed was then reacted with water.

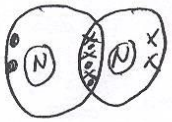
a) Write the chemical formula for the product Q (1 mark)

Mg_3N_2

b) Write the equation for the reaction between product Q and water (1 mark)

$Mg_3N_{2(s)} + 6H_2O_{(l)} \rightarrow 3Mg(OH)_{2(aq)} + NH_{3(g)}$

c) Using dot (•) and cross (x) diagrams to represent electrons, draw the structure to show bonding in nitrogen molecule (1 mark)



4. (i) What are isotopes (1 mark)

Atoms of the same element with same atomic number but different mass number.

(ii) Element Y (not the actual symbol of the element) has two isotopes with mass number 6 and 7. If the relative atomic mass of Y is 6.94, determine the percentage abundance of each isotope (2 marks)

$\frac{6x + 7(100-x)}{100} = 6.94$ $-x = -6$

$6x + 700 - 7x = 694$ $x = 6\%$ and 94%.

5. Given zinc oxide, dilute nitric (V) acid and sodium carbonate solution. Briefly describe how you can prepare zinc carbonate (3 marks)

Add excess Zinc oxide to dilute nitric(V) acid. Filter to get Zinc nitrate solution as filtrate and ZnO as residue, To the filtrate add Na_2CO_3 aq. Filter to obtain $ZnCO_3$ as residue, wash with distilled water and dry between filter papers.

6. The elements shown in the table below (not actual symbols) belong to a certain family of metals in the periodic table. Study the information and answer the questions that follow.

Element	Atomic size (nm)
S	0.160
T	0.180
V	0.930

(i) Define the term ionization energy (1 mark)

Minimum energy required to remove one electron(s) from the outermost energy level of an atom in a gaseous state.

(ii) Which element is likely to have the highest ionization energy. Explain (2 marks)

S. It has the smallest atomic radius hence the outermost electron(s) are strongly attracted to the nucleus hence more energy required to remove electron(s).

7. A certain mass of copper (II) carbonate was strongly heated.

a) Write a balanced chemical equation for the reaction (1 mark)

$CuCO_{3(s)} \longrightarrow CuO_{(s)} + CO_{2(g)}$

b) Given that 300cm^3 of carbon(IV) oxide gas was collected at s.t.p. and this represents 83% yield, determine the mass of copper (II) carbonate heated. (molar gas volume = 22.4dm^3, Cu=64, O=16, C=12) (3 marks)

Moles of $CO_{2(g)} = \frac{1 \times 300}{22400} = 0.01339$ moles

83% of $CO_2 = 0.01339$ moles

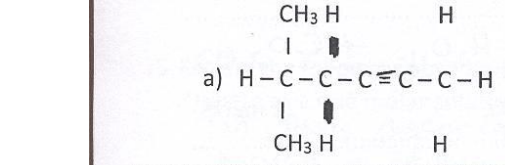
100% of $CO_2 = \frac{0.01339 \times 100}{83} = 0.016136$ moles

Mole ratio of $CuCO_3 : CO_2$ is 1:1

Mass of $CuCO_3$ 0.016136×124

2.0008g

8. (i) Give the IUPAC names for the following organic compounds

a) 

5-methylhex-2-yne. (1 mark)

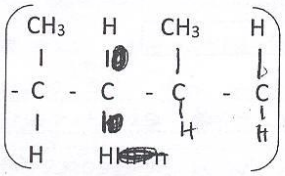
b) $CH_3CH_2CH_2\overset{O}{\overset{\|}{C}}-OH$ (1 mark)

butanoic acid.

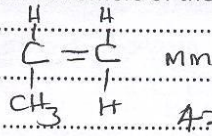
c) $CH_3CH_2\overset{O}{\overset{\|}{C}}-O-CH_2-CH_2-CH_3$ (1 mark)

Propylpropanoate.

(ii) A polymer has the following structure



A sample of this polymer is found to have a molecular mass of 2184. Determine the number of monomers of the polymer. (C = 12, H = 1) (3 marks)



Mm = 42. n = 52

42n = 2184

9. During an experiment, chlorine was bubbled into a solution of sodium bromide in a beaker

a) State and explain one observation made (2 marks)

Colourless solution turns brown.

Chlorine gas displaces bromide ions in the solution to form bromine molecules.

b) Write an ionic equation for the reaction that took place in the beaker (1 mark)

$Cl_{2(g)} + 2Br^-_{(aq)} \rightarrow Br_{2(g)} + 2Cl^-_{(aq)}$

10. Hardness of water may be removed by either boiling or addition of chemicals.

a) Write down an equation to show how boiling removes hardness of water (1 mark)

$Ca(HCO_3)_{2(aq)} \rightarrow CaCO_{3(s)} + H_2O_{(l)} + CO_{2(g)}$

b) Name two chemicals that are used to remove hardness of water (2 marks)

Ammonia solution

Sodium carbonate.

11. i) Define solubility (1 mark)

Is the maximum amount of solute dissolved in 100g of solvent at a particular temperature.

ii) 115g of a saturated solution at 65°C is found to contain 65g of potassium nitrate. Calculate the solubility of potassium nitrate at 65°C. (2 marks)

65g KNO_3 → 50g H_2O
? → 100g H_2O

$\frac{100 \times 65}{50}$ = 130g KNO_3 / 100g H_2O.

12. The equation for the reversible reaction of Bismuth (III) chloride in water is

$BiCl_{3(s)} + H_2O_{(l)} \rightleftharpoons BiOCl_{(s)} + 2H^+_{(aq)} + 2Cl^-_{(aq)}$

a) State Le chatelier's principle (1 mark)

If a system in equilibrium is subjected to a change in conditions, the system adjust so as to oppose the change.

b) What would be the effect of adding NaOH pellets to the equilibrium mixture. Explain. (2 marks)

Forward reaction will be favoured, NaOH contain hydroxide which react with H^+ to form water. More water molecules are converted to H^+.

13. In the equation, below identify the reagent that acts as an acid in the forward reaction. Give a reason.

$NH^+_{4(aq)} + H_2O_{(l)} \rightleftharpoons NH_{3(aq)} + H_3O^+_{(aq)}$ (2 marks)

NH_4^+ ✓ (1) is a proton donor ✓ (1)

14. In preparation of oxygen gas, a student used hydrogen peroxide and added a black solid and collected the gas over water.

a) What is the name of the black solid and what is its function (1 mark)

Manganese(IV) oxide, ½ ✓ ½ it acts as a catalyst.

b) During collection of the gas, why should the first bubbles be allowed to escape (1 mark)

The first bubbles are mixed with air initially in the tube hence allowed to escape.

c) Give one main advantage of collecting a gas over water. (1 mark)

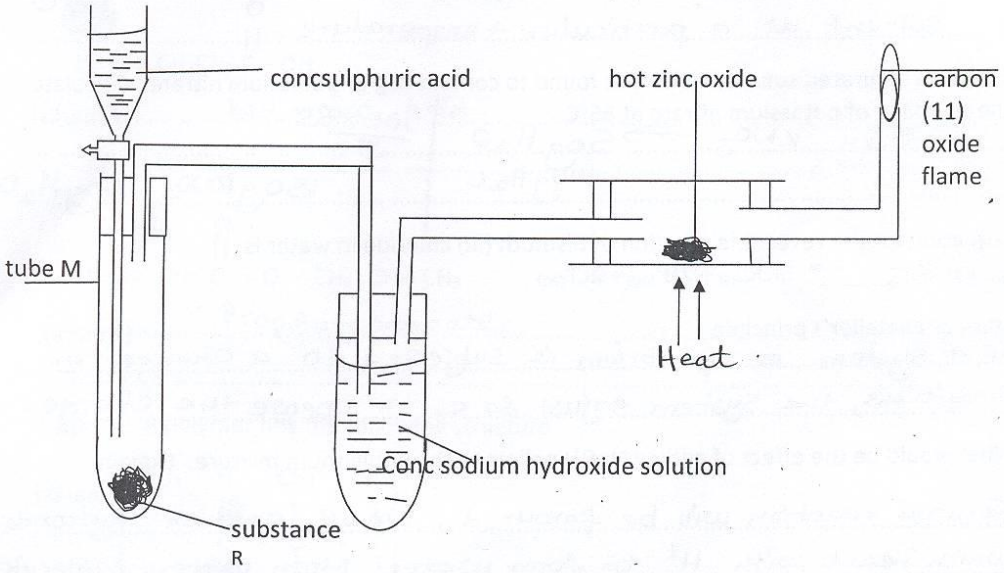
Dissolves / absorbs any acidic gas present.

15. Explain the following observation, a one molar solution of nitric (III) acid (1M HNO_2) has a pH of 2 where as a one molar solution of chloric(I) acid (IM HOCl) pH of 4. (2 marks)

1M HNO_2 dissociates fully in water releasing more H^+ ions hence a strong acid, HOCl dissociates partially releasing

fewer H^+.

16. a) Study the set-up below and use it to answer the questions that follow.



a) Identify substance R (1 mark)

Ethanedioic acid.

b) State the function of concentrated sodium hydroxide solution (1 mark)

Absorbs carbon(IV) oxide gass

c) State the property of carbon (II) oxide gas demonstrated in the above set-up (1 mark)

It is a reducing agent.

d) Write a balanced chemical equation for the reaction occurring in tube M. (1 mark)

$H_2C_2O_{4(s)} \xrightarrow{\text{conc } H_2SO_4} CO_{(g)} + CO_{2(g)} + H_2O_{(l)}$

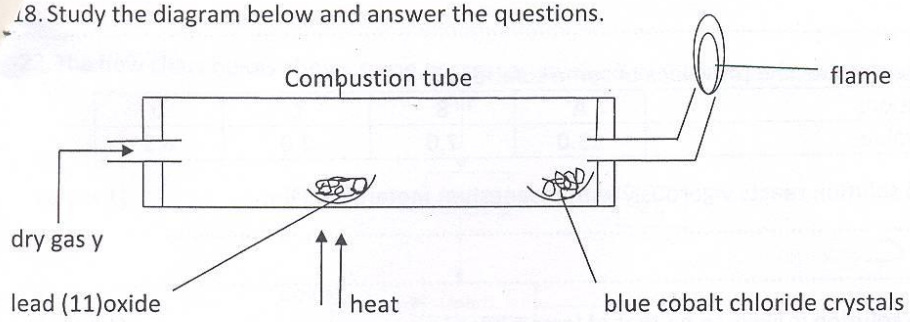
17. 200cm^3 of oxygen diffused through a porous plug in 60 seconds. How long will it take 300cm^3 of sulphur (IV) oxide to diffuse through the same plug? (S = 32, O = 16) (3 marks)

$\frac{R_{O_2}}{R_{SO_2}} = \sqrt{\frac{Mm_{SO_2}}{Mm_{O_2}}}$ $\left(\frac{3.333}{R_{SO_2}}\right)^2 = 2$ $= 707$ sec

$\frac{3.333}{R_{SO_2}} = \sqrt{\frac{64}{32}}$ $R_{SO_2}^2 = 5554$

$R_{SO_2} = 2,357 \times 300$

18. Study the diagram below and answer the questions.



(i) Identify gas Y (1 mark)

Hydrogen.

(ii) State and explain two observations made in the combustion tube. (2 mark)

Yellow PbO turns grey due to reduction by hydrogen.
Blue Cobalt(II)chloride turns pink due to reaction with water.

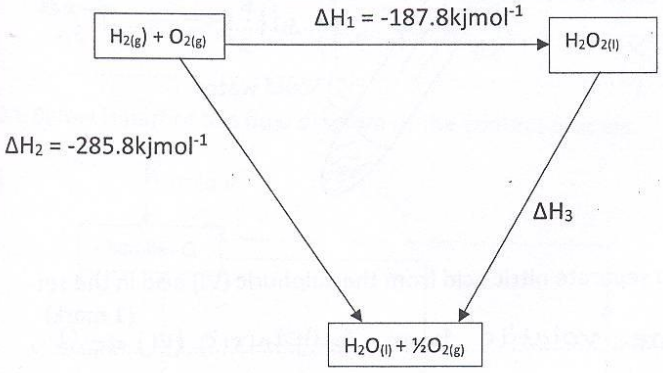
(iii) Write a chemical equation for the reaction between lead (II) oxide and gas Y (1 mark)

$PbO_{(s)} + H_{2(g)} \Rightarrow Pb_{(s)} + H_2O_{(l)}$

19. i) State Hess's law. (1 mark)

The energy change in converting reactants to products is the same regardless of the route by which the chemical changes occurs.

(ii) The figure below shows an energy cycle diagram.



a) Give the name of the enthalpy change ΔH_1 (1 mark)

Molar enthalpy of formation of H_2O_2.

b) Determine the value of ΔH_3 (1 mark)

$\Delta H_3 = 187.8 - 285.8 = -98 kJmol^{-1}$.

20. The table below shows the pH values of some solutions.

Solutions	A	B	C	D
pH values	13.0	7.0	2.0	6.5

a) Which solution reacts vigorously with magnesium metal? Explain. (1 mark)

C

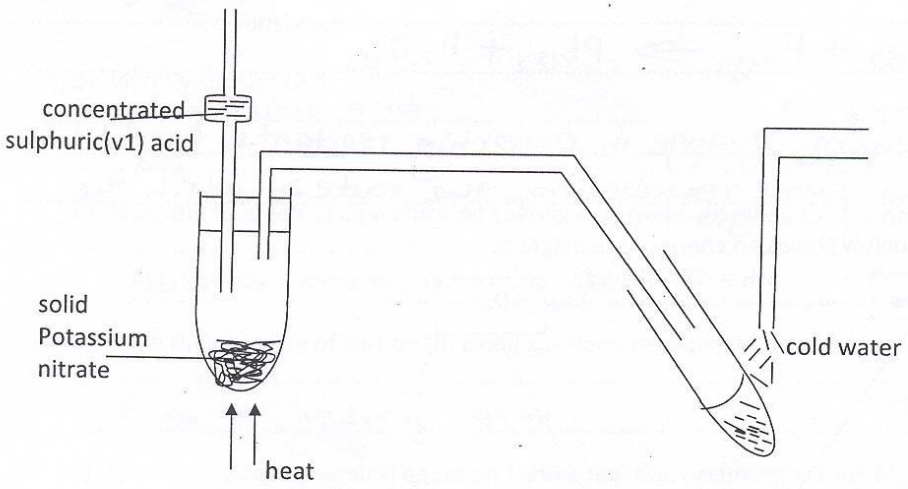
b) Which solution is likely to be that of lemon juice? (1 mark)

D

c) Which solution is likely to produce green colour with the universal indicator. (1 mark)

B

21. The diagram below shows a set-up that was used to prepare and collect a sample of nitric (V) acid in the laboratory.



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

Nitric(v) acid is more volatile than Sulphuric(VI) acid.

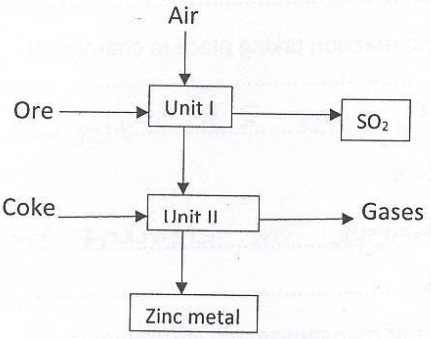
b) Name another substance that can be used instead of potassium nitrate (1 mark)

Sodium nitrate

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

Manufacture of nitrogenous fertilizers.

22. The flow chart below shows some processes involved in the industrial extraction of zinc metal.



a) Name one ore from which Zinc is extracted (1 mark)

Zinc blende.

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

$ZnO_{(s)} + C_{(s)} \rightarrow Zn_{(s)} + CO_{(g)}$

c) Name two uses of Zinc metal (1 mark)

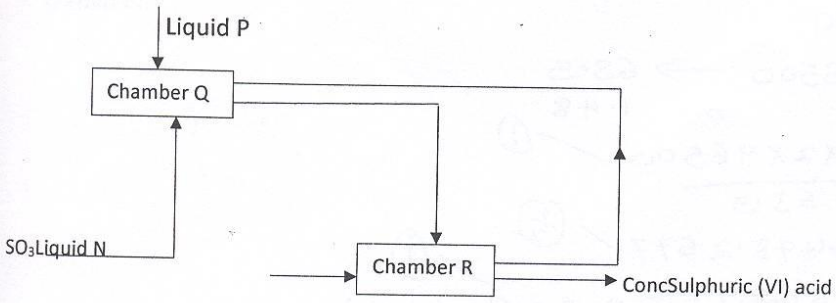
23. Thorium $^{232}_{90}Th$ undergoes two consecutive alpha decays followed by two consecutive beta decays to form the nuclide $^{x}_{y}R$. Identify the values of x and y. (2 marks)

$^{232}_{90}Th \rightarrow 2\,^{4}_{2}He + 2\,^{0}_{-1}e + {}^{224}_{88}R$

$x = 224$

$y = 88$

24. Below is part of the flow diagram of the contact process



a) Identify

(i) Liquid P (1 mark)

Concentrated Sulphuric(VI) acid

(ii) Liquid N (1 mark)

Water.

b) Write the equation for the reaction taking place in chamber R (1 mark)

$H_2S_2O_{7(l)} + H_2O_{(l)} \rightarrow 2H_2SO_{4(aq)}$

25. a) Define the term oxidation state (1 mark)

An apparent charge an element has in an ion or a compound.

b) Calculate the oxidation states of manganese and chromium in:

(i) MnO_2 (1 mark)

$x + (-4) = 0$ ✓½

$x = +4$ ✓½

(ii) CrO_4^- (1 mark)

$x + (-8) = -1$ ✓½

$x = +7$ ✓½

26. When hydrogen sulphide gas is bubbled through a solution of iron (III) chlorides, a green solution and a yellow solid are formed. Explain the observations (2 marks)

$2Fe^{3+}_{(aq)} + S^{2-}_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + S_{(s)}$

brown — pale green — yellow.

27. During purification of copper by Electrolysis, 1.48g of copper were deposited when a current was passed through copper (II) sulphate solution for 2½ hours. Calculate the amount of current that was passed (3 marks)

(Cu = 63.5, IF = 96500C)

$2 \times 96500 \rightarrow 63.5$

1.48

$\frac{1.48 \times 2 \times 96500}{63.5}$ ✓(1)

$= 4498.2677$ ✓(½)

$4,498.2677 = 2.5 \times 60 \times 60A$ ✓(1)

$0.5A$ ✓(½)

233/2
CHEMISTRY
Paper 2
MARCH/APRIL 2015
Time: 2 hours

M O K A S A J O I N T E X A M I N A T I O N - 2015

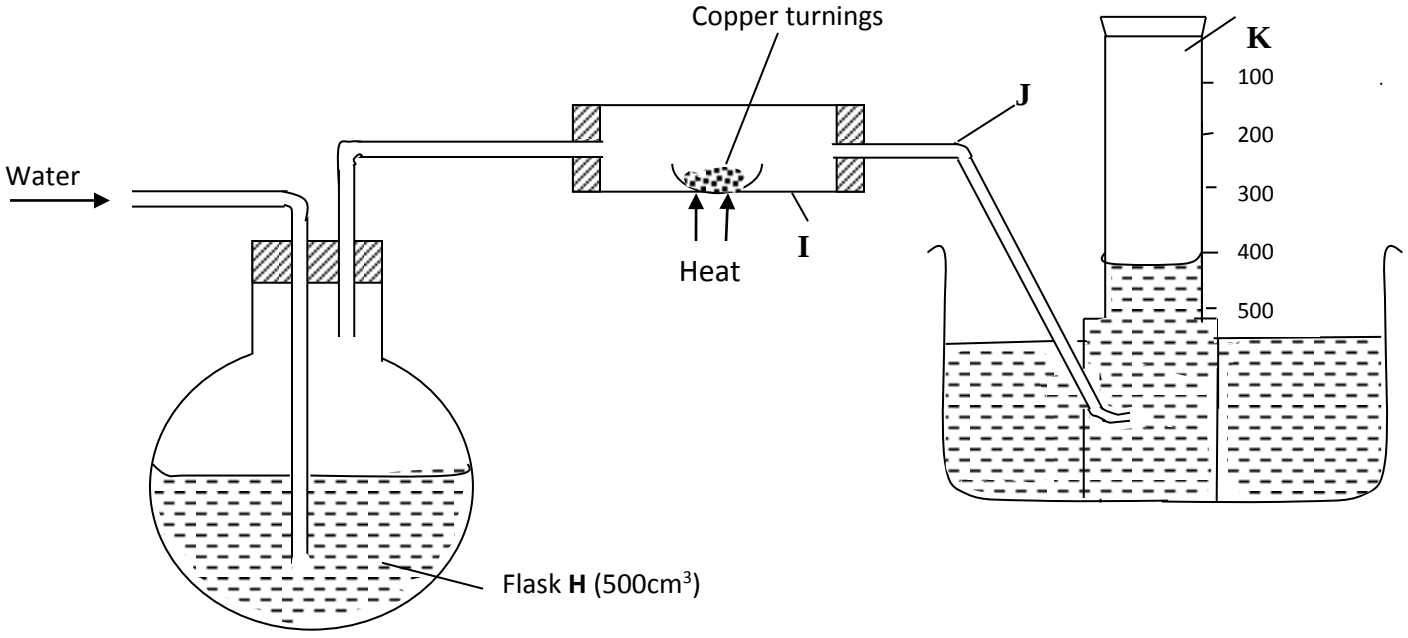
Kenya Certificate to Secondary Education

CHEMISTRY PAPER 2

TIME: 2 HOURS

M A R K I N G S C H E M E

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



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

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

To displace air in flask H over the hot copper turnings.

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

The brown solid changes to black

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

Nitrogen, carbon (IV) oxide, argon, (Xeron, neon) ***(Any one)***

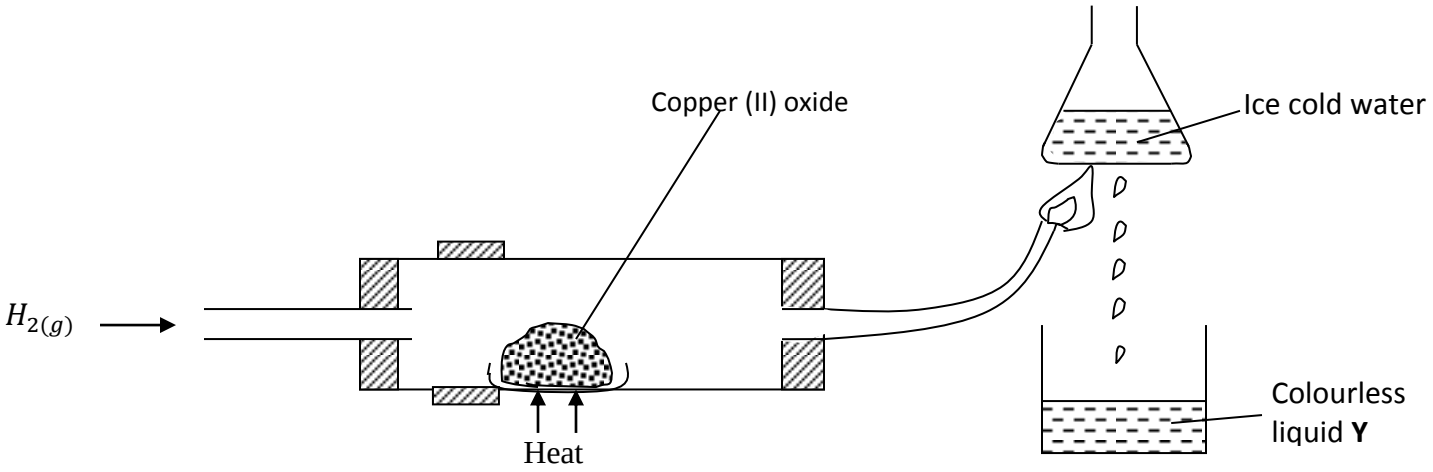
(iv) What was the volume of the gas collected in the measuring cylinder at the end of the experiment? **(1 mark)**

410cm³

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

$$\frac{(500 \times 410)}{500} \times 100 = \frac{90 \times 100}{500} = 18\% \quad \checkmark 1 \quad \checkmark 1$$

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



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

Black CuO turns to red-brown Cu.

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

$$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$$

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

To determine the reducing property of hydrogen. ✓1 ***Hydrogen is above Cu*** ✓1 ***in the reactivity series, thus it reduces the oxygen from CuO.***

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

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

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

T - 2.8.5 ✓½
W - 2.8.8 ✓½

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

Q - Basic Oxide ✓**1**
U - Acidic oxide ✓**1**

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

The two elements exhibit allotropy.

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

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

There is gradual increase in the strength of the metallic bonds ✓**1** ***due to the increase in the number of delocalized (valence) electrons in the element*** ✓**1**

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

The atomic radius of V is smaller than that of U. ✓**1** ***V has more protons therefore has a stronger nuclear attraction hence the smaller atomic radius.*** ✓**1**

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

Elements U, V and W have simple molecular structures ✓1 in which the molecules are held by weak Van der waals forces. The Van der waals ✓1 forces weaken from U to W.

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

The atomic radius of V is smaller than that of U. ✓1

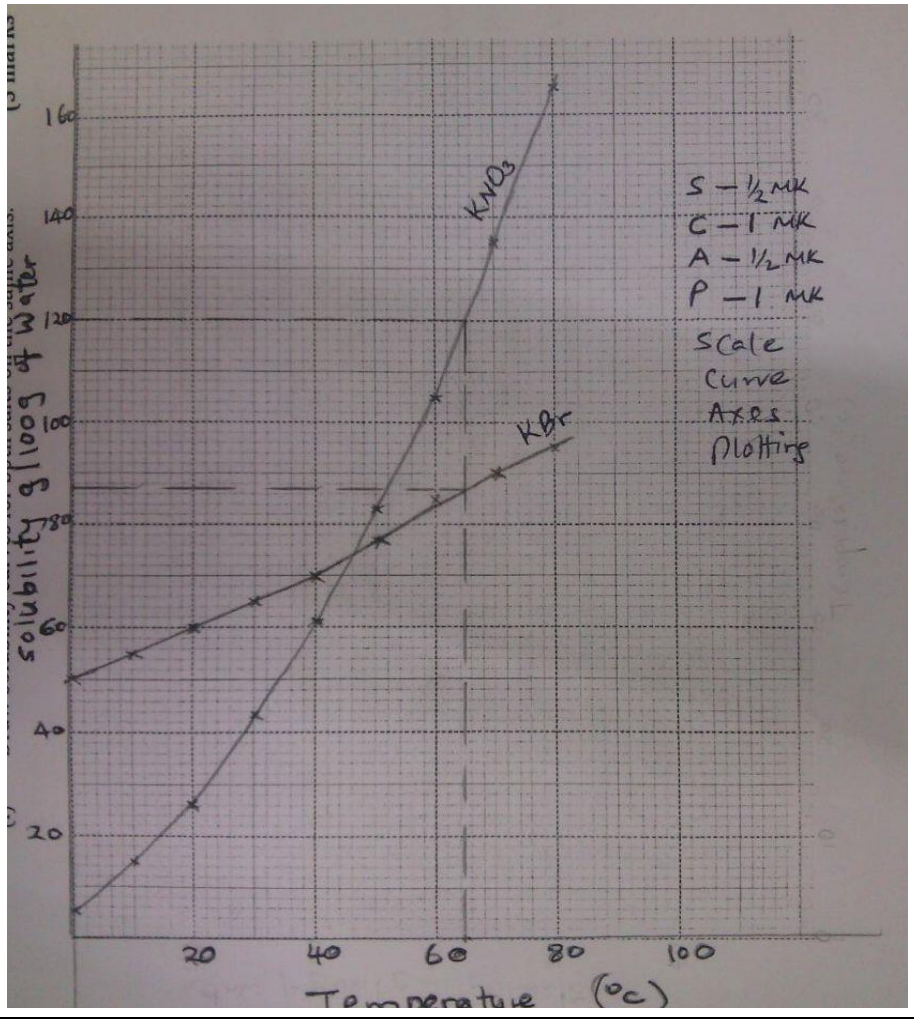
(ii) Why is there no ionic for **W** reported in the table? **(1 mark)**

It has a stable electron configuration hence does not ionize.

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

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

(i) Draw solubility curves for both salts on the same axis. **(3 marks)**



(ii) What was the solubility of each salt at 65^0C? **(1 mark)**

$\mathbf{KNO_3 - 120g/100g\ of\ water \pm 1}$ ✓½

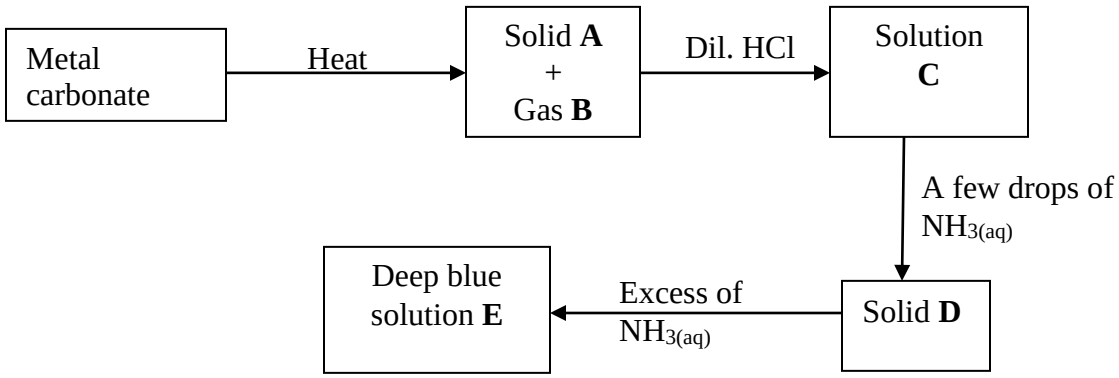
$\boldsymbol{KBr - 87g/100g\ of\ water \pm 1}$ ✓½

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

At 70^0C solubility = 135g/100g of water
If 235g contain 135g of salt
100g contain 135g
$\frac{100 \times 135}{235} = 57.4468g$ ✓½

At 20^0C solubility = 26g/100g of water
If 126g contain 26g of salt
100g contain ?
$\frac{100 \times 26}{126} = 20.6349g$ ✓½
Mass which will crystallized
57.4468 – 20.6349
= 36.8119g

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



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

$\boldsymbol{CuCO_{3(s)} \xrightarrow{heat} CuO_{(s)} + CO_{2(g)}}$

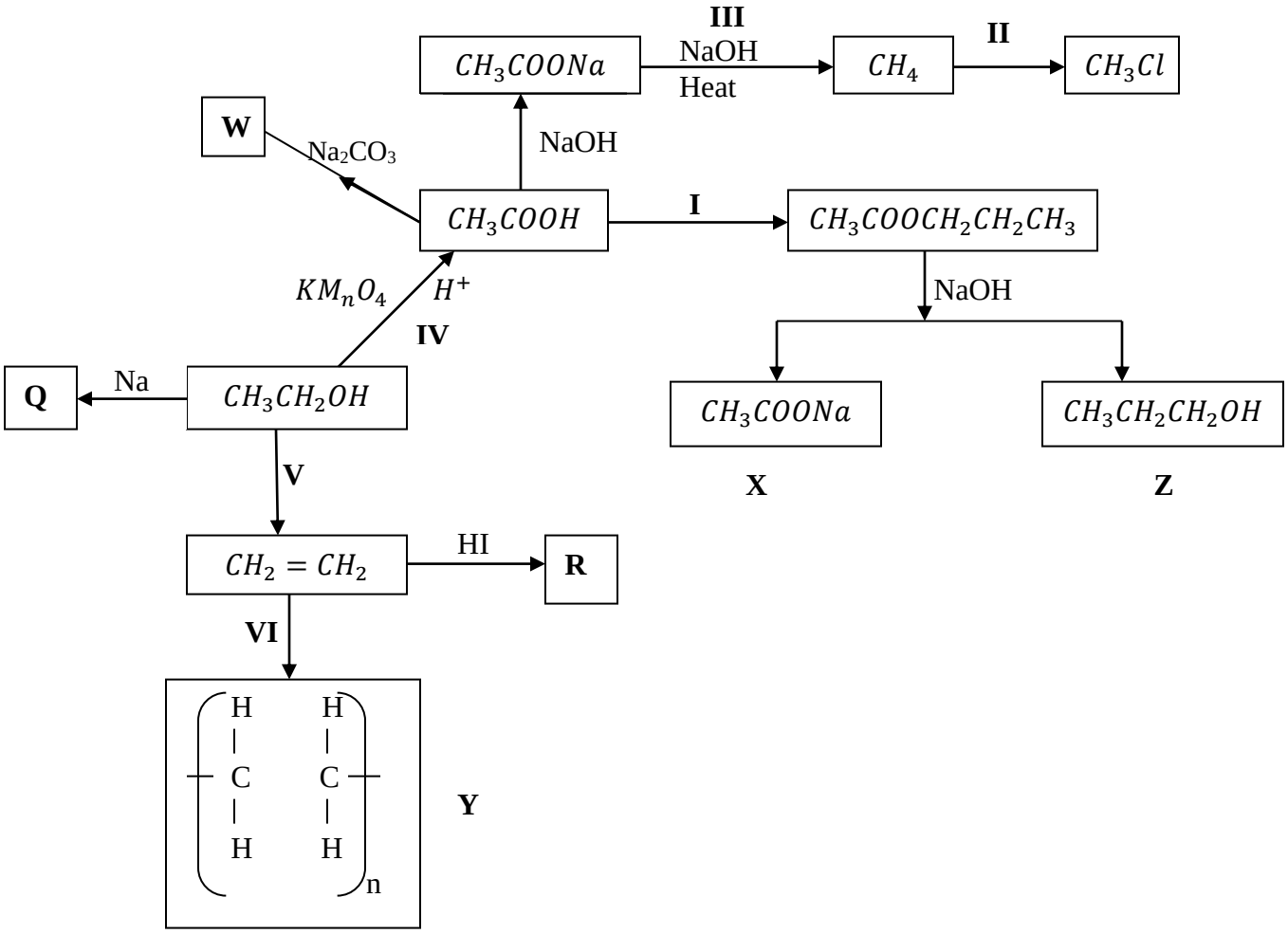
(ii) Name;

Solution **C** - ***Copper (II) chloride*** **(1 mark)**
Solid **D** - ***Copper (II) hydroxide*** **(1 mark)**

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

$\left[Cu\,(NH_3)_4 \right]^{2+}$

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



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

X - ***Sodium ethonoate*** ✓***1***

Q - ***Sodium ethoxide*** ✓***1***

R - ***Iodoethane*** ✓***1***

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

$$CH_3COONa_{(s)} + NaOH_{(aq)} \longrightarrow CH_{4(g)} + Na_2CO_{3(s)}$$

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

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

Reagent - ***Propan-l-ol*** ✓*1*

Condition - ***Conc. H_2SO_4*** ✓*1*

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

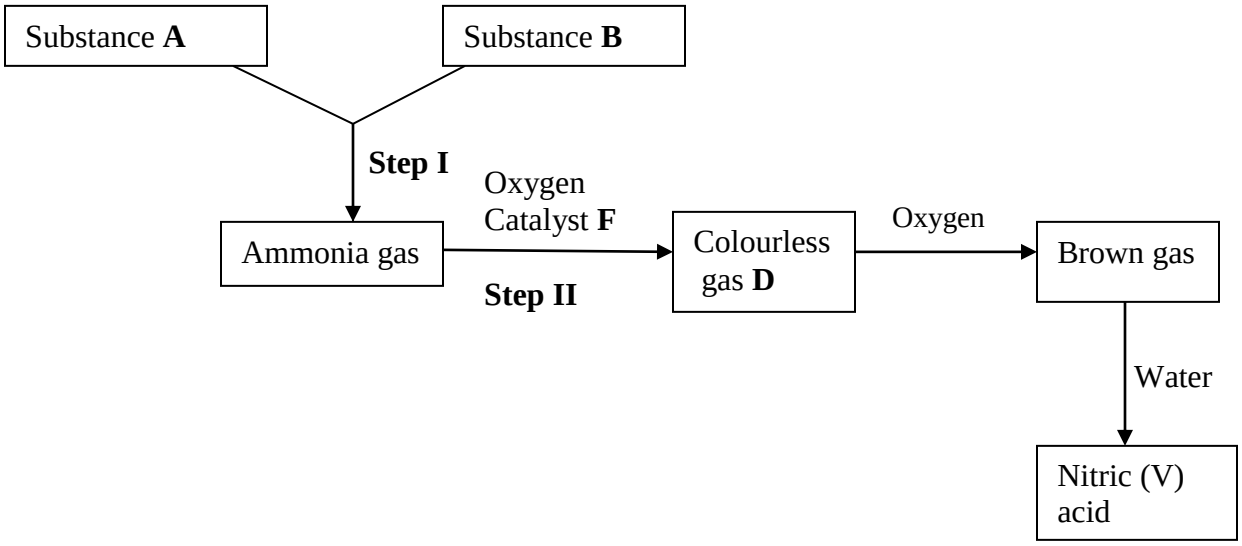
Reagent - ***Conc. H_2SO_4*** ✓*1*

Condition - **Temp 160 – 180^{0}C** ✓*1*

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

I - ***Esterification***
II - ***Substitution***
IV - ***Oxidation***
V - ***Dehydration***

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



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

A - ***Hydrogen***
B - ***Nitrogen***
D - ***NO***

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

Step **I** - ***Iron finely divided / iron***
Step **II** - ***Platinum – rhodium catalyst***

(c) Write a balanced chemical equation for taking place in step **II**. **(1 mark)**

$4NH_{(3)} + SO_2 \longrightarrow 2NO_{(g)} + 6H_2O$

(d) Write two balanced chemical equations for the reaction between chlorine Gas and;

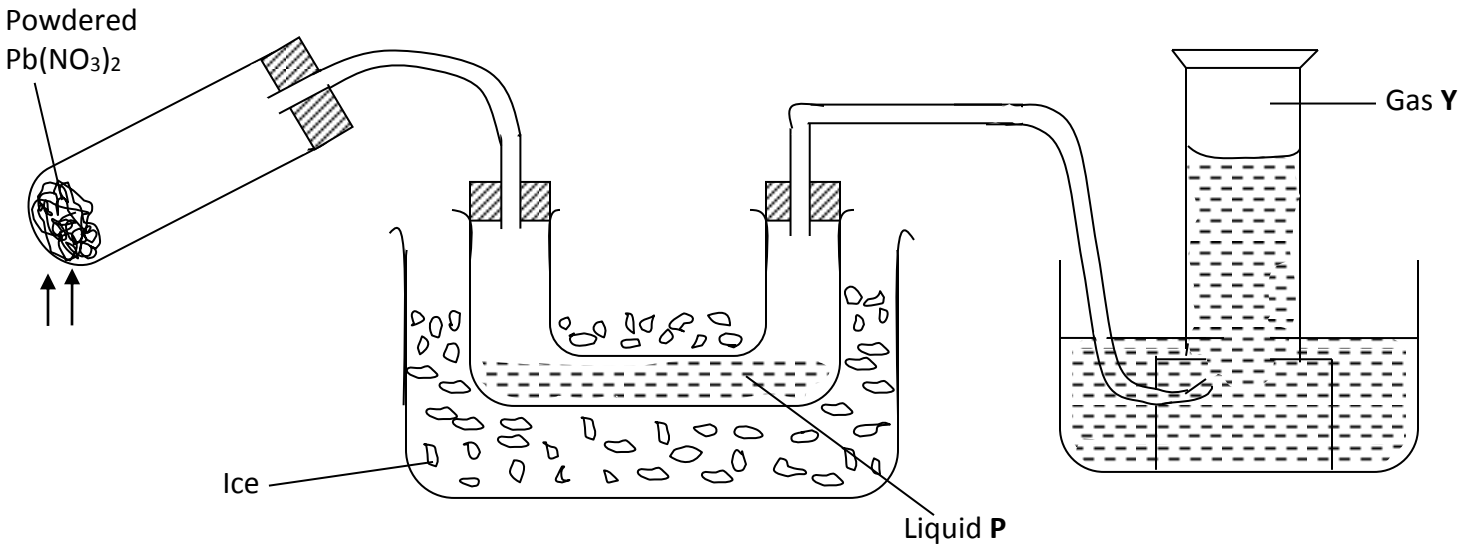
(i) Hot and concentrated sodium hydroxide. **(1 mark)**

$6NaOH_{(aq)} + 3Cl_{2(g)} \longrightarrow NaClO_{3(aq)} + 5NaCl_{(aq)} + H_2O_{(l)}$

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

$2NaOH_{(aq)} + Cl_2 \longrightarrow NaOCl + NaCl + H_2O$

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



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

(i) Liquid **P** - ***dinitrogen tetra oxide***
(ii) Gas **Y** - ***oxygen***

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

$2Pb(NO_3)_2 \longrightarrow 2PbO_{(s)} + 4NO_{2(s)} + O_{2(g)}$

(c) Explain how you can distinguish between nitrogen (II) oxide and nitrogen (I) oxide. **(2 marks)**

- ***Nitrogen (V) oxide relights a glowing splint while nitrogen (II) oxide does not.***
- ***N_2O has xtic sweet smell, while. NO_2 is odourless.***

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

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

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

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

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

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

(a) Identify the strongest:

(i) Reducing agent ***D*** **(1 mark)**

(ii) Oxidizing agent $\boldsymbol{R^{2+}}$ **(1 mark)**

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

$\boldsymbol{e.m.f = E^\theta R - E^\theta O}$

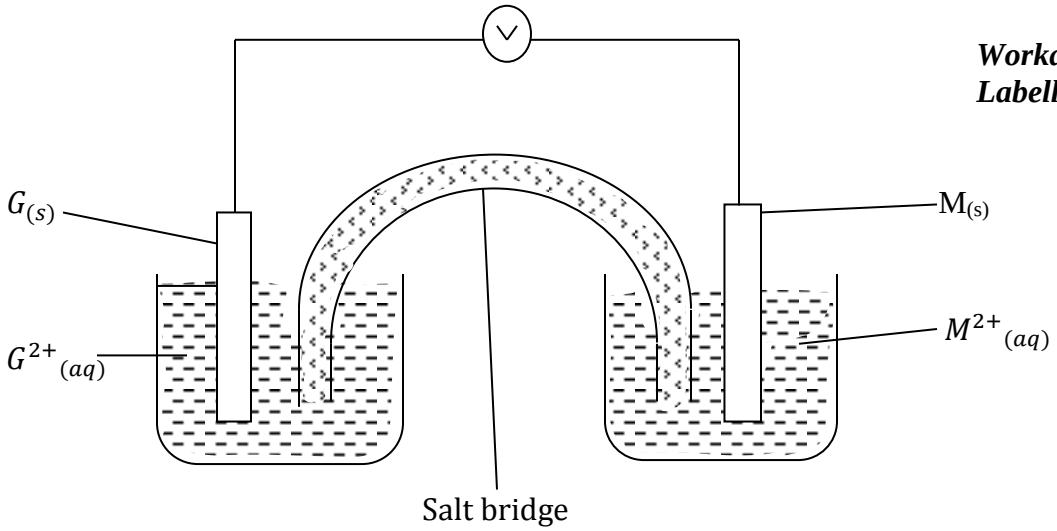
$\boldsymbol{= +0.34 - {}^{-}2.36}$

$\boldsymbol{= +2.70V}$

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

$\boldsymbol{G_{(s)} \left/ G^{2+}_{(aq)} \right\!\!\right/ M^{2+}_{(aq)} \left/ M_{(s)} \right. ; E = +2.70V}$ ***Penalize for lack of states and E value***

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



Workability ✓1
Labelling ✓1

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

$$G_{(s)} + M^{2+}{}_{(aq)} \longrightarrow G^{2+}{}_{(aq)} + M_{(s)} \; ; E = +2.70V$$

II. Electrolysis of aqueous solution of metal M resulted in the deposition of 1.07g of metal upon passage of a current of 1.32 amperes for 75 minutes.
(M = 52, 1F = 96500C)

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

$Q = 1t$
$= 1.32 \times 75 \times 60$ ✓½
$= 5940C$ ✓½

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

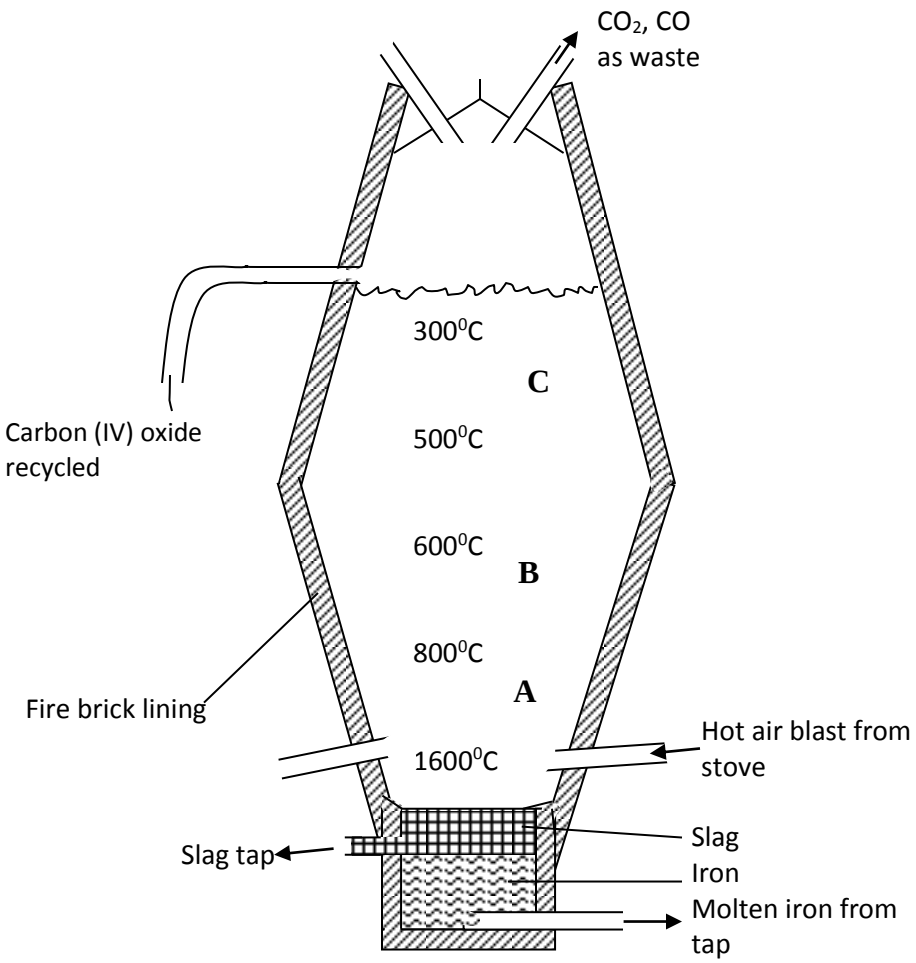
If 1.07g is departed by 5940C
52g " "
$\frac{52 \times 5940}{1.07} = 288,672.8972C$ ✓1

If 1F is 96500C
? " 288672.8972C

$\frac{1 \times 288,672.8972}{96500}$ ✓1

$= 2.994$
$\simeq 3$
$\underline{\underline{+3}}$ ✓1

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



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

Extraction of a metal from its ore using a reducing agent and heat.

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

Carbon (in form of coke)

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

Hot air reacts with coke to form carbon (IV) oxide producing a lot of heat which melts the iron formed in the blast furnace.

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

A $C_{(s)} + O_{(2)} \longrightarrow CO_{2(g)}$

B $CO_{2(g)} + C_{(s)} \longrightarrow 2\,CO_{(g)}$

C $2Fe_2O_{3(s)} + 3C_{(s)} \longrightarrow 4Fe_{(s)} + 3CO_{2(g)}$

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

To remove silica impurities in the ore.

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

$CaCO_{3(s)} \xrightarrow{\text{heat}} CaO_{(s)} + CO_{2(g)}$

$CaO_{(s)} + SiO_{2(s)} \longrightarrow CaSiO_{3(s)}$

$Al_2O_{3(s)} + CaO_{(s)} \longrightarrow CaAl_2O_{4(s)}$

slag

233/2
CHEMISTRY PAPER 2

MARKING SCHEME

NAME: ……INDEX:…….

CLASS:…….. DATE:……SIGN:……

INSTRUCTIONS
- ✓ Write your name and index number in the spaces provided.
- ✓ Answer all questions in the spaces provided.
- ✓ Mathematical tables and calculators may be used.
- ✓ All working must be clearly shown.

EXAMINERS USE

QUESTION	MAX SCORE	CANDIDATES SCORE
1	14	
2	15	
3	16	
4	11	
5	05	
6	11	
7	08	
Total	80	

Analyse
APPL.

1. **(a) Calculate the oxidation** number of chromium Cr $(H_2O)^{3+}{}_6$ (2 mks)

$x + C(+2-2)6 = +3$

$x + 0 = +3$

$x = +3$

(b) The table below shows the standard reduction potentials for four half-cell. Study it and answer the questions that follow:

Half reaction	**E^0 (volts)**
$Au^{3+} + 3e \longrightarrow Au_{(s)}$	+1.50
$Cu^{+} + e^{-} \longrightarrow Cu_{(s)}$	_0.52
$Pb^{2+} + 2e^{-} \longrightarrow Pb_{(s)}$	-0.13
$Fe^{2+} + 2e^{-} \longrightarrow Fe_{(s)}$	-0.44
$Cr^{3+} + Cr_{(s)} \longrightarrow Cr_{(s)}$	-0.74
$Al^{3+} + 3e^{-} \longrightarrow Al_{(s)}$	-1.66
$Mg^{2+}\ 2e^{-} \longrightarrow Mg_{(s)}$	-2.37
$Rb^{+} + e^{-} \longrightarrow Rb_{(s)}$	-.2.98

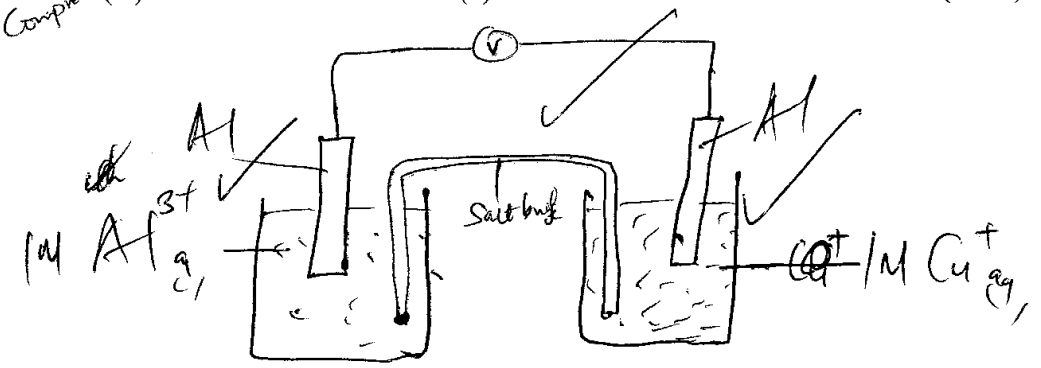
Knowledge (i) Identify the strongest reducing agent. (1 mk)

Rb.

Knowledge (ii) Write the equation for the redox reaction which takes place between (Cu/ Cu^{+}) and (Al/Al^{3+}). (1 mk)

$Al_{(s)} + 3Cu^{+}_{(aq)} \longrightarrow Al^{3+}_{(aq)} + 3Cu_{(s)}$

Comprehension (iii) Draw the cell obtained in (ii) above. (3 mks)



NB Check Cu^{+}.

7

(iv) Calculate the emf for the cell above. (2 mks)

$Emf = E_{red} - E_{ox}$

$= -0.52 - -1.66$

$= -0.52 + 1.66$

$= +1.14\ V$

Applicable (c) A current of 2.75 A is measured during recharging with an external potential of 2.0V using $Cd^{2+}_{(aq)}$ solution. After 5 minutes charging, how many moles of Cadnium will be redeposited. Hence calculate the mass redeposited. (Cd = 112, F = 96500C). (3 mks)

$Q = It$

$t = 5 \times 60 = 300sec$

$Q = 300 \times 2.75$

$= 825\ C$

$Cd^{2+} + 2e^- \rightarrow Cd_{(s)}$

$2F = 2 \times 96500 = 193000C$

$193000C \equiv 1mole$

$825 \equiv \frac{825}{193000}$

$= 0.00427\ moles$

$Mass = 0.00427 \times 112$

$= 0.47889g$

Knowledge (d) State two uses of electrolysis (2 mks)

- Extraction of reactive metals
- Manufacture of Chemicals eg NaOH ag 2
- Refining of metals eg Cu

Okay 2. Petrol (octane) a long hydrocarbon alkane can be converted to ethane and hydrogen gas mixtures as follows.

$$C_8H_{18(l)} \rightarrow 4\ C_2H_{4(g)} + H_{2(g)}$$

Knowledge (a) What do we call the process by which the products are obtained from octane? (1 mk)

Catalytic cracking

8

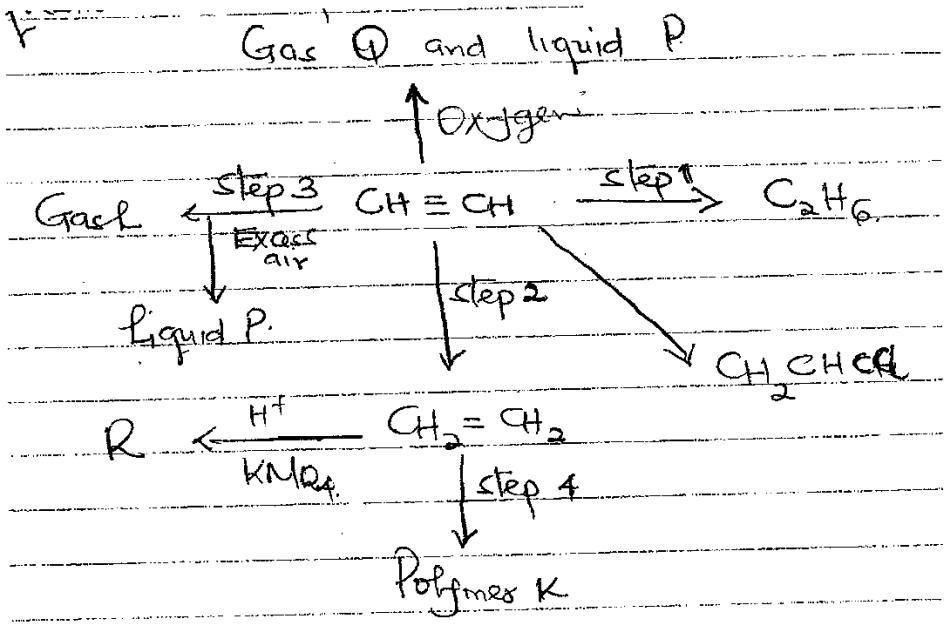
Knowledge

(b) Unleaded fuel is now widely used and has to be used in modern cars fitted with catalytic converters. State the merits of unleaded petrol. (1 mk)

Its less pollutant ✓1

(c) Study the scheme given below and answer the questions that follows:

Synthesis



(i) Name the reagents used in: (4 mks)

Step 1 Excess Hydrogen ✓1

Step 2 Hydrogen ✓1

Step 3 Hydrogen Chloride ✓1

Step 4 Ethene ✓1

(ii) Identify substance. (3 mks)

L Carbon IV Oxide ✓½

P Water ✓½

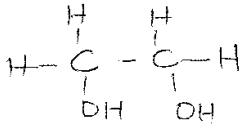
Q Carbon IV oxide ✓½

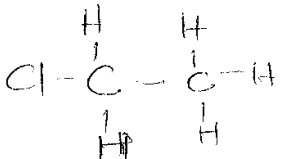
N

K Polyethene ✓½

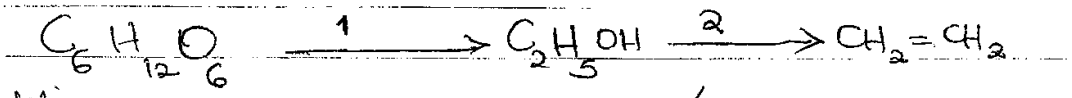
R Ethan-1,2-diol ✓½

(iii) Draw the structural formula of:

R  (1 mk)

K  (1 mk)

(d) Ethanol from glucose can be converted to ethane as shown below:



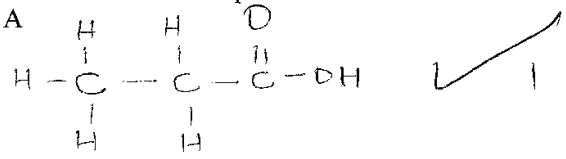
(i) Name the process that takes place in 1. (1 mk)

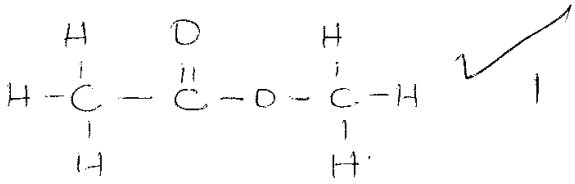
Fermentation

(ii) Name the reagent used in step 2. (1 mk)

Concentrated sulphuric vi acid

(e) Compound A and B have the same molecular formulae $C_3H_6O_2$. Compound A liberates carbon iv oxide on addition of sodium carbonate while compound B doesn't. Compound B has a sweet smell. Draw the possible structures of: (2 mks)

(i) A 

(ii) B 

3. (i) (a) Write the chemical name for rust. (1 mk)

hydrated iron (III) oxide

(b) State any two ways of preventing rusting. (2 mks)

Electroplating

Galvanization

Painting

Alloying

Oiling and greasing.

Knowledge

(c) Give a reason why vehicles based in Mombasa rust faster than those based in Limuru. (1 mk)

Salty solution in mombasa but not in limuru. salty promote rusting.

Knowledge

(d) Oxygen to obtained by fractional distillation of liquid air. Name two other gases which are obtained during the distillation. (1 mk)

Nitrogen and argon

Application

(ii) In an experiment to determine the solubility of sodium chloride, $5cm^3$ of a saturated solution of sodium chloride of mass 5.35g were placed in a volumetric flask and diluted to a total of 250 cm^3. 25 cm^3 of the dilute solution reacted completely with $24cm^3$ of 0.1 $moldm^3$ silver nitrate solution. Calculate:

(a) Moles of silver nitrate in $24cm^3$ of solution. (1mk)

$\frac{24 \times 0.1}{1000} = 2.4 \times 10^{-3}$ moles.

(b) Moles of sodium chloride in $25cm^3$ of solution. (1mk)

$AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow AgCl_{(s)} + NaNO_{3(aq)}$

Ratio 1:1 $\therefore = 2.4 \times 10^{-3}$ mole (1mk)

(c) Moles of sodium chloride in 250 cm^3 of solution.

$2.4 \times 10^{-3} \equiv 25cm^3$

x mole $\equiv 250cm^3$

x Mole $= 2.4 \times 10^{-2}$ mole

(d) Mass of sodium chloride in 5 cm^3 of the original saturated sodium chloride solution (1mk)

$NaCl = 23 + 35.5 = 58.5$

Mass $= 58.5 \times 2.4 \times 10^{-2} = 1.404g.$

(e) Solubility of sodium chloride. (1mk)

mass of water $= 5.35 - 1.404 = 3.946g.$

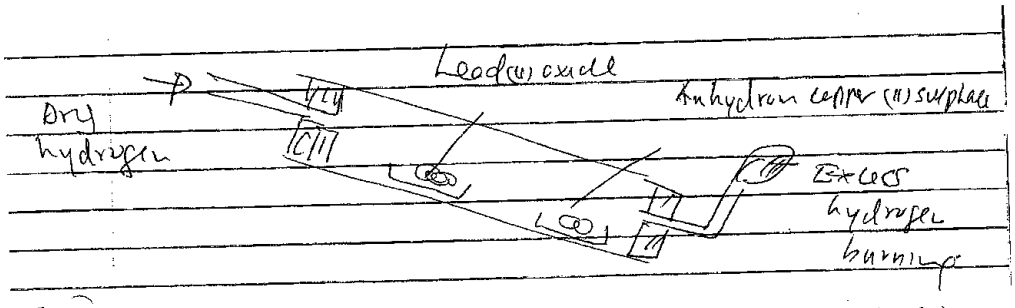
$3.946g \equiv 1.404.$

$100g \equiv ?$

$\equiv \frac{100 \times 1.404}{3.946}$

$\equiv 35.58g/100g$ of H_2O

(iii) The appacteatus below was used to investigate the effect of dry hydrogen gas on hot lead (II) oxide.



Evaluation (a) What is observed in the combustion tube at the end of the experiment? (2 mks)

grey element

Anhydrous Copper (II) sulphate white turn blue

Application (b) Write an equation for the reaction between hydrogen gas and lead (II) oxide. (1 mk)

$PbO_{(s)} + H_{2(g)} \longrightarrow Pb_{(s)} + H_2O_{(l)}$

Comprehension (c) Why should the tube be slanting? (1 mk)

To prevent any liquid collecting in the cooler part not coming back and cracking the hot part of the tube

Knowledge (d) State any 2 precautions to be observed when doing this experiment. (2 mks)

(1) hydrogen must be passed first so as to remove air and prevent explosion.

(2) The reduced lead must cool in a stream of hydrogen so as to prevent re-oxidation.

Kamau

4. The table below shows volumes of nitrogen (IV) oxide gas produced when different volumes of 1M nitric (V) acid were reacted with 2.07g of lead at room temperature. (Pb = 207)

Volume of 1M nutirc (V) acid	Volume of nitrogen (IV) oxide gas (cm^3)
5	60
15	180
25	300
35	420
45	480
55	480

Application (a) Give a reason why nitric (V) is not used to prepare hydrogen gas. (1 mk)

It is an oxidising agent and Oxidises hydrogen gas to water ✓

Analysis (b) On the grid provided plot a graph of the volume of the gas produced against the volume of the gas produced against the volume of the acid. (3 mks)

(c) Use your graphs to determine:

(i) Volume of nitrogen (IV) oxide produced when 30 cm^3 of 1M nitric (V) acid were reacted with 2.07g of lead. (1 mk)

360cm^3

(ii) Volume of 1M nitric (V) acid that would react completely with one mole of lead. (1 mk)

4500cm^3

Comprehension (d) Calculate the number of moles of:

(i) 1M nitric (V) acid that reacted with one mole of lead. (1 mk)

1mole → 1000cm³ ← 4500cm³ $\frac{4500}{1000} = 4.5$ moles

(ii) Nitrogen (IV) oxide produced when one mole of lead reacted with excess nitric (V) acid. (Molar gas volume = 24000cm^3) (1 mk)

1mole → 24000cm³ ← 48000cm³

$\frac{48000}{24000} = 2$ moles

Application

(e) Use the answers to d above and write the equation for the reaction between lead and nitric(V) acid. (1 mk)

$Pb_{(s)} + 4HNO_{3(aq)} \rightarrow Pb(NO_3)_{2(aq)} + 2NO_{2(g)} + 2H_2O_{(l)}$

Comprehension

(f) Explain how the rate of the reaction between lead and nitric (V) acid would be affected if the temperature of the reaction mixture was raised. (2 mks)

The rate of reaction would increase

Numbers

5. (a) When ammonia gas is passed through copper (II) sulphate solution a blue precipitate is formed which dissolves to give a deep blue solution. Write an ionic equation for the formation of:

Application

(i) The blue precipitate (1 mk)

$Cu^{2+}_{(aq)} + OH^-_{(aq)} \rightarrow Cu(OH)_{2(s)}$ ✓1

(ii) the deep blue precipitate. (1 mk)

$Cu(OH)_{2(s)} + 4NH_{3(aq)} \rightarrow [Cu(NH_3)_4]^{2+}_{(aq)} + 2OH^-_{(aq)}$

(b) Aluminum oxide is amphoteric.

Comprehension

(a) Explain the term amphoteric. (1 mk)

It means it has both acid and basic properties

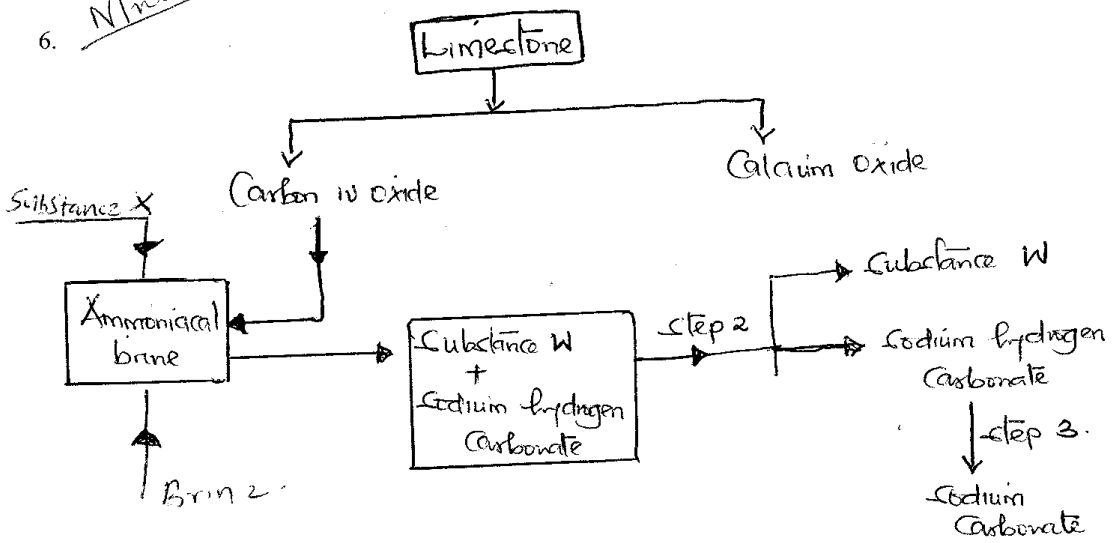
Knowledge

(b) Name and give the formula of other two amphoteric oxides. (2 mks)

Zinc oxide ZnO ✓½ ✓½

Lead(II) oxide PbO ✓½ ✓½

6. Misses



Knowledge

(a) What is the chemical name for limestone ✓ 1 (1 mk)

Calcium carbonate

Knowledge (b) Identify substances: (2 mks)

(i) X - Ammonia gas ✓ 1

(ii) W - ammonium chloride ✓ 1

Knowledge (c) Name the process taking place in: (2 mks)

(i) Step II Filtration ✓ 1

(ii) Step III Thermal decomposition ✓ 1

Knowledge (d) Write a chemical equation for the reaction of:

(i) Leading to formation of substances W and sodium hydrogen carbonate. (1 mk)

$NH_{3(g)} + CO_{2(g)} + H_2O_{(l)} + NaCl_{(aq)} \rightarrow NaHCO_{3(s)} + NH_4Cl_{(aq)}$ ✓ 1

(ii) Taking place in step (III). (1 mk)

$2NaHCO_{3(s)} \rightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$ ✓ 1

Application (e) Carbon (V) oxide and ammonia are required during the solvay process. Write equation to show how ammonia is recycled. (1 mk)

$2NH_4Cl_{(s)} + Ca(OH)_{2(aq)} \rightarrow 2NH_{3(g)} + 2H_2O_{(l)} + CaCl_{2(aq)}$

Knowledge (f) Name the other product of solvay process and state one use of it. (1 mk)

Calcium chloride → used as a drying agent. used in extraction of sodium

Knowledge (g) State two uses of sodium carbonate. (2 mks)

1. used in making glass
2. used in making sodium silicate used in making detergents.

7. The grid below represents past of the periodic table. Study it and answer the questions.

				B			C	
K	F		D			E	A	Y
	G							

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

Alkaline earth metals ✓1

Knowledge (b) Name the type of bond formed when C and F react. (1 mk)

Ionic bond ✓1

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

D_2O_3 ✓1

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

Amphoteric Oxide ✓1

Evaluation

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

D has a smaller atomic radius than F ✓

D has more protons ✓½ hence stronger nuclear attraction ✓½

Application

(f) Element F burns in air to form two products. Write 2 equations for the two products formed. (2mks)

$2F_{(s)} + O_{2(g)} \rightarrow 2FO_{(s)}$ ✓1

$3F_{(s)} + N_{2(g)} \rightarrow F_3N_{2(s)}$ ✓1

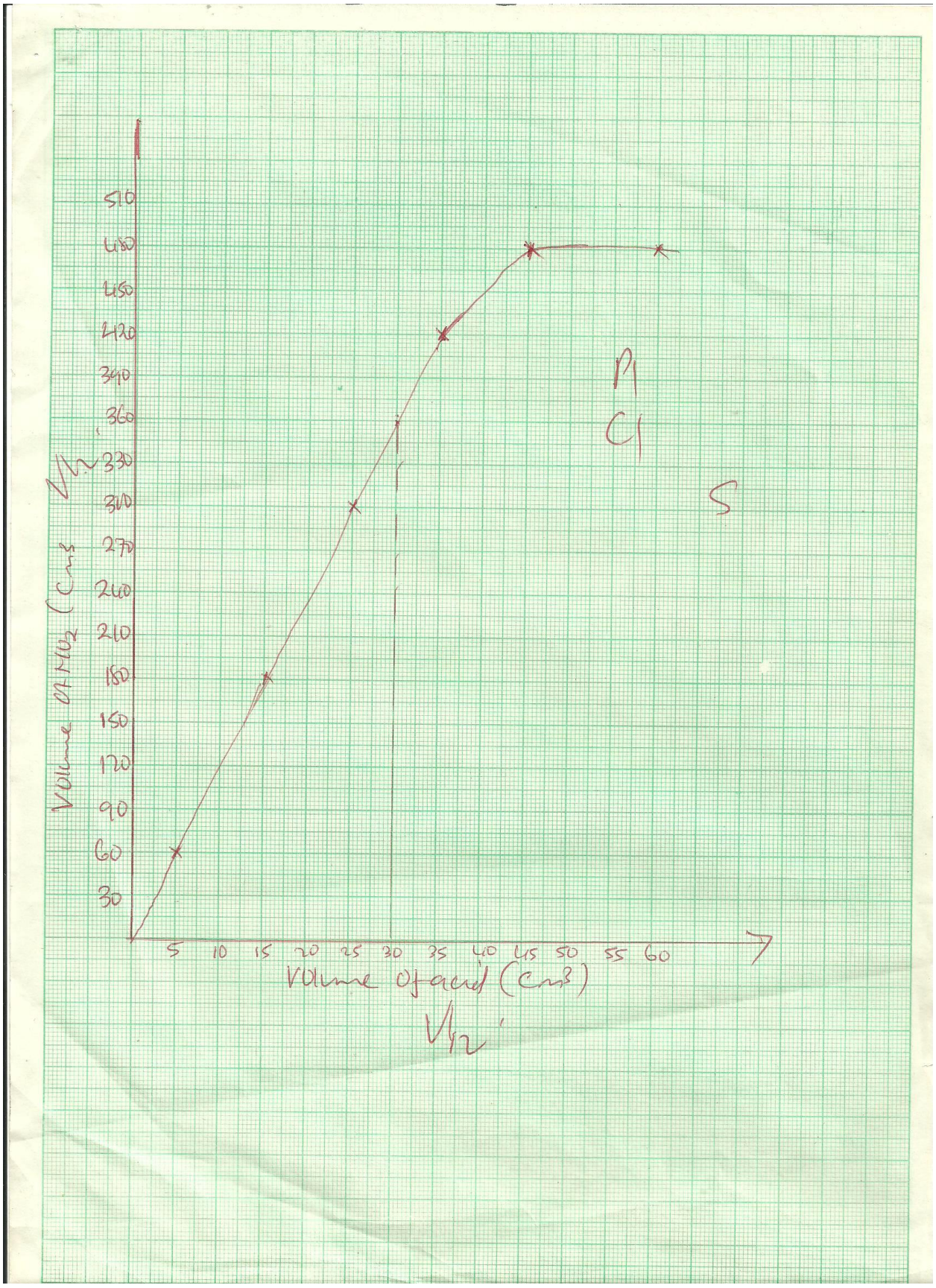
Knowledge

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

- K cyanide is used in extraction of gold ✓1
- Mixture of K and potassium is used as nuclear coolant ✓1

Any 2.

6mks


510
480
450
420
390
360
330
300
270
240
210
180
150
120
90
60
30
Volume of H2 (Cm3)
V1
P
C
S
5
10
15
20
25
30
35
40
45
50
55
60
Volume of acid (Cm3)
V2'

MARKING SCHEME

233/3

CHEMISTRY

MARCH/APRIl

MOKASA JOINT EXAMINATION-2015

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

1. **Table 1**

a)

Complete table …… 1mark

Conditions:

i) Complete table with 3 titrations done ……. 1 mark
ii) Incomplete table with two titrations done….½ mark
iii) Incomplete table with only one titration done ….0 mark

Penalties:

i) Wrong arithmetic
ii) Inverted table
iii) Unrealistic values i.e less than 1 cm^3,or in 100s
iv) Burette readings >50 cm^3,unless explained

Penalize ½ mark each to a maximum of ½ mark, i.e, penalize ½ mark ONCE.

Use of decimal places…… 1 mark (Tied to

1st and 2nd row only)

i) Accept 1 or 2 decimal places used consistently, otherwise penalize FULLY.
ii) If two decimal places are used, the 2nd must be a "0" or a "5", otherwise penalize FULLY.
iii) Accept the inconsistency in the use of zeros in the initial burette readings e.g 0.0,0.00, 00.0

Accuracy…….. 1 mark

Compare candidate's correct titre value with school value (s.v) and tick (✓) if it earns a mark and award accordingly.

Coditions:

i) If at least one titre value is within ± 0.1 cm^3 of s.v award…… 1 mark
ii) If no value is within ± 0.1 cm^3 of s.v but there is at least one within ± 0.2 cm^3 award …… ½ mark
iii) If no titre value is within ± 0.2 cm^3 award…… 0 mark

Principles of averaging…… 1 mark

i) If three consistent values are averaged ……. 1 mark

ii) If three titrations are done and only two are consistent and averaged…… (1 mark)

iii) If two titrations are done, are inconsistent and averaged … (0 mark)

Final Accuacy (tied to correct average titre)…….. (1 mark)

Compare the candidate's correct average titre with s.v;

i) If within ± 0.1 of s.v …….. 1 mark

ii) If not within ± 0.1 but within ± 0.2 of s.v ……½ mark

iii) If beyond ± 0.2 of s.v ……. 0 mark

b) $250\ cm^3$ ⟶ 1.325g of Na_2CO_3

⟶ 1.325 x 4g of $N_{a2}CO_3$

= 5.3/ RFM

= $\frac{5.3}{106}$ grams per litre

= 0.05M ✓

c) i) Moles of Na_2CO_3 reacted = $\frac{0.05 \times 25}{1000}$

= 0.00125 ✓

Reacting mole ratio of HA: Na_2CO_3 = 2:1

ii) 0.0025 moles of HA ⟶ average titre

? ⟵ $1000cm^3$

= $\frac{0.0025 \times 1000}{\text{Average titre}}$

= 0.12M ✓

Table II: mark as in table I

e) i) $1000cm^3$ ⟶ 0.12 mol.

Titre volume ⟶ $\frac{\text{average volume x 0.12}}{1000}$ moles

= correct answer

ii) Reacting mole ratio of HA to Na_2CO_3 is 2 : 1
∴ Moles of Na_2CO_3 = ½ * answer above

=Correct answer

2. **Table 1**

d)

Complete table …… 1mark

Conditions:

iv) Complete table with 3 titrations done ……. 1 mark
v) Incomplete table with two titrations done….½ mark
vi) Incomplete table with only one titration done ….0 mark

Penalties:

v) Wrong arithmetic
vi) Inverted table
vii) Unrealistic values i.e less than 1 cm^3,or in 100s
viii) Burette readings >50 cm^3,unless explained

Penalize ½ mark each to a maximum of ½ mark, i.e, penalize ½ mark ONCE.

Use of decimal places…… 1 mark (Tied to

1^{st} and 2^{nd} row only)

iv) Accept 1 or 2 decimal places used consistenly, otherwise penalize FULLY.

v) If two decimal places are, the 2nd must be a "0" or a "5", otherwise penalize FULLY.
vi) Accept the inconsistency in the use of zeros in the initial burette readings e.g 0.0,0.00, 00.0

Accuracy…….. 1 mark

Compare candidate's correct titre value with school value (s.v) and tick (✓) if it earns a mark and award accordingly.

Coditions:

iv) If at least one titre value is within ± 0.1 cm^3 of s.v award…… 1 mark
v) If no value is within ± 0.1 cm^3 of s.v but there is at least one within ± 0.3 cm^3 award …… ½ mark
vi) If no titre value is within ± 0.2 cm^3 award…… 0 mark

Principles of averaging…… 1 mark

iv) If three consistent values are averaged ……. 1 mark
v) If three titrations are done and only two are consistent and averaged…… (1 mark)
vi) If two titrations are done, are inconsistent and averaged … (0 mark)

Final Accuacy (tied to correct average titre)…….. (1 mark)
Compare the candidate's correct average titre with s.v;
iv) If within ± 0.1 of s.v …….. 1 mark
v) If not within ± 0.1 but within ± 0.2 of s.v ……½ mark
vi) If beyond ± 0.2 of s.v …… 0 mark

e) 250 cm^3 ⟶ 1.325g of Na_2CO_3
⟶ 1.325 x 4g of $N_{a2}CO_3$

= 5.3/ RFM

= $\frac{5.3}{106}$ grams per litre

= 0.05M ✓

f) i) Moles of Na_2CO_3 reacted = $\frac{0.05 \times 25}{1000}$

= 0.00125 ✓

Reacting mole ratio of HA: Na_2CO_3 = 2:1

ii) 0.0025 moles of HA ⟶ average titre

? ⟵ $1000cm^3$

= $\frac{0.0025 \times 1000}{\text{Average titre}}$

= 0.12M ✓

Table II: mark as in table I

e) i) $1000cm^3$ ⟶ 0.12 mol.

Titre volume ⟶ $\frac{\text{average volume} \times 0.12}{1000}$ moles

= correct answer

iii) Reacting mole ratio of HA to Na_2CO_3 is 2 : 1
∴ Moles of Na_2CO_3 = ½ * answer above

=Correct answer

iv) $25cm^3$ ⟶ answer(ii)
$75\ cm^3$ answer (ii) x $\frac{75}{25}$ = correct answer

v) Original solution c: 75 x answer (iii) = correct answer

vi)

vii) 0.00375 – answer (iV) = correct answer

viii) Reacting mole ratio is 1 : 1 ∴ moles of $M(OH)_2.8H_2O$= = answer (v)

f) i) answer b(vi) are in 25 cm^3 of $M(OH)_2.8H_2O$

x $\frac{1000}{25}$ cm^3

$x = \frac{\text{answer} \times 1000}{25}$ ✓

= correct answer (moles per litre) ✓

ii) 15.75 g ⟶ answer (i)

?? ⟵ 1mol.

$x = \frac{18.3 \times 1}{\text{answer (i)}}$ ✓

= correct answer ✓ (accept rounded off to ma whole number)

iii) M + 178 = answer (ii)
M = Answer (ii) - 178 ✓

∴ R.A.M of M = correct answer ✓

ix) answer(ii)
75 cm^3 answer (ii) x $\frac{75}{25}$ = correct answer

x) Original solution c: 75 x answer (iii) = correct answer

xi) 0.00375 – answer (iV) = correct answer

xii) Reacting mole ratio is 1 : 1 ∴ moles of $M(OH)_2.8H_2O$= = answer (v)

f) i) answer b(vi) are in 25 cm^3 of $M(OH)_2.8H_2O$

x $\frac{1000}{25}$ cm^3

x = $\frac{\text{answer} \times 1000}{25}$ ✓

= correct answer (moles per litre) ✓

ii) 15.75 g ⟶ answer (i)

?? ⟵ 1mol.

x = $\frac{18.3 \times 1}{\text{answer (i)}}$ ✓

= correct answer ✓ (accept rounded off to a whole number)

iv) M + 178 = answer (ii)
M = Answer (ii) - 178 ✓

∴ R.A.M of M = correct answer ✓

Question 2

Table

(i) Complete table…..2 readings recorded…. 1 mk

Penalty:

penalize fully for any space not filled.

(ii) Use of decimal…… 1 mk

Accept temperature readings for 1 mk if consistently given either as whole numbers of 1 d.p. of .0 or .5

(iii) Accuracy…… 1 mk

Compare candidate's initial temperature reading to school value. Award 1 mk for value within $\pm$ 2^{o}C of SV otherwise penalize fully.

Questions

(a) ΔT = Final-Initial = Correct ans 1 mk

Penalties

- Penalise ½ mark for wrong units or omission of unit on the answer.

(b) (i)Accept correct transfer of ΔT, even if rejected in (a) above.

Heat change= m.c. ΔT

= 30 x 4.2 x ΔT 1 mk

= correct ans 1 mk

ii) Number of moles= $\frac{2.0}{126}$ = 0.01587 1 mk

- Penalise ½ mk for wrong units used otherwise ignore if omitted.

iii) Molar heat of solution.

ΔH= $\frac{\text{ans b(i)}}{ans\ b(ii)}$ ½ mk

= correct ans ½ mk

Penalties

- Penalise ½ mk for transfer of either b(i) or b(ii), otherwise penalize fully for strange values.

3 i)

Observation	Inference
No white precipitate formed ✓½	Na^+, K^+, NH_4^+ ✓½

(ii)

Observation	Inference
Burns with a golden-yellow flame ✓1	Na^+ present ✓½

(iii)

Observation	Inference
White precipitate ✓½ dissolves on addition of HCl acid ✓½	SO_3^{2-}, CO_3^{2-} *present* ✓

(iv)

Observation	Inference
Colour changes from <u>orange</u> to <u>green</u> ✓½	SO_3^{2-} *present* ✓½

b) You are provided with solid F. Carry out the tests below and record your observations and inferences in the spaces provide

(i) Using a metallic spatula, heat half of solid F in a non-luminous burnsen burner flame for some time then remove when it ignites

Observations	Inferences
Melts burns with a sooty/smoky/luminous yellow flame√½ (accept melts on its own for ½ mk)	C= C or –C = C- present √1 Organic compound with high C:H ratio long chain organic compound (½ mk)

ii) Put a half spatula endful of solid F into a boiling tube. Add about 10cm3 of distilled water and shake vigorously

Observations	Inferences
Dissolves into a colourless solution ½ mk	Soluble compound /salt/polar substance ½ mk

iii)Divide the resulting solution into two portions

a) To the first portion,add 2-3 drops of universal indicator and dertermine its PH

Observations	Inferences
pH 2.0√ ½	Strongly acidic H^+/-COOH √ ½ (½ mk

b) To the second portion, add two drops of acidified potassium manganate (VII) solution and shake vigorously

Observations	Inferences
$H^+/KMnO_4$ decoclourises √1 (½ mk)	C=C or –C= C- present √ ½ Or R-OH present √ ½

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CHEMISTRY

PAPER 3

MOKASA 2015

(CONFIDENTIAL)

In addition to the apparatus found in the laboratory each candidate will require the following;

- About 0.5g of solid F
- About 1g of solid G
- 6 clean test-tubes
- Universal indicator solution and a pH chart
- Ethanol supplied with a dropper
- Clean dry metallic spatula
- 1 boiling tube
- Distilled water
- Solution J, about $130cm^3$
- Solution Q, about $160cm^3$
- Solution R, about $30cm^3$
- Screened methyl orange indicator
- Methyl orange indicator
- 100ml measuring cylinder
- Filter paper
- Means of labeling
- Solid P
- Thermometer
- 100ml beaker

Access to the following;

- Ethanol supplied with a dropper
- Concentrated sulphuric (VI) acid supplied with a dropper bottle
- Acidified Potassium dichromate (VI) solution
- Acidified Potassium Manganate (VII) solution.
- 2M $Ba(NO_3)_2$ solution.
- 2M NaOH solution.
- 2M HCl acid.
- Source of heat.

Preparation

- ✓ Solurion J is 0.12M HCL, prepared by adding about 800cm^3 of distilled water to 4.05$cm^3$of concentrated HCL of density 1.08gcm^{-3} and making it to one litre of solution.
- ✓ Solution Q is prepared by dissolving 5.3g of anhydrous sodium carbonate in enough distilled water and making up to one litre of solution.
- ✓ Solution R is prepared by dissolving 15.75g of hydrated barium hydroxide in enough distilled water and top up to one litre of solution.
- ✓ Solid P is 2.0g of oxalic acid weighed accurately and supplied in a stoppered container
- ✓ Solid F is maleic acid
- ✓ Solid G is sodium sulphite