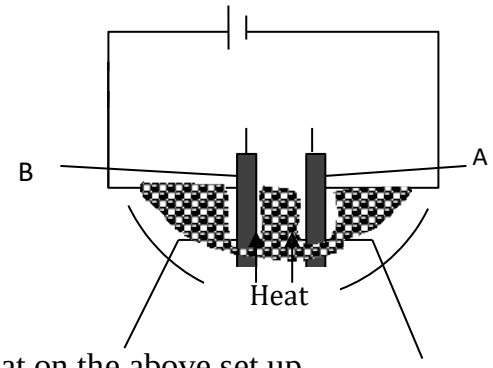
CHEMISTRY PAPER 1 MS

1. A luminous flame produces more light than a non-luminous flame. Explain. (2 marks)

Presence of unburnt (1)carbon which glow (1)

2. The diagram below was used to electrolyze molten copper (II) chloride using graphite electrodes at s.t.p.



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

Keep $CuCl_2$ in molten form so as the ions are mobile to conduct electricity.

(b) Write equations at electrode A and B. **(2mark)**

A ***$Cu^{2+}(l) + 2e \rightarrow Cu(s)$***

B ***$2Cl^-(l) \rightarrow Cl_2(g) + 2e$***

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

(a) State and explain the observation that was made. **(2 marks)**

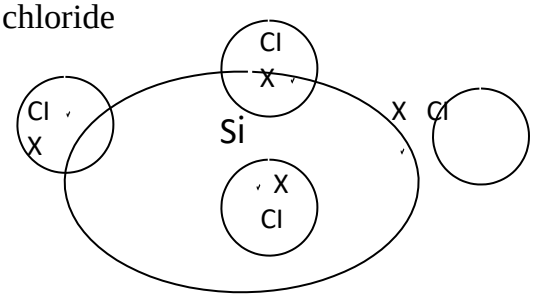
Black copper (II) oxide changed to brown - ammonia reduces copper (II) oxide to copper// Colourless liquid forms on cooler parts of combustion tubes- Ammonia is oxidised

(b) Write a balanced chemical equation for the reaction above. **(1 mark)**

$$\text{CuO}_{(s)} + \text{NH}_{3(g)} \longrightarrow \text{Cu}_{(s)} + \text{H}_2\text{O} + \text{N}_{2(g)}$$

4. Use dots (˙) or crosses (x) to show bonding in the following molecules.

(a) Silicon chloride



b) Ethanol and dimethylether have both molecular formulae C_2H_6O. Explain why ethanol C_2H_5OH boils at 78.2^{0}C and dimethyl ether CH_3OCH_3 has a boiling point -24^{0}C. (2 marks)

Ethanol contains hydrogen bond which are strongerbonds than Van der Waal forces in dimethyl ether.

5. When 17.2 g of hydrated calcium sulphate was heated to a constant mass, 13.6g of the residue was obtain. Find the value of n in $CaSO_4 \cdot xH_2O$. (3 marks)
(Ca = 40, S = 32, O = 16, H = 1)

	$CaSO_4$	H_2O
Mass	***13.6***	***3.6***
R.A.M	***136***	***18***
No. of moles	$\frac{13.6}{136}$	$\frac{3.6}{18}$
Mole ratio	$\frac{0.1}{0.1}$	$\frac{0.2}{0.1}$
	1	***2***

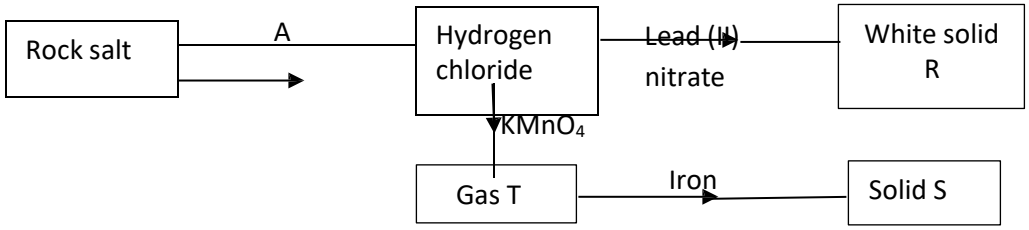
n = 2

6. In an experiment, ammonium chloride was heated in a boiling tube with a moist red and blue litmus paper at the mouth of test tube. State and explain the observation made. (3 marks)

First ***Moist red litmus changed to blue and both the moist blue litmus papers later changed to red.***
When ammonium chloride is heated it decomposes into ammonia and hydrogen chloride gases.

Ammonia is light hence diffuses faster changing the litmus to blue. HCl diffuses slower changing the two litmus back to red. (W.T.T.E)

7. Study the chart below and answer the questions that follow.



(a) Name reagent used in step A. (1 mark)

Concentrated sulphuric (VI) acid

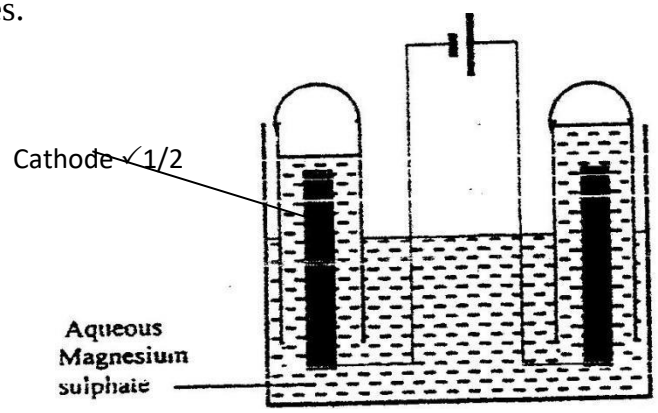
(b) Write the ionic equation for formation of white solid R. (1 mark)

$$\square\square^{\square+}_{(\square\square\square)} + \square\square\square\square^{-(\square\square\square)} \longrightarrow \square\square\square\square\square_{\square}\textbf{(s)}$$

(c) Write an equation for formation of solid S. (1 mark)

$$\square\square\square\square\square_{(\square\square)} + \square\square\square\square_{\square(\square\square)} \longrightarrow \square\square\square\square\square\square\square\square_{\square}(s)$$

8. The set-up below was used during the electrolysis of aqueous magnesium sulphate using inert electrodes.



i) On the diagram label the cathode. (½mark)

ii) Write an equation for the reaction that took place at the cathode. (1 mark)

$2H^+_{(aq)} + 2e^- \longrightarrow H_{2(g)}$ ✓1

iii) Explain the change that occurred to the concentration of magnesium sulphate solution during the experiment. (1½ marks)

Concentration increased✓½ because the amount of water decreased✓½ as it was decomposed to hydrogen and oxygen gases which escaped✓½

9. The equation below shows the oxidation of Sulphur (IV) oxide to Sulphur (VI) oxide in the contact process.

$$2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_{3(g)} \quad \Delta H = -196kJ/mol^-$$

State and explain the effect on the yield of Sulphur (IV) oxide when:

a) the temperature increased. ($1^1/_2$ marks)

Yield decreases 1 backward reaction is favoured which endothermic//lower temperature $^1/_2$

b) the amount of oxygen is increased. **($11^/_2$marks)**

Yield increases 1 Oxygen reacts with Sulphur (IV) oxide forming more Sulphur (VI) oxide//equilibrium shifts to the right to lower concetration of oxygen.

10. Dry carbon (II) oxide is passed over heated iron (III) oxide.

a) Name the type of reaction between carbon (II) oxide and iron (III) oxide. (1mark)

Redox reaction (1 mk)

b) Write an equation for the reaction between carbon (II) oxide and iron (III) oxide (1mark)

$Fe_2O_3 + 3CO \longrightarrow 2Fe(s) + 3CO_2(g)$

c) Name a suitable drying agent for carbon (II) oxide (1mark)

Concentrated sulphuric acid// anhydrous calcium chloride// calcium oxide

11. Thermochemical equation for combustion of ethanol is shown below;
$C_2H_5OH\ (l) + 3\ O_2\ (g) \longrightarrow 2\ CO_2\ (g) + 3\ H_2O\ (l),\ AH = -1337 kJmol$

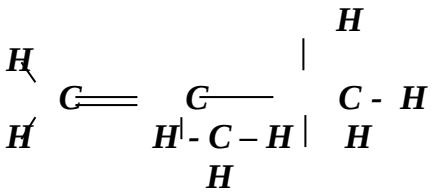
(a) Determine the heating value for ethanol? (2 mark)

(C= 12, H = 1, O = 16)

$\frac{\text{}}{\text{}}$ ***(1mark)***

= 29.07 kJg^{-1} (1mark)

(c) Draw the structural formula for 2-methylprop-l-ene {1 mark)



12. a) Define oxidation in terms of electrons (1mark)

Oxidation is lose of electrons

b) Determine the oxidation state of (1mark)

i) Suphur in SO_3^{-2} ion

$$x + 3(-2) = -2$$
$$x - 6 = -2$$
$$x = +4$$

ii) Phosphorous in PO_4^{3-} ion (1mark)

$$x + 4(-2) = -3$$
$$x - 8 = -3$$
$$x = +5$$

13. Labels on acid solutions indicated the following:-

Acid 1 :0.1M, 6.5% ionized

Acid 2 :0. 2M, 1.3% ionized

(a) Identify the strong acid (1 mark)

Acid 1

(b) If 25cm^3 of distilled water are added to 50cm^3 of acid 2, what is its new concentration? (2 mark)

$$M_1V_1 = M_2V_2$$

$$M_2 = \frac{M_1V_1}{V_2} = \frac{0.2M \times 50CM^3}{75cm^3} = 0.133M$$

14. When 0.05 mole of magnesium were added to 100cm^3 of dilute hydrochloric acid at 25°C, 25kJ of heat energy were released. The acid was in excess.

(a) Calculate the highest temperature of the reaction mixture.
(2mark) (specific heat capacity for water is 4.2J/g/ °C, density of the solution is lg/cm^3)

$$\Delta H = mc\Delta T$$

$$25000\ J = 100g \times 4.2Jg^{-1}k\text{-}1 \times \Delta T$$

$$\Delta T = \frac{25000J}{100g \times 4.2Jg\text{-}1\ K^{-1}}$$

= 59. 52

Highest temperature reached

59.52 + 25

= 84.52^{0}C

(b) Calculate the molar heat of reaction for the reaction below (1 mark}

$Mg(s) + 2HCI(aq) \longrightarrow MgC!_2(aq) + H_2(g)$

0.05moles 25kJ

1 mole x

X = [illegible] ***= -500kJ mol^{-1}***

15. Hydrogen sulphide is a highly toxic and flammable gas and is usually prepared in the fume chamber.

a) Name any two reagents that can be used to prepare hydrogen sulphide in the laboratory. (1mk)

iron(II)sulphide and dilute hydrochloric acid// any metal sulphide and an acid

b) Hydrogen sulphide could be used to produced sulphur as shown in the equation below:

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

In the equation above, identify the reducing agent and give a reason for your answer. (1mk)

H_2S – oxidation number of sulphur decreases from +4 to 0

c) Other than Vulcanisation of rubber, identify any other uses of Sulphur. (1mk)

Manufacture of sulphuric (VI)acid// any other correct use

16. The following table shows the P^H values of solutions A ,B and C

Solution	A	B	C
pH	2	7	11

(a) Which solution is likely to be magnesium chloride. Give a reason. (1mk)

B- it is neutral

(b) Identify the solution in which a sample of aluminium chloride is likely to be when dissolved in water. Explain (2mks)

A – hydrolyses in water to produce hydrochloric acid which is a strong acid

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

		Ionization Energy_kJ/Mole	
Element	**Electronic configuration**	**1st ionization energy**	**2nd ionization energy**
A	2.2	900	1800
B	2.8.2	736	1450
C	2.8.8.2	590	1150

a) What is ionization energy (1mk)

Minimum amount of energy required to remove an electrom from an atom in the gaseous state

b) Explain why the 2nd ionization energy is higher than the 1st ionization energy. (1mk)

Once an electron is removed from an atom, the remaining electrons are held more strongly by the net charge than the first one

18. An element K has relative atomic mass of 40.2. It has two isotopes of masses 39 and 42. Calculate the relative abundance of each isotope. (3mks)

$$\frac{39x + 42(100-x)}{100} = 40.2$$

$4020 = 39x + 4200 - 42x$

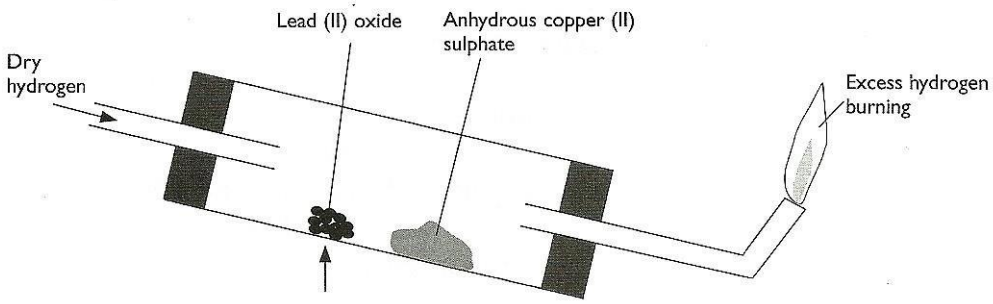
$3x = 180$

$X = 60$

$K39 = 60\%$

$K42 = 40\%$

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



a) After the experiment has been running for some time, record two major observations made in the tube. (2mks)

Red lead (II) oxide turns grey

White copper (II) sulphate turns blue

b) Write an equation for the reaction that takes place in the dish containing lead (II) oxide. (1mk)

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

20. a) Name two ores of iron. (1mks)

haematite

magnetite

siderite ***any two***

b) Give the name of the suitable method used in extracting iron from the ore. (1mk)

reduction

a) Name one impurity present in pig iron and state one effect of the impurity in the physical property of iron. (1mks)

Carbon//silicon – makes iron brittle

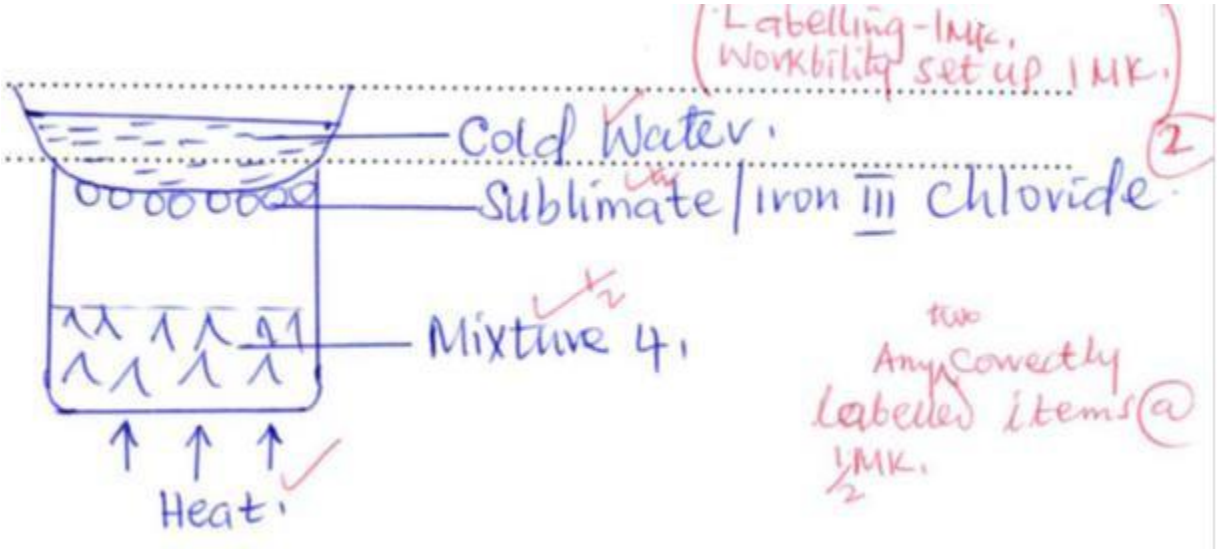
22. The table below gives two samples of mixtures. Study the table and answer the questions that follow

Mixture 1 components	Mixture 2 components
Silver Chloride	Iron (III) Chloride
Lead Chloride	1ron (III) Oxide
water	-

a) State the main property that makes components of **Mixture 1** separable (1mk)

lead(II) chloride dissolves in warm/hot water

b) Draw a well labeled diagram of a simple laboratory set up which can be used to separate the components of **Mixture 2** (2mks)



23. a) what name is given to group one elements ? (1mk)

Alkali metals

b) Explain why there is a general increase in the atomic radii of the elements down a group of the periodic table. (2 mks)

There is increase in number of occupied energy levels which leads to a weaker force of attraction for valence electrons

24. Study the flow chart below and answer the question that follows.

Solid J

Excess PbO

1. Warm
2.Filter
3. Cool Filtrate

White solid

Heat strongly

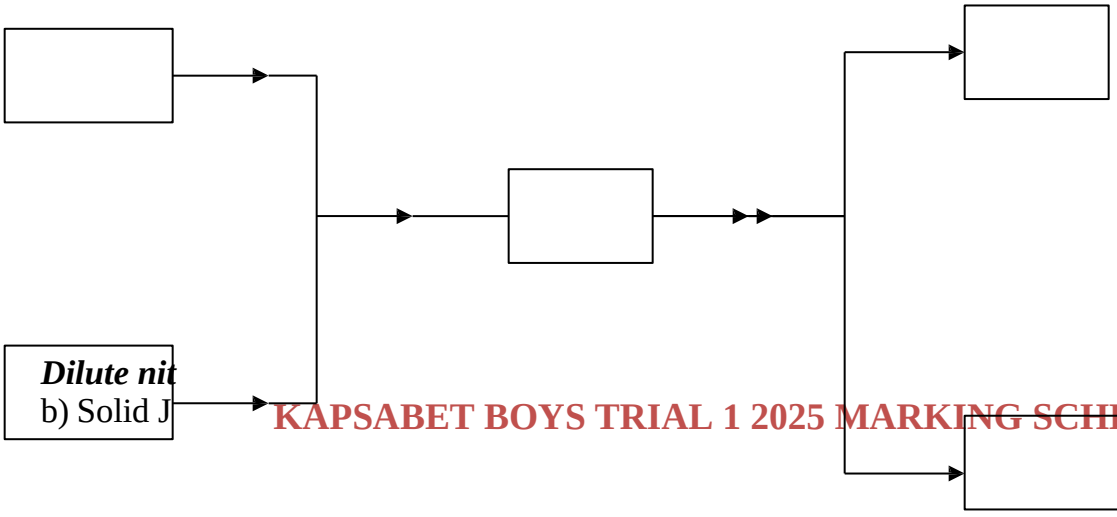
Identify: (3mks)

a) Solution G

Solution G ***ric(V) acid// HNO_3***

Lead(II)oxide// PbO

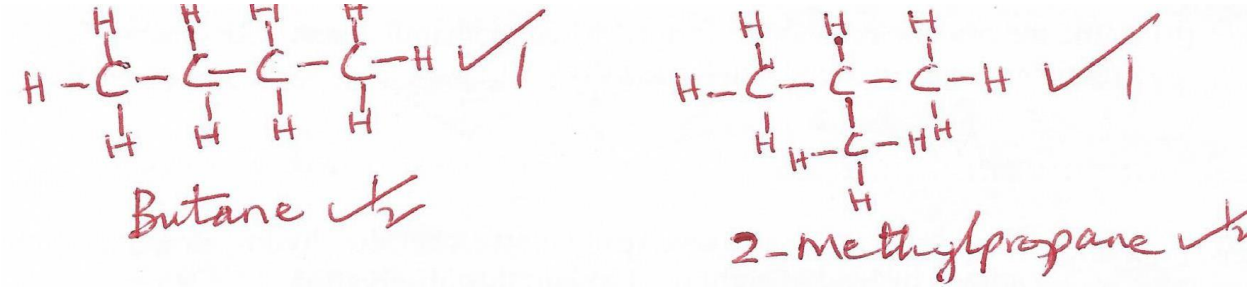
Brown gas +
gas K



c) Gas K

Oxygen//O_2

25. Draw and name structural formulae of two isomers whose molecular formula is C_4H_{10}. (3mks)



26. The concentration of a solution of aluminium sulphate is 0.02M. How many sulphate ions are contained in 150 cm^3 of the solution? (3 mks)
(Avogadro's constant= 6.0 x 10^{23})

Moles of $AI_2(SO_4)_3$ = $\frac{150 \times 0.02}{1000}$

= 0.003moles(1)

Moles of SO_4^{2-} = 0.003 x 3

= 0.009moles(1)

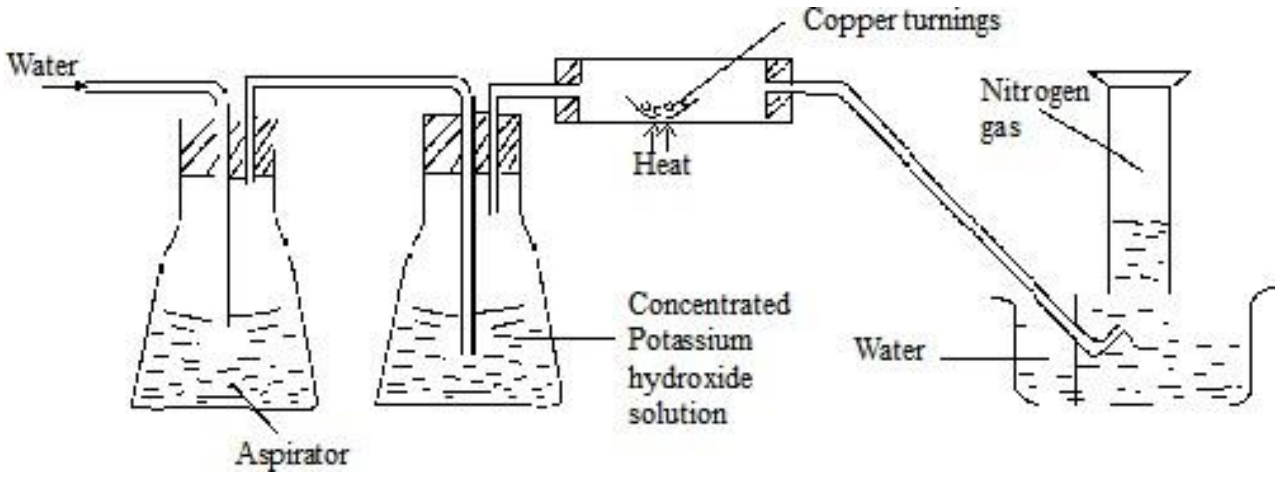
No. of SO_4^{2-} ions = 0.009 x 6.0 x 10^{23}

= 5.4 x 10^{21} ions(1)

27. Explain why a solution of hydrogen chloride gas in methylbenzene does not conduct electricity but solution of the gas in water conduct electricity. (2mks)

Methylbenzene is a non- polar compound hence hydrogen chloride in it does not ionize // exist as a molecule substance but in water hydrogen chloride ionizes to give H^+ and cl^- ions that's why it conduct electricity in water.

28. Nitrogen gas can be obtained from air as shown below.



a) What is the purpose of concentrated potassium hydroxide solution? (1mk)

Absorb carbon(IV) oxide gas.

b) write the equation that takes place in the chamber containing copper turnings

$2Cu(s) + O_2(g) \xrightarrow{\Delta} 2CuO(s)$ (1 mk)

c) The nitrogen gas obtained above is not pure. Identify one gaseous impurity in the gas.
Argon (1mk)

29. Radioactive, polonium, $^{216}_{84}Po$, decays as shown below:-

$$^{216}_{84}Po \longrightarrow {}^{208}_{82}Pb + M\,\alpha + n\,\beta$$ (2 marks)

Determine the values of M and N.

M =2

N=2