

Name.....Index Number...../.....

Adm No:.....Class: ..... Candidates Signature: .....date: .....

233/2  
CHEMISTRY  
PAPER 2  
Theory  
JULY 2016  
2 HOURS

**SUKEMO JOINT EXAMINATION TEST – 2016**  
Kenya Certificate of Secondary Education  
Chemistry paper 2

**INSTRUCTIONS TO CANDIDATES**

- Write your name and index number in spaces provided above.
- Sing and write the date of examination in the spaced provided above.
- Answer all the questions in the spaces provided.
- KNEC Mathematical tables and silent electronic calculators may be used.
- All working MUST be clearly shown where necessary.
- Candidates should answer the questions in English.

**For examiners use only**

Question	Maximum score	Candidate's score
1	13	
2	09	
3	12	
4	13	
5	13	
6	09	
7	11	
<b>Total score</b>	<b>80</b>	

1. Use the table below to answer the questions below

A				E			H	
	C		D		G			K
B				F			J	

i) Giving reasons, select the element which is

I) Most reactive nonmetal (2 marks)

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 .....

II) Most reactive metal (2 marks)

.....  
 .....

ii) How does reactivity of **A** compare with that of **B**. Explain (1 mark)

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 .....

iii) Explain why the atomic radius of **G** is smaller than that of **C** (1 mark)

.....  
 .....

iv) An element **W** forms ion **W<sup>2+</sup>** if **W** is in period 3, indicate the position of **W** on the grid (1 mark)

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 .....

v) Write the formula of the compound formed when **C** reacts with **H** (1 mark)

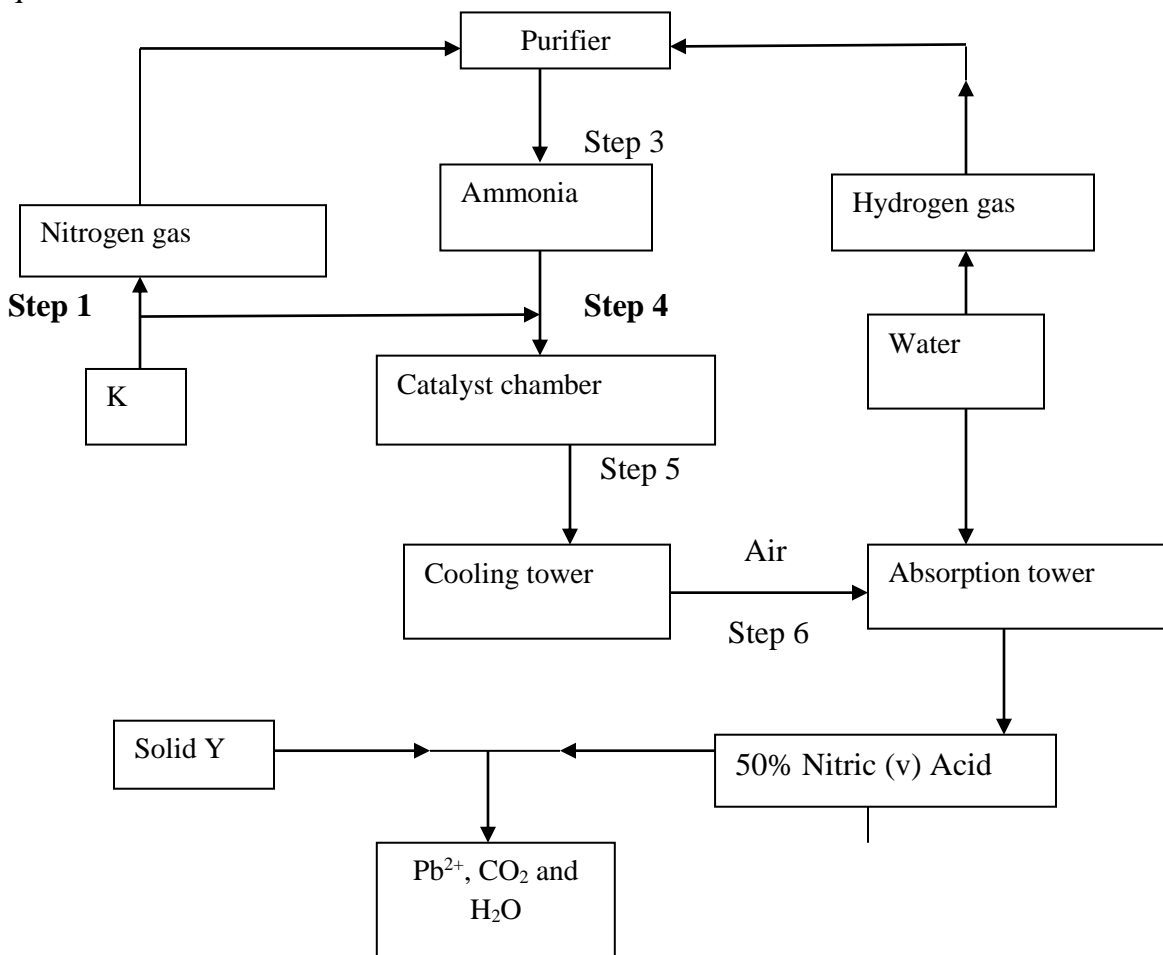
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b) Study the information in the table below and answer the questions that follow

Substance	M.P (°C)	B.P (°C)	Electrical conductivity		Solubility in water
			In solid state	In molten state	
P	714	1418	Does not conduct	Conducts	Very soluble
Q	-95	56	Does not conduct	Conducts	Insoluble
R	1083	2580	Conducts	Conducts	Insoluble
S	-101	-34	Does not conduct	Does not conduct	Very soluble
U	-23	77	Does not conduct	Does not conduct	Soluble
V	-219	-183	Does not conduct	Does not conduct	Insoluble
W	1560	2600	Does not conduct	Does not conduct	insoluble

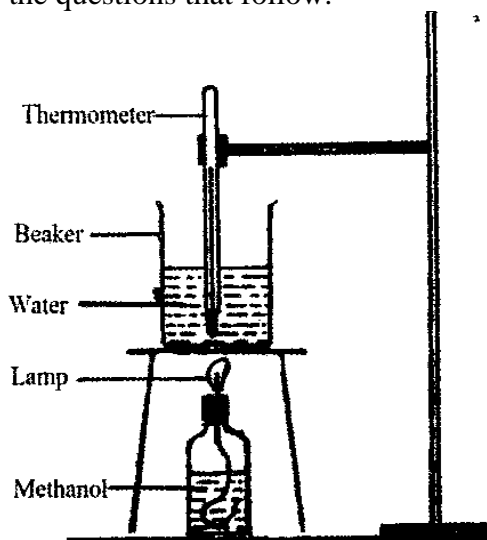
- i) Name two substances which are gaseous at room temperature (1 mark)
- .....
- .....
- ii) Select the substance that could be dissolved in water and be separated from the solution by fractional distillation (1 mark)
- .....
- .....
- iii) Which substance could be an electrolyte? (1 mark)
- .....
- iv) Element U has low M.P and B.P whereas W has high M.P and B.P. Explain (2 marks)
- .....
- .....
- .....

2. The flow chart below shows the industrial preparation of nitric V. acid. Study it and answer the questions that follow:



- a) Identify substance
- i) K ( ½ mark)  
 .....
- ii) Y ( ½ mark)  
 .....
- b) Name two impurities that are removed in the purifier (1 mark)  
 .....  
 .....
- c) The nitric (IV) acid produced is about 50% concentrated. Name the process that can be used to increase the concentration (1 mark)  
 .....
- d) Name the catalyst used in
- i) Step 3 ( ½ marks)  
 .....
- ii) Catalytic chamber ( ½ mark)  
 .....
- e) Write down the equation for the reaction taking place in the cooling tower (1 mark)  
 .....
- f) Excess air is used in step 6. Explain (1 mark)  
 .....
- g) State and explain the observations made when concentration nitric v acid is heated with sulphur in open (2 marks)  
 .....  
 .....  
 .....
- j) State one industrial use of nitric v acid (1mk)  
 .....

3. (a) In an experiment to determine the heat of combustion of methanol,  $\text{CH}_3\text{OH}$  a student used a set up like the one shown in the diagram below. Study the set-up and the data below it and answer the questions that follow.



Volume of water	=	$500\text{cm}^3$
Final temperature of water	=	$27.0^\circ\text{C}$
Initial mass of lamp + methanol	=	$20.0^\circ\text{C}$
Final mass of lamp+ methanol	=	$22.1\text{g}$
Initial mass of lamp + methanol	=	$22.98\text{g}$
Density of water	=	$1.0\text{g}/\text{cm}^3$

- i) Write an equation for the combustion of methanol (1 mark)

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- ii) Calculate:

- I) The number of moles of methanol used in the experiment ( $\text{C} = 12, \text{O} = 16, \text{H} = 1$ )

(1 mark)

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 .....  
 .....

- II) The heat change in the experiment

(1 mark)

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 .....  
 .....

III) The heat of combustion per molar of methanol (1 mark)

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(IV) Explain why the value of the molar heat of combustion for methanol obtained in this experiment is different from the theoretical value (1 mark)

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(iii) Differentiate between lattice energy and hydration energy (2 marks)

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(iv) Use the values given in the table below to answer the questions that follow

Low	Enthalpy of hydration
Mg <sup>2+</sup>	- 1891
Cl <sup>-</sup>	- 384

Given that lattice energy of MgCl<sub>2</sub> is -2489 KJmol<sup>-1</sup>

a) Draw an energy cycle diagram for dissolving magnesium in water (2 marks)

b) Use your energy cycle diagram above to calculate the enthalpy of magnesium chloride in water (2 marks)

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- c) Given that heat of combustion of S is  $296.8 \text{ kJ mol}^{-1}$  determine the heating value of S = 32 (1 mark)

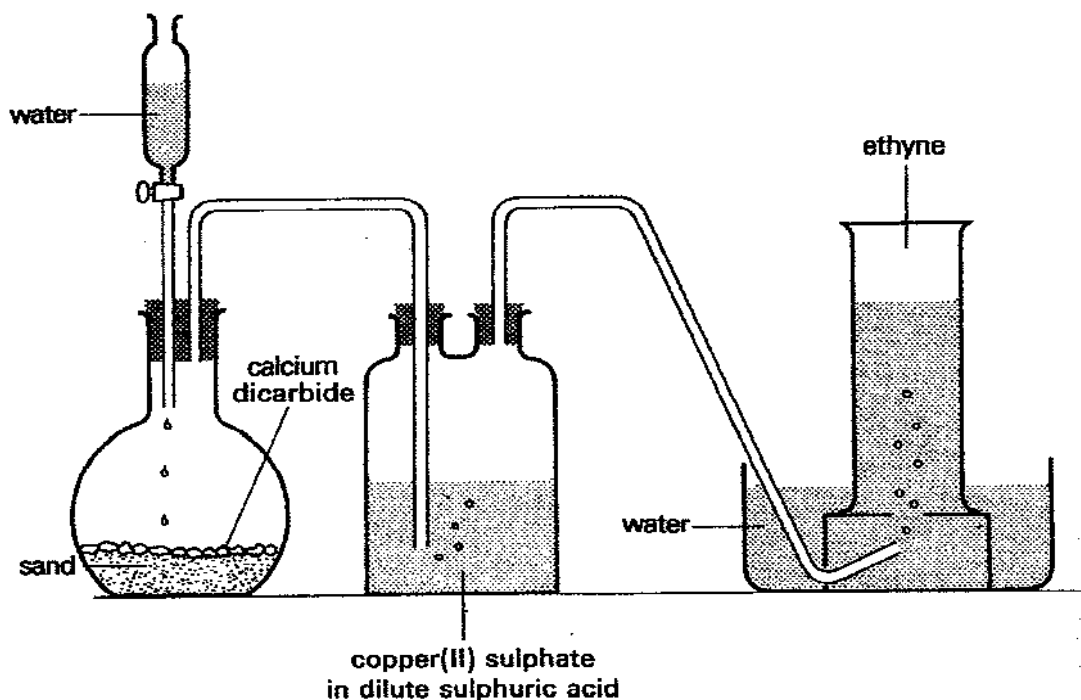
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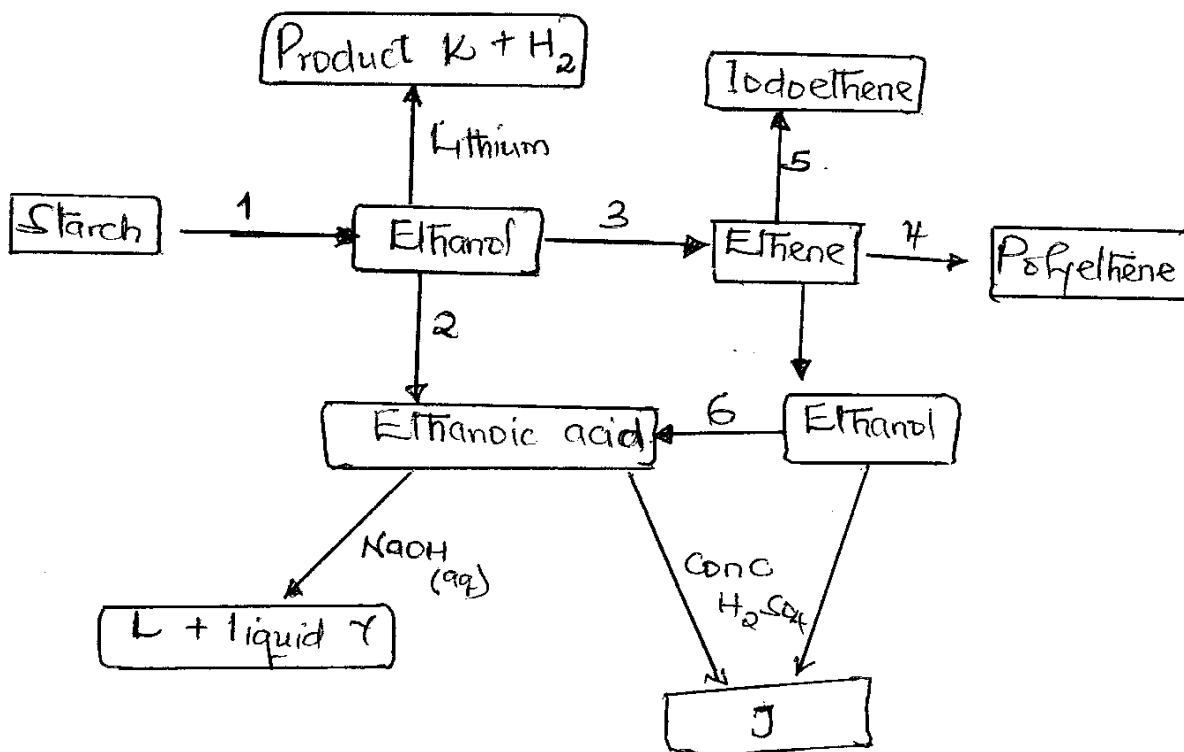
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4. (a) The set up below was used to prepare ethyne gas.



- i) Write an equation for the reaction that produces ethyne gas (1 mark)
- .....
- ii) When ethyne is ignited, it burns with a sooty flame. Explain (1 mark)
- .....
- .....
- .....
- iii) In the reaction flask, sand is used to prevent the flask from breaking due to the great amount of heat produced. How else is this prevented (1 mark)
- .....

b) Study the flow chart below and use it to answer the questions that follow.



i) Name the process (2 marks)

Process 1..... Process 2.....

Process 3..... Process 4.....

ii) Name products K, J, L (3 marks)

.....

iii) Reagent for process 2 (1 mark)

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iv) Write an equation to show formation of: (2 marks)

Product L

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Product J

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v) What conditions are required to convert ethane to ethanol (1 mark)

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vi) Name the reagent used in step 6. (1 mark)

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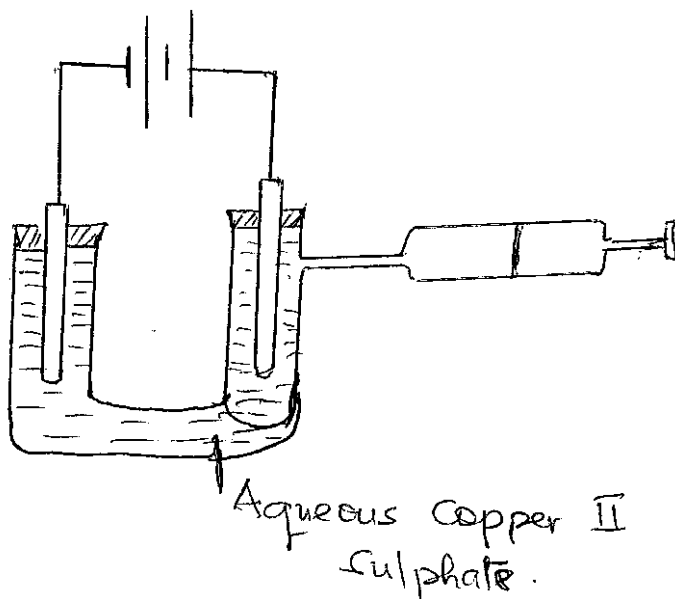


5. a) The table below gives reduction potential obtained when the half cells for each of the metals represented by letters J, K, L, M and N were connected to a copper half cell as reference electrode.

<b>Metal</b>	<b>A reduction potential (volts)</b>
J	-1.10
K	-0.047
L	0.00
M	+0.45
N	+1.16

- i) What is metal L likely to be ? Explain (1 mark)
- .....
- .....
- .....
- ii) Which is the metal cannot be displaced from the solution of its salt by any other metal in the table. Explain (2 marks)
- .....
- .....
- .....
- iii) In the space provided draw a labeled diagram of the electrochemical cell that would be obtained when half cells of element K and M are combined if the 2 are divalent metals (3 marks)

b) The set-up of apparatus shown below was used to electrolyze aqueous copper (II) sulphate



i) What is meant by electrolysis (1 mark)

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ii) Write an equation for the reaction at the anode (1 mark)

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iii) Calculate the volume of the gas collected in the syringe when a current of 0.4 amperes is passed through the electrolyte for 50 minutes. (If = 96500C and the molar gas volume is 24000cm<sup>3</sup> at room temperature and pressure) (3 marks)

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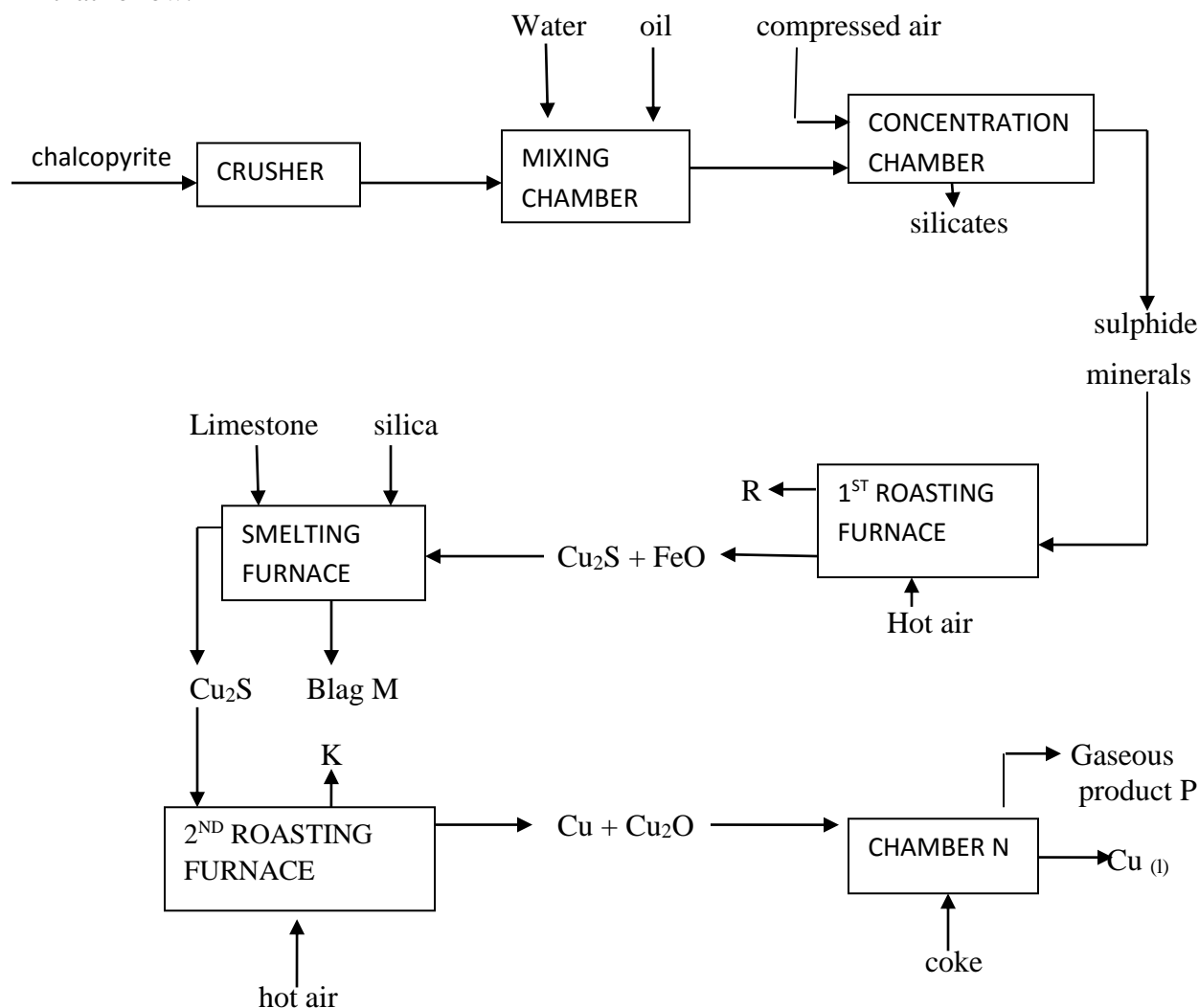
b) Explain what happens to the colour of the electrolyte during the electrolysis. (1 mark)

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 .....

c) Explain why no gas is obtained in the syringe when platinum are replaced with copper. (1 mark)

.....  
 .....

6. One of the main mineral sources of copper is chalcopyrite,  $\text{CuFeS}_2$ . Study the following flow chart which shows how copper can be extracted from chalcopyrite and answer the questions that follow.



i) Name gas K (1 mark)

.....

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

.....

iii) Write the formulae of the cation present in the slag m (1 mark)

.....

iv) Identify gas P (1 mark)

.....

v) What name is given to the reaction taking place in chamber N? (1 mark)

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b) Copper obtained from chamber N is not pure. Draw a well labeled diagram to show the set-up that can be used to refine the copper by electrolysis (2 marks)

c) Give 2 uses of copper metal. (2 marks)

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8. The table below gives some properties of three salts, D, E and F

Salt	D	E	F
Solubility	Insoluble	Soluble	Soluble
Effects of heat	Decomposes forming a white residue G and a colourless gas H. Gas H forms a white precipitate with lime water	Decomposes to form yellow residue and two gases, I and J. Gas I is reddish brown. Gas J is colourless	Dissociates into two gases; K and L. Gas K turns wet litmus wet litmus paper blue. Gas K and L readily recombine on cooling to form dense white fumes of salt F

Further tests showed that when residue G was reacted with water and the product heated with salt F, gas K was evolved. When D reacted with nitric (V) acid, there was effervescence. the resulting solution formed a white precipitate with dilute sulphuric (VI) acid, But not with hydrochloric acid.

a) Identify;

i) Gas H (1 mark)

.....

ii) Gas I (1 mark)

.....

iii) Salt D (1 mark)

.....

iv) Salt F (1 mark)

.....

b) Write an equation for the thermal decomposition of D (1 mark)

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c) Name the compound formed when residue G is reacted with water (1 mark)

.....

.....

d) A solution of E reacted with an aqueous solution of gas L, forming a white precipitate that dissolved when warmed

i) Write an ionic equation for the formation of the white precipitate (1 mark)

.....

ii) Write the formula of the ions that are present in salt E (1 mark)

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e) Explain what would be observed if sodium hydroxide was added to a solution of E, dropwise till in excess (2 marks)

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f) State one use of salt F (1 mark)

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