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NAME……………………………………………….. ADM NO…………CLASS:……….

INDEX NUMBER:………………… DATE ……………CANDIDATE'S SIGNATURE………

233/2
CHEMISTRY THEORY
PAPER 2
AUGUST /SEPTEMBER 2022
Time: 2 Hours

SUKELLEMO JOINT MOCK 2022
Kenya Certificate of Secondary Education (K.C.S.E)

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
- All workings must be clearly shown where necessary

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1	12	
2	12	
3	11	
4	12	
5	11	
6	11	
7	11	
TOTAL	**80**	

This paper consist of 13 printed pages check the question paper to ensure that all pages are printed as indicated and no questions are missing

1. I) The grid below represents part of the periodic table. The letters do not represent the actual symbols of the elements. Study it and answer the questions that follows;

L							L	
M	P					J	U	
N			Q	S		W	V	X

i. Explain why element L appears into two different groups in the grid above.   (1 mark)

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ii. What type of bond is formed when elements M and J react? Give a reason.   (2 marks)

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iii.   Write the formula of the compound formed between P and V.   (1 mark)

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iv. How does the melting points and boiling point of oxides of W and S compare?   (2 marks)

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v. What property of element Q makes it possible to be used in.

a. Manufacture of sufurias   (1 mark)

………………………………………………………………………………………………..

b. Manufacture of electrical cables.   (1 mark)

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vi. Select the strongest oxidizing agent. Give a reason.   (1 mark)

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vii. State one use of element X.   (1 mark)

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II)   Study the table below and answer the questions that follow;

Substance	A	B	C	D	E	F
Melting point (^{o}C)	801	113 119	39	5	-101	1356
Boiling point (^{o}C)	1410	445	457	54	-36	2860
Electrical Conductivity in Solid	Poor	Poor	Good	Poor	Poor	Poor
Conductivity in Liquid	Good	Poor	Good	Poor	Poor	Poor

a) Identify with reasons the substance that;

i) Has a metallic structure.   (1 mark)

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ii)Has a molecular structure   (1 mark)

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b) Suggest a reason why substance B has two melting points.   (1 mark)

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2.   a) A Sample of crude oil was heated and its vapour passed over red-hot pumice stone. A
      mixture of gases was evolved, which decolorized bromine in tetrachloromethane and burned
      in air with a yellow sooty flame.

i.   What process is taking place when the vapour from crude oil passes over heated pumice

      stone?   (1mk)

      ……………………………………………………………………………………………………

ii.   Name the most likely type of compound causing the decolorization of the bromine solution

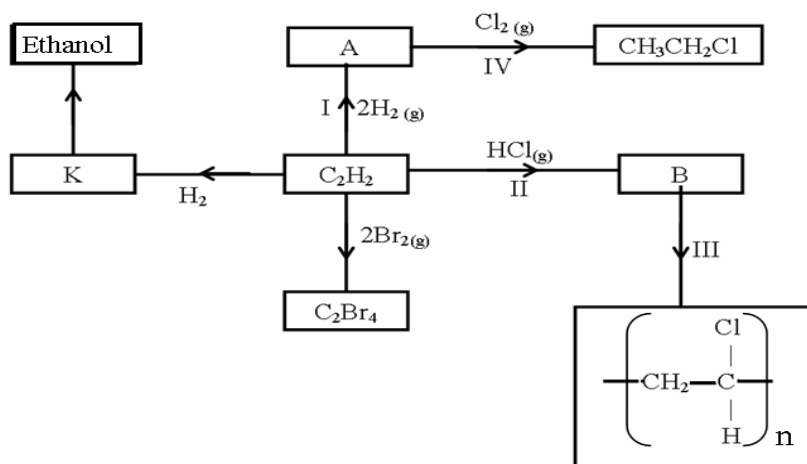   (1mk)

      ……………………………………………………………………………………………………

iii. `Name two compounds which could be formed when the gas mixture burns in air (1mk)

      …………………………………………………………………………………………………

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

(i)   Identify the catalyst used in step I   (1 mark)

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(ii)   Give **one** disadvantage of the compound formed in step III   (1 mark)

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(iii) Name the reactions taking place at steps: (1 mark)

I ………………………………………………………

IV………………………………………………………….

(iv)   Describe how substance K is converted to ethanol   (2 marks)

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c) An organic **compound P** is found on analysis to have the empirical formula $C_6H_{14}O$. Compound P is slightly soluble in water. On oxidation compound P is converted into a **compound Q** of empirical formula 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)

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

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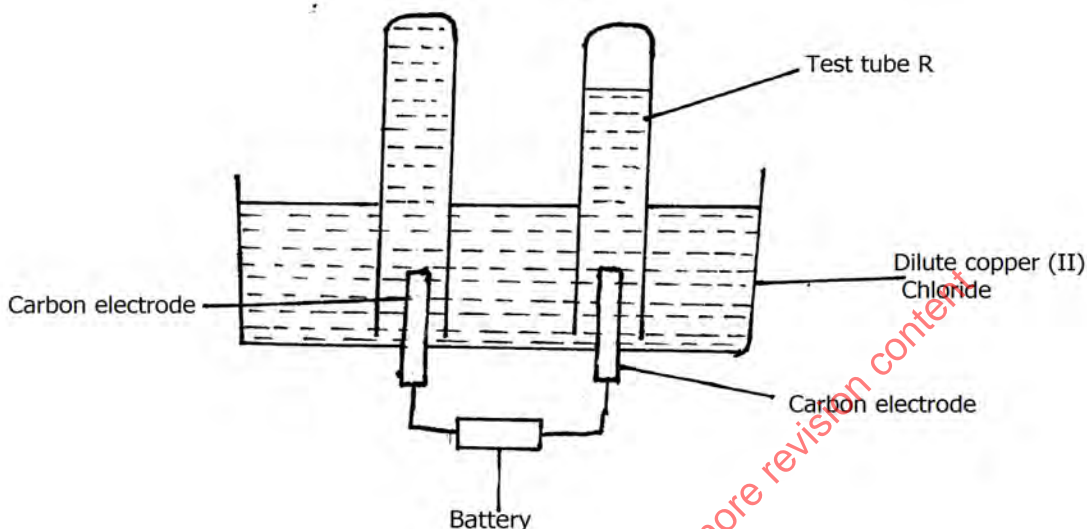
(iii) What other test would you carry out on Q to confirm the presence of the functional group you have indicated? (1 mark)

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3. I. The set up below shows the electrolysis of dilute copper (II) chloride. Study it and answer the questions that follow.

(a) Label the cathode on the diagram. (1mk)

(b) Write an equation for the reaction responsible for formation of gas in tube R. (1mk)

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(c) Explain the observation that would be made on the electrolyte as the experiment progresses. (2mks)

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II. A current of 0.5 amperes was passed through a cell containing Copper (II) Sulphate using copper anode and copper cathode for 10 minutes and the mass of copper deposited was recorded. For each experiment as shown in the table below.

Current (Ampheres)	Time (Minutes)	Time (Seconds)	Quantity of electricity (C)	Mass of copper deposited (g)
0.5	10.0	600	300	0.0991
1.0	10.0	600		0.1960
1.5	10.0	600	900	0.2970
2.0	10.0	600		0.3961
2.5	10.0	600	1500	0.4960
2.0	15.0	900	1800	0.5950
2.0	20.0	1200	2400	0.7930

a) Complete the table by filling the column of quantity of electricity in Coulombs (1mk)

b) Plot a graph of mass of copper deposited (vertical axis) against quantities of electricity. (3mks)
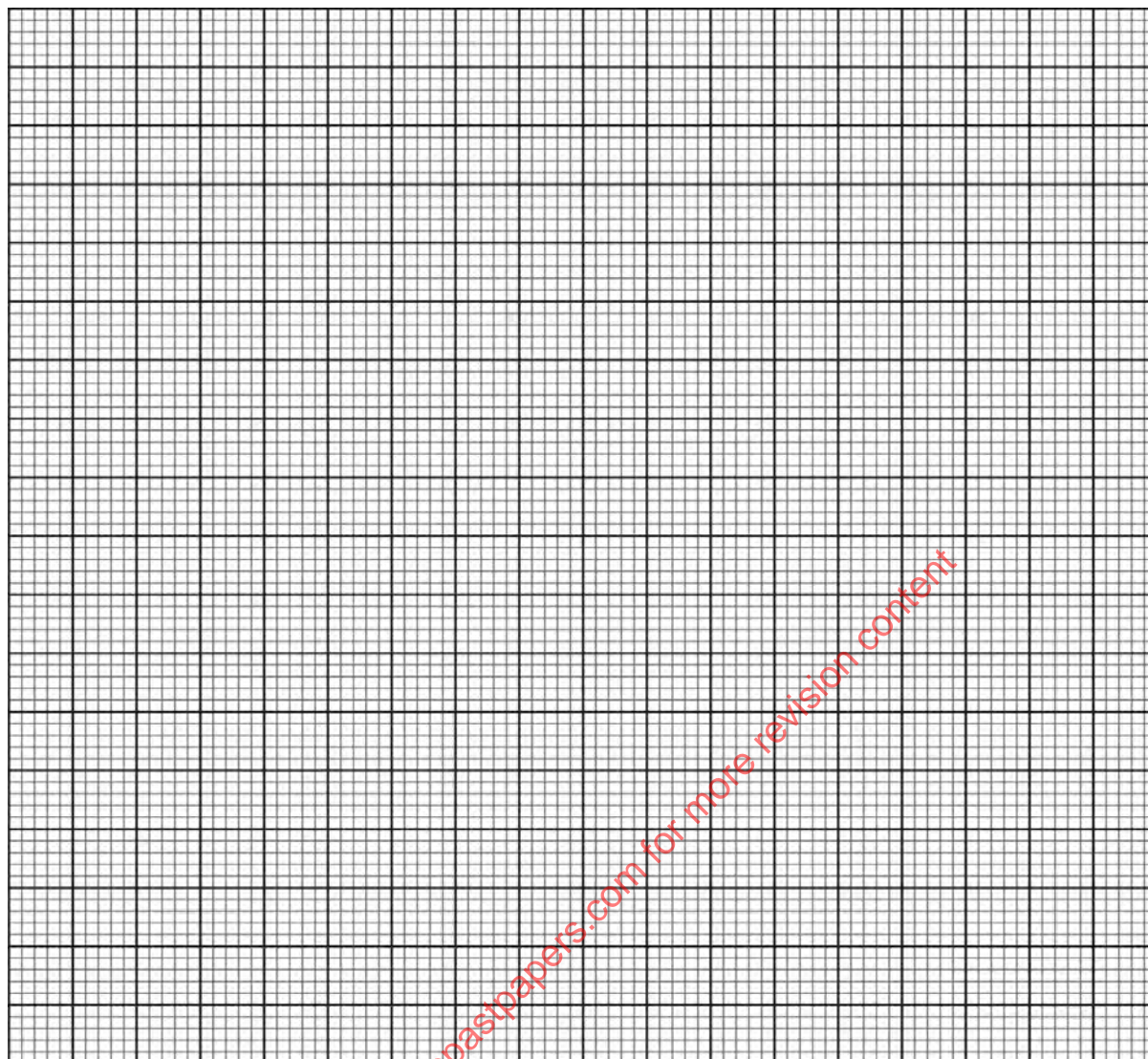
From the graph, determine the mass of copper per unit quantity of electricity   (1mk)

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III. Given the following reduction potentials;

$$Zn^{2+}_{(aq)} + 2e^- \longrightarrow Zn_{(s)} \qquad E^\theta = -0.76V$$

$$Cu^{2+}_{(aq)} + 2e^- \longrightarrow Cu_{(s)} \qquad E^\theta = +0.34V$$
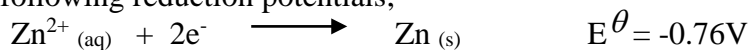
Determine whether a container made of zinc metal can be used to store a solution of copper (II) sulphate. Explain   (2mks)

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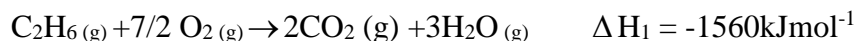4. a) Define the standard enthalpy of formation of a substance.   (1 mark)

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(b)   Use the thermochemical equations below to answer the questions that follow.

$C_2H_{6\,(g)} + 7/2\ O_{2\,(g)} \rightarrow 2CO_2\ (g) + 3H_2O_{\,(g)}$ $\Delta H_1 = -1560kJmol^{-1}$

$C_{\,(graphite)} + O_{2\,(g)} \rightarrow CO_2\ (g)$ $\Delta H_2 = -394kJmol^{-1}$

$H_{2\,(g)} + \frac{1}{2}O_{2\,(g)} \rightarrow H_2O_{\,(g)}$ $\Delta H_3 = -286kJmol^{-1}$

i) Calculate the standard enthalpy of formation of ethane.   (2 marks)

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ii) Draw an energy level diagram for the formation of ethane.   (2 marks)

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c) When a sample of ethane was burnt, the heat produced raised the temperature of 500cm^3 of water by 21.5K. (Specific heat capacity of water 4.2J g^{-1}k^{-1})

Calculate;

i) Heat change for the reaction.   (2 marks)

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ii) Mass of ethane that was burnt (C= 12, H= 1)   (2 marks)

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iii) The heating value of ethane.   (2 marks)

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d)Apart from heating value, give two factors that affect choice of a fuel   (1 mark)

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5. a) Define the term **solubility** of a substance   (1mark)

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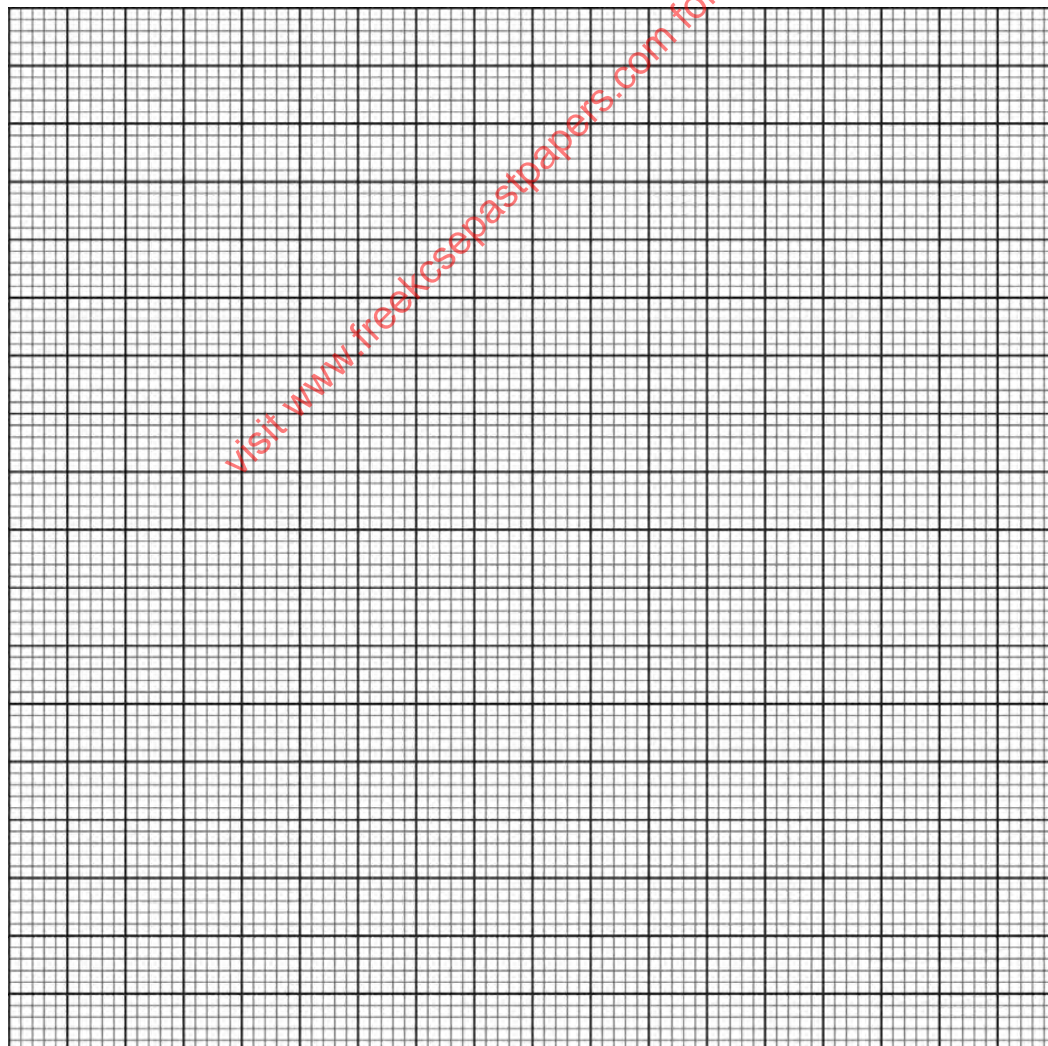
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   b) The table below shows the solubilities of two salts **L** and **M** at different temperatures.

Temperature(ºC)		10	20	30	40	50
Solubility	**L**	11.0	14.0	20.1	28.0	36.0
(g/100g of water)	**M**	15.0	17.0	19.0	21.2	25.0

i) Plot on the grid below a graph of solubilities of **L** and **M** against temperature   (3marks)

From the graph determine

  I: The temperature at which solubilities are equal   (1mark)

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  II: The solubility at the temperature mentioned above   (1mark)

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  III: If the relative formula mass of **M** is 132, determine the concentration of **M in** moles per litre
                                                  (2marks)

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c) **W** is a colourless aqueous solution with the following properties

  I. It turns blue litmus paper red

  II. On addition of cleaned magnesium ribbon, it gives off a gas that burns with a pop sound

  III. On addition of powdered sodium carbonate, it gives off a gas which forms a white precipitate with calcium hydroxide solution.

  IV. When warmed with copper (II) oxide powder, a blue solution is obtained but no gas is given off.

  V. On addition of aqueous barium chloride , a white precipitate is obtained.

  (i) State what properties (I) and (III) indicate about the nature of **W**   (1mk)

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  (ii) Give the identity of **W**   (1mk)

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  (iii) Name the colourless solution formed in (II) and (III)   (1mk)

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    (iv) Write the ionic equation in (V)   (1mk)

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6. (a) Name **one** ore that can be used to commercially extract Zinc metal   (1mark)

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(b) The flow chart below illustrates the extraction of zinc and preparation of zinc sulphate crystals.
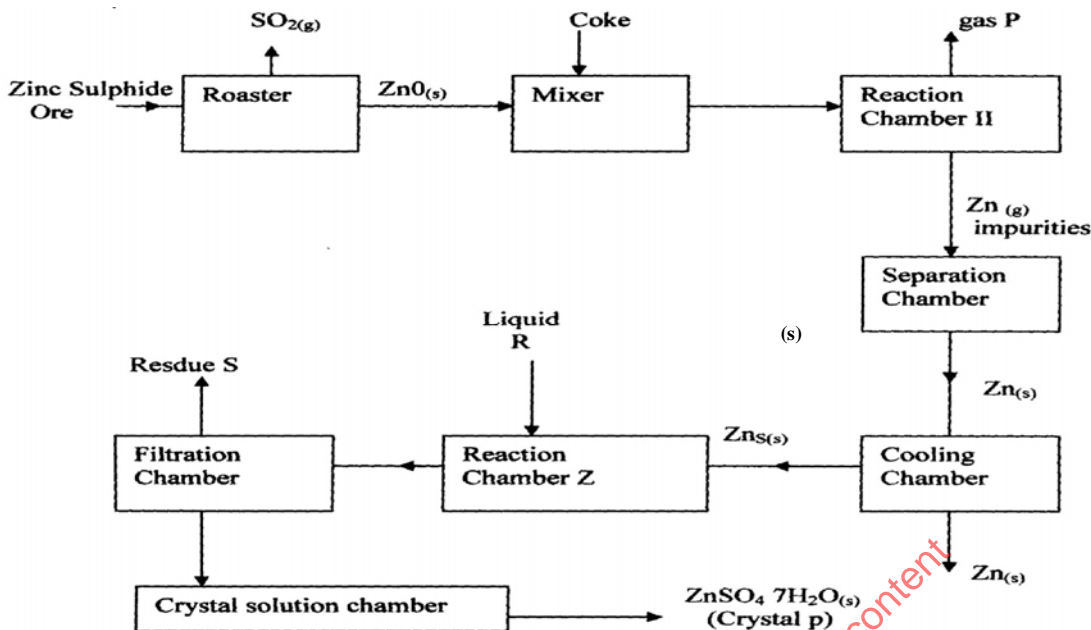
(i) Name:

    (I) Gas **P**   (1mark)

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    (II) Residue **S**   (1mark)

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(ii) What is the role of coke in the above process?   (1mark)

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(iii)Name the main impurity removed in the separation chamber.   (1mark)

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(iv) Write an equation for the reaction that takes place in ;
    I)Roaster: (1mark)

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    II) Reaction chamber II: (1mark)

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(v) Given that zinc Sulphide ore contains only 45% of zinc Sulphide by mass, calculate the mass in grams of zinc Sulphide that would be obtained from 250kg of the ore. (1mk)

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(vii) Give **one** commercial use of Zinc metal   (1mk)

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c) Zinc can also be obtained by electrolysis. The zinc oxide obtained from the roaster is converted into Zinc Sulphate which is then electrolyzed.

i) Write an equation for the conversion of Zinc oxide to Zinc sulphate   (1mk)
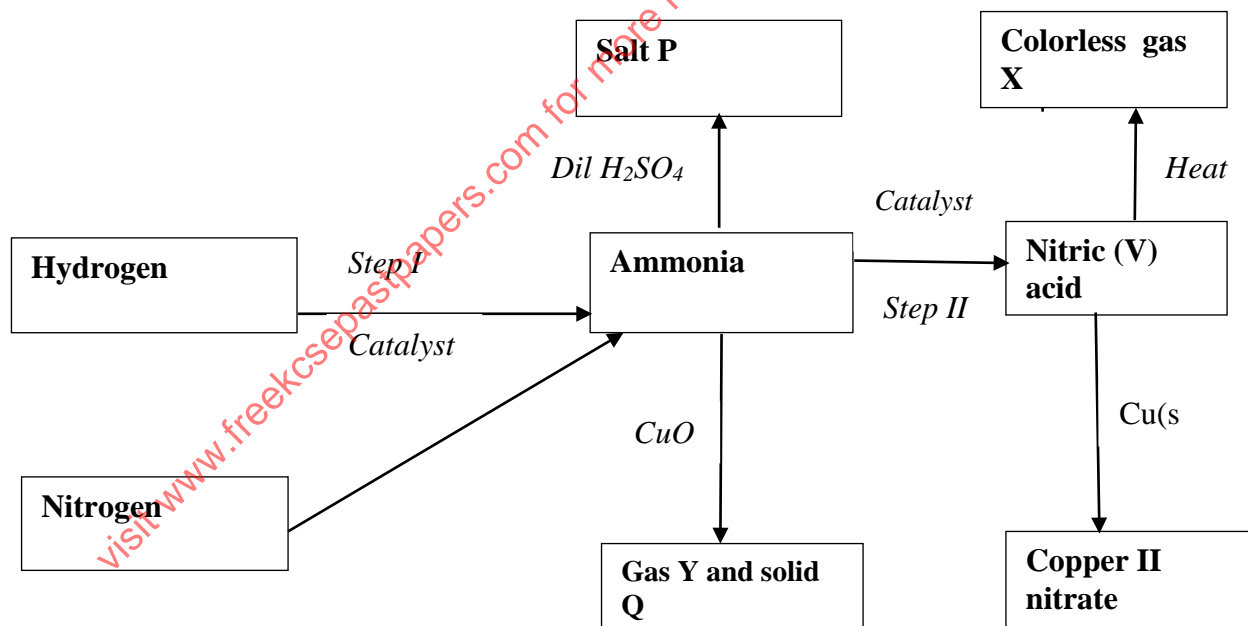
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ii) Identify the substance that makes the cathode   (1mk)

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iii) Write the half equation for the reaction that takes place at the cathode   (1mk)

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7. I) Study the scheme below and answer the questions that follow.

a) State one source of each of the following   (2 marks)
    (i)   Hydrogen

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    (ii)   Nitrogen

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b) State two other conditions other than the use of catalyst that would favour the reaction in step I   (2 marks)

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c) Name the catalyst used in each of the steps I and II   (2 marks)

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d) Name the following substances   (2mks)
   (i) Salt P

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   (ii) Gas X

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   (iii)Solid Q

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   (iv)Gas Y

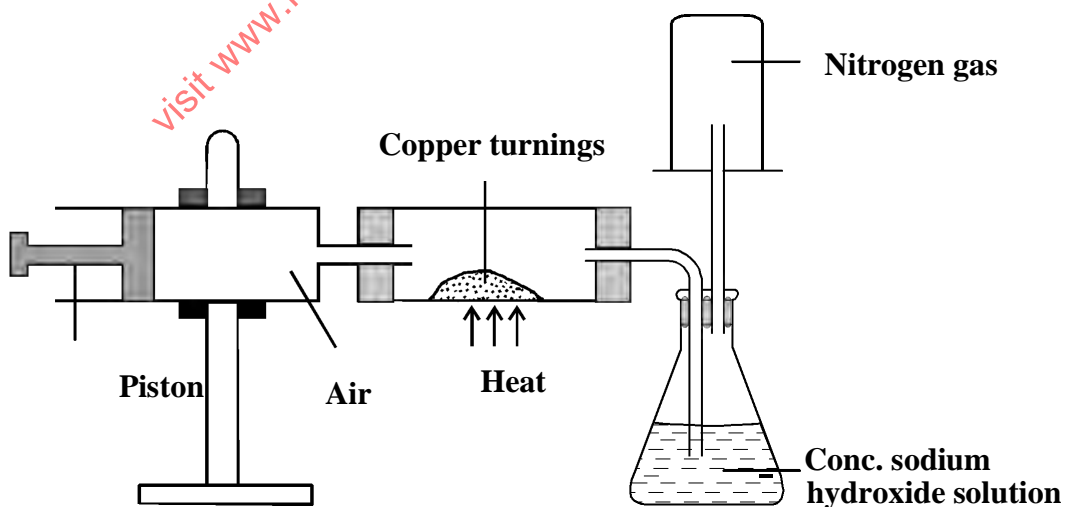……

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II) The diagram below shows an arrangement made to prepare and collect nitrogen from   air.

(i)   The piston was pushed slowly to the right. Explain.   (1 mark)

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(ii)   State the function of;

(I) Concentrated sodium hydroxide solution.   (1 mark)

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(II) copper turnings.   (1 mark)

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(iii)   What property of Nitrogen makes it possible to be collected as shown in the diagram?

                                                                                              (1 mark)

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