



CHEMISTRY PAPER 2

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Name Admission number
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STAREHE GIRLS' CENTRE MOCK EXAMINATION

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.*
- b) Sign and write the date of examination in the spaces provided above*
- c) Answer all the questions in the spaces provided below each question. .*
- d) KNEC Mathematical tables and silent electronic calculators may be used.*
- e) All working must be clearly shown where necessary.*
- f) Candidates should answer the questions in English.*

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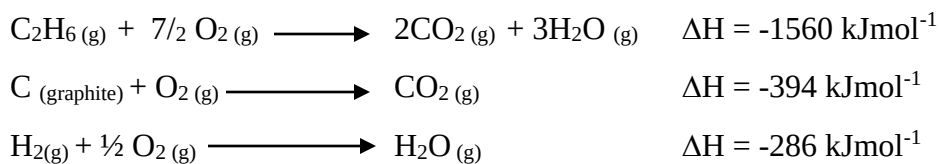
QUESTION	Maximum Score	Candidate's Score
1	12	
2	12	
3	13	
4	10	
5	10	
6	10	
7	13	
Total Score	80	

1. Use the table below to answer the questions that follow.
(The letters are not the actual symbols of the elements)

Element	Atomic number	Melting point ($^{\circ}\text{C}$)
A	11	97.8
B	13	660
C	14	1410
D	17	-101
E	19	63.7

- (a) Write the electronic arrangement for the ions formed by the elements B and D
 B _____ ($\frac{1}{2}$ mark)
 D _____ ($\frac{1}{2}$ mark)
- (b) Select an element which is
 (i) a poor conductor of electricity _____ ($\frac{1}{2}$ mark)
 (ii) most reactive metal _____ ($\frac{1}{2}$ mark)
- (c) Explain briefly how the atomic radii of element B and C compare. (2 marks)
- (d) Use dots (•) and crosses (x) to represent outermost electrons and show the bonding in the compound formed between C and D. (2 marks)
- (e) Explain why the melting point of element B is higher than that of element A. (2 marks)
- (f) Write an equation for the reaction that takes place between element A and water. (1 mark)
- (g) Describe how a solid mixture of the sulphate of element E and lead (II) sulphate can be separated into solid samples. (3 marks)

2. (a) (i) State Hess's law. (1 mark)
- (ii) Use the thermochemical equations given below to calculate the enthalpy of formation of ethane. (3 marks)

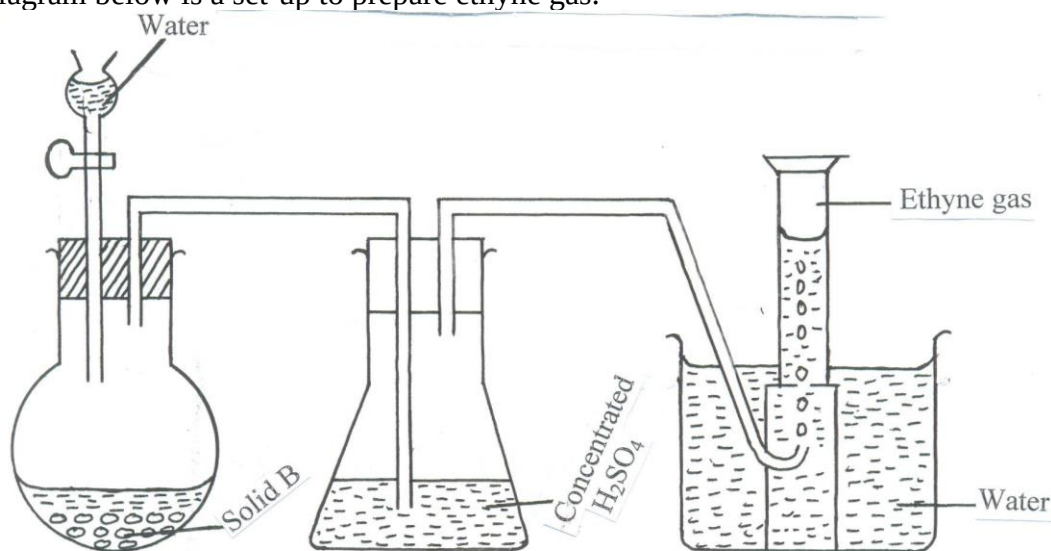


- (b) The table below gives the volumes of oxygen gas produced at different times when hydrogen peroxide solution decomposed in the presence of a catalyst.

Time in seconds	0	10	20	30	40	50	60
Volume of oxygen (cm ³)	0	66	98	110	119	120	120

- (i) Name the catalyst used for this reaction. (1 mark)
- (ii) Write the chemical equation for the decomposition of hydrogen peroxide. (1 mark)
- (iii) On the grid provided, draw the graph of the volume of oxygen gas (vertical axis) against time. (3 marks)
- (iv) Using the graph, determine the rate of decomposition of hydrogen peroxide between 24th second and 34th second. (2 marks)
- (v) Give a reason why the total volume of oxygen gas produced after 50 seconds remain constant. (1 mark)

3. (a) The diagram below is a set-up to prepare ethyne gas.



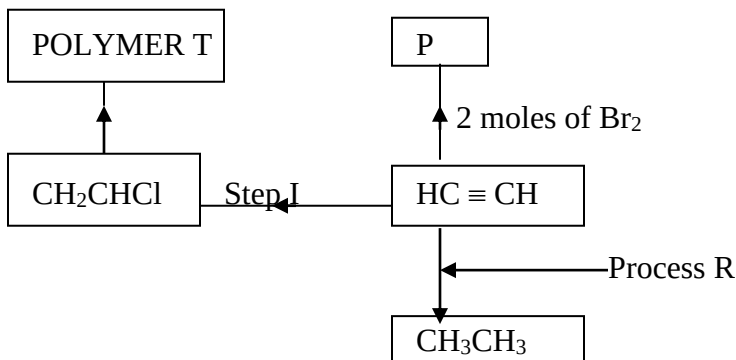
- (i) Name solid B _____ (1mark)

(ii) Write an equation for the reaction taking place between solid B and water. (1 mark)

(iii) State the property that makes the gas to be collected by the method shown in the diagram. (1mark)

(iv) State the main commercial use of ethyne. (1 mark)

(b) The scheme below represents some reactions of ethyne. Study it and answer the questions that follow.



(i) Name compound P and draw its structural formula. (1 mark)

(ii) Name the reagents used in:

I) Process R _____ (½ mark)

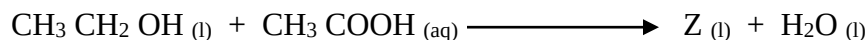
II) Step I _____ (½ mark)

(iii) Draw the repeating unit in polymer T. (1 mark)

(iv) Name polymer T _____ (1 mark)

(v) Give one use of T (1 mark)

(c) Ethanol and ethanoic acid react according to the following equation under condition M and process N to form product Z.



Name:

(i) Condition M _____ (½ mark)

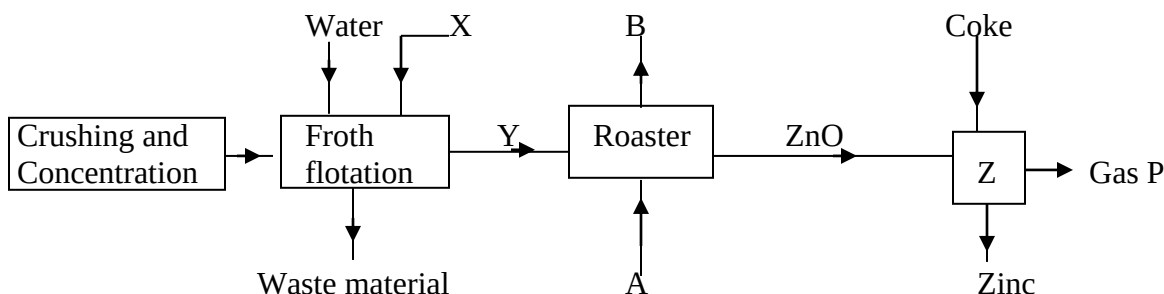
(ii) Product Z _____ (½ mark)

(iii) Draw the structural formula of product Z. (1 mark)

(iv) State any 2 differences between the above reaction and that of an hydroxide and an acid. (1 mark)

(v) Butane is often used as the main component in domestic gas fuels. Calculate it's heating value (H = 1, C = 12, $\Delta H^\circ C(C_4H_{10}) = 2877.0 \text{ k Jmol}^{-1}$) (1 mark)

4. The flow chart below shows the extraction of zinc. Study it and answer the questions that follow.



(a) (i) Identify substance X _____ (1 mark)

(ii) Give one waste material of the froth flotation process. (1 mark)

(iii) Identify substances A and B.

A _____ (½ mark)

B _____ (½ mark)

(iv) Write equation for the reaction taking place in the roaster. (1 mark)

(v) Identify gas P and write an equation for it's formation. (1 ½ marks)

(b) Use the standard electrode potentials given below to answer the questions that follow.

Half reactions	Electrode potential, E^θ (V)
$D^+_{(aq)} + e^- \longrightarrow D_{(s)}$	+ 0.80
$E^{2+}_{(aq)} + 2e^- \longrightarrow E_{(s)}$	+ 0.34
$F^{2+}_{(aq)} + 2e^- \longrightarrow F_{(s)}$	-0.13
$G^{2+}_{(aq)} + 2e^- \longrightarrow G_{(s)}$	-0.76

(i) Construct an electrochemical cell that will produce the lowest emf. (3 marks)

(ii) Calculate the emf of the cell constructed in (i) above.

(1 mark)

(iii) From the half reactions listed in the table in (b) above select strongest oxidizing agent. (½ mark)

5. (a) Fractional distillation of liquid air is mainly used to obtain nitrogen and oxygen.

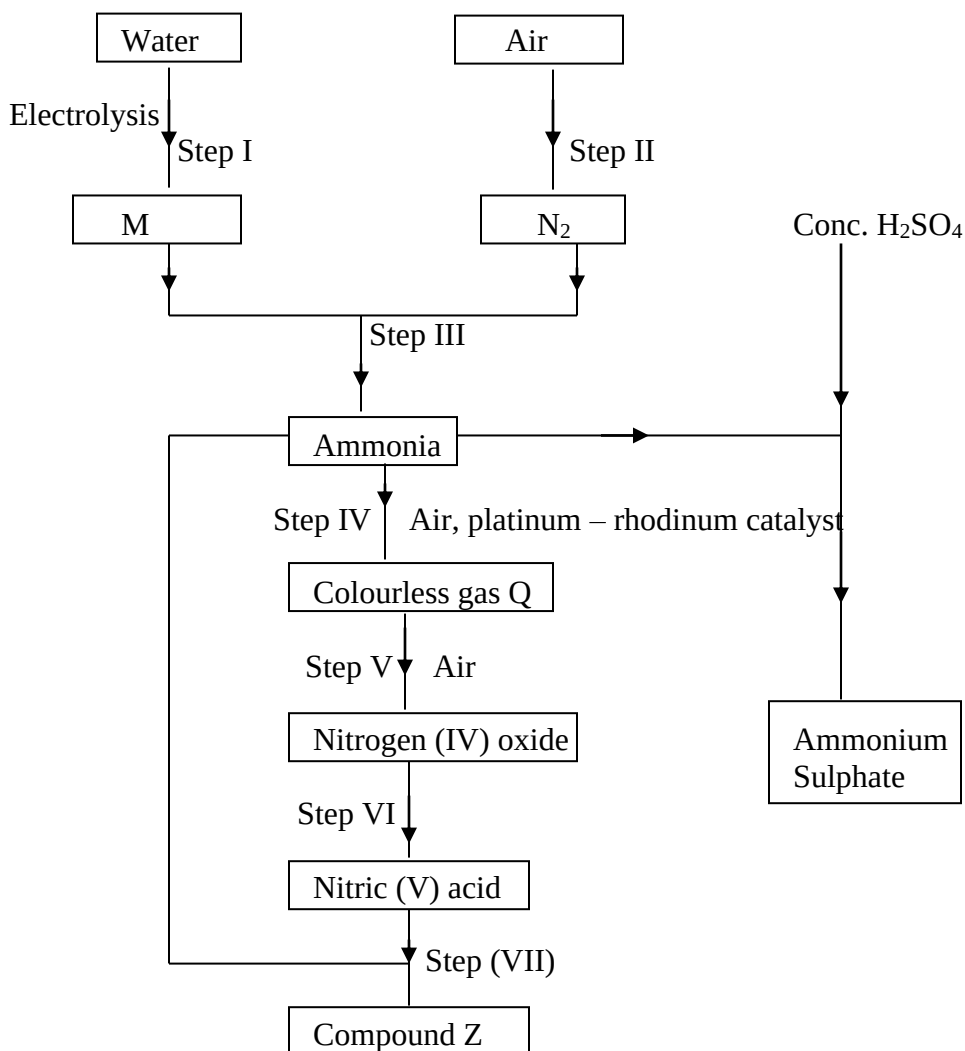
(i) Name one substance that is used to remove carbon (IV) oxide from the air before it is changed into liquid. (1 mark)

(ii) Describe how nitrogen gas is obtained from the liquid air.

(Boiling points nitrogen = -196°C , Oxygen = -183°C)

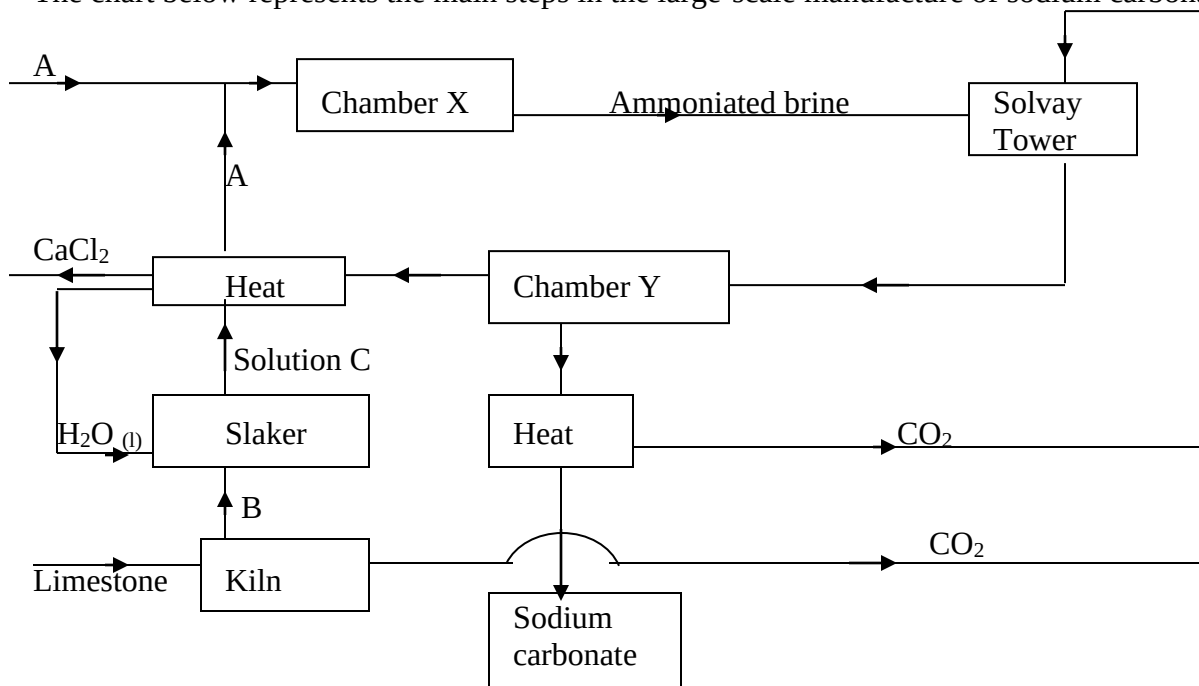
(3 marks)

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



- (i) Name substance M _____ (1 mark)
- (ii) Identify gas Q _____ (1 mark)
- (iii) State one use of compound Z (1 mark)
- (iv) A fertilizer manufacturing industry uses 1400dm^3 of ammonia gas per hour to produce ammonium sulphate. Calculate the amount of ammonium sulphate produced in kg for one day if the factory operates for 18 hours.
(N = 14, H = 1, S = 32, O = 16, 1 mole of gas = 24dm^3) (3 marks)

6. The chart below represents the main steps in the large-scale manufacture of sodium carbonate.



- (a) Name substances A and B.
A _____ (1 mark)
B _____ (1 mark)
- (b) Write down the chemical equation leading to formation of C. (1 mark)
- (c) A stream of cold water is made to circulate around chamber X. What does this suggest about the reaction taking place. (1 mark)
- (d) Name the process that takes place in chamber Y. (1 mark)
- (e) State any 2 by-products recycled in the process. (2 marks)
- (f) In an experiment, wood charcoal was mixed with concentrated sulphuric (VI) acid in

a test-tube. The mixture was then placed over a Bunsen-burner flame for sometime.

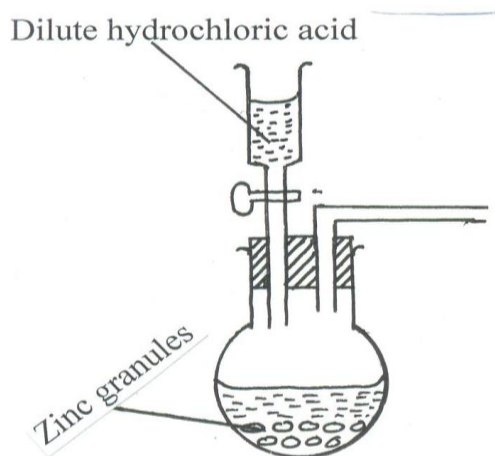
(i) Write down the chemical equation of the reaction that takes place. (1 mark)

(ii) State the property of concentrated sulphuric (VI) acid investigated in (i) above. (1 mark)

(g) Mention any 2 uses of sodium carbonate. (1 mark)

7. The set up below shows the reagents that can form hydrogen gas in a laboratory.

(a) Complete the diagram to show how a dry sample of hydrogen gas can be collected. (3 marks)

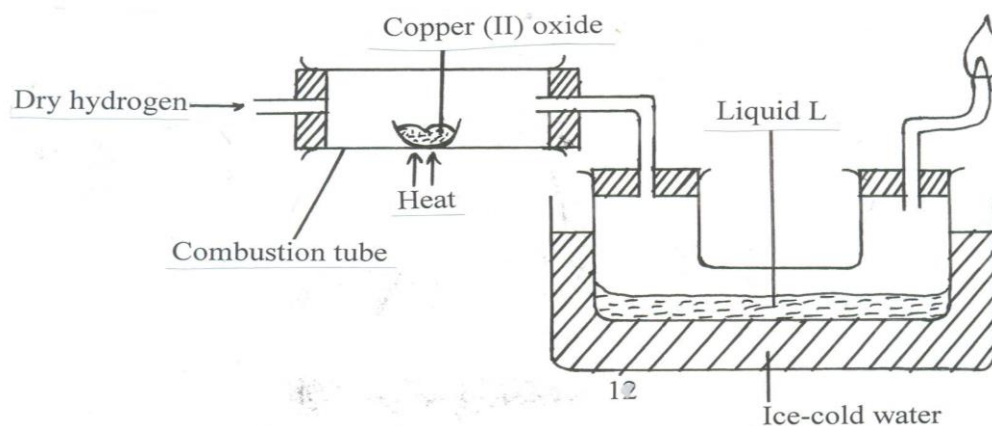


(b) Write the chemical equation for above reaction. (1 mark)

(c) Why is it not advisable to use calcium in this method to prepare hydrogen? (1 mark)

(d) Why is it advisable to discard the first jar of the gas collected. (1 mark)

(e) The set-up below was used to investigate the properties of hydrogen gas.



(i) State the observation made in the combustion tube. (1 mark)

- (ii) Write down the equation leading to formation of liquid L. (1 mark)
- (iii) What property of hydrogen is being investigated. (1 mark)
- (iv) Why is potassium oxide not used to investigate this property of hydrogen gas. (1 mark)
- (v) Hydrogen gas is used in hydrogenation of oils. What do you understand by the term hydrogenation? (1 mark)
- (vi) Give any 2 other industrial uses of hydrogen gas. (2 marks)

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MOI GIRLS ELDORET TRIAL SERIES

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

Instructions to candidates;

- *Answer all the questions in the spaces provided*
- *All working must be shown clearly where necessary*
- *Ensure the paper has all the questions*
- *Non-programmable silent calculators and mathematical sets may be used.*

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QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	11	
2	13	
3	13	
4	11	
5	12	
6	11	
7	9	

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

A hand-drawn diagram of a periodic table. The elements are represented by letters in boxes:

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

- (a) What is the name of the chemical family to which element P belongs? (1 mk)

.....

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

Electronic arrangement.....

- (c) Compare the size of the atom of R and of its ion. Explain your answer. (2 mks)

.....

- (d) Give the formula of the compound formed (1mk)

I. Pand W.....

II.T and Y.....

- (e) Compare the melting points of element Q and S. Explain. (2 mks)

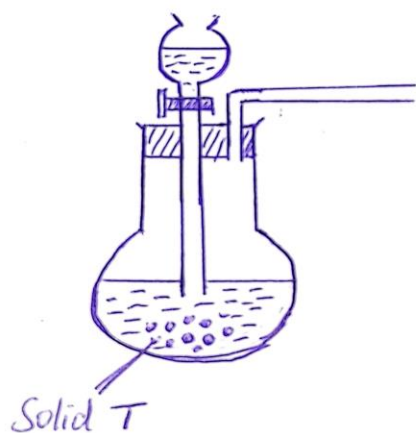
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(f) Give **one advantage** that element S has over element Q in making electric cables. (1 mk)

(g) Draw a dot (•) and cross (x) diagram to represent the bonding in the compound formed between T and Y. (2 mks)

(2). (a) The diagram below represents a set up that can be used to prepare and collect dry sulphur (IV) oxide gas .



(I.) Name solid T. (1 mk)

(II.) Complete the diagram to show how a dry sample of the gas can be collected. (2 mks)

(III.) Write an equation for the reaction that took place in the flask containing solid T. (1 mk)

(IV) State and explain one harmful effect of sulphur (IV) oxide on the environment. (1mk)

(b) Sulphur (IV) oxide is a major raw material in an **industrial process** to manufacture sulphuric (VI) acid.

I. What name is given to this industrial process?

(1 mk)

.....

II. Complete the table below by writing down the observations made when concentrated sulphuric (VI) acid is added to the substances shown. (2 mks)

Substances	Observation
Iron filings	
Crystals of white sugar	

III. Give reasons for the observations made on:

(i) Iron filings..... (1 mk)

(ii) Crystals of white sugar..... (1 mk)

(c) Name one fertilizer made from sulphuric (VI) acid.

(1 mk)

.....

(d) Suggest a reason why barium sulphate (A pigment made from sulphuric (VI) acid) is suitable for making paint for cars. (1 mk)

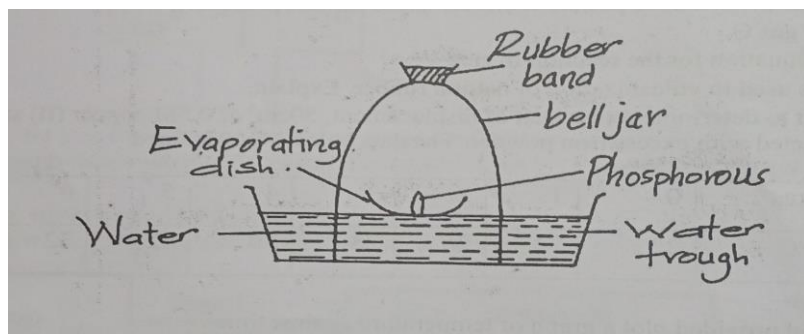
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(e) Other than in the manufacture of sulphuric (VI) acid, state **two** uses of sulphur (IV) oxide.

.....(1mk)

.

(3) (a) During the experiment the band was removed and a hot glass rod put through the opening to ignite the phosphorus by touching. It was then immediately removed and the rubber band replaced as the phosphorus burnt producing thick white fumes.



(I.) How is phosphorus stored in the laboratory? Give a reason.

(2mks)

(II.) State reasons why the level of water in the bell jar first went down as phosphorus burned then rose after it got extinguished.

(2 mks)

(III.) The white fumes formed in the bell jar slowly disappeared until the bell jar finally became clear. Explain.

(1 mk)

(IV.) Given that the initial reading was 80 cm^3 and final volume was 64 cm^3 , determine the percentage by volume of oxygen in air.

(2 mks)

(V.) Write a chemical equation for the reaction that took place in the bell jar.

(1 mk)

(VI.) Red and blue litmus paper were placed in the resulting solution. State and explain the observation that were made.

(2 mks)

(b.) Painting, oiling, galvanizing or tin plating are methods of preventing rusting.

(I.) Give the general formula of rust.

(1 mk)

(II.) How are these methods similar in the way they prevent rusting. (1 mk)

.....
.....

(III.) Explain why galvanized objects are better protected even when scratched. (1 mk)

.....

(4.) (a) Define the term homologous series. (1 mk)

.....

(b) Give the name of the following compound

$\text{CH}_3\text{CHCHCH}_2\text{CH}_3$ (1 mk)

.....

(c) Study the information in the table below and answer the questions that follow.

Number of carbon atoms per molecule	Relative molecular mass of hydrocarbon
2	28
3	42
4	56

(I) Write the general formula of the hydrocarbons in the table. (1 mk)

.....

(II) Predict the relative molecular mass of the hydrocarbon with 5 carbon atoms. (1 mk)

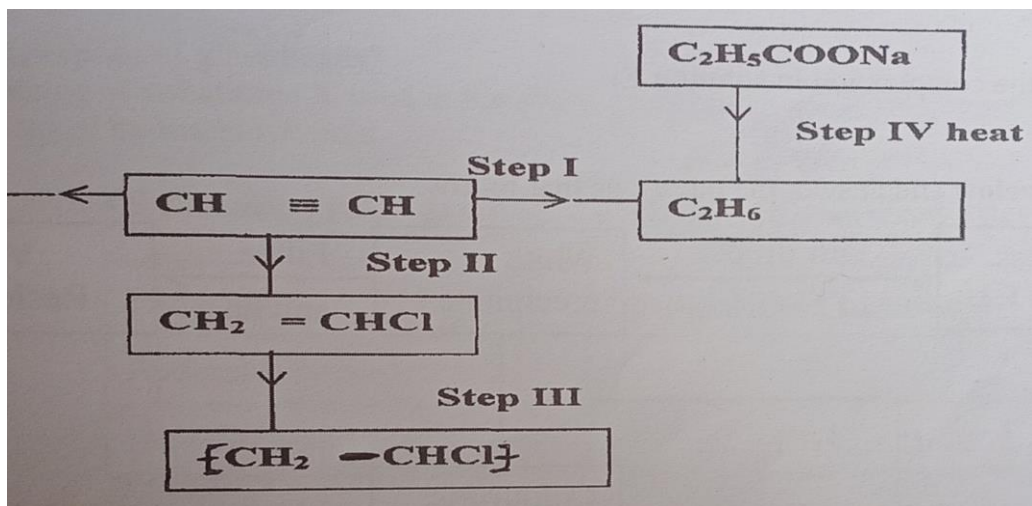
.....

(III) Determine the molecular formula of the hydrocarbon in **(II)** above and draw its structural formula. (2 mks)

.....

.....

(c) Study the scheme given below and answer the questions that follow.



(I) Name the reagent used in

Step I..... (1mk)

Step II..... (1mk)

Step IV..... (1 mk)

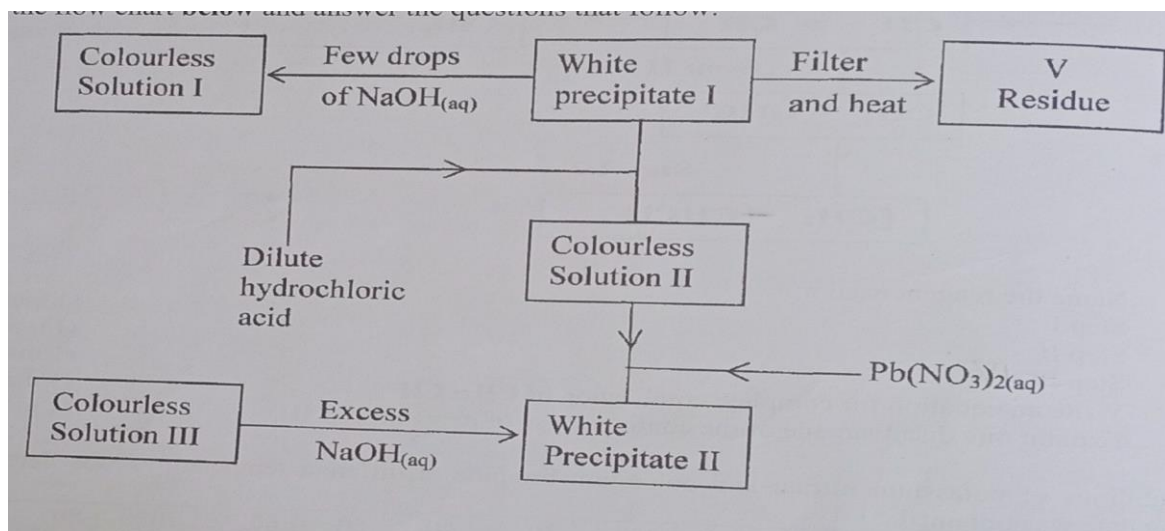
(II) Write an equation for complete combustion of C_2H_2 . (1 mk)

.....

(III) Explain **one** disadvantage of the continued use of items in **step III** (1mk)

.....

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



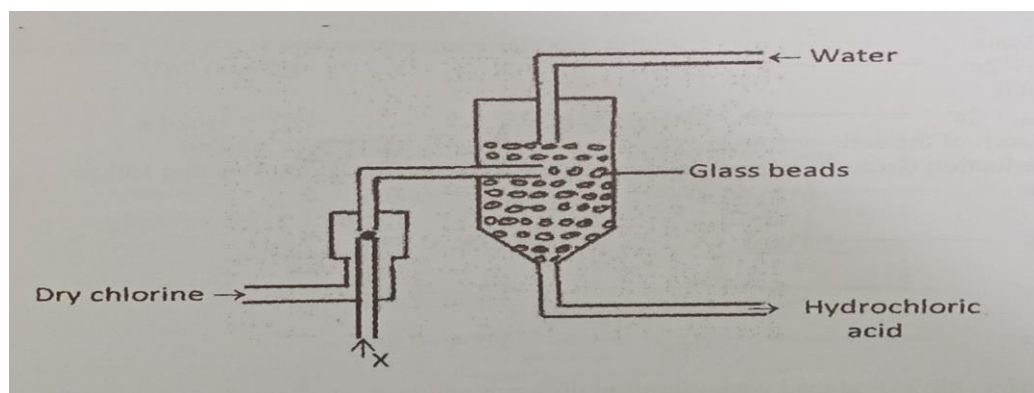
Residue V was yellow when hot and white when cold. Identify:

- (I) White precipitate **I**..... (1 mk)
- (II) Solution **II**..... (1 mk)
- (III) Residue **V** (1 mk)

(IV) Write an ionic equation for the reaction of **solution II** with **lead (II) nitrate** solution. (1 mk)

(V) Write observations that would made when ammonia solution is added drop-wise untill in excess to the colourless **solution II**. (1 mk)

(b) The diagram below represents a set- up for large scale manufacture of hydrochloric acid. Study it and answer the questions that follow:



- (I.) Name **substance X**. (1 mk)
- (II.) What is the purpose of glass beads? (1 mk)
-
- (III.) Give one source of **substance X** used in the above process. (1 mk)
-
- (IV.) Give two uses of hydrochloric acid. (2 mks)
-
- (c.) The table below shows the ammeter readings obtained when two different electrolytes of the same Concentration was tested.

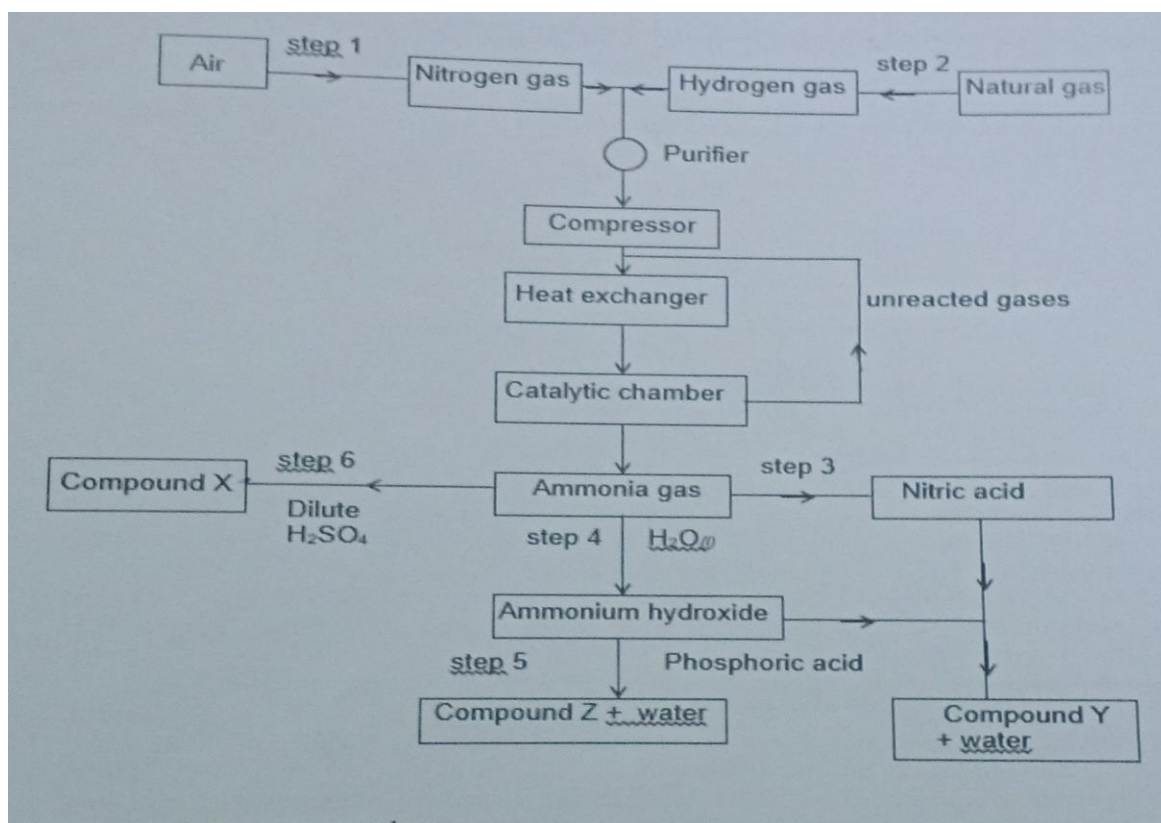
Electrolyte	Ammeter readings (Amps)
Hydrochloric acid	4.0
Ethanoic acid	1.2

Why does ethanoic acid give a lower ammeter reading? Explain your answer. (2 mks)

.....

.....

(6.) The flow chart below shows industrial preparation of ammonia and the process used on the manufacture of some ammonium compounds. Study it and answer the questions that follow.



(a) Apart from natural gas name another

I. Source of hydrogen gas (1 mk)

II. Name other two substances obtained in step I. (1 mk)

III. Give the name of the;

(i.) Process on **step I**: (1 mk)

(ii.) Reaction that takes place in **step 5**:..... (1 mk)

(b.) Explain why it is necessary to compress nitrogen and hydrogen in this process. (1 mk)

.....

.....

(c.) Write an equation for the reaction which takes place in **step 6**. (1 mk)

.....

(d.) Name the catalyst and reagents used in step 3. (2 mks)

Catalyst.....

Reagent.....

(e.) Name compounds (2 mks)

X.....

Y.....

(f.) Give one commercial use of compound Z. (1 mk)

.....

(7.) The following were results obtained when the molar heat of neutralization between hydrochloric acid and sodium hydroxide was determined. 100 cm³ of 1.0M hydrochloric acid was reacted with 50 cm³ of 2.0M sodium hydroxide solution.

Initial temperature of the base was 25°C

Initial temperature of the acid was 27°C

The final stable temperature when the acid and the base were mixed was 34°C.

(a) Write an ionic equation for the reaction. (1 mk)

.....

.....

(b) Calculate the;

(i) Change in temperature

(1 mk)

.....

.....

(ii) Heat change for the reaction (specific heat capacity= 4.2J/g/K and density of solution= 1.0g/cm^3). (1 mk)

.....

(iii) Molar heat of neutralization of hydrochloric acid.

(2 mk)

.....(c)

Write the thermochemical equation for the reaction. (1 mk)

.....

(d) Draw an energy level diagram for the reaction.

(1 mk)

.....

(e) How can the heat loss be minimized?

(1 mk)

.....

(f) Account for the heat loss.

(1 mk)

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Name Admission number
Candidate's Signature.....Date.....

NAIROBI SCHOOL TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

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- b) Sign and write the date of examination in the spaces provided above*
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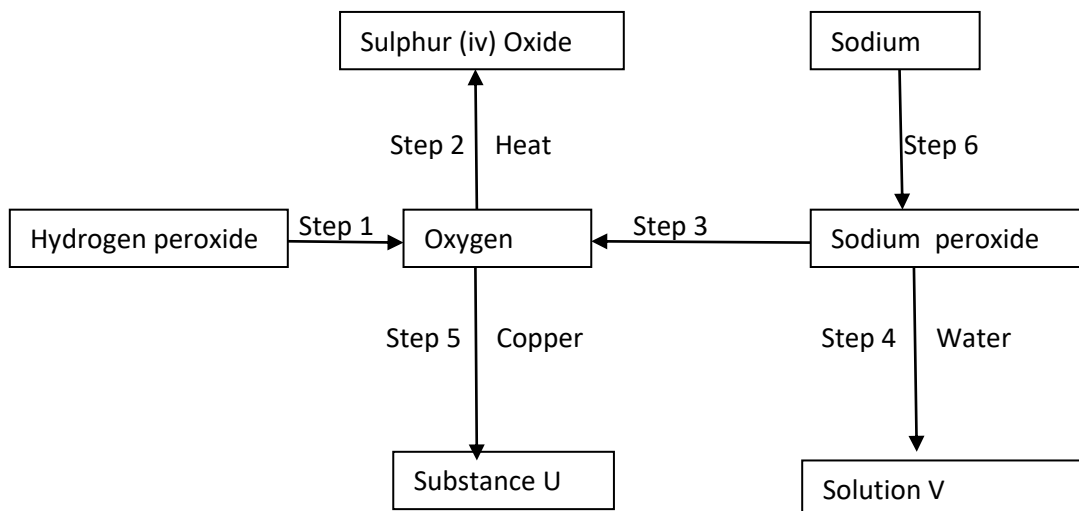
EMAIL: Goldlitepublishers@gmail.com

1. The grid shown below represents the periodic table. Study it and answer the questions that follow (the letters do not represent actual symbols of the element)

	K							S
G							T	
	H							
L								

- a) Which element exists naturally as a; (2mks)
- Diatomic gas
 - Monoatomic gas
- b) Write down the formula for the most stable ion of K and its electronic arrangement. (1mk)
- c) How do the atomic radii of G and L compare? Explain. (2mks)
- d) How do the first ionization energies of G and L compare? Explain. (2mks)
- e) Which two elements would react most vigorously with each other? (1mk)
- f) Give an equation for the reaction between the elements you have given in (e) above. (2mks)
- g) Which element has the smallest atomic radius? Explain. (2mks)

- h) Give the number of valence electrons in; (2mks)
- K
 - T
2. Study the reaction scheme below and answer the questions that follow.



- Identify substance U and solution V. (2mks)
- Name the reagents necessary for the reactions in the following steps. (2mks)
 - Step 1
 - Step 2
 - Step 3
 - Step 6
- Give the condition necessary for the reaction in step 5 to take place. (1mk)
- Write equations for the reactions in the following steps. (3mks)
 - Step 1
 - Step 2

iii. Step 5

e) State and explain the observation made in step 5. (2mks)

3. The table shows the variation of volumes at different amounts of pressure.

Pressure in atmosphere	10	8	5	2	1
Volume (cm ³)	160	200	320	800	1600
Reciprocal of pressure ($1/p$)					

i. Complete the table by determine the reciprocal of pressure. (2mks)

ii. Plot a graph of volume against reciprocal of pressure. (3mks)

iii. Use the graph to determine the volume of gas P at a pressure of 3.2 atmosphere. (1mk)

iv. Calculate the pressure of gas P which has a volume of 5 litres. (2mks)

v. A given volume of nitrogen gas requires 68.3 seconds to diffuse through a tinny hole in a chamber. Under the same conditions another unknown gas requires 85.6

seconds for the same volume to diffuse. What is the molecular mass of this gas? (r=14) (3mks)

4. In an experiment to determine the molar heat of neutralization of hydrochloric acid with sodium hydroxide, students of Bidii Secondary school reacted 100cm^3 of 1M hydrochloric acid with 50cm^3 of 2M sodium hydroxide solution. They obtained the following results.

Initial temperature of acid = 25.0°C

Initial temperature of base = 25.0°C

Highest temperature reached (acid +alkali mixture) = 34.0°C

- a) Define the term molar heat of neutralization. (1mk)

- b) Write an ionic equation for the neutralization reaction between hydrochloric acid and sodium hydroxide. (1mk)

- c) Calculate:

i. The change in temperature (ΔT)

ii. The amount of heat produced during the reaction (specific heat capacity = $4.2\text{KJkg}^{-1}\text{K}^{-1}$)

iii. The molar heat of neutralization of sodium hydroxide.

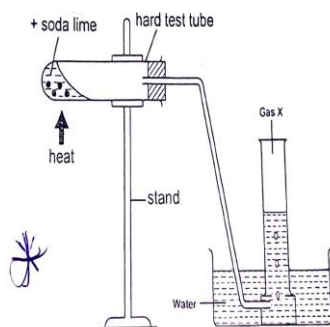
- d) Write the thermochemical equation for the reaction. (1mk)

e) Draw an energy level diagram for the reaction.

(2mks)

f) Explain why the enthalpy of neutralization of ethanoic acid with sodium hydroxide

5. a) The diagram below was used to prepare a gas X in the laboratory. Study it answer the questions that follow.



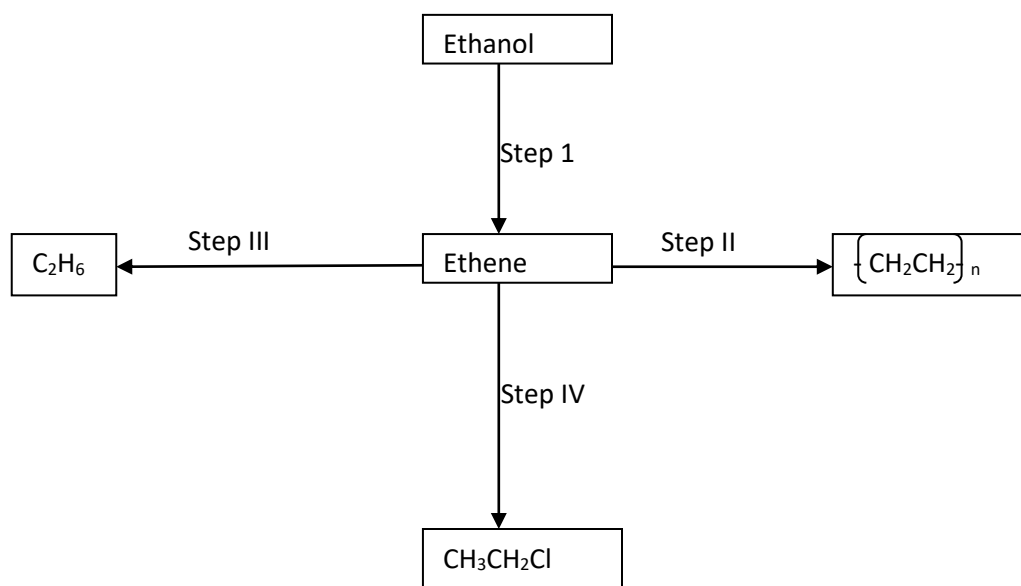
i. Name gas x.

(1mk)

ii. Write an equation to show the production of gas x.

(1mk)

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

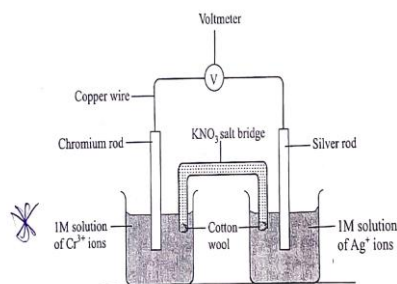


- Name the catalyst that is suitable to carry out the reaction in step 1. (1mk)
- Name the process that takes place in step II. (1mk)
- State the conditions necessary for the reaction in step III to occur. (1mk)
- Write down the equation for the reaction that takes place in step IV. (1mk)

c) Other than using burning, describe how you would distinguish between ethane and ethyne.

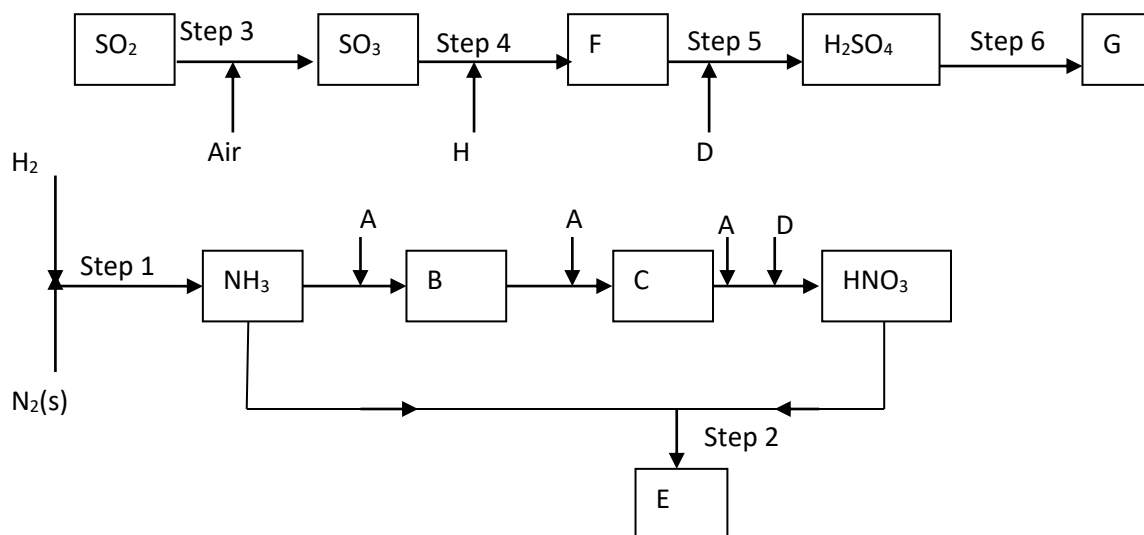
d) Draw and name all structures of the isomers of the compound with molecular formula C_4H_8 . (3mks)

6. The diagram below shows a voltaic cell formed between half cells $\text{Cr}^{3+}(\text{aq})/\text{Cr}(\text{s})$
 $E^\circ = +0.80$
 Study it and answer the questions that follow.



- What is the e.m.f of the cell? (1mk)
- State the direction of movement of electrons. (1mk)
- Which electrode is the anode? Explain. (1mk)
- State the half cell in which reduction occurs and give the equation for the reaction. (2mks)
- What will happen to the electrodes during the operation of the cell? (2mks)
- State two function of the salt bridge. (2mks)

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



- Name substance A, B, D, and F. (2mks)
- Substance E and ammonium sulphate have one common use. State the use. (1mk)
- Name the suitable catalyst in step 3. (1mk)
- Write the chemical equation in step 4. (1mk)
- Identify two gaseous environmental pollutants from the above flow chart. (1mk)
- State the observation when potassium hydroxide is warmed with substance G. (1mk)
- Write a chemical equation where concentrated sulphuric (VI) acid is used as an oxidizing agent. (2mks)

h) Write type of reaction is shown in the equation: (1mk)
 $\text{KNO}_3(\text{aq}) + \text{H}_2\text{SO}_4(\text{l}) \rightarrow \text{HNO}_3(\text{g})$

i) Carbon (IV) oxide reacts with red hot carbon to produce a colourless gas P. Name gas P and state and explain the precaution you take when preparing this colourless gas P. (2mks)

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Name Admission number

Candidate's Signature.....Date.....

BAHATI GIRLS TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.*
- b) Sign and write the date of examination in the spaces provided above*
- c) Answer all the questions in the spaces provided below each question. .*
- d) KNEC Mathematical tables and silent electronic calculators may be used.*
- e) All working must be clearly shown where necessary.*
- f) Candidates should answer the questions in English.*

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Question	Maximum Score	Candidate's Score
1	11	
2	10	
3	12	
4	12	
5	12	
6	14	
7	9	
Total score		

1. Crystals of copper (ii) nitrate can be prepared by reacting solid copper (ii) oxide with dilute nitric (v) acid.

(a) Write a chemical equation for this reaction. (1mk)

.....

(b).A student is given a sample of copper (ii) oxide containing small amounts of insoluble impurities.

The passage is from her notebook and describes the method she uses to prepare some pure, dry crystals of copper (ii) nitrate from her sample of copper (ii) oxide.

Stage 1: place 50cm³ of dilute nitric (v) acid into a beaker and warm.

Stage 2: add the impure copper (ii) oxide a little at a time and stir, until it is in excess.

Stage 3: filter the mixture

Stage 4: heat the filtrate until the crystallization point is reached

Stage 5: allow the filtrate to cool

Stage 6: filter off the crystals and dry within filter paper.

(i) Why is the acid warmed in stage 1? (1mk)

.....

(ii) How will the student know when the copper (ii) oxide is in excess in stage 2. (1mk)

.....

(iii) How will the student know when the crystallization point is reached in stage 4 (1mk)

.....

(iv) In which stage are the insoluble impurities removed? (1mk)

.....

(c) Substance X was known to be sodium iodide, potassium iodide or potassium bromide. state how a flame test could be used to decide whether substance X is a sodium or potassium compound.

(2mks)

.....

.....

(d) Study the table below and answer the questions that follow

process	observation
Copper metal was warmed with conc H_2SO_4	A gas V with a choking smell is produced. The gas changed the acidified potassium dichromate (vi) from orange to green. A blue solution is formed.
To a little of the blue solution excess aqueous ammonia was added	A light blue precipitate formed which dissolved to give a deep blue solution.

(i) Name gas V (1mk)

.....

(ii) What property of gas V is indicated by the change in the acidified dichromate solution?

(1mk)

.....

(iii) Write the formula of the ion in the deep blue solution and name it (2mks)

Formula of the ion.....

Name of the ion

2. Crude oil is a source of many compounds that contain carbon and hydrogen only.

(i) Name the process used to separate components of crude oil (1mk)

.....

(ii). On what physical property does separation of the above components depend on. (1mk)

.....

(b) Describe two simple chemical tests that be used to distinguish between C_2H_4 and C_2H_6

(4mks)

.....

.....

.....

.....

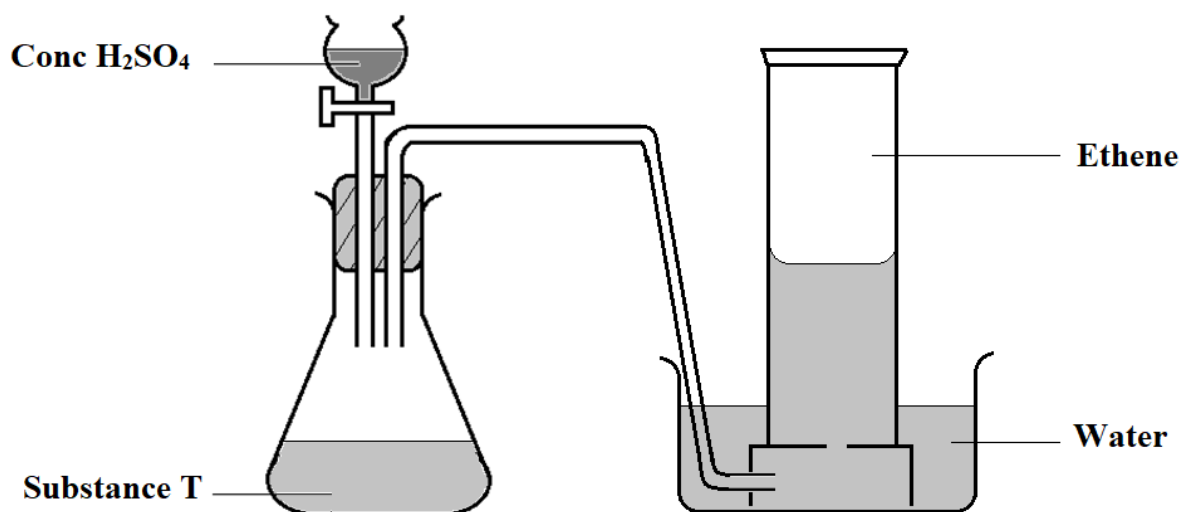
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.....

(c) The set up below was used to prepare and collect ethene gas. study it and answer the question that follow.



(i) Name the substance T (1mk.)

.....

(ii) Give the property of ethene that allows it to be collected as shown in the set up above. (1mk)

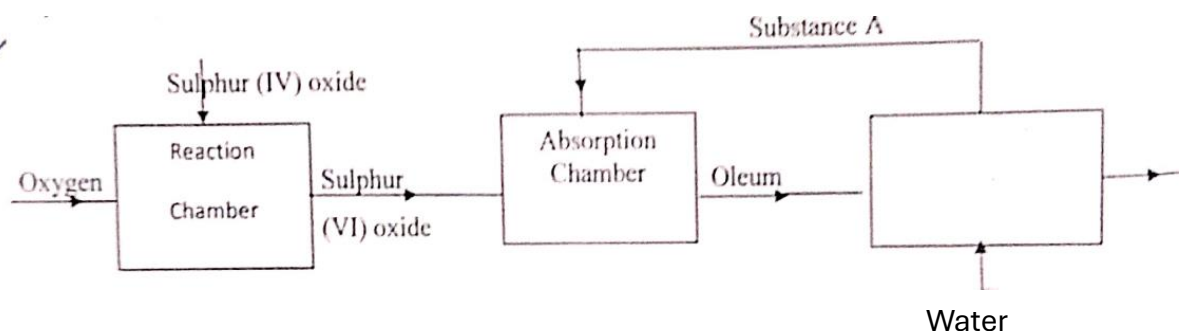
.....

(d) One of the reaction undergone by ethene is addition polymerization. Give the name of the polymer and one disadvantage of the polymer it forms. (2mks)

Name:.....

Disadvantage of the polymer:.....

3.The flow chart below shows some of the processes involved in large scale production of sulphuric (vi) acid. Use it to answer the questions that follow.



(a).State the name of the industrial process described above. (1mk)

.....

(b). Name substance A (1mk)

.....

(ii).Write an equation for the process that takes place in the absorption chamber (1mk)

.....
(c). Vanadium (v) oxide is commonly used catalyst in the contact process. Name another catalyst which can be used in this process. (1mk)

.....
(d). Give two reasons why vanadium (v) oxide is commonly used catalyst (2mks)

.....
(e).State and explain the observation made when concentrated sulphuric (vi) acid is added to crystals of copper (ii) sulphate in the beaker. (2mks)

.....
(f). A part from the catalyst ,list two other optimum conditions for the production of sulphuric(vi) acid. (2mks)

.....
(g). List any two uses of sulphuric (vi) acid. (2mks)

.....
4. a) During the manufacture of hydrochloric acid, 50dm³ of hydrogen gas was burnt in 80dm³ chlorine.

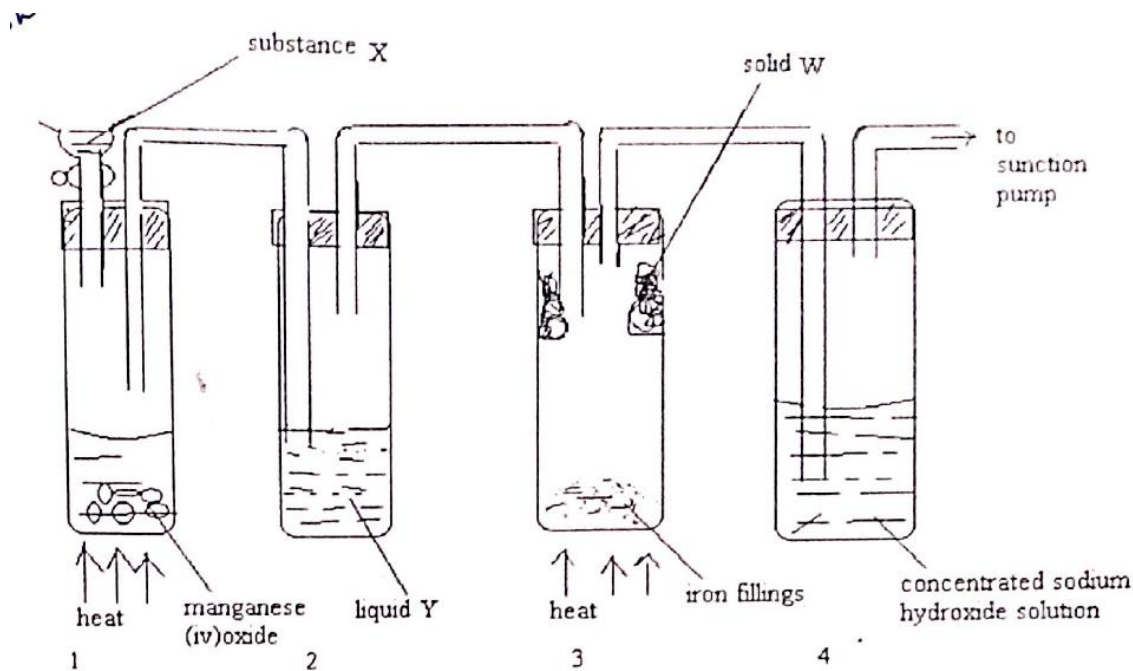
(i) Write a chemical equation for the reaction between hydrogen and chlorine.(1mk)

.....
(ii) Which gas was in excess and by how much? (2mks)

.....
iii) What is the source of hydrogen used during the manufacture? (1mk)

.....
(iv) A solution of hydrogen chloride gas in water turns blue litmus red while a solution of hydrogen chloride gas in methyl benzene has no effect. Explain (2mks)

- (b) The set up below was used to prepare and study the reaction of chlorine gas. study it and answer the questions that follow,



- (i) Give the role of manganese (iv) oxide in the first boiling tube. (1mk)

.....

- (ii) Identify substances X and Y (2mks)

X:.....

Y:.....

- (iii) Write a chemical equation for the reaction in boiling tube 3. (1mk)

.....

- (iv) Explain why solid W is collected as shown in the set up. (1mk)

.....

- (v) Name the other reagent that can be used instead of manganese (iv) oxide (1mk)

.....

- 5.a) State two factors that should be considered when choosing fuel for cooking (2mks)

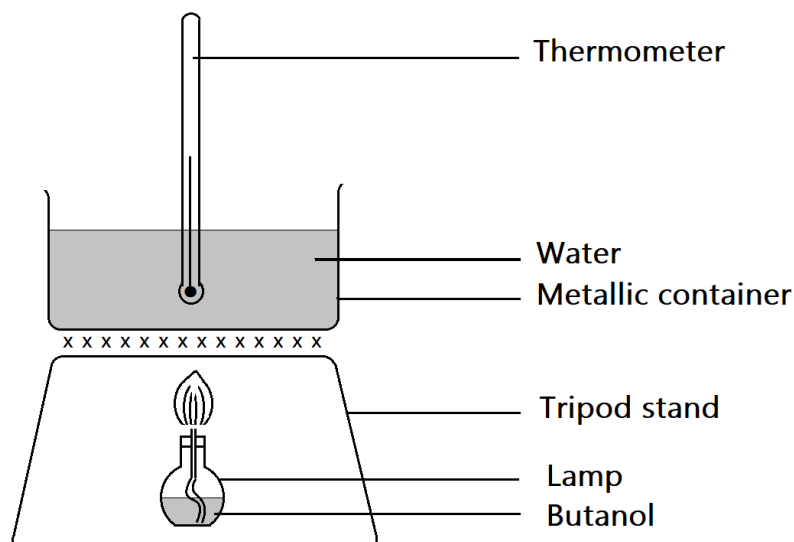
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.....

- b) Define the term molar heat of combustion (1mk)

.....

c) The diagram below represents a set up that was used to determine the molar heat of combustion of butanol. 250cm³ of water was heated from 225K to 295K. the mass of butanol and lamp initially was 154.4g and dropped to 124.8g after the experiment.



Calculate the;

- (i) The mass of butanol burnt (1mk)

.....

.....

- (ii) The heat change that occurred during the process (specific heat capacity of water=4.2Jg⁻¹K⁻¹, density of water 1g/cm³, C=12, H=1, O=16) (2mks)

.....

.....

.....

- (iii) The molar heat of combustion of butanol(C₄H₉OH) (2mks)

.....

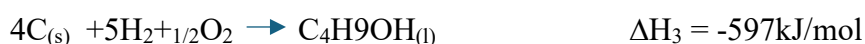
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- (iv) Heating value of butanol (1mk)

.....

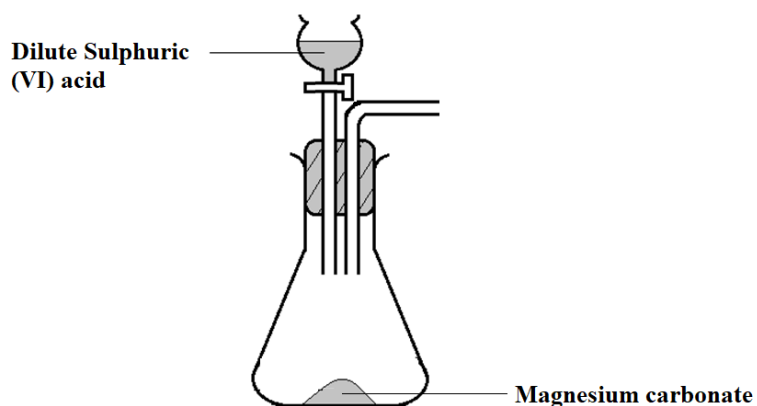
.....

(d) Using the information below, determine the heat of combustion of butanol using the following data. (3mks)



6.a) The diagram below represents an incomplete set up of apparatus used to prepare and collect a dry sample of carbon (iv) oxide.

- (i) Complete the diagram to show how a dry sample of carbon (iv) oxide was collected (3mks).



- (ii) Write the equation for the reaction that took place in the conical flask (1mk)

.....

- (iii) Why is it not suitable to use the lead (ii) carbonate in place of magnesium carbonate in the set up (2mks)

.....

.....

- (iv) State two properties of carbon (iv) oxide that makes it suitable for use in fire extinguishers. (1mk)

.....

.....

- (b) Carbon (iv) oxide gas reacts with red-hot carbon to produce a colourless gas P

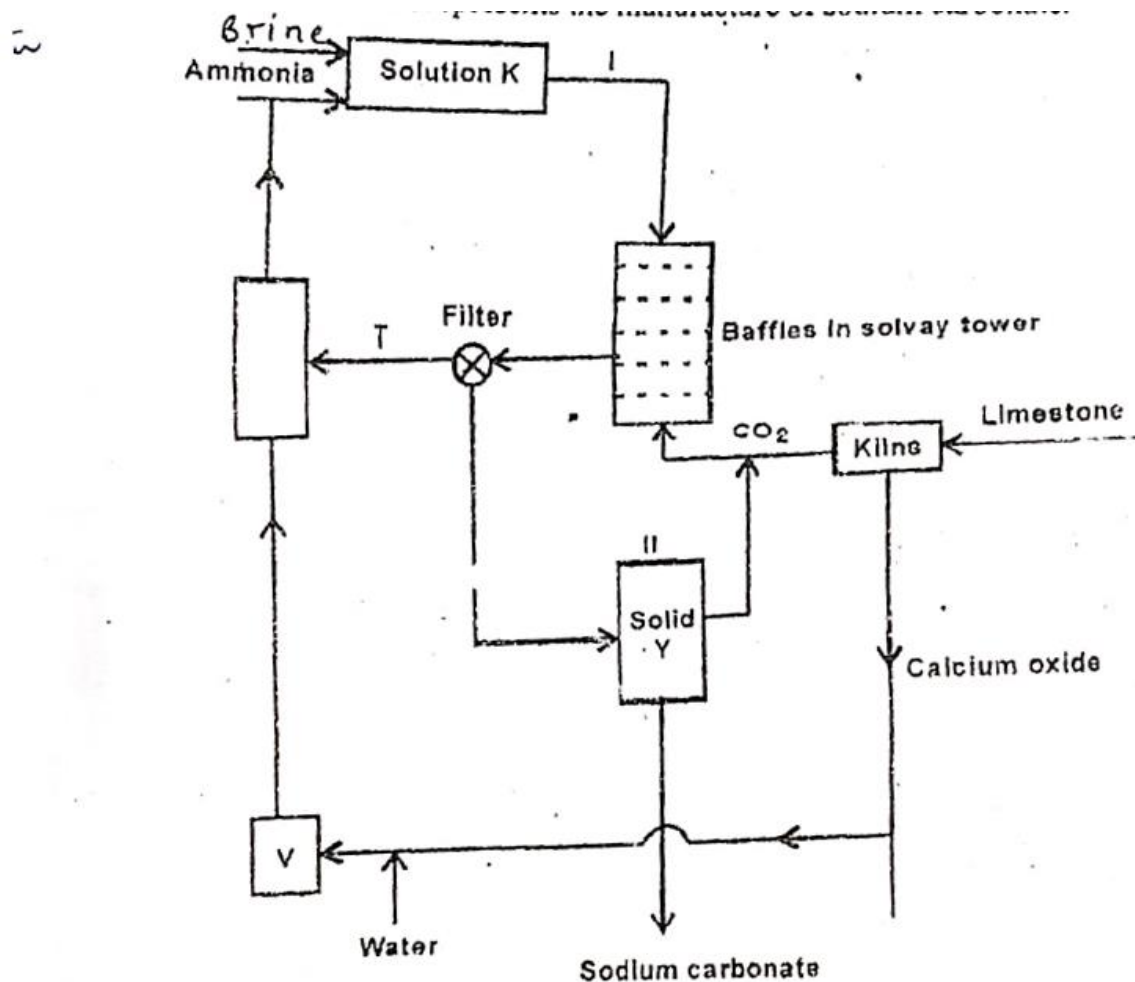
- i) Identify gas P (1mk)

- ii) State one precaution to be taken while preparing gas P in the laboratory. Explain your answer. (2mks)

.....

.....

c) Study the flow chart below that represents the manufacture of sodium carbonate



(i) Identify substances;

(2mks)

K:

T:

Y:

V:

ii) Write an equation for the reaction that takes place in the in the;

Lime kiln

(1mk)

.....

Solvay tower

(1mk)

.....

7. The diagram below shows part of the periodic table. The letters do not represent the actual symbols of the elements. Use the diagram to answer the questions that follow.

								Q
R						T		
	Z		N			V	W	
Y							X	

i) Compare the reactivity of W and X, explain (2mks)

.....

.....

ii) Give the formula of the compound formed between Z and W (1mk)

.....

iii) Element K is in group (v) and period 2 of the periodic table. Locate the position of the element in the grid above (1mk)

iv) How do the melting points of R and T compare. Explain (2mks)

.....

.....

v) Using dots (.) and crosses (x), show the bonding between K and hydrogen. (2mks)

vi). Select an element that could be used : (2mks)

i). In weather balloons

.....

ii). For making cooking pots

.....

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FRIENDS SCHOOL KAMUSINGA TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.*
- b) Sign and write the date of examination in the spaces provided above*
- c) Answer all the questions in the spaces provided below each question. .*
- d) KNEC Mathematical tables and silent electronic calculators may be used.*
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1. a. What is meant by molar heat of solution? (1 mark)

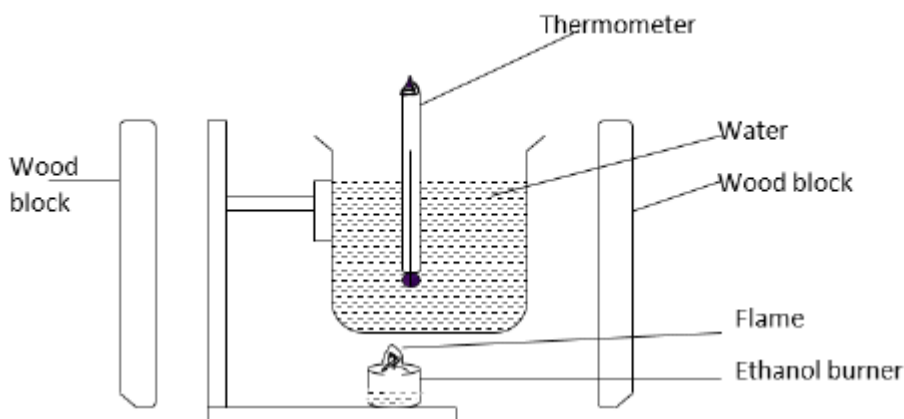
b. The enthalpies of combustion of carbon (II) oxide are indicated below.



i. Draw an energy level diagram that links the enthalpy of formation of carbon (II) oxide to enthalpies of combustion of carbon and carbon (II) oxide. (2 marks)

ii. Determine the enthalpy of formation of Carbon (II) Oxide. (2 marks)

c. The set up below was used by a student to determine the enthalpy of combustion of ethanol ($\text{CH}_3\text{CH}_2\text{OH}$). Study it and answer the questions that follow.

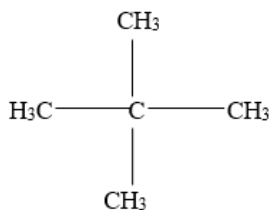


The following data was collected from the experiment:

Initial temperature of water	12°C
Final temperature of water	22°C
Initial mass of spirit lamp	11.42g
Final mass of spirit lamp	10.50g
Specific heat capacity of water	4.20 J g ⁻¹ K ⁻¹

- a. What is the function of the wood block? (1mk)
- b. Using the data above, calculate the enthalpy of combustion of the ethanol assuming the density of water is 1g/cm³. (2mks)
- c. Calculate the molar heat of combustion of ethanol? (C=12, O=16, H=1). (3mks)
- d. Write a thermochemical equation for the reaction above? (1mk)
- e. Find the heating value of ethanol. (2mks)
- f. State two precautions necessary when using fuels. (2mks)

2. a. Give the names of the following compounds. (1 mark)



i.

ii. $\text{CH}_3\text{C}\equiv\text{CCH}_2\text{CH}_3$

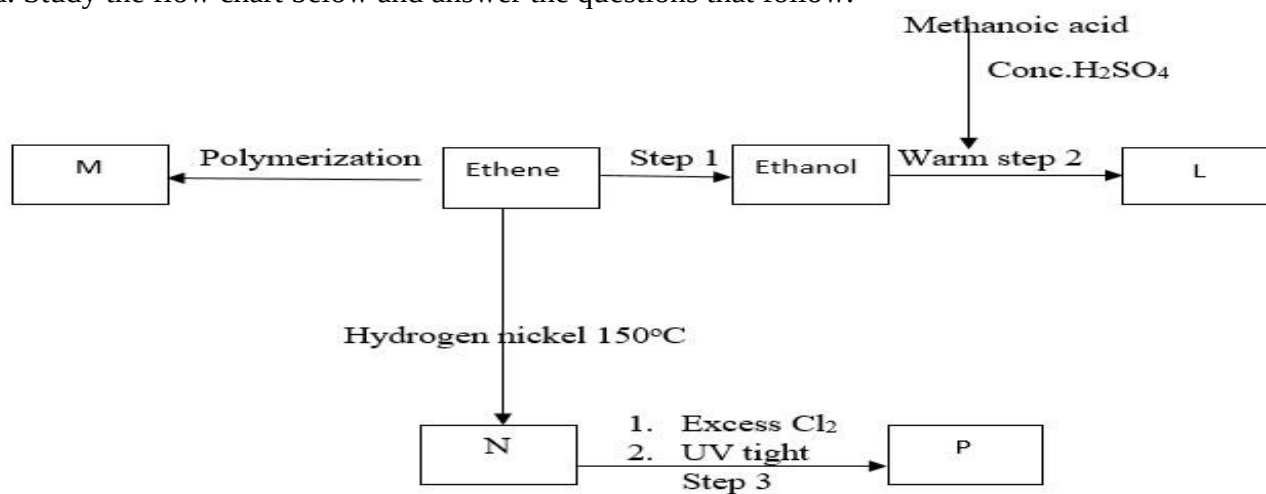
b. Describe a chemical test that can be used to distinguish between the two compounds identified in (a) above. (2mks)

c. Two cleansing agents are represented below.



- Select one that would be suitable for use in hard water and identify its name. (1mk)
- What is the advantage of detergent P over R.? (1mk)

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



- Name the compounds (2 marks)
 L.....
 N.....
- Draw the structural formula of compound M using three repeating units. (1mk)

- iii. What type of polymerization is exhibited by compound M above? (1mk)
- iv. Name the reagent and condition used in step 1. (2mks)
 Reagent.....
 Condition.....
- v. State the type of reaction that takes place in: (2mks)
 Step 2.....
 Step 3.....
- vi. The molecular formula of compound P is $C_2H_2Cl_4$. Draw any two possible structural formula of its isomers. (1mk)

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

S			R		E		X	
				D				V
Q	Z					M		
							T	

- i. Identify the most reactive non-metal. Explain. (1mk)
- ii. Identify the most reactive metal. Explain. (1mk)
- iii. What name is given to the family of elements to which V belong. (1mk)
- iv. Giving reasons, why is ionic radius of Q is smaller than that of M? (1mk)
- v. Giving reasons, why is atomic radius of Q is greater than that of S? (1mk)

vi. Give an element that does not form compounds under ideal conditions. Explain. (2mks)

vii. Give the bond type and formula of the compound between T and Z. (1mk)

b. Table 1 shows some properties of substances A,B,C,D,E and F study them and answer the questions that follow.

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

i. Identify substances with; (2mks)

I. Giant metallic structure.

II. Molecular structure and exists in gaseous state at r.t.p conditions.

ii. Suggest a reason why substance B has two melting points. (1mk)

iii. State one way in which liquid A and liquid C above differ during conductivity of electric current. (2mks)

4. a. Define the term solubility. (1mk)

b. The table below gives the solubilities of potassium nitrate at different temperature.

Temperature (°C)	12	20	28	36	44	52
Solubility g/100g water	22	31	42	55	70	90

a. Plot a graph of solubility of potassium nitrate (vertical axis) against temperature. (3mks)

b. Using the graph;

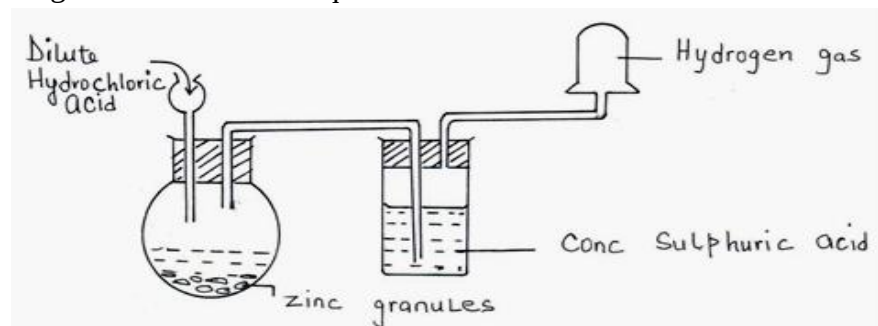
i. Determine the solubility of potassium nitrate at 25°C. (1mk)

ii. Determine the mass of potassium nitrate that remained undissolved given-that 100g of potassium nitrate were added to 100cm³ of water and warmed to 50°C.

(2mks)

c. Determine the molar concentration of potassium nitrate at 25°C. (Assume there is no change in density of water at this temperature). (K = 39.0; N = 14.0; O = 16.0). (3mks)

5. The diagram below shows the set-up used to prepare dry hydrogen gas in the laboratory. Study the diagram and answer the questions that follow:



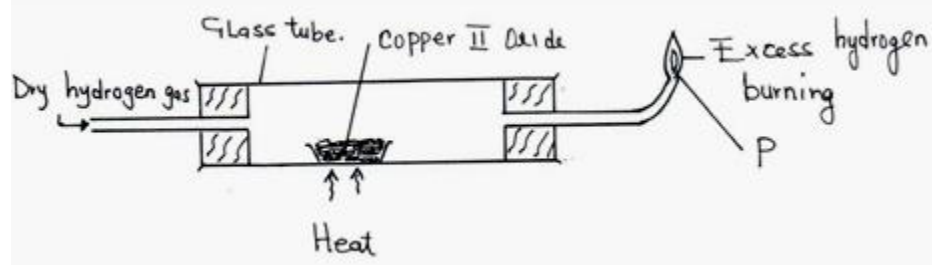
i. State one mistake in the set up. (1mk)

ii. Which property of hydrogen gas enables it to be collected as shown in the diagram? (1mk)

iii. Write a chemical equation for the reaction between dilute sulphuric (VI) acid and zinc to produce hydrogen gas. (1mk)

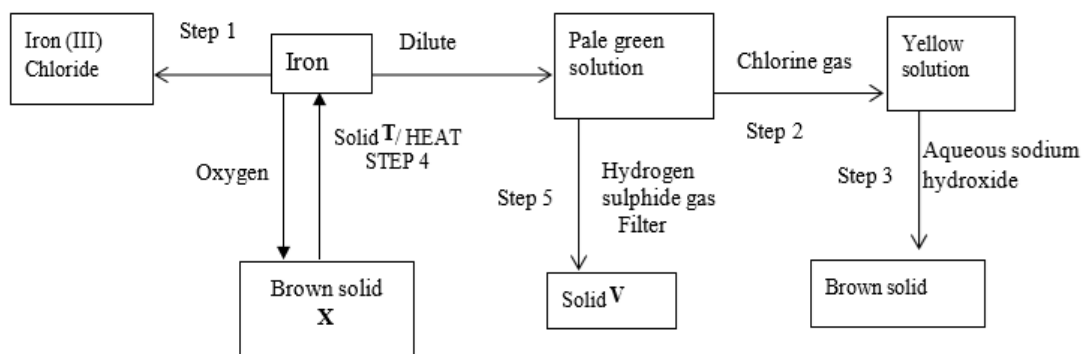
iv. If 200cm^3 of hydrogen gas was produced at R.T.P, calculate the mass of Zn used. (Zn = 65, MGV at R.T.P is 24dm^3). (2mks)

6. Hydrogen gas was passed over heated copper (II) oxide in a hard glass tube as shown below.



- What precaution is taken before lighting the gas at point P.? (1mk)
- State the observation made at the end of the experiment in the glass tube. Explain? (2mks)
- Excess hydrogen burns to form water. State **one** chemical test that can be carried out to identify water. (1mk)
- What would you expect to happen if magnesium oxide (MgO) was used instead of copper (II) oxide? Explain. (1mk)
- State one industrial use of hydrogen. (1mk)

7. The flow chart below shows a sequence of reactions starting with iron. Study it and answer the questions that follow.



- (a) Write balanced chemical equations and conditions where necessary for the reaction that takes place in

(i) Step 1 (1mark)

(ii) Step 2 (1mark)

(iii) Step 3 (1mark)

- (b) State the observation that will be made in step 5. (1mark)

- (c) Give a reason for the color change in Step 2. (1mark)

- (d) Give the names of substances:

X (1mark)

V (1mark)

T (1mark)

(e) The mass of the product formed in step 1 was 2.0g. Calculate the volume of the gas used at r.t.p. (Fe =56. Cl = 35.5 and molar gas volume at r.t.p is 24 dm³) (3 marks)

8. Explain how a catalyst affects the rate of a chemical reaction. (1mk)

9. Distinguish between a strong base and a weak base. (1mk)

b) i) Explain why permanent hardness cannot be removed by boiling. (1mk)

ii) State one disadvantage of hard water. (1mk)

(INSERT GRAPH)

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KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name Admission number

Candidate's Signature.....Date.....

MOI GIRLS NAIROBI HIGH SCHOOL TRIALS EXAMS

Instructions to candidates

- (a) Write your name, admission number, index number, and stream in the spaces provided above.
- (b) Sign and write the date of the examination in the spaces provided
- (c) Answer **ALL** the questions in the spaces provided.
- (d) Candidates **MUST** answer all questions in English.
- (e) KNEC mathematical tables and silent non-programmable electronic calculators may be used.
- (f) This paper consists of **13** printed pages
- (g) Candidates should **check** the question paper to ascertain that **ALL** the pages are printed as indicated and that **NO QUESTIONS ARE MISSING**

FOR EXAMINER'S USE ONLY.

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	09	
2	13	
3	12	
4	11	
5	14	
6	11	
7	10	
TOTAL SCORE	80	

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1. a) The relationship between the pressure and volume of a fixed mass of gas was studied at 25°C. The data was recorded as shown in the table below.

Volume (m ³)	1	2	4	6
Pressure (Pa) $\times 10^5$	12	6	3	2
Product of volume and pressure				

- (i) Complete the table by calculating the product of the volume and pressure. (2 marks)

- (ii) Using the data, state the law governing the relationship between volume and pressure of a fixed mass of a gas. (1 mark)

- (b) The volume of nitrogen gas at 27°C and a pressure of 1×10^5 pa is 8m³. Calculate its volume at 128°C and a pressure of 3.2×10^5 pa (2 marks)

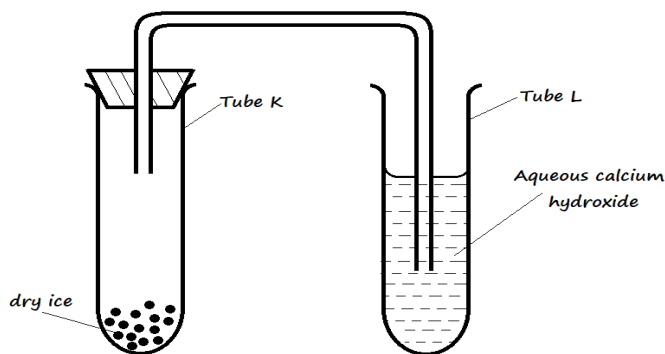
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- (c) The set up below was used to study the properties of dry ice. Study it and answer the questions that follow:



- (i) State the observation(s) that was made in tubes **K** and **L** after some time. (2 marks)

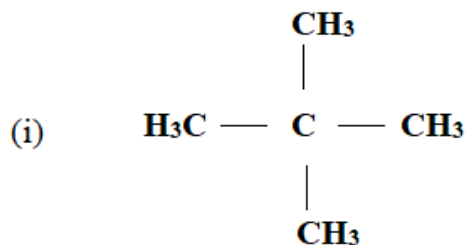
I. Tube **K**

II. Tube L

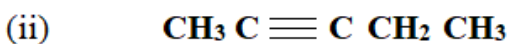
(ii) Name **two** processes that took place in tube K. (2 marks)

.....

2. (a) Give the names of the following compounds.

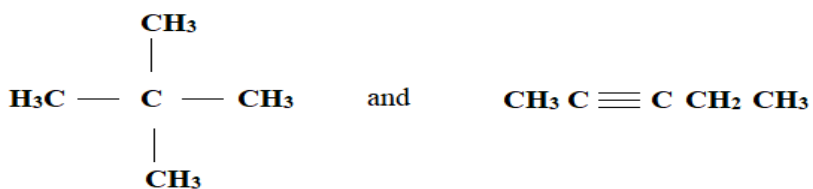


(1 mark)



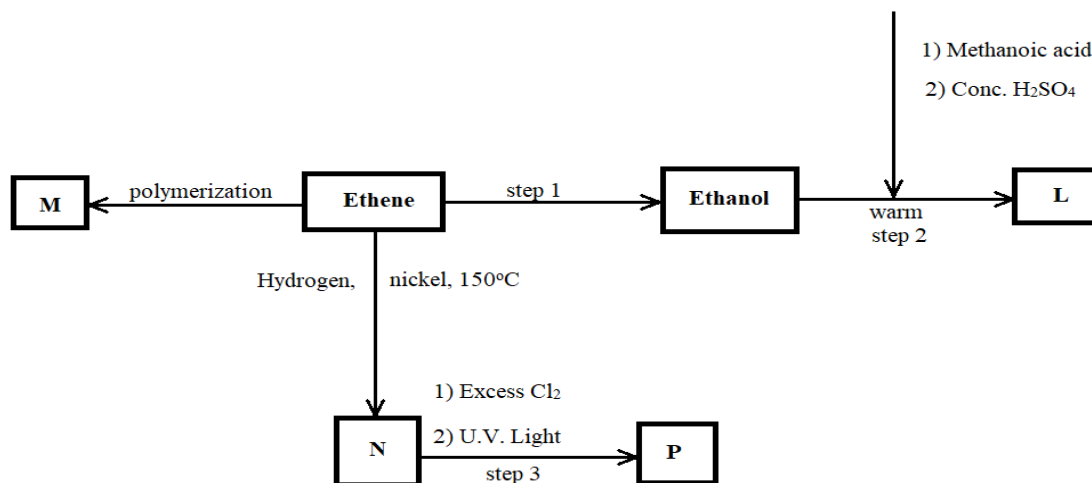
(1 mark)

(b) Describe a chemical test that can be carried out to distinguish between the compounds: (2 marks)



.....

c) Study the flow chart below and answer the questions that follow



(i) Name the compounds (2 marks)

I) L:

II) N:

(ii) Draw the structural formula of compound **M** showing **three** repeating units. (1 mark)

.....

.....

.....

.....

(iii) Give the reagent and condition used in **step 1** (2 marks)

.....

.....

.....

.....

(iv) State the type of reaction that takes place in: (2 marks)

I) **Step 2:**

II) **Step 3:**

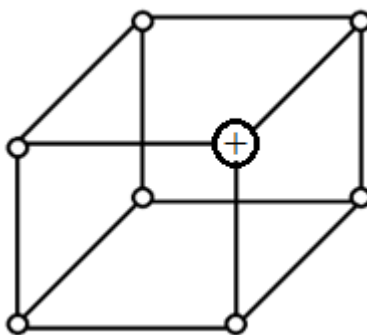
- (v) The molecular formula of **compound P** is $\text{C}_2\text{H}_2\text{Cl}_4$. Draw the **two** structural formulae of **compound P** (2 marks)

.....

.....

.....

2. (a) The diagram below represents part of the structure of a sodium chloride crystal. The position of one of the sodium ions in the crystal is shown as +.



- (i) On the diagram, mark the positions of the other three sodium ions (3 marks)

- (ii) The melting and boiling points of sodium chloride are 801°C and 1413°C respectively. Explain why sodium chloride does not conduct electricity at 25°C but does at temperatures between 801°C and 1413°C . (2 marks)

.....

.....

.....

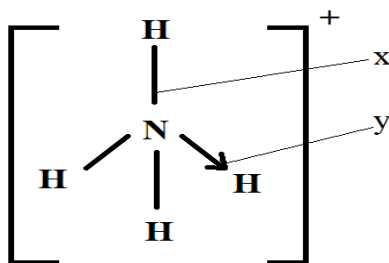
- (iii) (b) Give a reason why ammonia gas is highly soluble in water (1 mark)

.....

.....

.....

(iv) (c) The structure of an ammonium ion is shown below.



Name the types of bonds represented by the letters **X** and **Y** (1 mark)

X

Y

(d) Carbon exists in different crystalline forms. Some of these forms were recently discovered in soot and are called fullerenes.

(i) What name is given to different crystalline forms of the same elements (1 mark)

.....

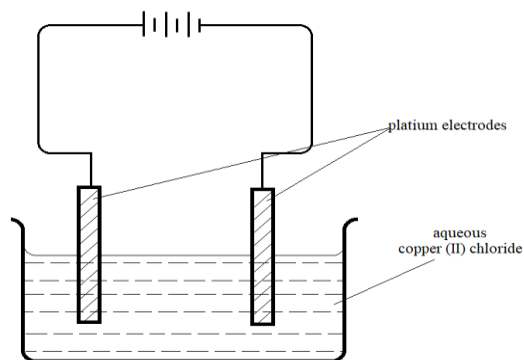
(ii) Fullerenes dissolve in methylbenzene while other forms of carbon do not. Given that soot is a mixture of fullerenes and other solid forms of carbon, describe how crystals of fullerenes can be obtained from soot. (3 marks)

.....

(iii) The relative molecular mass of one of the fullerenes is 720. What is the Molecular formula of this fullerene? (C = 12.0) (1 mark)

.....

3. The set up below was used by a student to investigate the product formed when aqueous Copper (II) chloride was electrolysed using platinum electrodes.



- (a) (i) Write the equation for the reaction taking place at the cathode. (1 mark)

.....

.....

- (ii) Name and describe a chemical test for the product initially formed at the anode when a highly concentrated solution of Copper (II) chloride is electrolysed. (3 marks)

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- (iii) How would the mass of the anode change if the platinum anode was replaced with copper metal? Explain. (2 marks)

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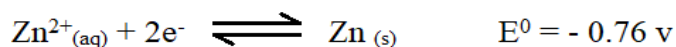
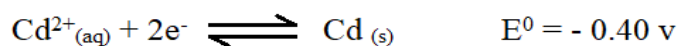
- (b) 0.6g of metal X were deposited when a current of 0.45A was passed through an electrolyte for 1 hour and 12 minutes. Determine the charge on the ion of metal X. (RAM of X = 59 1 Faraday = 96500 C) (3 marks)

.....

.....

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(c) The electrode potentials for cadmium and zinc are given below



Explain why it is not advisable to store a solution of cadmium nitrate in a container made of zinc.

(2 marks)

.....

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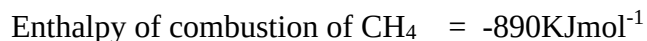
4. (a) (i) what is meant by the term Enthalpy of formation?

(1 mark)

.....

.....

(ii) The enthalpies of Carbon, methane and hydrogen are indicated below: -



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

(2 marks)

II) Determine the enthalpy of formation of methane.

(2 marks)

.....

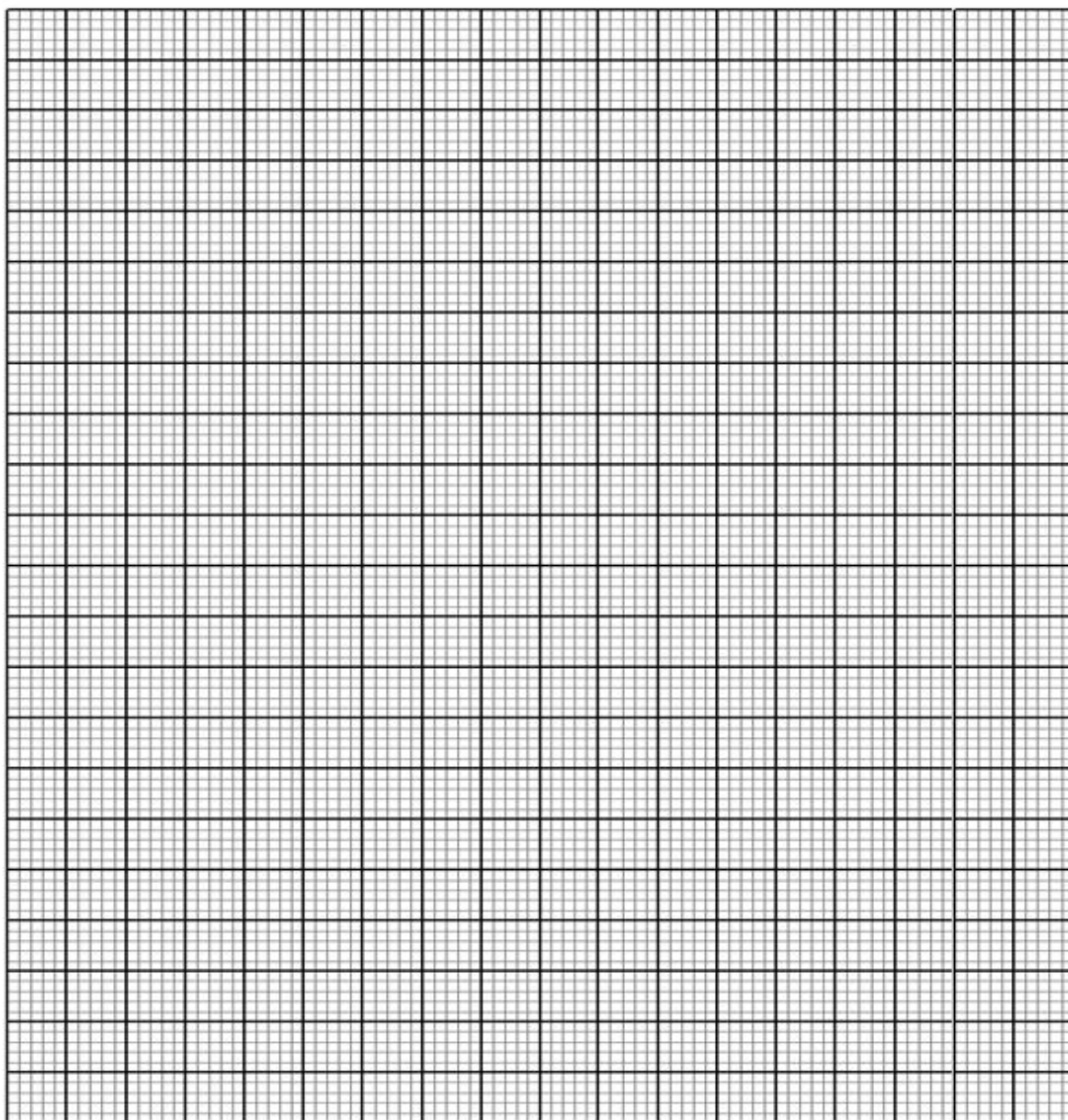
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- (b) An experiment was carried out where different volumes of dilute nitric (V) acid and aqueous potassium hydroxide both at 25°C were mixed and stirred with a thermometer. The highest temperature reached by each mixture was recorded in the table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

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

- (i) On the grid provided, plot a graph of highest temperature (vertical axis) against volume of nitric (V) acid. (3 marks)



- (ii) Using your graph, determine the:

I) Highest temperature reached

(1 mark)

.....

II) Volume of acid and base reacting when highest temperature is reached.

(1 mark)

.....

.....

.....

(iii) Calculate the amount of heat liberated during the neutralization process. (Specific heat capacity is $4.2\text{Jg}^{-1}\text{K}^{-1}$ and density of solution is 1.0gcm^{-3}). (2 marks)

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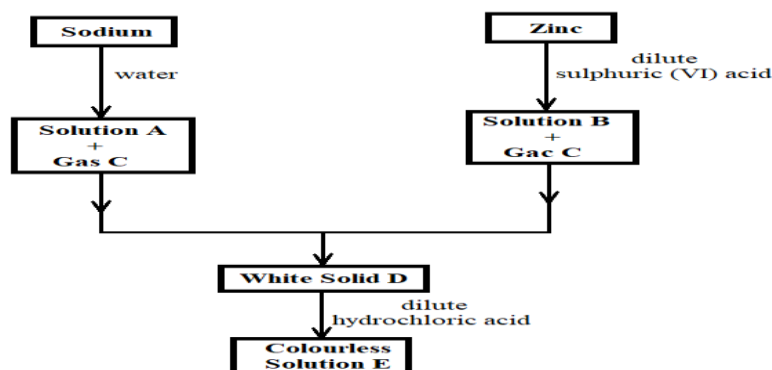
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(iv) (c) The molar enthalpy of neutralisation between nitric (V) acid and ammonia solution was found to be -52.2KJmol^{-1} , while that of nitric (V) acid and potassium hydroxide was -57.1KJmol^{-1} . Explain the difference in these values. (2 marks)

.....

.....

5. The scheme below shows the preparation of a certain salt. Study it and answer the questions that follow.



(a) Identify the following substances:

(2 marks)

Solution A

Solution B

Gas C:

Solid D

(b) (i) Write an ionic equation for the formation of solid **D**. (1 mark)

.....

(ii) Write an equation for the formation of colourless solution **E**. (1 mark)

.....

(c) (i) Describe how the identity of **gas C** can be confirmed (2 marks)

.....

(ii) Name the catalyst that can be used in the reaction between zinc and dilute sulphuric (VI) acid.

(1 mark)

.....

(d) Explain any **two** observations made when sodium reacts with water. (2 marks)

.....

.....

(e) Describe how you can obtain from **solution E**:

(i) A hydrated salt (1 mark)

.....

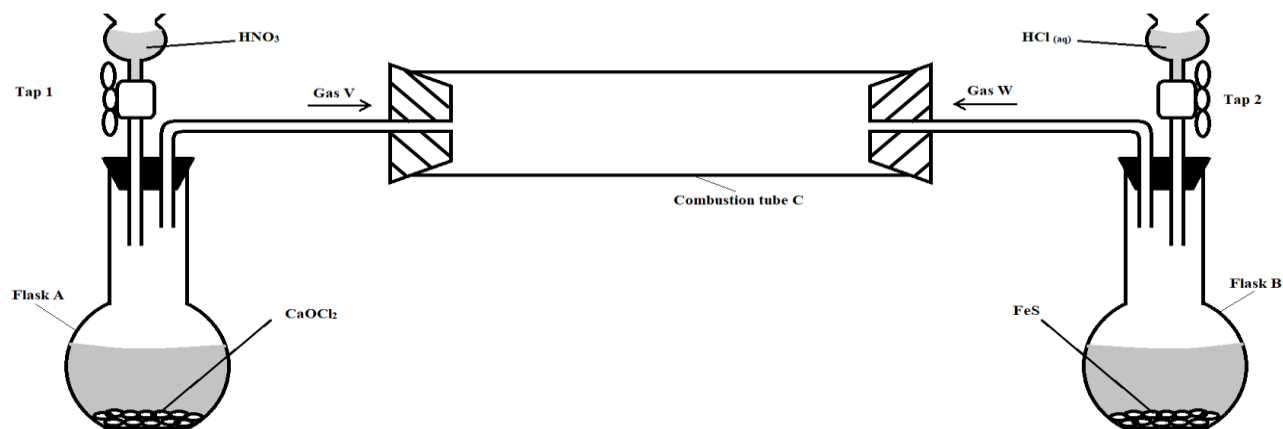
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(ii) Anhydrous salt (1 mark)

.....

.....

6. A student set up the following arrangement to prepare and react gases **V** and **W**. Use it to answer the questions that follow. (S =32, H =1, Cl =35.5).



Taps 1 and 2 were opened at the same time.

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

.....

.....

- (ii) State and explain the observations that were made in: (2 marks)

I) Flask B

.....

.....

II) Combustion tube

(2 marks)

.....

.....

- (iii) Mark on the diagram the approximate position where reaction occurred in the combustion tube. Explain your answer. (2 marks)

.....

.....

- (iv) State **one** possible objective of the experiment apart from testing whether gas **W** reacts with gas **V**.

(1 mark)

- (v) Giving a reason, state **one** precaution that should be taken when carrying out this experiment.

2mks

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233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.*
- b) Sign and write the date of examination in the spaces provided above*
- c) Answer all the questions in the spaces provided below each question. .*
- d) KNEC Mathematical tables and silent electronic calculators may be used.*
- e) All working must be clearly shown where necessary.*
- f) Candidates should answer the questions in English.*

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	14	
2	14	
3	10	
4	10	
5	11	
6	12	
7	10	
TOTAL SCORE	80	

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1. The grid below represents part of the periodic table. Study it and use it to answer the questions that follow. The letters do not represent actual symbols of the elements.

Z			X		L	D	Y	M
	Q			N				
T				K			P	

- a. To which chemical family does **element M** belong? (1 mark)
-
- b. Giving a reason, compare the following; (2 marks)
- i. Atomic radius of T and K
-
-
-
- ii. Boiling point of Y and P (2 marks)
-
-
-
-
- iii. Physical state at room temperature (25 °C) of an **oxide of Q** and an **oxide of L** (2 marks)
-
-
-
- c. An element W forms a stable ion with the formula W^{2+} . The ion of W has an electron configuration similar to the electron configuration of an **atom of M**
- i. Write the electron configuration of an **atom of W**. (1 mark)
-
- ii. Place element W in its position on the grid (1 mark)
- d. Identify the element from the grid that; (1 mark)
- i. Has the lowest first ionization energy (½ mark)
-
- ii. Forms an amphoteric oxide (½ mark)
-

- e. G is a metallic element in the same group Z and less reactive than T. Draw a dot (O) and cross(X) diagram showing how element G and D combine (1 mark)

.....

.....

.....

- f. The table below gives the atomic and ionic radii of three elements P, Q and R. Study it and use it to answer the questions that follow.

Element	Atomic radius	Ionic radius
P	0.099	0.181
Q	0.157	0.095
R	0.133	0.216

- i. Identify the element that is a good conductor of electricity. (1 mark)

.....

- ii. Give a reason for your answer in e(i) above (1 mark)

.....

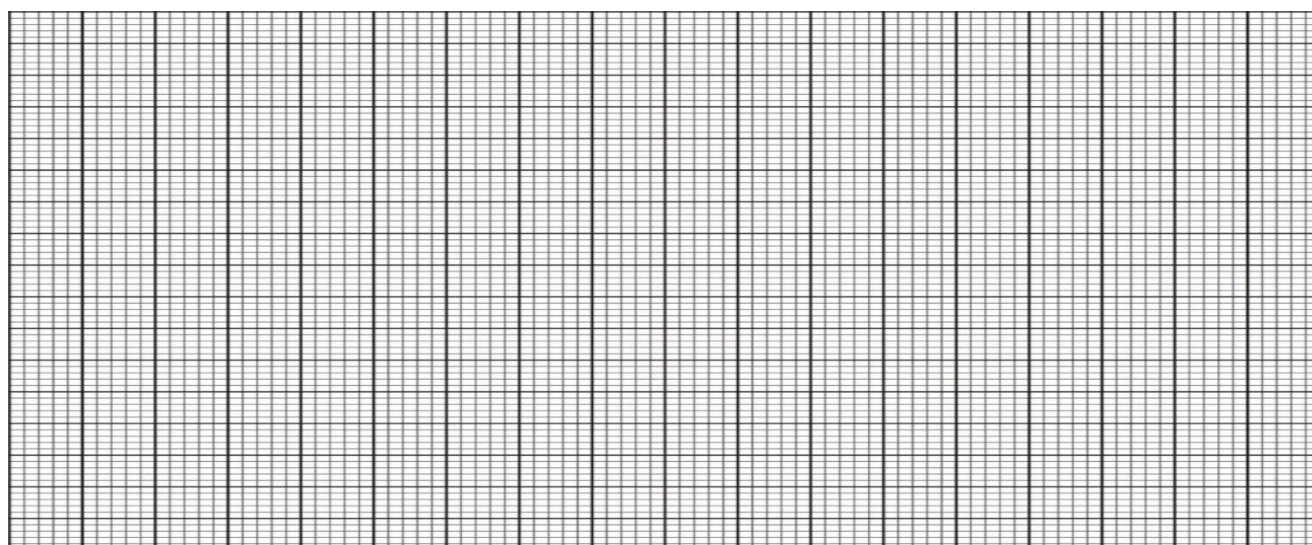
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2. In an experiment to investigate the molar enthalpy of displacement of copper (II) ions, 25 cm³ of 0.1M copper (II) sulphate solution was reacted with zinc powder. The temperature of the solution was recorded after every minute for 2 minutes. On the 3rd minute, 6g of zinc was added to the solution. The mixture was stirred with a thermometer and temperature was recorded after every minute for an additional 6 minutes. The results were recorded in the table below.

Time in minutes	0	1	2	3	4	5	6	7	8	9
Temperature (°C)	25.0	25.0	25.0	X	28.6	28.3	28.0	27.7	27.5	27.1

- a. On the grid provided, plot a graph of temperature (y– axis) against time (x – axis) (3 marks)



b. Use your graph to determine the temperature change (1 mark)

.....

c. Calculate the;

i. Enthalpy change for the reaction (density of solution = 1g/cm^3 , specific heat capacity = 4.2 kJ/Kg/K) (2 marks)

.....

.....

.....

ii Moles of copper (II) ions displaced, given that the zinc powder was in excess (1 mark)

.....

.....

iii Molar enthalpy of displacement of copper (II) ions (2 marks)

.....

.....

d) A similar reaction was carried out using the copper (II) sulphate solution and metal Q in place of zinc powder. The molar enthalpy change was found to be -201kJ/mol .

i. Compare the reactivity of element Q and zinc. (1 mark)

.....

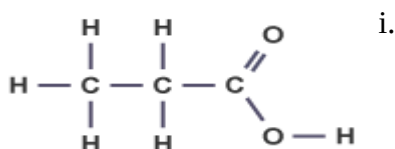
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ii. Explain your answer in d(i) above (1 mark)

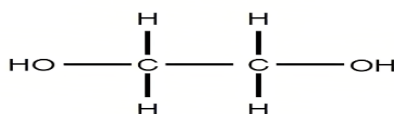
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3. a) Name the following compounds; (2 marks)



ii.



b) An organic compound has the molecular formula C_5H_{12} .

i. To which homologous series does the compound belong? (1 mark)

.....

ii. Define isomers (1 mark)

.....

.....

.....

iii. Draw and name two isomers of the compound. (2 marks)

.....

.....

.....

.....

.....

c) In an experiment, ethanol was reacted with acidified potassium manganate (VI) to form product T

i. Identify the product T (1 mark)

.....

ii. Name the process of converting ethanol to product T (1 mark)

.....

iii. State the observation made when;

Acidified potassium manganate (VII) is added to ethanol (1 mark)

.....

.....

Sodium carbonate is added to solution T (1 mark)

.....

.....

d) An organic compound L has the formula $CH_3CH_2CH_2COOCH_3$.

i. To which group of organic compounds does it belong to. (1 mark)

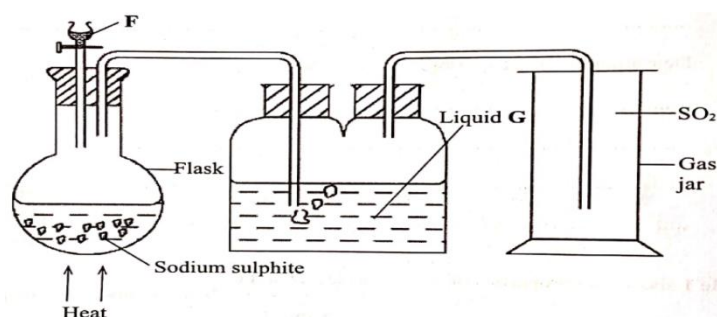
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ii. Identify the two substances that react to give the compound above (2 marks)

.....

.....

4. The set – up below was used to prepare sulphur (IV) oxide in the laboratory. Study it and use it to answer the questions that follow.



- a. Identify (1 mark)
 - (i) Liquid F.....
 - (ii) Liquid G.....
- b. State the role of liquid G (1 mark)

.....

.....
- c. State and explain two observations made when moist blue litmus paper is put in the gas jar. (2 marks)

.....

.....

.....
- d. Sulphur (IV) oxide is used industrially in the manufacture of sulphuric (VI) acid.
 - i. Name the process (1 mark)

.....
 - ii. Identify two raw materials used in the process named above (1 mark)

.....
 - iii. Name the most suitable catalyst used (1 mark)

.....
 - iv. Write an equation for the reaction in the catalytic chamber (1 mark)

.....
- e. State and explain the observations made when concentrated sulphuric (VI) acid is added to the following
 - i. Glucose (1 mark)

.....

.....

.....

ii. Hydrated cobalt (II) chloride (1 mark)

.....

.....

.....

5. a) Define the following terms; (3 marks)

i. Deliquescence

.....

.....

ii. Strong acid

.....

.....

iii. Saturated solution

.....

.....

b) Starting with lead (II) oxide, describe how you can obtain a dry sample of lead (II) sulphate in the laboratory. (3 marks)

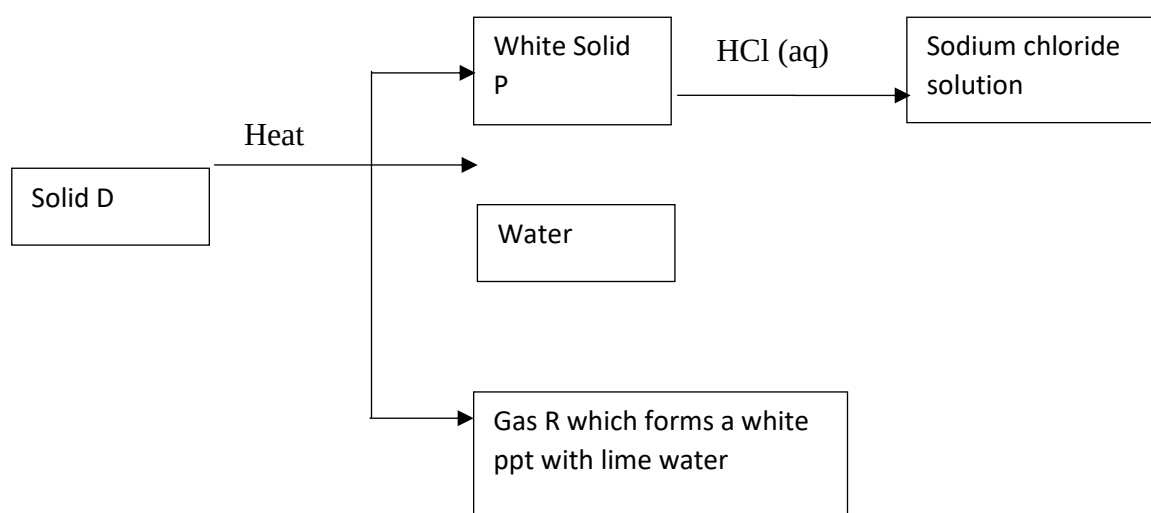
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c) Study the flow diagram below and use it to answer the questions that follow.



- i. Identify the following (1 ½ marks)
- Solid D
- White solid P
- Gas R

- ii. State and explain the observation made when lead (II) nitrate is added to sodium chloride solution (1 ½ mark)

.....

.....

.....

- d) Study the equation below and answer the question that follows



Giving a reason, identify the;

- i. Acid (1 mark)

.....

.....

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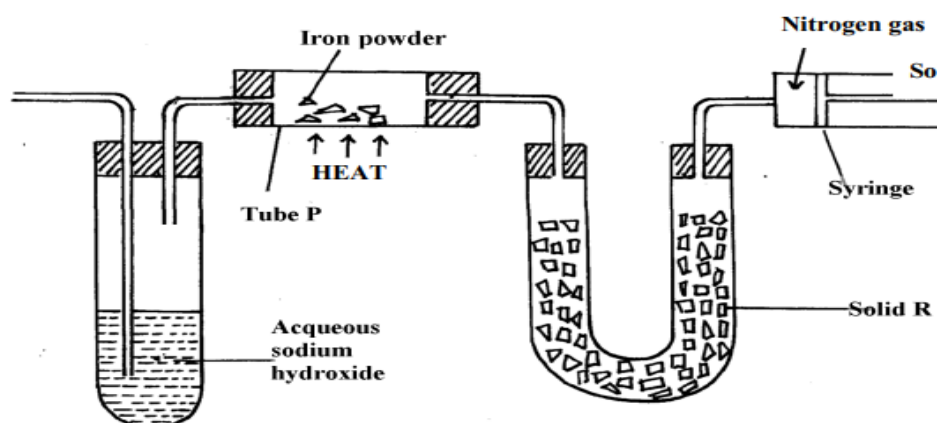
- ii. Base (1 mark)

.....

.....

.....

5. The set up below was used to isolate nitrogen from a sample of air. Use it to answer the questions that follow.



- a. Name solid R and state its role (2 marks)

Name

Role.....

b. Identify the substance removed in the; (2 marks)
i. Boiling tube
.....

ii. combustion tube
.....

c. Write an equation for the reaction in the boiling tube (1 mark)
.....

d. Explain what would happen if iron powder is replaced with magnesium powder (1 mark)
.....

e. Name the impurity collected in the syringe (1 mark)
.....

f. State two uses of nitrogen gas (1 mark)
.....
.....

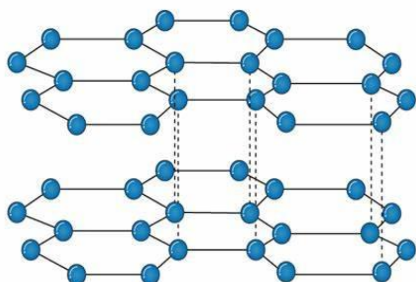
g. Ammonia gas is prepared in the lab by reaction of ammonium chloride with solid F

i. Name solid F (1 mark)
.....

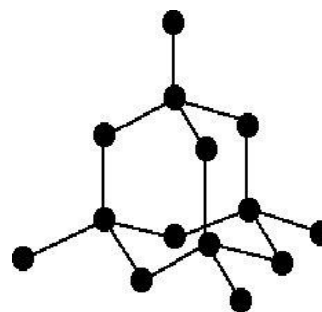
ii. Name the most suitable substance used to dry ammonia gas (1 mark)
.....

iii. State two physical properties of ammonia gas (2 marks)
.....
.....
.....

7. a) The diagrams below represent allotropes of carbon



Allotrope X



Allotrope Y

i. Define allotropes (1 mark)

.....

.....

.....

ii. Identify allotrope (2 marks)

X

Y

iii. Using structure and bonding, explain one physical difference between the two allotropes (2 marks)

.....

.....

.....

b) Carbon reacts with **excess** oxygen to form a gaseous oxide of carbon

i. State the nature of the oxide formed (1 mark)

.....

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

.....

iii. 400g of carbon was burnt in **limited** oxygen gas. Calculate the volume of the gaseous product formed at R.T.P (C=12.0, O=16.0, Molar gas volume at RTP=24,000 cm³) (3 marks)

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233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.
- b) Sign and write the date of examination in the spaces provided above
- c) Answer all the questions in the spaces provided below each question. .
- d) KNEC Mathematical tables and silent electronic calculators may be used.
- e) All working must be clearly shown where necessary.
- f) Candidates should answer the questions in English.

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Question	Maximum Score	Candidates score
1	13	
2	15	
3	11	
4	10	
5	10	
6	10	
7	11	
TOTAL SCORE	80	

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

E							F
G	D				K		N
			W		T		M
R	Q					Y	

- a) i) Which letter represents an element that is least reactive? (1 mark)
-
- ii) Why are elements D and Q referred to alkali earth metals? (1 mark)
-
-
- b) How does the atomic radius of W and T compare? Explain. (2 marks)
-
-
-
- c) Select **two** letters representing elements that would react most explosively. (2 mark)
-
-
- d) Write the equation showing how Y forms its ion. (1 mark)
-
-
- e) Write the formula of:-
- i) Chloride of D. (½ mark)
-
-
- ii) Nitrate of W. (½ mark)
-
-
- f) What type of bonding exists between;
- i) G and N. (½ mark)
-
- ii) K and Y. (½ mark)
-
- g) Explain why melting point of Y is higher than N. (1 mark)

h) The 1st, 2nd and 3rd ionization energies (in KJ/mol) of elements G and R are given below.

Element	1 st I.E	2 nd I.E	3 rd I.E
G	520	7,300	9,500
R	420	3,100	4,800

i) Define the term ionization energy.

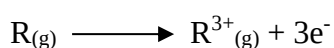
(1 mark)

ii) Apart from the decrease in energy levels, explain the big difference between 1st and 2nd ionization energies.

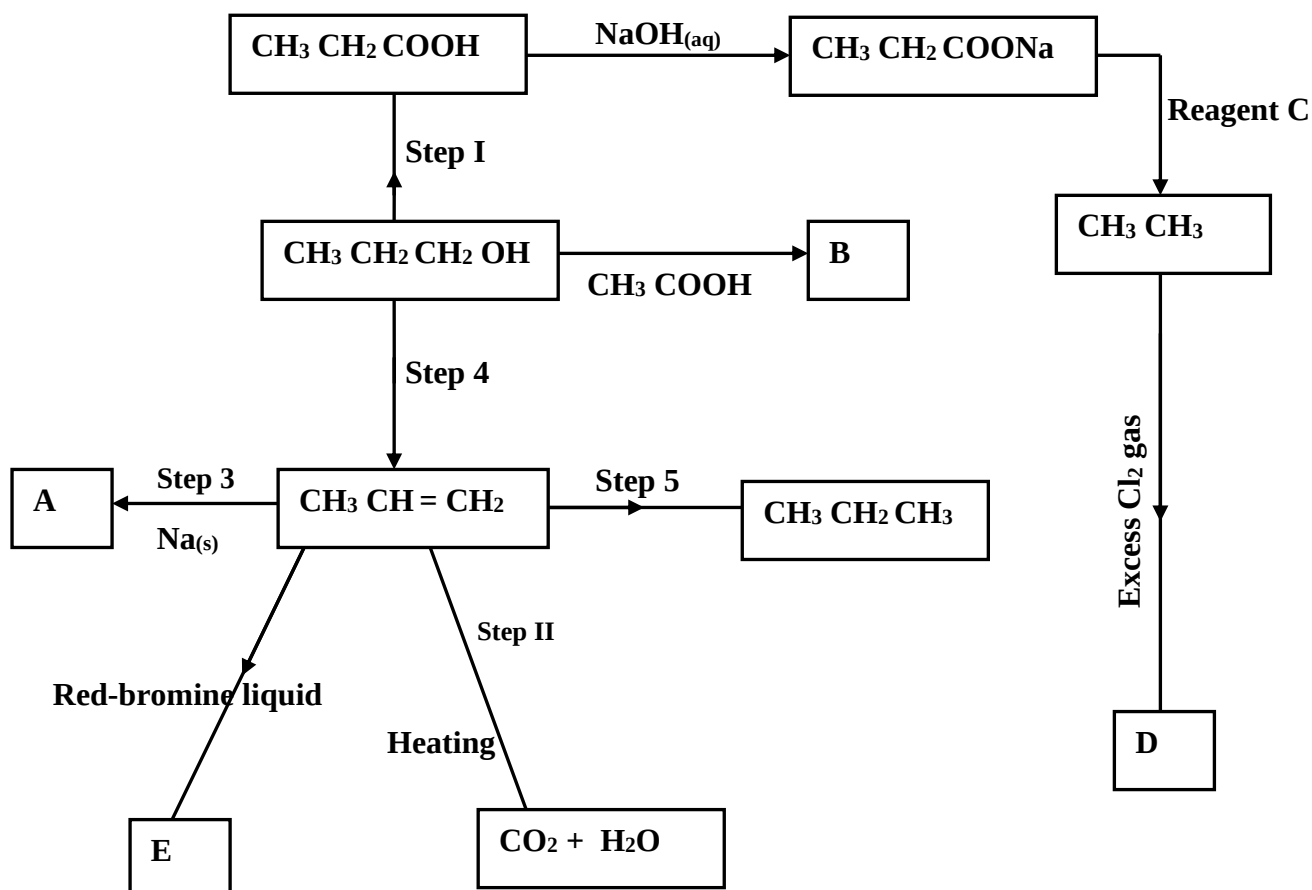
(1 mark)

iii) Calculate the amount of energy in KJ/mol for the process.

(1 mark)



2. I. The scheme below shows some organic reactions. Study it carefully and answer the questions that follow.



a) Write the formula of compounds. (2 marks)

i) B

.....
.....

ii) A

.....
.....

b) Name the type of reaction, reagent and conditions for the reactions of the following steps.

i) Step 1: (2 marks)

Type.....

Reagent

.....

ii) Step 4: (2 marks)

Type.....

Reagent

.....

iii) Step 5: (2 marks)

Type.....

Reagent

.....

c) Name reagent C.

.....

d) Draw and name the structural formula of D. (2 marks)

.....
.....
.....
.....

e) Name the structure E. (1 mark)

.....

f) Give **one** property of compound B. (1 mark)

.....
.....

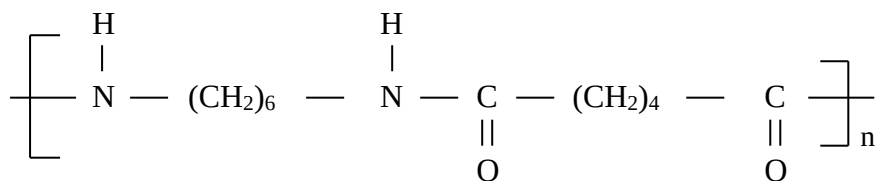
II. Polymers and fibres are either synthetic or natural.

i) Give **two** examples of synthetic fibres and polymers. (1 mark)

.....

.....

 ii) A polymer is formed whose formula is;

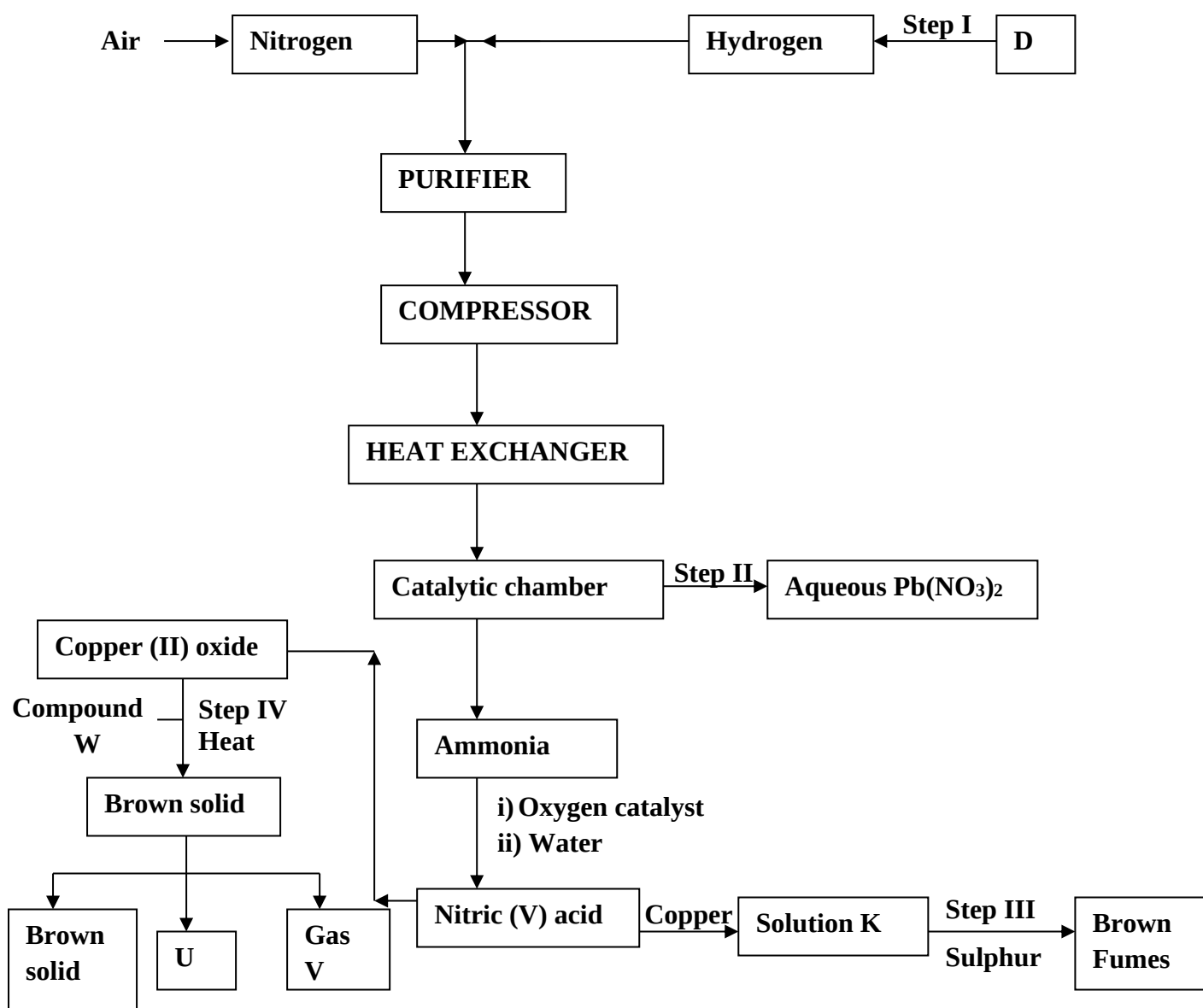


Draw the structural formula of the monomers.

(2 marks)

.....

3. Study the scheme below and answer the questions that follow.



a) Name the impurities removed by the purifier.

(2 marks)

.....

.....

.....

b) What is the work of the heat exchanger? (1 mark)

.....

.....

c) Write down the chemical equation for the reaction taking place where Nitric (V) acid is formed. (1 mark)

.....

.....

d) Name;

i) Compound W. (1 mark)

.....

ii) Substance U. (1 mark)

.....

iii) Gas V. (1 mark)

.....

e) Write down the formula of compound P. (1 mark)

.....

f) Other than manufacture of ammonia write down **one** other use of Nitrogen. (1 mark)

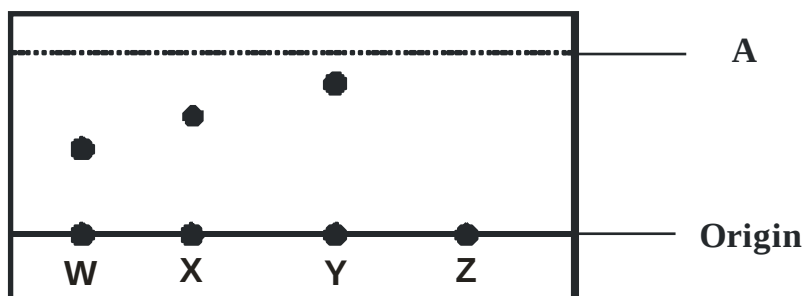
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g) Calculate the mass of Nitrogen in 6.6g of Ammonium Sulphate. (H = 1, S = 32, O = 16). (2 marks)

.....

.....

4. The diagram below represents a paper chromatogram of pure substances W, X, Y and Z.



a) Name A. (1 mark)

.....

- b) Explain why substance Y moves faster from origin than X. (1 mark)

.....
.....

- c) Explain the observation made on substance Z in the chromatogram. (1 mark)

.....
.....

- d) The relationship between pressure and volume of a fixed mass of a gas was studied at 25°C. The data was recorded as shown in table below.

Volume (dm ³)	0.5	1	2	3
Pressure (atmosphere)	6	3	1.5	1
Product of volume and pressure				

- i) Complete the table by calculating the products of volume and pressure. (2 marks)
- ii) Using the data comment on the relationship between volume and pressure of fixed mass of gas at constant temperature. (1 mark)

.....
.....
.....

- e) Use the information below to answer the questions that follow.



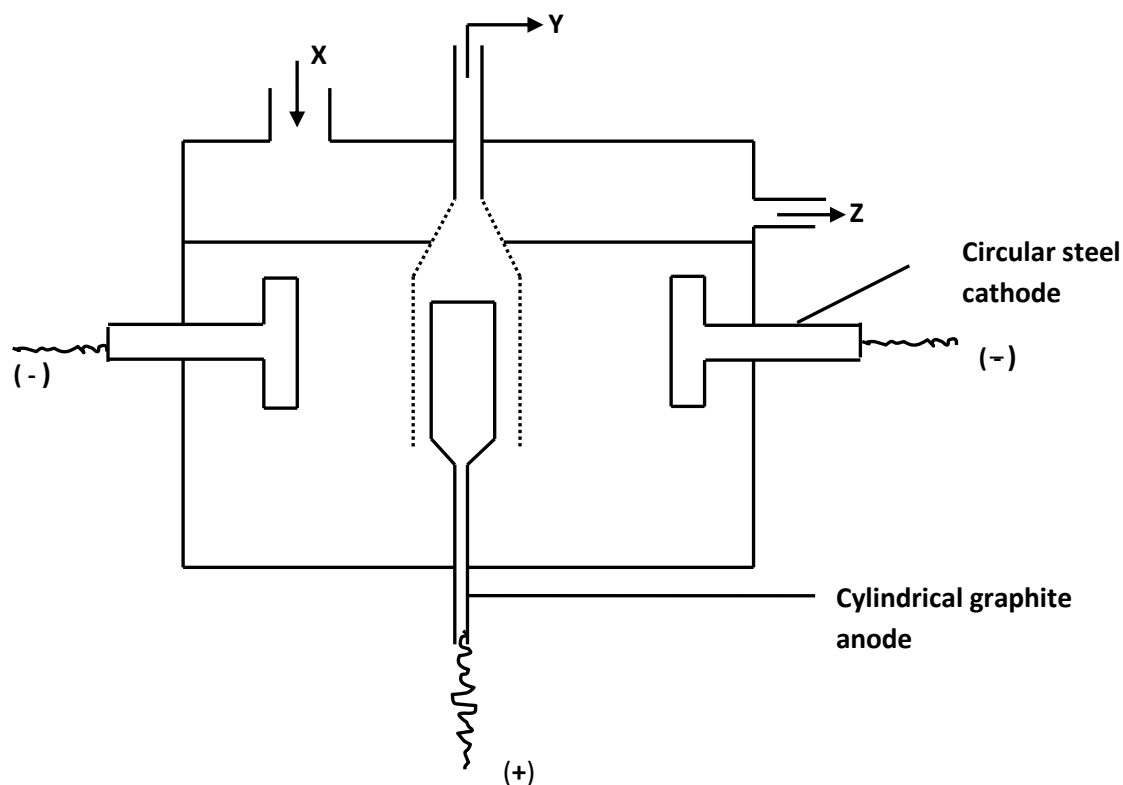
- i) Define the term heat of formation. (1 mark)

.....
.....

- ii) Calculate the heat of formation of ethanol. (3 marks)

.....
.....
.....
.....
.....
.....

5. a) Sodium is extracted in the Downcell shown below.



i) Name Y. (1 mark)

.....

ii) Down's cell must operate at high temperature of about 600°C . Explain. (2 marks)

.....

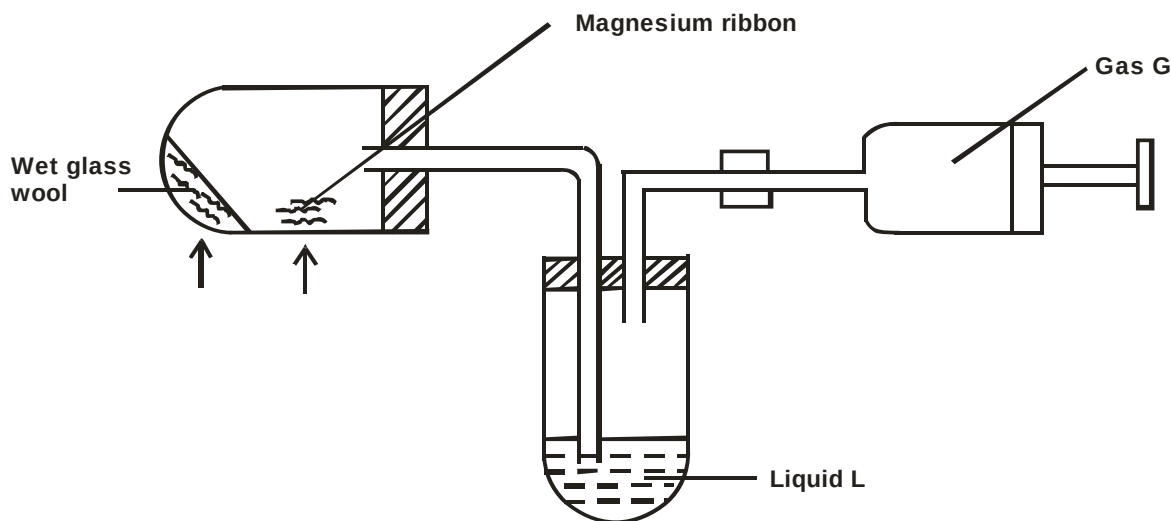
iii) Explain why anode is made of graphite instead of steel though it's a better conductor. (1 mark)

.....

iv) State the purpose of steel diaphragm. (1 mark)

.....

b) The set up below was used to prepare and collect dry sample of gas G. During the experiment, cleaned magnesium ribbon was strongly heated before heating the wet glass wool.



i) Why was the magnesium ribbon cleaned before it was used? (1 mark)

.....

.....

ii) State the observations that would be noted in the reaction tube. (1 mark)

.....

.....

iii) Name;

a) Gas G. (1 mark)

.....

b) Suitable liquid L. (1 mark)

.....

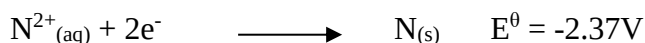
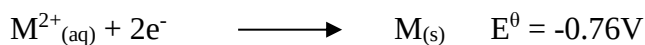
iv) Write equation of reaction in the reaction tube. (1 mark)

.....

.....

6. I) Study the standard electrode potential below and answer the questions that follow.

The letters are not the actual symbols of the elements.



a) The standard electrode potential of Fe^{2+} is -0.44 volts. Select the element which would be best to protect iron from rusting. (1 mark)

.....

.....

b) i) Calculate the E^{θ} value for cell represented as $M_{(s)} / M^{2+}_{(aq)} // P^{+}_{(aq)} + P_{(s)}$. (2 marks)

.....

.....

.....

ii) Draw the electrochemical cell represented in b(i) above. (2 marks)

.....

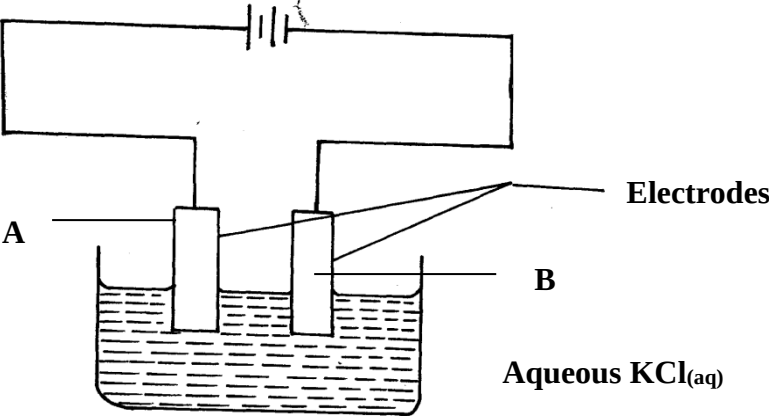
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II) The diagram below represents an experiment by a student.



- a) Name the products at the electrodes. (1 mark)
-
- b) Write equation of reaction at each electrode. (1 mark)
-
-

III) During purification of copper by electrolysis, 1.48g of copper were deposited when a current was passed through aqueous copper (II) sulphate for 2½ hours. Calculate the amount of current that was passed. CU = 63.5 and 1 Faraday = 96500C. (3 marks)

.....

.....

.....

.....

.....

.....

7. a) Define the term solubility. (1 mark)

.....

.....

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

Temp °C	0	8	20	40	60	80
Solubility in g/100g of the H ₂ O	254	225	140	80	25	10

i) Plot a graph of solubility in g/100g of water of copper (II) sulphate against temperature. (4 marks)

ii) From the graph,

a) How does the solubility of Copper (II) sulphate vary with temperature? (1 mark)

.....

b) Determine solubility of Copper (II) sulphate in g/100g water at 35°C. (1 mark)

.....

.....

iii) If 30g of Copper (II) sulphate are dissolved in 100g of water at 30°C, is the resulting solution saturated, supersaturated or unsaturated. (1 mark)

.....

iv) A saturated solution of copper (II) sulphate is cooled from 70°C to 20°C.

a) Should the mass of copper (II) sulphate be reduced or increased for the solution to remain saturated. (1 mark)

.....

b) Determine the amount of mass in (iv) (a) above. (2 marks)

.....

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Kenya Certificate of Secondary Education

KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name Admission number

Candidate's Signature.....Date.....

ASUMBI GIRLS' TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.*
- b) Sign and write the date of examination in the spaces provided above*
- c) Answer all the questions in the spaces provided below each question. .*
- d) KNEC Mathematical tables and silent electronic calculators may be used.*
- e) All working must be clearly shown where necessary.*
- f) Candidates should answer the questions in English.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1	12	
2	10	
3	13	
4	11	
5	13	
6	10	
7	9	
TOTAL	80	

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

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

- a) Write the general name given to the element P belong. **(1mark)**
-
- b) An element N has an atomic number of 15. Write down its electronic arrangement and hence fix it in its right position on the grid above. **(1mark)**

Electronic arrangement

- c) Compare the size of the atom of R and that of its ion. Explain your answer. **(2mks)**

.....

.....

.....

.....

- d) Give the formula of the compound formed between **(1mark)**

i. P and W

ii. T and Y

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

.....

.....

.....

- f) State the least reactive element in the grid. Give a reason for your answer **(1mk)**

.....

.....

- g) Give two advantages that element S has over element Q in making electric cables **(2mks)**

.....

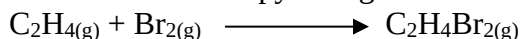
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- h) Draw (a) dot (.) and cross (x) diagram to represent the bonding in compound formed between T and Y **(2 marks)**

2) a) Study the table below and answer the questions that follow

<u>Bond type</u>	<u>bond energy kJmol⁻¹</u>
C-C	346
C = C	610
C-H	413
C-Br	280
Br-Br	193

- i) Calculate the enthalpy change for the following reaction **(3 marks)**



- ii) Name the type of reaction that took place in (a) above **(1mark)**

- b) Butane C_4H_{10} cannot be prepared directly from its elements but its standard heat of formation (ΔH_f^θ) can be obtained indirectly.

The following heats of combustion are given.

$$\Delta H_c^\theta (\text{Carbon}) = -393\text{kJ/mol}$$

$$\Delta H_c^\theta (\text{Hydrogen}) = -286\text{kJ/mol}$$

$$\Delta H_c^\theta (\text{Butane}) = -2877\text{kJ/mol}$$

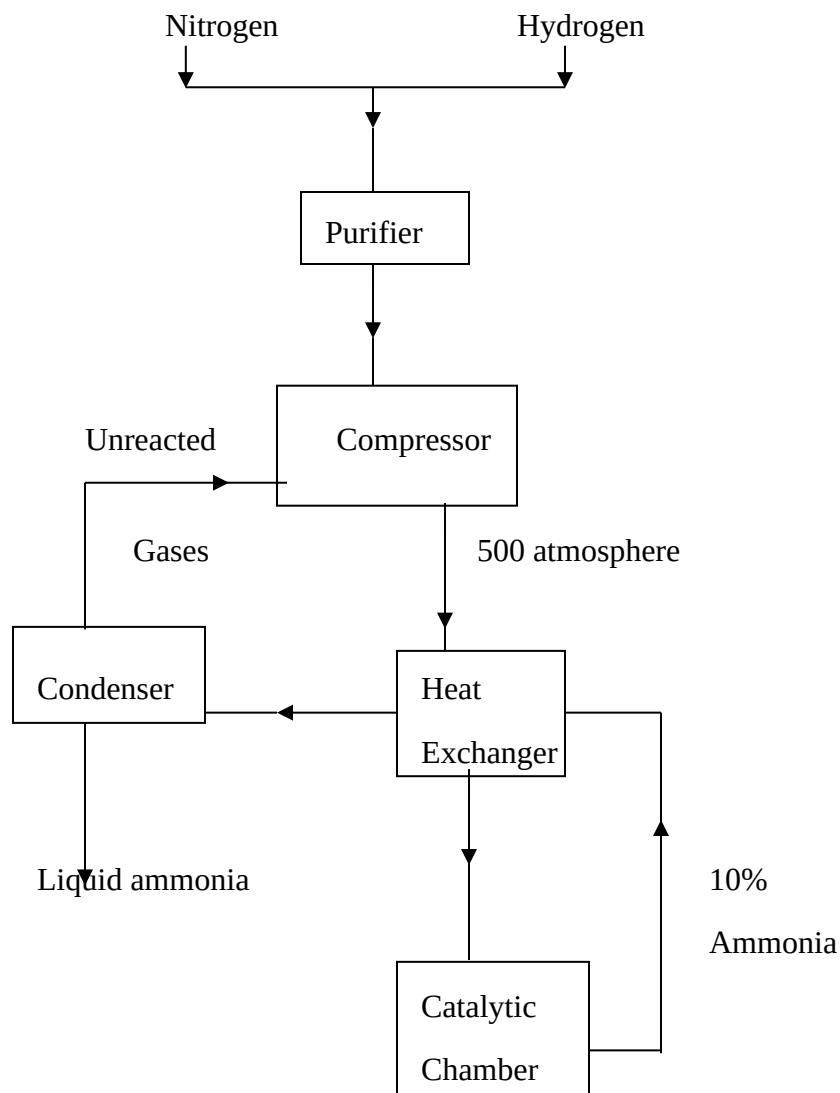
- i) Draw an energy cycle diagram linking the heat of formation of butane with its heat of combustion and the heat of combustion of its constituents elements.

(2mk)

- ii) Calculate the heat of formation of butane $\Delta H_f^\theta (\text{C}_4\text{H}_{10})$ **(2mks)**

- c) Given that the lattice enthalpy of potassium chloride is $+690\text{kJ/mol}$ and hydration enthalpies of K^+ and Cl^- are -322kJ and -364kJ respectively. Calculate the enthalpy of solution of potassium chloride. **(3 mks)**

- 3) The diagram below represents the Haber process for the manufacture of ammonia. Study it and answer the questions that follow.



- a) Name any two impurities removed by the purifier.

(1mark)

b) The catalyst used in the process is finely divided iron. Why iron is finely divided? (1mk)

c) In the Haber process the conversion of nitrogen and hydrogen into ammonia is only 10%.

The remaining unreacted gases are recycled. What is the advantage of this? (1mk)

d) A part from iron catalyst and pressure of 500 atmospheres, name any other condition required for this process. (1mk)

e) Give any two uses of ammonia (1mk)

f) In the manufacture of nitric (v) acid from ammonia and air, ammonia is catalytically oxidized to nitrogen (ii) oxide

(i) Name the catalyst used in this reaction (1mk)

(ii) Write a balanced chemical equation for the reaction between ammonia and air. (1mk)

(iii) State one environmental problem likely to be faced in an area where nitric (v) acid manufacturing plant is located. (1mark)

g) (i) In the preparation of chlorine gas in a school laboratory, either manganese (IV) oxide or potassium manganate(VII) may be used on concentrated hydrochloric acid. State one advantage of potassium manganate (VII) over manganese (IV) oxide in this reaction. (1mark)

(ii) State and explain what would be observed when dry litmus papers are dipped in a gas jar of chlorine.
(1mark)

(iii) Freshly prepared chlorine water bleaches but chlorine water exposed to sunlight for sometime does not bleach. Explain.
(2marks)

(iv) When preparing hydrogen chloride gas from sodium chloride and sulphuric (VI) acid, two conditions are necessary. State the conditions.
(1mark)

4) A label on the bottle containing Sulphuric (IV) acid has the following information

- Density = 1.836 g/cm³
- Percentage purity = 98%
- Relative formula mass = 98

(a) Calculate:

- i. The concentration of the acid (3 mks)

- ii) The volume of concentrated sulphuric (IV) acid that should be diluted to produce 2 litres of 2 M Sulphuric (IV) acid (2 mks)

(b) A solution of sodium hydroxide was found to contain 12.4g/dm³ of sodium hydroxide. 25cm³ of this solution reacted with 15cm³ of a solution of sulphuric (VI) acid. (Na=23.0, H=1.0, S=32.0, O=16.0)

(i) Find the molarity of the sodium hydroxide solution. (1 mark)

(ii) Calculate the number of moles of sodium hydroxide solution used. (1 mark)

(iii) Calculate the number of moles of the acid used. (1 mark)

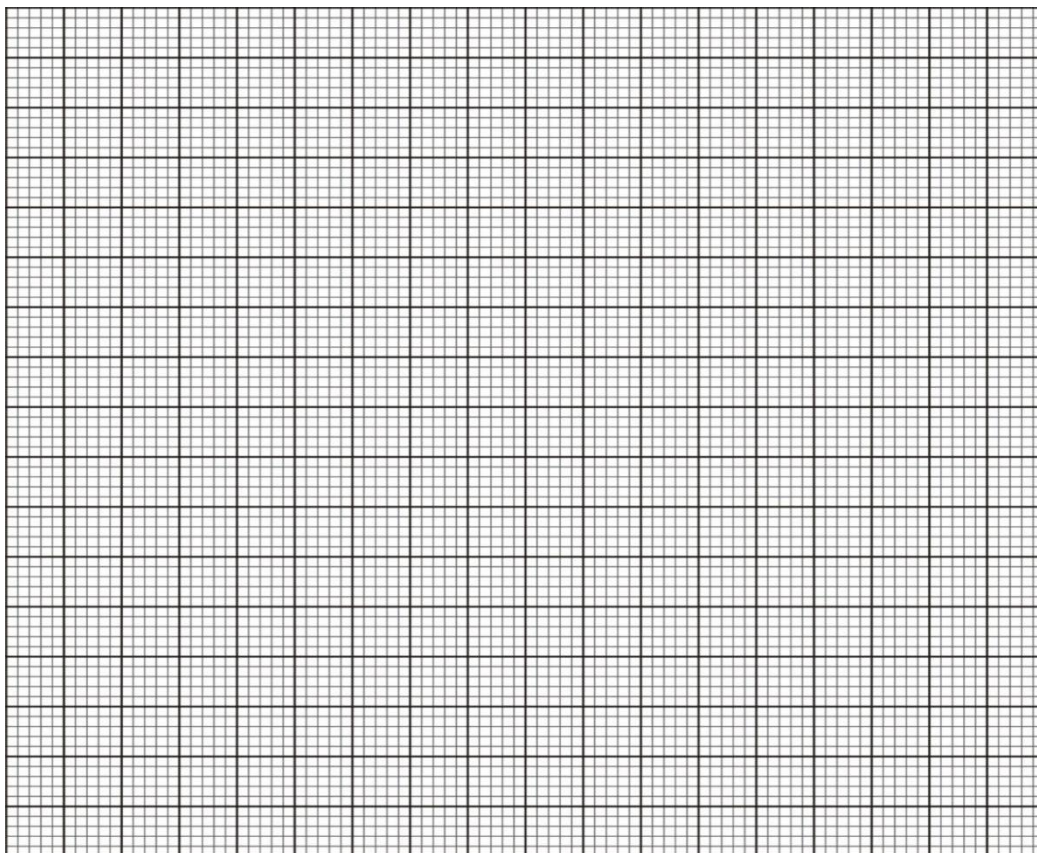
(iv) Determine the concentration of the sulphuric (VI) acid solution in g/dm^3 . (3marks)

5) Define a saturated solution. (1 mark)

(b) The table below represent the solubilities of sodium nitrate and Sulphur (IV) oxide at different temperatures.

Temp (°C)	10	18	26	34	42
Solubility of Sodium Nitrate (g/ 100g of water)	20	29	40	53	68
Solubility of Sulphur (IV) Oxide (g/ 100g of water)	78	55	45	40	36

On the grid provided below, plot a graph of solubilities of sodium nitrate and Sulphur (IV) oxide against temperature. (4 marks)



Using the graph;

- i. Determine the solubility of Sulphur (IV) oxide at 16°C. (1 mark)

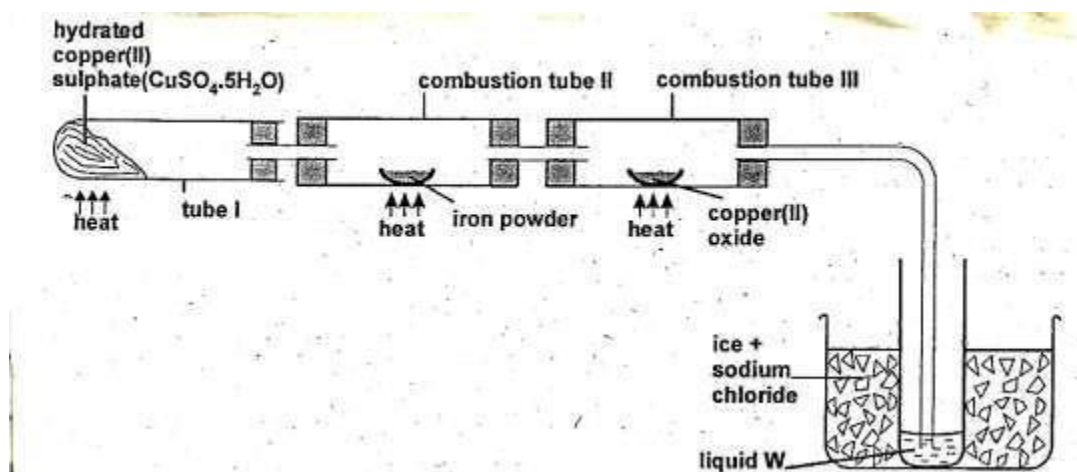
- ii. The concentration, in moles per litre, of sodium nitrate at 16 °C. (assume density of solution is 1 g/cm³) (Na=23, O=16, N=14). (3 marks)

- iii. Mass of crystals formed when a solution of sodium hydroxide is cooled from 40°C to 26°C. (2 marks)

- iv. What is the relationship between solubility of sodium nitrate and temperature? (1 mark)

- (c) Give one advantage of hard water. (1 mark)

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



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

(ii) suggest property of gas A under investigation (1 mark)

(iii) Write chemical equations for the reactions in the;
Boiling tube I (1 mark)

Combustion tube II (1 mark)

b) (i) State and explain the observation made in
Tube I. (1 mark)

Combustion tube II (1 mark)

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

(ii) Name one other substance that comes out of tube III. (1 mark)

(iii) Name liquid W. (1 mark)

(iv) What is the role of sodium chloride in the ice (freezing mixture) (1 mark)

7. Study the condensed formulae below and answer the questions that follow

(a) I $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CHCH}_2$

II $\text{CH}_3\text{CHCH}(\text{CH}_3)\text{CH}_3$

i. Draw the structural formula of each of the compounds I and II (2mks)

I. .

II.

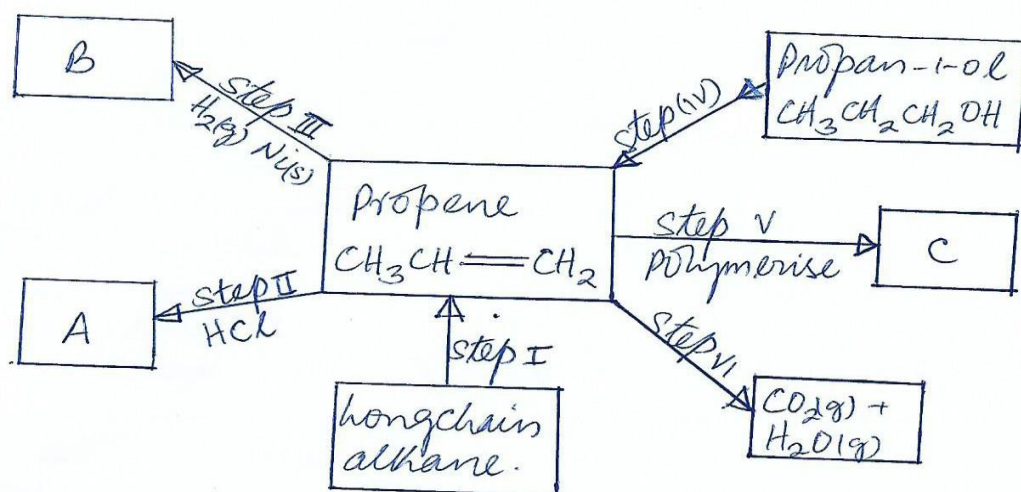
ii. Give the systematic name of each of the compounds represented by the formulae above (2mks)

I _____

II _____

iii. To which homologous series does the compound represented by I belong (1/2 mk)

(b) The flow chart below shows some reactions starting with a long chain alkane. Study it and answer the questions that follows.



- i. Name substance (1½ mks)
 - A _____
 - B _____
 - C _____
- ii. What is the name given to the process represented by
 - Step I _____ (½ mk)
 - Step III _____ (½ mk)
 - Step IV _____ (½ mk)
 - Step VI _____ (½ mk)
- iii. Write down the chemical equation represented by the reaction in step VI (1mk)

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KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name Admission number

Candidate's Signature.....Date.....

KENYA HIGH SCHOOL TRIALS

Instructions to candidates

- (a) Write your name, admission number, index number, and stream in the spaces provided above.
- (b) Sign and write the date of the examination in the spaces provided
- (c) Answer **ALL** the questions in the spaces provided.
- (d) Candidates **MUST** answer all questions in English.
- (e) KNEC mathematical tables and silent non-programmable electronic calculators may be used.
- (f) This paper consists of **13** printed pages
- (g) Candidates should **check** the question paper to ascertain that **ALL** the pages are printed as indicated and that **NO QUESTIONS ARE MISSING**

For examiners' use only.

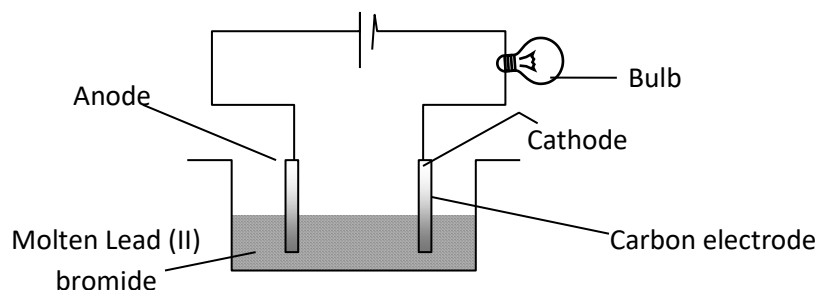
Questions	Max-score	Candidates score
1	12	
2	14	
3	13	
4	11	
5	12	
6	12	
7	8	
Total score = 80		

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1. The set-up was used to electrolyse Lead (II) bromide. Study it and answer the questions that follow;



- (a). Write an ionic equation for the reaction that occurred at the cathode (1 mark)

.....

- (b). State the observation made at the anode (1 mark)

.....

- (c). Study the following half reactions and answer the questions that follow

	E^0/Volts
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Zn}(\text{s})$	-0.76
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Fe}(\text{s})$	-0.44
$\text{Br}_2(\text{l}) + 2\text{e}^- \rightleftharpoons 2\text{Br}^-(\text{aq})$	+1.36
$\text{Fe}^{3+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Fe}^{2+}(\text{aq})$	+0.77
$\text{Ce}^{4+}(\text{aq}) + \text{e}^- \rightleftharpoons \text{Ce}^{3+}(\text{aq})$	+1.61

- (i). Identify the strongest reducing agent. (1 mark)

.....

- (ii). Which substance from the table can be used to convert bromide ions to bromine molecules (1 mark)

.....

- (iii). Which pair can be used to construct a cell with highest emf. (1 mark)

.....

- (iv). Write the cell representation above (1 mark)

.....

- (v). Calculate the emf of the cell above (2 marks)

.....

(d).During the electrolysis of aqueous copper(ii) sulphate using copper electrode, a current of 0.2 amperes was passed through the cell for 5 hours.

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

.....

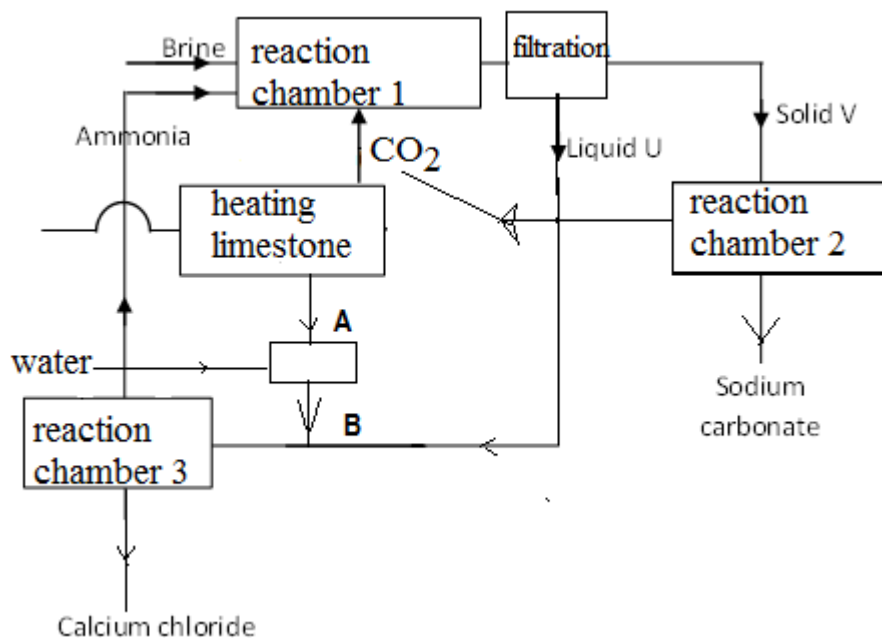
ii) Determine the change in the mass of the anode which occurred as a result of the electrolysis process. (Cu=63.5, 1 Faraday=96,500 Coulombs) **(3 marks)**

.....

.....

.....

2. The figure below shows the stages in the manufacture of sodium carbonate. Study the diagram below and use it to answer the questions that follow.



a) (i) Name **three** starting materials in the manufacturer of sodium carbonate. **(1½ marks)**

.....

.....

(ii) Name three substances that are recycled in this process. **(1½ marks)**

.....

(iii) Identify the chambers in which the recycled substances are regenerated. **(1 mark)**

.....

.....

(iv) Name the substances U and V. **(1 mark)**

.....

b) Write an equation for the reaction which occurs:

(i) In the reaction chamber 1 (1 mark)

.....

(ii) When solid V is heated. (1 mark)

.....

(iii) In the reaction chamber 3. (1 mark)

.....

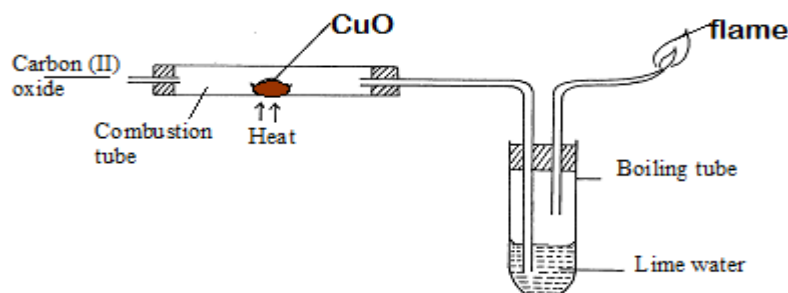
c) State **one commercial use for Sodium carbonate** (1 mark)

.....

(d) Give a reason why the Solvay plant is located near a river (1 mark)

.....

(e) Study the experimental set up of apparatus shown below.



(i) State two observations made in the set up as the experiment progressed. (2 marks)

.....

.....

(ii) Write an equation for the reaction that occurred in the boiling tube. (1 mark)

.....

(f) Why was the gas burned at the end of the tube? (1 mark)

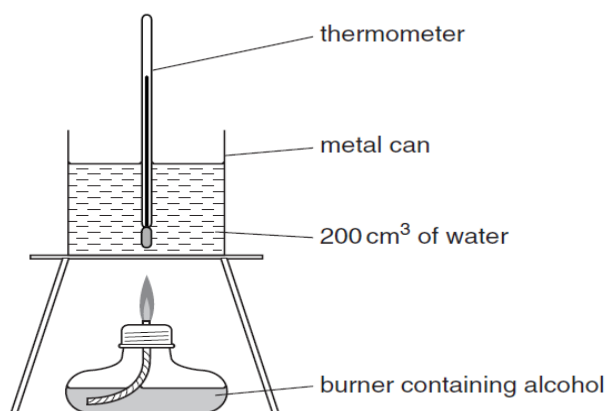
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3.(a) State two factors that should be considered when choosing a fuel for cooking. (1 mark)

.....

.....

(b) When alcohols burn they give out heat. A student used the apparatus below to investigate the amount of heat produced when ethanol was burnt.



During the experiment, the data given below was recorded.

Volume of water = 200cm³

Initial temperature of water = 25⁰C

Final temperature of water = 46.5⁰C

Mass of ethanol + lamp before burning = 125.5g

Mass of ethanol + lamp after burning = 124.0g

Calculate;

(i) Heat evolved during the experiment (Density of water = 1g/cm³, specific heat capacity of water = 4.2J/g/k.

(2 marks)

.....
.....
.....

(ii) The number of moles of ethanol involved in the experiment

(2 marks)

.....
.....

(iii) Molar heat of combustion of ethanol (C = 12.0, O = 16.0, H = 1.0)

(2 marks)

.....
.....

(c) Write the equation for the complete combustion of ethanol.

(1 mark)

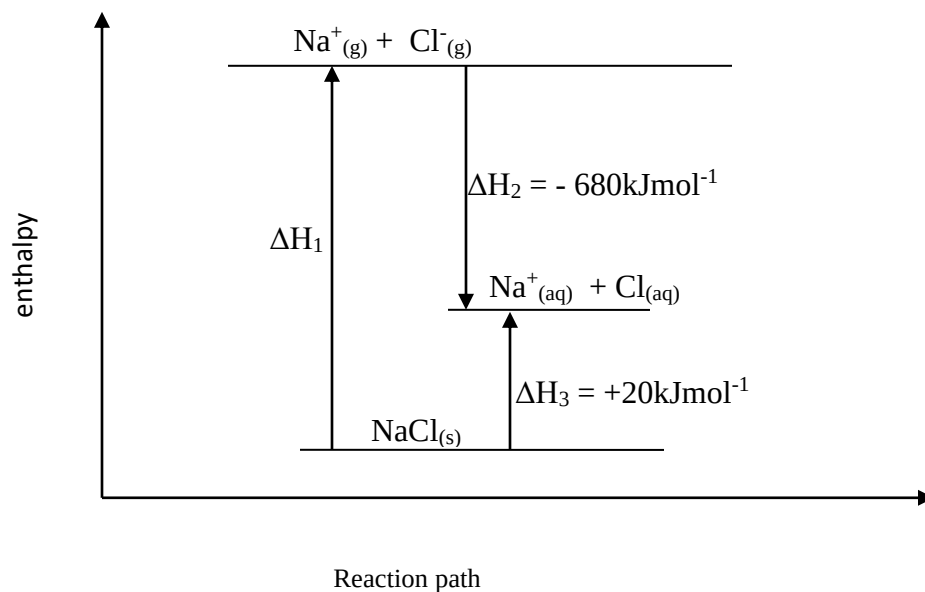
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- (d) The experiment value of molar heat of combustion of ethanol obtained in (b) (iii) above is lower than the theoretical value. Give two reasons for this variation. **(2 marks)**

.....

.....

- (e) Study the diagram below which shows an energy level diagram.



- i) Name enthalpy

(1½ mark)

ΔH_1

ΔH_2

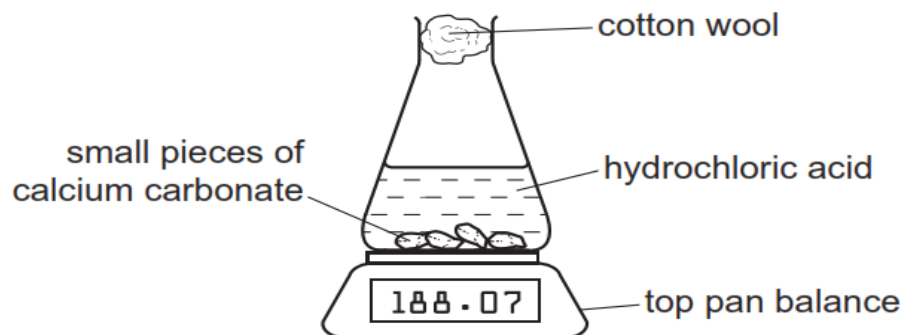
ΔH_3

- ii) Calculate the ΔH_1 from the energy level diagram

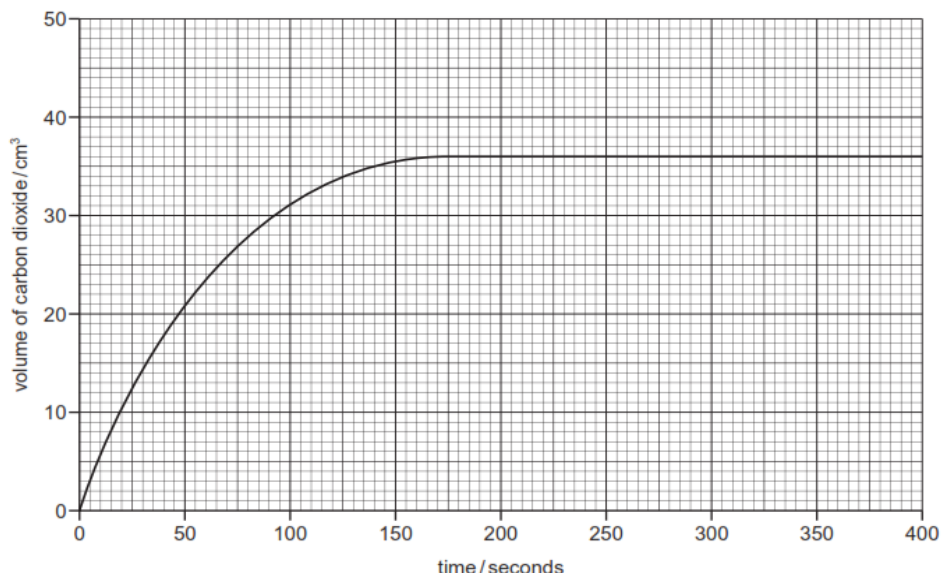
(1½ mark)

.....

4. The rate of reaction of calcium carbonate with hydrochloric acid can be found using the apparatus shown below.



- (a) The course of this reaction can be followed by measuring the volume of carbon (iv)oxide given off at various time intervals. The graph below shows the results obtained from an experiment using 0.15 g of calcium carbonate in small pieces.



- (i) What volume of gas is given off in the first 75 seconds of the reaction **(1 mark)**

.....

- (ii) From the graph calculate the rate of reaction at t=75s **(3 marks)**

.....

.....

- (iii) On the grid, sketch the line you would expect for the same reaction using large pieces of calcium carbonate. Assume that the mass of the calcium carbonate and all other conditions remain the same.

(1 mark)

- (iv) What would happen to the rate of this reaction if: **(1 mark)**

- the temperature is increased,

.....

-the concentration of hydrochloric acid is decreased?

.....

- (b).In the Haber process, the optimum yield of ammonia is obtained when the temperature of 450°C, a pressure of 200 atmospheres and an iron catalyst are used.



- (i).How would the yield of ammonia be affected if the temperature was raised to 600°C?

(1 mark)

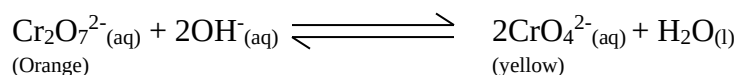
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- (ii) Give one use of ammonia

(1 mark)

.....

(d) A dynamic equilibrium between dichromate and chromate ions is established as shown in the equation below.



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

.....

.....

(ii). State and explain the observation that would be made if a few pellets of potassium hydroxide are added to the equilibrium mixture. **(2 marks)**

.....

.....

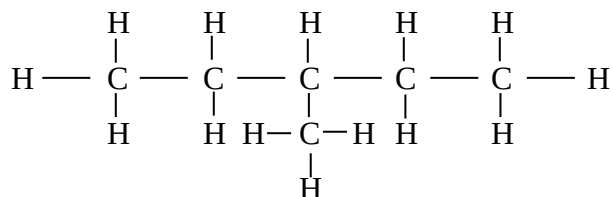
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5. (a) Define the term hydrocarbon **(1 mark)**

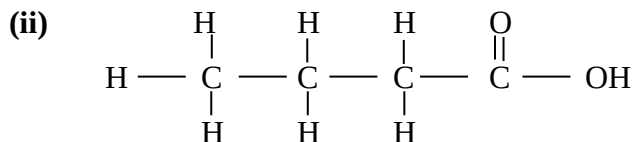
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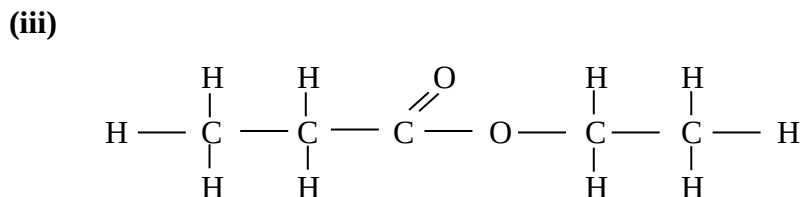
(b)(i) Give the I.U.P.A.C names of the following compounds.



Name **(1 mark)**

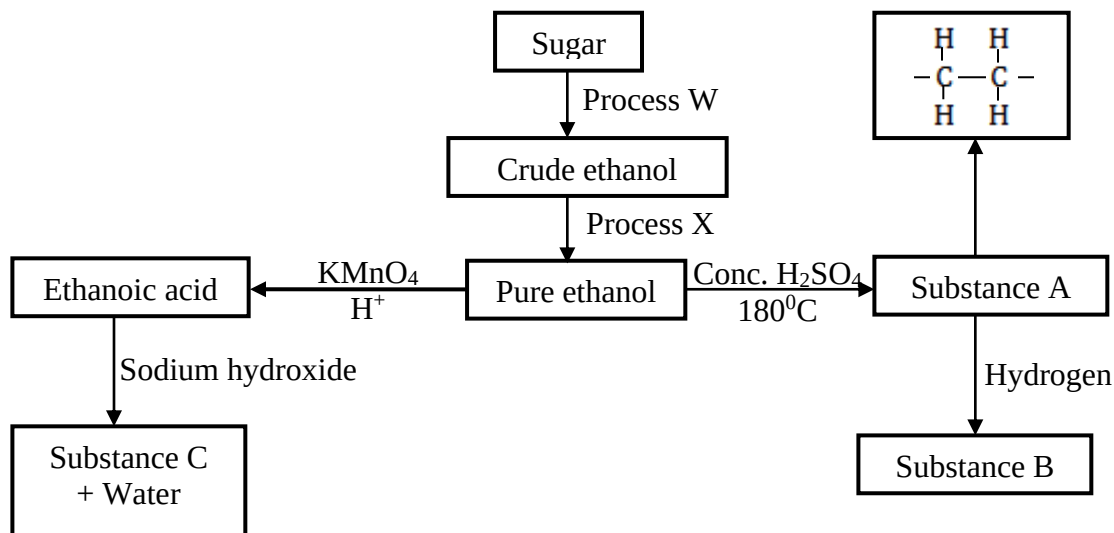


Name **-(1 mark)**



Name (1 mark)

(c). Study the flow chart below and answer the questions that follow:-



(i) Identify process W and X (1 mark)

.....
.....

(ii) Name substances B and C (1 mark)

.....
.....

(iii) Write the equation for the reaction leading to production of substance A. (1 mark)

.....

(iv) Substance B was completely burned in air. Write the equation for the reaction.

(1 mark)

.....
.....

(v) State and explain the observation made when bromine is added to a gas jar full of substance B in the presence of sunlight. (2 marks)

.....
.....

(vi) The polymer D has a relative molecular mass of 112, 000. Calculate the value of n

(C = 12, H = 11)

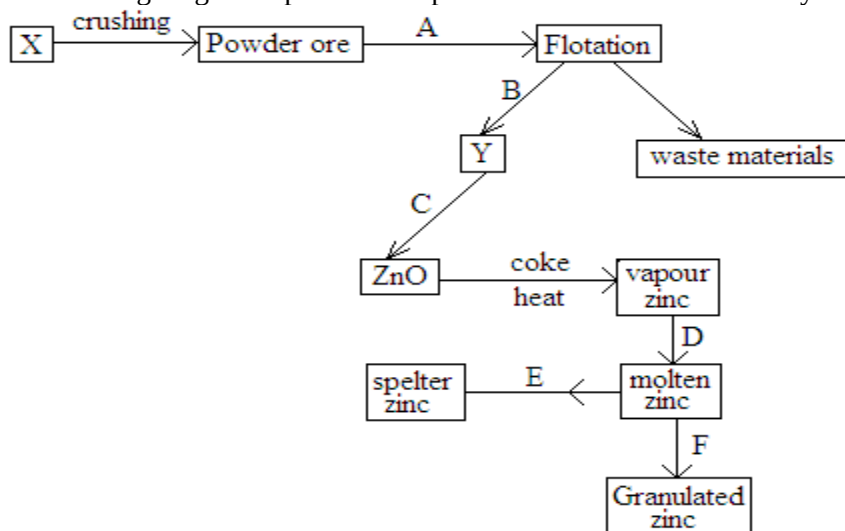
(2 marks)

.....
.....

6.(a) An ore is suspected to contain zinc metal. Describe how one will confirm the presence of zinc in the ore (2 marks)

.....

(b) The following diagram represents the process of zinc extraction. Study it and answer the questions



I. Give the names of:

- (i) X – (1 mark)
 (ii) Y - (1 mark)

II. The process represented by A involves making of slurry and frothing. Name the substances used for:
 (i) Making slurry. (1 mark)

.....

- (ii) Frothing. (1 mark)

.....

III.(i) Explain how process B is used to obtain Y. (1 mark)

.....

(ii) Explain why it is easy to separate Y from the waste material. (1 mark)

.....

IV. Write the equation for the reaction which changes Y to Zinc oxide. (1 mark)

V. Name the process represented by D, E, and F.

(3 marks)

7. The grid below shows part of the periodic table. Use it to answer the questions that follow. The letters do not represent actual symbols.

			S	U	V	
P	R		T		W	
Q				X		

(a) Which of the elements has the highest electron affinity.

(1 mark)

(b) Give the electronic configuration of:

(2 marks)

(i) Element S

(ii) Element Q

(c) Compare the atomic radius of P and R. Explain

(2 marks)

(c) Given that the atomic mass of W is 40. Write down the composition of its nucleus.

(1 mark)

(e) Write the formula of the compounds formed between: Element P and S. (1 mark)

(f) Give the formula of one stable ion with an electron arrangement of 2.8 which is negatively charged

(1 mark)

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Name Admission number
Candidate's Signature.....Date.....

LENANA SCHOOL TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.*
- b) Sign and write the date of examination in the spaces provided above*
- c) Answer all the questions in the spaces provided below each question. .*
- d) KNEC Mathematical tables and silent electronic calculators may be used.*
- e) All working must be clearly shown where necessary.*
- f) Candidates should answer the questions in English.*

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Question	Maximum score	Candidate's score
1	10	
2	12	
3	12	
4	11	
5	13	
6	11	
7	11	
Total	80	

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1. The grid below shows part of the periodic table. Use it to answer the questions that follow. The letters do not represent actual symbols. (10 marks)

			S	U	V	
P	R		T	X	W	
Q						

- (a) Which of the elements has the highest atomic radius? Explain. (2 marks)

.....

.....

.....

- (b) Identify the most reactive non-metal. Explain. (2 marks)

.....

.....

.....

- (c) Compare the atomic radius of P and R. (1 mark)

.....

- (d) Give the formula of one stable ion with an electron arrangement of 2.8 which is:

- (i) Negativity charged divalent ion. (2mks)

.....

- (ii) Positively charged monovalent.

.....

- (e) Given that the mass number of W is 40. Write down the composition of its nucleus. (1 mark)

.....

.....

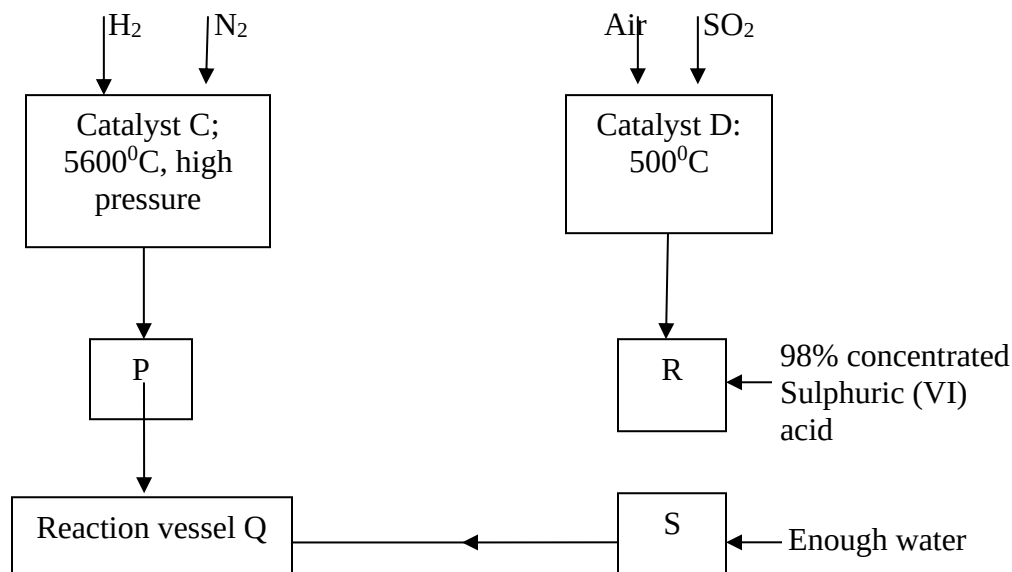
- (f) Write the formula of the compounds formed between.

- (i) Element R and X. (1 mark)

.....

- (ii) Give one property of the structure formed when R and X bond. (1 mark)

2. The flow chart below shows how a fertilizer can be manufactured. Use it to answer the questions that follow.



- I. (a) Name catalyst C and catalyst D.

(1 mark)

- (b) Give the identifies of substance:

(1 ½ marks)

P:.....

Q:.....

R:.....

- (c) Give the identity of the fertilizer formed.

(½ mark)

- (d) Write an equation for the reaction at vessel Q.

(1 mark)

- (e) Explain why substance R is absorbed in 98% sulphuric (VI) acid first before adding water.

(1 mark)

- (f) Name the methods by which pollution is controlled in contact process

(1 mark)

- (g) Which industry can be set next to the plant

(1mark)

-
- II. (a) When hydrogen sulphide gas was bubbled into an aqueous solution of Iron (III) chloride, a yellow precipitate was deposited.
(i) State another observation that was made. (1 mark)

.....

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

.....

.....

- III. (a) Explain why old newspapers slowly turn brownish when exposed to air and sunlight. (1 mark)
-
-

(b) Describe a chemical test that can be used to distinguish sodium sulphate and sodium sulphite. (2 marks)

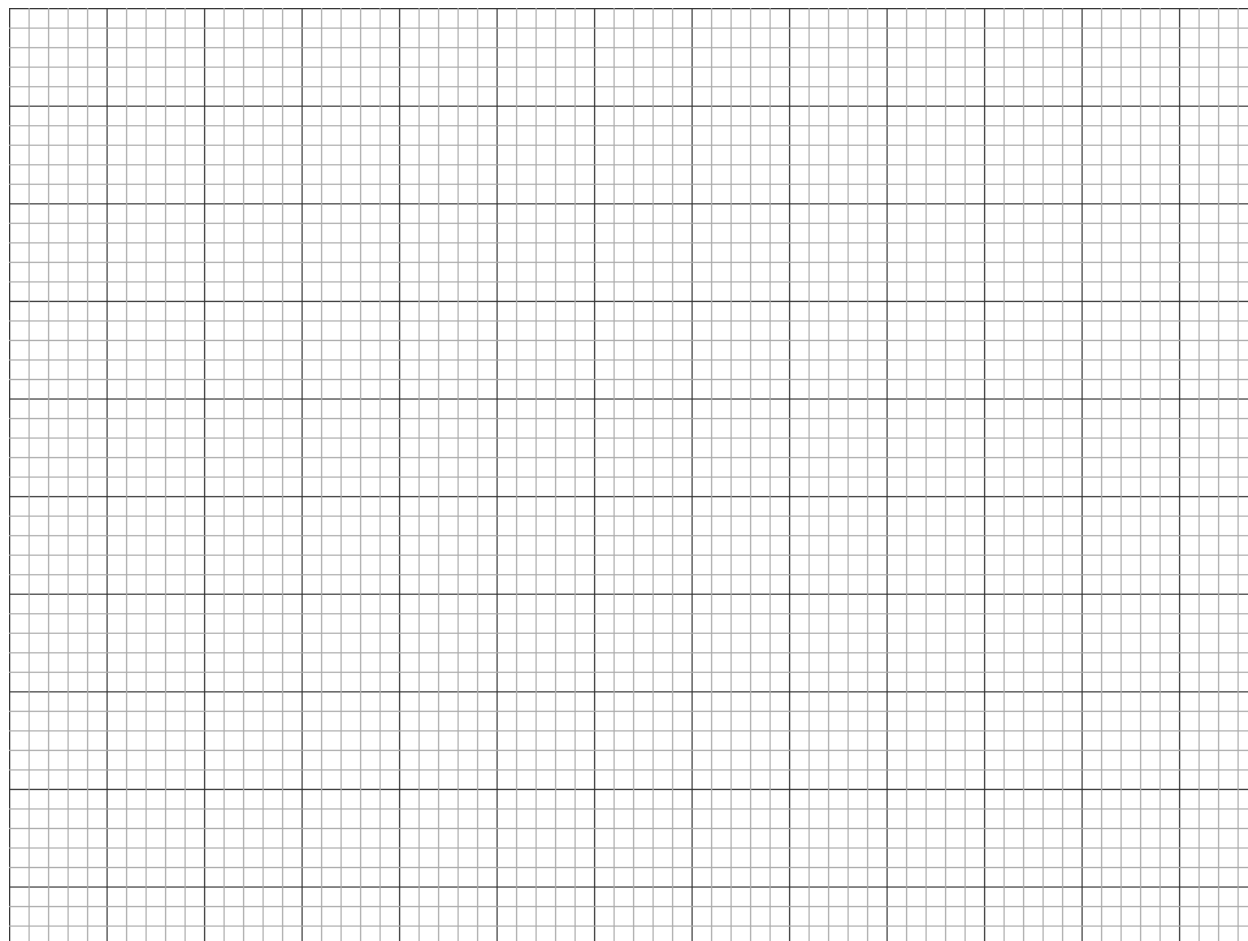
.....

.....

3. (a) What is solubility as used in chemistry? (1 mark)
-
-
-

- (b) By using the same axes, plot graphs of solubility of substances X and Y against temperature from the data below. (5 marks)

Temp ($^{\circ}\text{C}$)	15	25	35	45	55	65	75
Sol. of X (g/100 gH ₂ O)	26	38	53	72	98	124	155
Sol of Y (g/100 gH ₂ O)	35.8	36.2	36.6	37	37.4	38	38



(c) From the graph, answer the following question:

- (i) At what temperature are the solubilities of X and Y the same? (1 mark)

.....

- (ii) By how many grams of solute does solubility of substance Y exceed that of substance Y at 50°C ? (1 mark)

.....

.....

.....

- (d) Given a mixture of equal masses, 80g each, of X and Y, how would you obtain some pure substance Y and how much? (2 marks)

.....

.....

.....

.....

- (e) 40g of X solution saturated at 60°C are cooled to 15°C . What mass of solid will separate out? (1 mark)

-
-
4. Excess marble chips (CaCO_3) was put in a beaker containing 100cm^3 of dil. HCl. The beaker was then placed on a balance and the total loss in mass recorded after every 2 minutes as shown in the table below.

Time (min)	0	2	4	6	8	10
Total loss in mass (g)	0	1.8	2.45	2.95	3.2	3.3

- (a) Why was there loss in mass? (1 mark)
-

- (b) Calculate the average rate of loss in mass between: (2mks)

(i) 0 and 2 minutes.

.....

.....

(ii) 6 and 8 minutes.

.....

.....

(iii) Explain the difference in the average rates of reaction in (i) and (ii) above (1 mark)

.....

.....

- (c) Write the equation for the reaction that takes place in the beaker. (1 mark)

- (d) State two ways in which the rate of the reaction above could be increased. (2 marks)
-
-

- (e) The solution in the beaker was evaporated to dryness. Explain what would happen if the open beaker and its contents were left in the laboratory overnight. (2 marks)
-
-

- (f) Finally some water was added to the content of the beaker. When aqueous sodium sulphate was added to the content of the beaker, a white ppt was found.

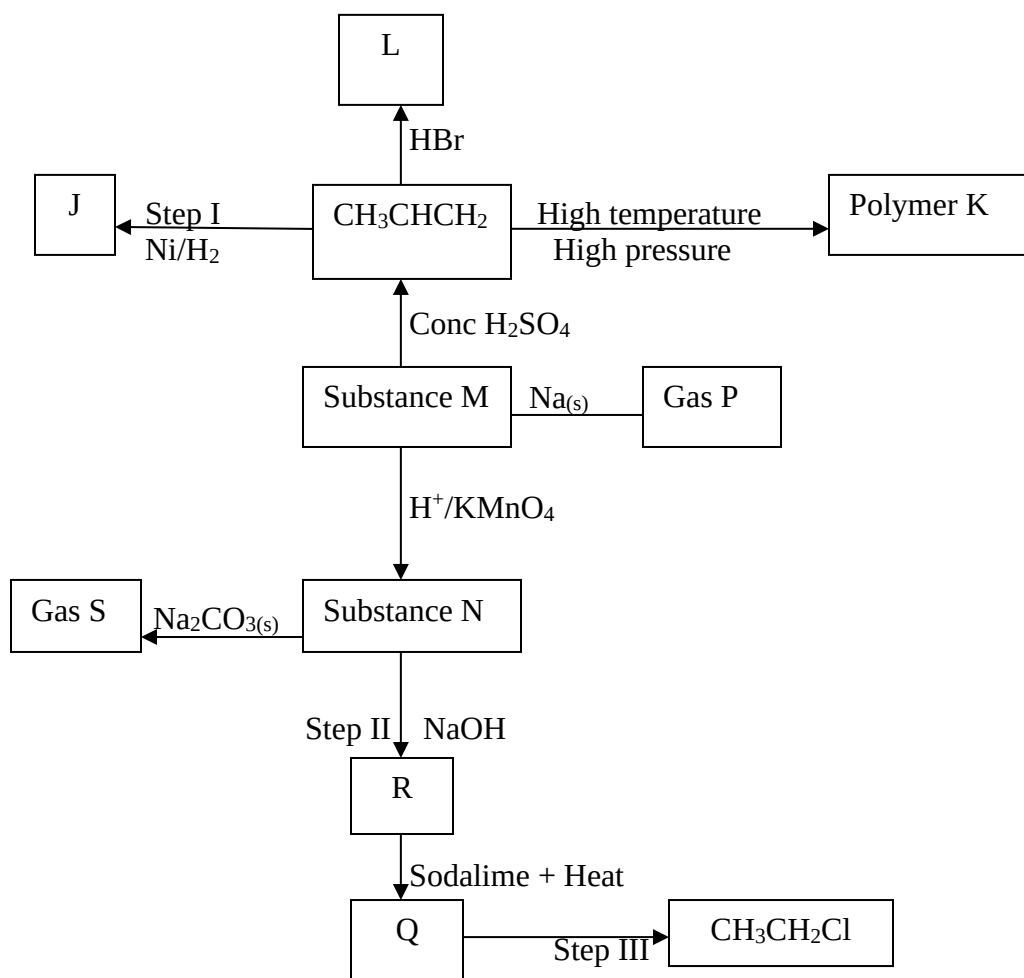
(i) Identify the white ppt. (1 mark)

.....

(ii) State one use of the substance identified in f (i) above. (1 mark)

.....

5. Use the flow chart below to answer the questions that follow.



- (a) Name the following: (1 ½ marks)
- Gas S.....
 - Gas P
 - Gas J
- (b) Name the process involved in the following step. (1 ½ marks)
- Step I.....
 - Step II
 - Step III
- (c) Draw two possible structure of compound L. (2 marks)

(d) Write equation for;

(i) The complete combustion of substance M (1 mark)

.....
.....

(ii) Formation of substance R. (1 mark)

.....
.....

(e) Name the condition and reagent in step III. (2 marks)

Reagent:.....

Condition:.....

(f) Draw the structure formula of compound N. (1 mark)

(g) Chlorine is used to prepare vinylchloride (chloroethene), ($\text{CH}_2=\text{CHCl}$).

(i) State why chloroethene, undergoes addition polymization. (1 mark)

.....

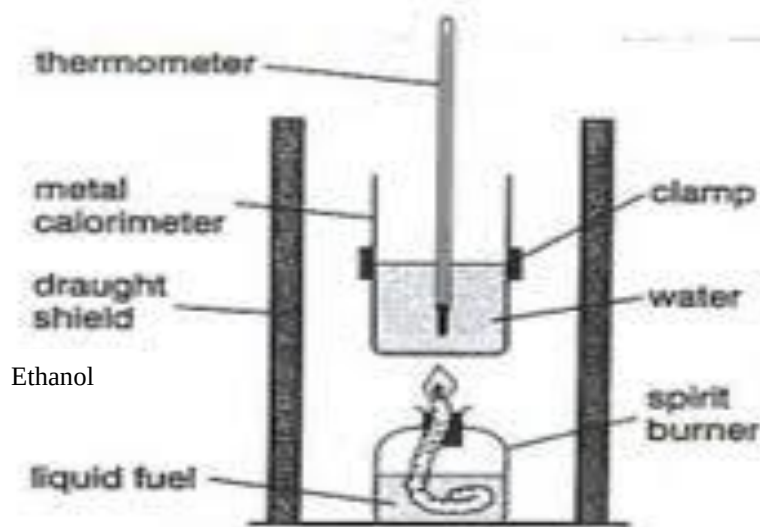
(ii) Name the polymer formed (1 mark)

.....

(iii) Complete the following equation to show the two monomers combined during the polymerization. (1mark)



6. The diagram below shows the set up of the apparatus by a student to determine the enthalpy change of combustion of ethanol. The heat produced by burning fuel warms known mass of water.



Results

Volume of water in the beaker = 500 cm^3

Initial temperature of water = 12°C

Final temperature of water = 31.5°C

Mass of ethanol burnt = 1.50g

Density of water = 1 g/cm^3

Specific heat capacity = $4.2 \text{ Jg}^{-1}\text{K}^{-1}$

(a) Define standard heat of combustion.

(1 mark)

.....

.....

(b) Calculate the heat required to raise the temperature of the water from 12°C to 31.5°C .

(2 marks)

.....

.....

.....

(c) Find the molar enthalpy of combustion of ethanol.

(2 marks)

.....

.....

(d) An accurate value for ΔH_C of ethanol is -1368 kJmol^{-1} . State two sources of errors for the low figure obtained.

(2 marks)

.....

.....

.....

(e) Draw an energy level diagram for the combustion of ethanol. (2 marks)

(f) Calculate the heating value of ethanol. (C = 12, H = 1, O = 16 (2 marks)

.....
.....
.....

7. The extraction of copper from copper pyrites is done in three main stages before pure copper is obtained.

(i) The concentration of the ore to remove impurities.

(ii) Roasting of the ore and reduction.

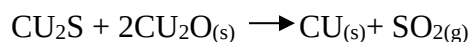
(iii) Purification of blister copper.

(a) Name the methods used to purify the ore. (1 mark)

.....
.....

(b) One of the equation in stage (ii) to form blister copper is

(c)



I. Name the reducing agent. (1 mark)

.....

II. Explain why this type of Copper is called “blister copper”. (1 mark)

.....

(d) One of the uses of copper is to make electrical conductors and it must be 99.99% pure.

I. Draw a diagram to illustrate how blister copper is purified. (2 marks)

II. State one other uses of copper. (1 mark)

.....

- (e) (i) State two properties of aluminium that makes if possible to be used in making overhead electric cables. (2 marks)

.....

.....

- (ii) A typical electrolysis cell uses a current of 40,000 amperes. Calculate the mass in kgs of Aluminium produced in ten hours. (IF = 96500C, Al = 27) (3 marks)

.....

.....

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KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name Admission number

Candidate's Signature.....Date.....

MANGU SCHOOL TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.
- b) Sign and write the date of examination in the spaces provided above
- c) Answer all the questions in the spaces provided below each question. .
- d) KNEC Mathematical tables and silent electronic calculators may be used.
- e) All working must be clearly shown where necessary.
- f) Candidates should answer the questions in English.

For Examiners Use Only

Question	Maximum score	Candidate's score
1	08	
2	12	
3	12	
4	12	
5	10	
6	13	
7	13	
Total score	80	

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1. (a) The table below shows the atomic numbers of elements in the periodic table represented by the letters A to I. The letters are not the actual symbols of the elements.

Element	A	B	C	D	E	F	G	H	I
Atomic number	3	7	8	9	11	12	13	14	16

- (I) Select two elements in the same group. (1 mk)

.....

- (II) Select the non-metal and the metal that would react most vigorously with each other. (1 mk)

.....

.....

- (b)(i) Draw cross (X) and dots(●) diagram to show bonding in the compound formed between hydrogen and element **B** (1 mk)

.....

.....

.....

- (ii) The compound formed in b(i) above does not conduct electric current in gaseous form but conducts in aqueous form. Explain. (2 mks)

.....

.....

- (c) Explain the difference between the melting points of the oxides of **H** and **I** (2 mks)

.....

.....

.....

- (d) Write an equation for the reaction that takes place between elements **G** and **C**. (1 mk)

.....

.....

2. (a) When few drops of ammonia solution was added to hydroxides of zinc, copper and Iron(III), the following solution were obtained; colourless solution, deep blue solution and brown precipitate. Identify the substances responsible for;

- (i) Deep blue solution (1 mk)

- (ii) Colourless solution (1 mk)

.....
(iii) Brown precipitate (1 mk)

.....
(b) A saturated solution of potassium chloride is to be prepared at 40°C. Its solubility at 40°C is 34g/100g water and 27g/100g of water at 5°C .

(i) What mass of water would be saturated with 8.5g of potassium chloride at 40°C?(1mk)

.....
(ii) What mass of potassium chloride would crystallize out if the saturated solution at 40°C is cooled to 5°C? (1 mk)

.....
(c) Given **two** samples of sodium carbonate and sodium hydrogen carbonate. Describe a chemical test that would distinguish them. (2 mks)

.....
(d) Two equal pieces of magnesium ribbon were placed in two separate test tubes, one containing 10cm³ of water and the other containing 10cm³ of methylbenzene. State and explain the observations made in the two test tubes. (2 mks)

.....
(e) In an experiment, soap solution was added to three separate samples of water. The table below shows the volumes of soap solution required to form lather with 2 litres of each sample of water before and after boiling.

Sample	Sample A	Sample B	Sample C
Volume of soap before water is boiled (cm ³)	30	3	13
Volume of soap after water is boiled (cm ³)	30	3	3

(i) Which sample is likely to be soft water? Explain. (2 mks)

.....
(ii) Explain the change in volume of soap used in Sample C. (1 mk)

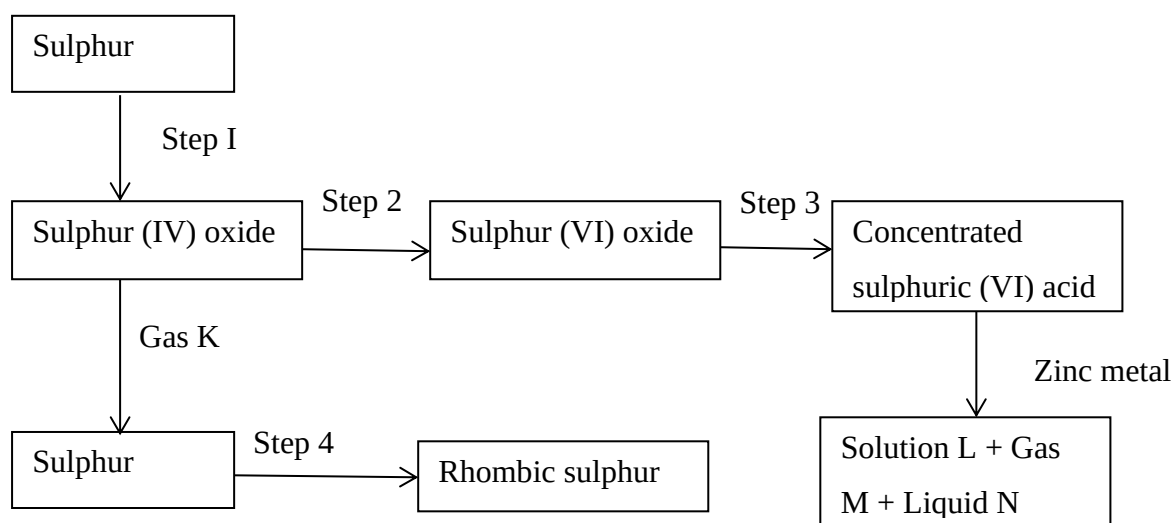
3. (a) 12.0cm³ of 0.05M hydrochloric acid reacted completely with calcium hydrogen carbonate solution.

(i) Write the chemical equation for the reaction. (1 mk)

(ii) Calculate the number of moles of hydrochloric acid used. (1 mk)

(iii) Determine the number of moles of calcium hydrogen carbonate used. (1 mk)

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



I) Name

(i) Gas K. (1 mk)

(ii) Gas M (1 mk)

II) Steps 1, 2 and 3 constitute the contact process. State optimum conditions necessary for step 2 to occur. (1 mk)

III) Explain what happens in step 4. (2 mks)

.....
.....

IV) Explain why water is not used in step 3 . (1 mk)

.....
.....

V) Write an equation to show how pollution effects of sulphur (IV) oxide is controlled in contact process. (1 mk)

.....

VI) State **two** uses of sulphur. (2 mks)

.....
.....

4. (a) Use the bond energies below to answer the questions that follow.

Bond	Bond energy (KJ/Mol)
H-H	436
C= C	612
C- C	347
C- H	413

Determine the enthalpy for the following reaction



.....
.....
.....

(b) Molar enthalpy of combustion of propanol is -1560KJmol^{-1} .

(i) Write a thermochemical equation for the complete combustion of propanol. (1 mk)

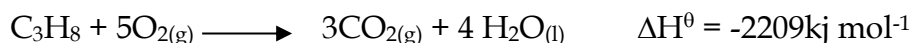
(ii) Calculate the amount of energy in joules released when 10g of propanol is burnt in excess oxygen. (C=12, H = 1.0, O=16.0) (2 mks)

.....
.....

(c) (i) State Hess' law

(1 mk)

(ii) Use the information below to answer the questions that follow.

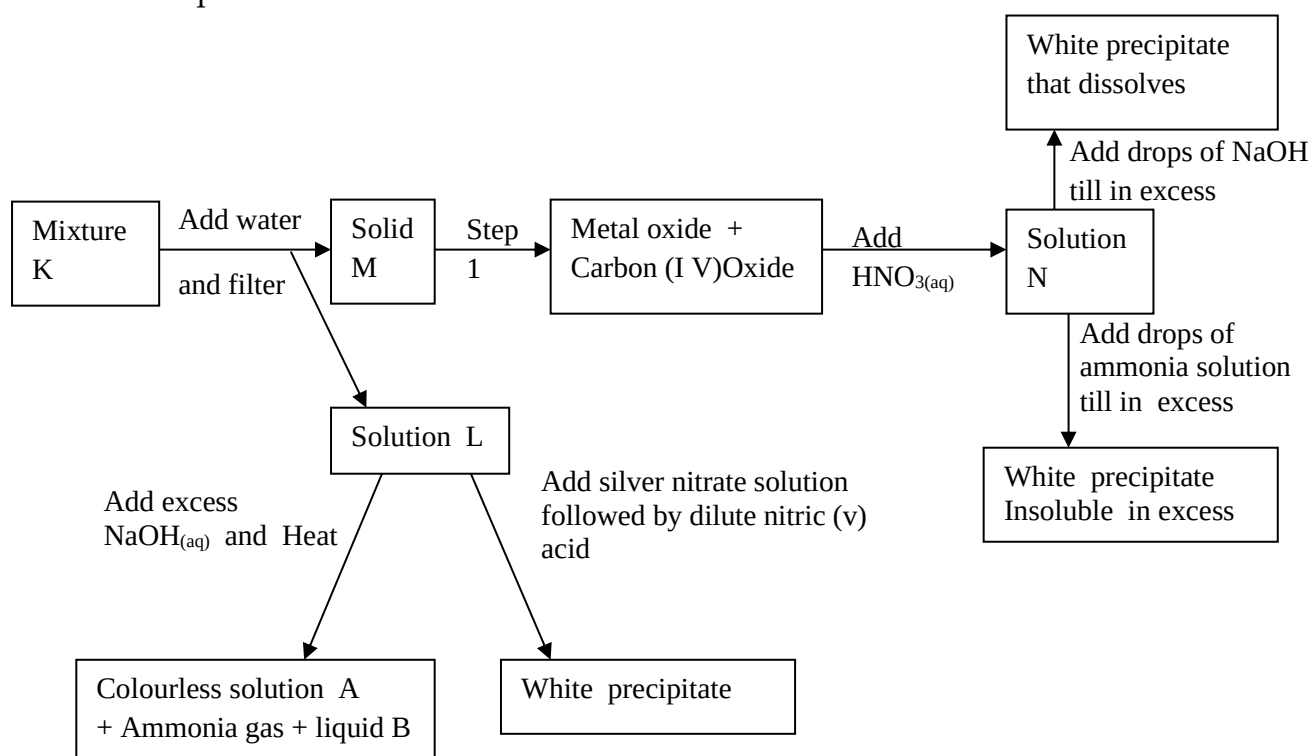


I. What does the symbol ΔH° represent? (1 mk)

II. Write the equation for the formation of propane from its constituent elements. (1 mk)

III. With the aid of an energy cycle diagram, calculate the enthalpy of formation of propane. (3 mks)

5. The flow chart below shows an analysis of mixture **K** that contains two salts. Study it and answer the questions that follow.



(a) Identify,

(i) Solution L: (1 mk)

(ii) Solid M: (1 mk)

.....
(iii) Solution **N** : (1 mk)

.....
(b) What condition is necessary in step 1 (1 mk)

.....
(c) State the observations made in step 1 (1 mk)

.....
(d) Write down an equation to show how;
(i) Solution **N** is formed. (1 mk)

.....
(ii) Colourless solution **A** and Ammonia gas are formed. (1 mk)

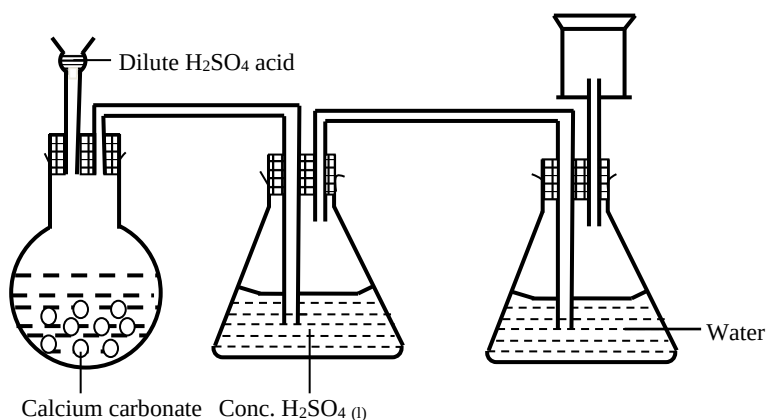
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(e) When excess $\text{NaOH}_{(\text{aq})}$ is added to solution **N**, a white precipitate is formed which dissolves. Give the name and formula of the ion formed. (2 mks)

Name:.....

Formula:

(f) Explain why it is necessary to add water to mixture **K** and then filter. (1 mk)

.....
6. A student set up the apparatus shown below to prepare and collect dry carbon (IV) oxide gas.



(a) State a correction for three mistakes in the set up above (3 mks)

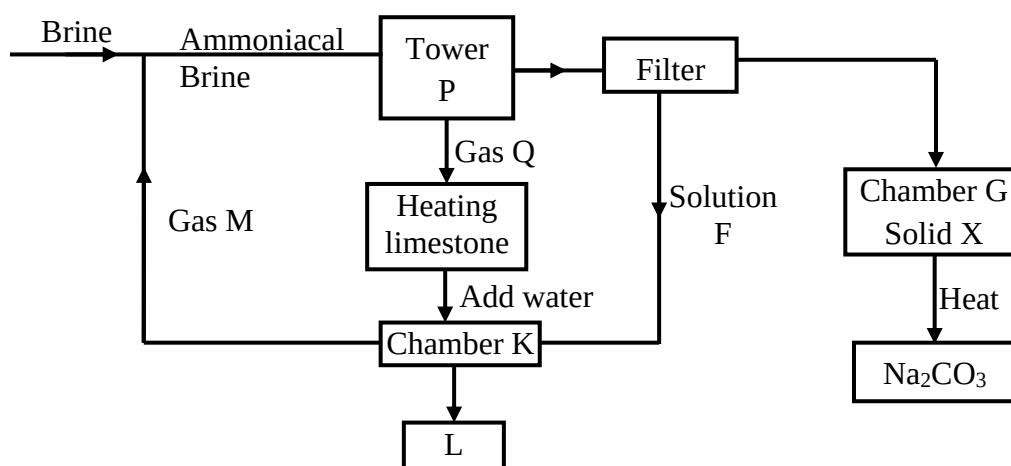
(i)

.....
(ii)

.....
(iii).....

.....
(b) Give two reasons why carbon (IV) oxide is used as a fire extinguisher (2 mks)

.....
(c) The flow chart below is for the manufacture of sodium carbonate by the Solvay process. Use it to answer the questions that follow.



(i) Name gas M: (1 mk)

Q:

(ii) Name solution F and solid X (1 mk)

F:

X:

(iii) Name the product L formed and give one of its uses (2 mks)

.....
(iv) Write equations of the reactions in (2 mks)

Tower:

Chamber K:

(v) Name the two raw materials required in the manufacture of sodium carbonate (2 mks)

-
-
7. A piece of marble chip (calcium carbonate) is put in a beaker containing excess of dilute hydrochloric acid which is placed on a reading balance. The mass of the beaker and its contents is recorded every two minutes as shown in the table.

Time (min)	0	2	4	6	8	10	12
Mass (g)	126.4	126.3	126.2	126.1	126.0	126.0	126.0

- i) Why is there a continuous loss of mass of the reaction mixture. (1 mk)

.....

.....

- ii) Write an equation for the reaction taking place. (1 mk)

.....

- iii) State two different ways by which the reaction could have been made more rapid. (2 mks)

.....

.....

.....

- iv) Why does the mass remain constant after 8 minutes (1 mk)

.....

.....

.....

- v) State the observations that would be made if a few drops of lead II nitrate solution was added to 1cm³ of the resulting solution followed by excess ammonia solution. (2 mks)

.....

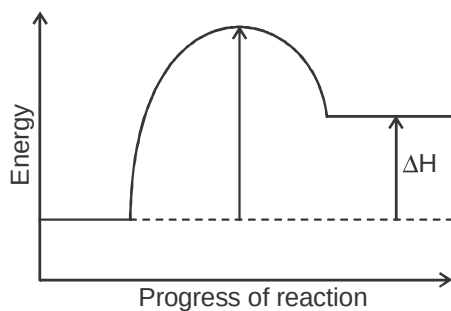
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.....

- vi) State one environmental effect that excess carbon (IV) oxide in the air causes. (1 mk)

.....

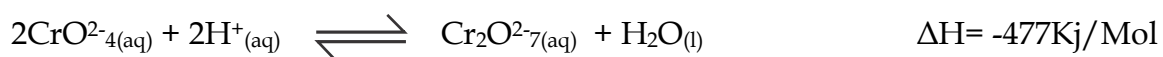
- vii) The energy profile for the forward direction of a reversible reaction is shown.



Sketch on the diagram the path for a catalysed reaction.

(1 mk)

viii) What do you observe when you introduce the following substances in this equation



Yellow

Orange

i) Dilute hydrochloric acid solution. Explain

(2 mks)

.....

ii) Increase heat

(2 mks)

.....

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Name Admission number
Candidate's Signature.....Date.....

MARANDA SCHOOL TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.*
- b) Sign and write the date of examination in the spaces provided above*
- c) Answer all the questions in the spaces provided below each question. .*
- d) KNEC Mathematical tables and silent electronic calculators may be used.*
- e) All working must be clearly shown where necessary.*
- f) Candidates should answer the questions in English.*

FOR EXAMINER'S USE ONLY

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

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1. Use the grid below to answer the questions that follow. The letters do not represent the actual symbols of elements.

					G		J	
A	D		E	F		H	K	L
B								
C								

- a Give the family name of the group in which elements B and C are members. (1 mark)

.....

- b State and explain the difference in reactivity between

- i. A and D (1 mark)

.....

.....

- ii. J and K (1 mark)

.....

.....

- c How does the atomic radius of E compare with that of F? Explain. (2 marks)

.....

.....

.....

.....

- d Element R forms an oxide of the formula RQ_2 and belongs to period two. Indicate in the grid the position of R. (1mark)

.....

- e Identify an element with the lowest first ionization energy. (1 mark)

.....

- f Give the formula of the compound formed between E and K. (1 mark)

.....

- g Name of type of bond formed when A reacts with K. Explain. (2 marks)

.....

.....
.....
.....

h Give one use of element L. (1 mark)

.....

i Give the electron arrangement of an ion of C- (1/2 mark)

.....

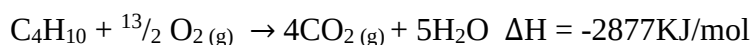
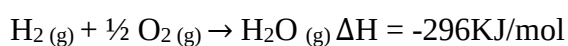
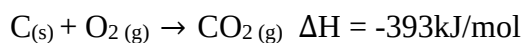
G- (1/2 mark)

.....

2 a) State Hess's law. (1 mark)

.....

b) Use the information to answer the questions that follow



i Draw an energy cycle diagram relating heat of formation and combustion of butane. (2 marks)

ii Define enthalpy of formation. (1 mark)

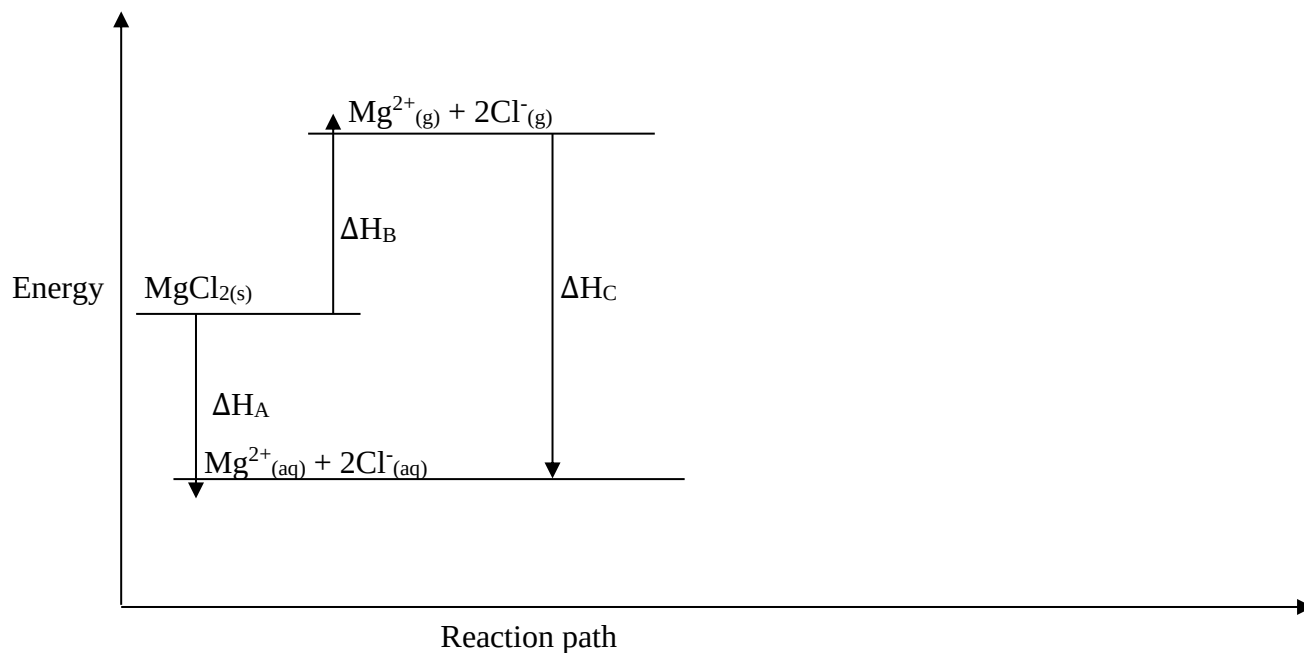
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iii Calculate the heat of formation of butane (2 marks)

.....

iv Draw the energy level diagram of combustion of butane. (2 marks)

- c The diagram below shows an energy level diagram for the formation of magnesium chloride. Study it and answer the questions that follow.



- i State the enthalpy changes represented by

A ($\frac{1}{2}$ mark)

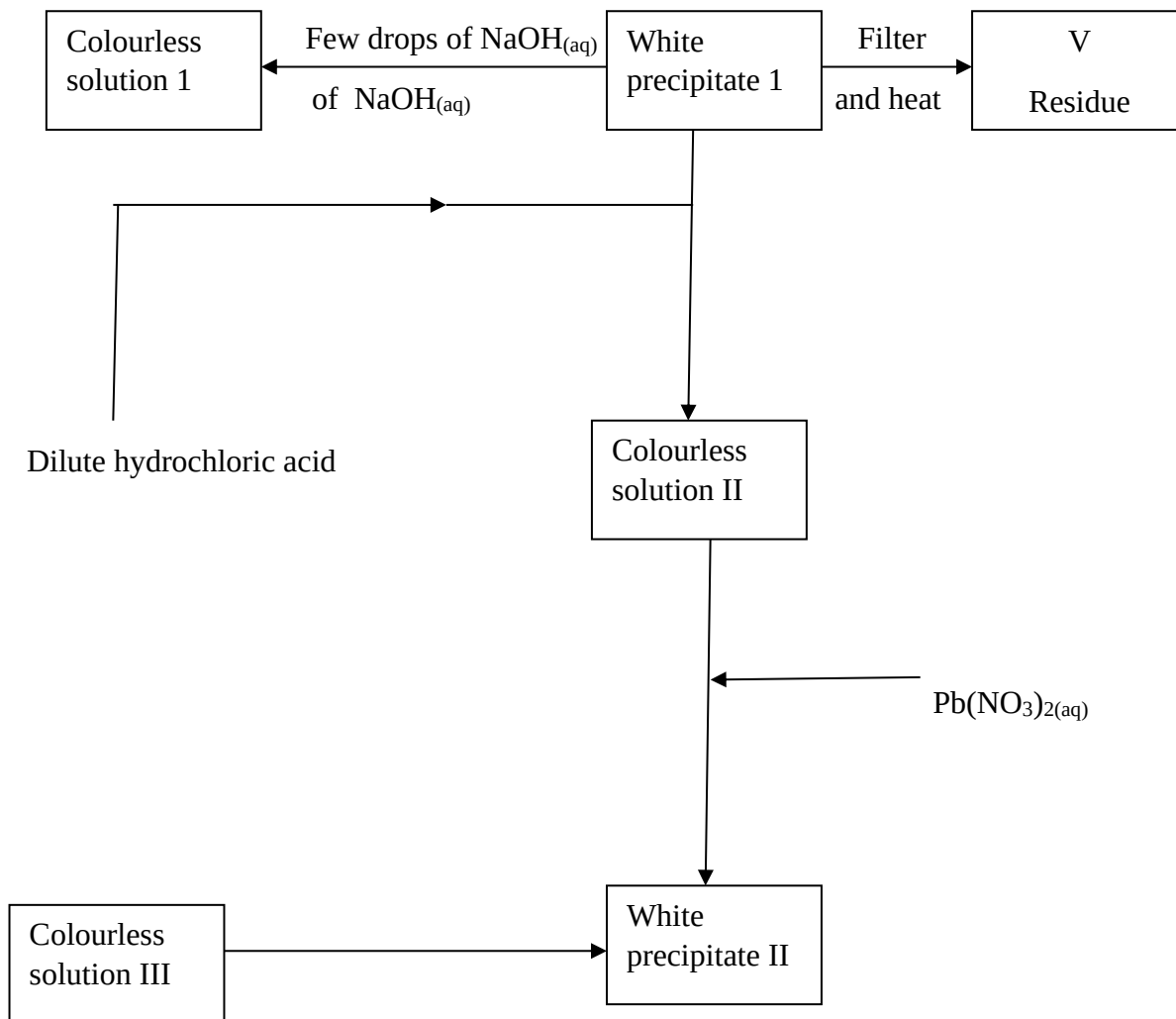
B ($\frac{1}{2}$ mark)

C ($\frac{1}{2}$ mark)

- ii What is the relationship between ΔH_A and ΔH_B and ΔH_C . ($\frac{1}{2}$ mark)

.....

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



Residue V was yellow when hot and white when cold

i. Identify

I white precipitate I

(1 mark)

.....

II Solution II

(1 mark)

.....

III Residue V

(1 mark)

.....

ii. Write an ionic equation for the reaction of solution II with $\text{Pb}(\text{NO}_3)_2(\text{aq})$ (1 marks)

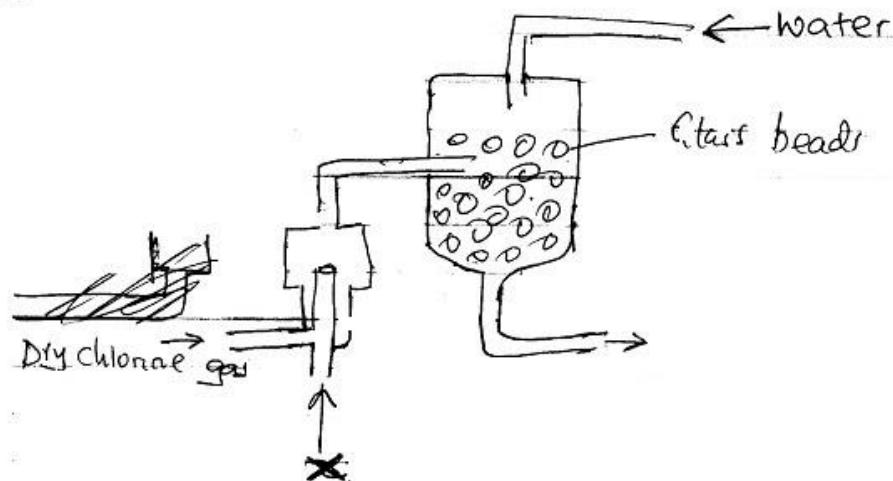
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iii. Write observations that would be made when ammonia solution is added drop wise till in excess to the colourless solution II (1 ark)

.....

b. The diagram below represents a set up for large scale manufacture of hydrochloric acid.

Study it and answer the questions that follow.



i. Name substance X (1 mark)

.....

ii. What is the purpose of glass beads? (1 mark)

.....

iii. Give one source of substance X used in the above process. (1 mark)

.....

iv. Give two uses of hydrochloric acid. (2 marks)

.....

.....

4.a) Define solubility. (1 mark)

b). The saturated point of sodium nitrate in 100g of water is given for various temperature in °C.

Temperature °C	0	20	40	60	80	100
Saturation point (g/100g of H ₂ O)	73	88	104	124	148	180

i. Plot a graph of saturation point of sodium nitrate against temperature. (3 marks)

ii. Using the curve determine the solubility at 70°C (1 mark)

iii. 100g of solution of sodium nitrate is in saturated conditions of 10°C. How many grams of the salt will have to be added to make the solution just saturation point at 80°C. (2 marks)

.....
.....
.....

iv. State two uses of solubility curve. (2 marks)

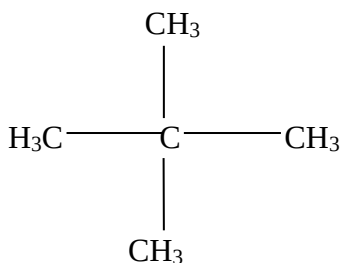
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v. Name a method of separating salts with different solubilities in the same solvent. (1 mark)

.....

5. a. Give the names of the following compounds.

i.

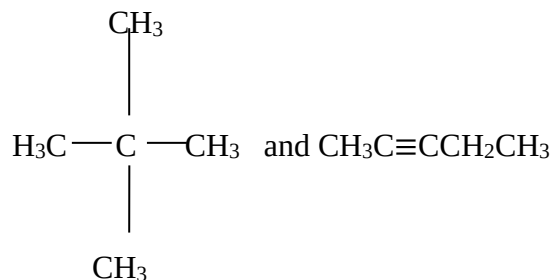


(1 mark)

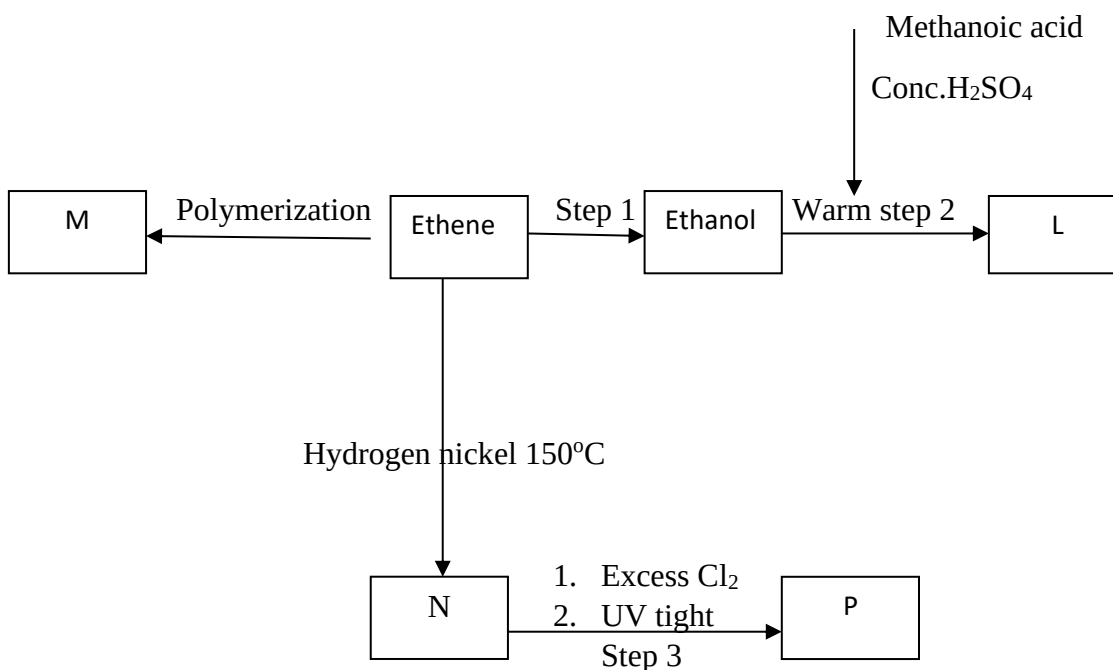
ii. $\text{CH}_3\text{C}\equiv\text{CCH}_2\text{CH}_3$

(1 mark)

b. Describe a chemical test that can be carried out to distinguish between the compounds. (2 marks)



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



i Name the compounds

(2 marks)

I L

II N

ii. Draw the structural formula of compound M showing three repeating units.

(1 mark)

iii. Give the reagent and condition used in step I.

(2 mark)

.....

iv. State the type of reaction that takes place in

(2marks)

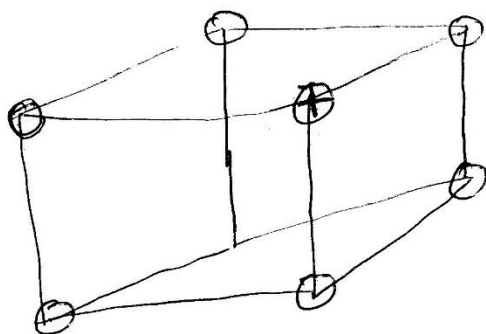
I Step 2

II Step 3

V The molecular formula of compound P is $C_2H_2Cl_4$. Draw the two structural formulae of compound P.

(2 marks)

6. a. The diagram below represent part of the structure of a sodium chloride crystal, the position of one of the sodium ions in the crystal is as shown as +



i. On the diagram mark the positions of the other three sodium ions. (3 marks)

ii. The melting and boiling points of sodium chloride are 801°C and 1413°C respectively. Explain why sodium chloride does not conduct electricity at 25°C but does at temperature between 801°C and 1413°C . (2 marks)

.....

.....

.....

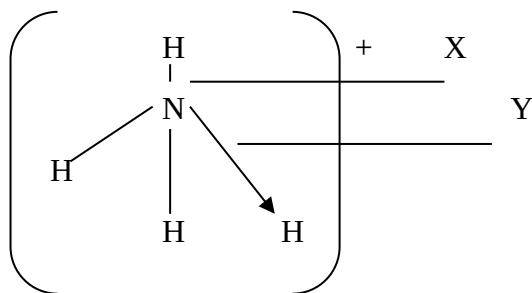
b. Give a reason why ammonia gas is highly soluble in water.

(1 mark).

.....

.....

c. The structure of an ammonium ion is shown below.



Name the types of bonds represented by the letters x and y.

(1 mark)

.....

d. Carbon exist in different crystalline forms some of these forms were recently discovered in soot and are called fullerenes.

i. What name is given to different crystalline forms of the same elements? (1 marks)

.....

ii. Fullerenes dissolves in methyl/benzene while other forms of carbon do not. Given that soot is a mixture of fullerenes and other solid forms of carbon, describe how crystals of fullerenes can be obtained from soot. (3 marks)

.....

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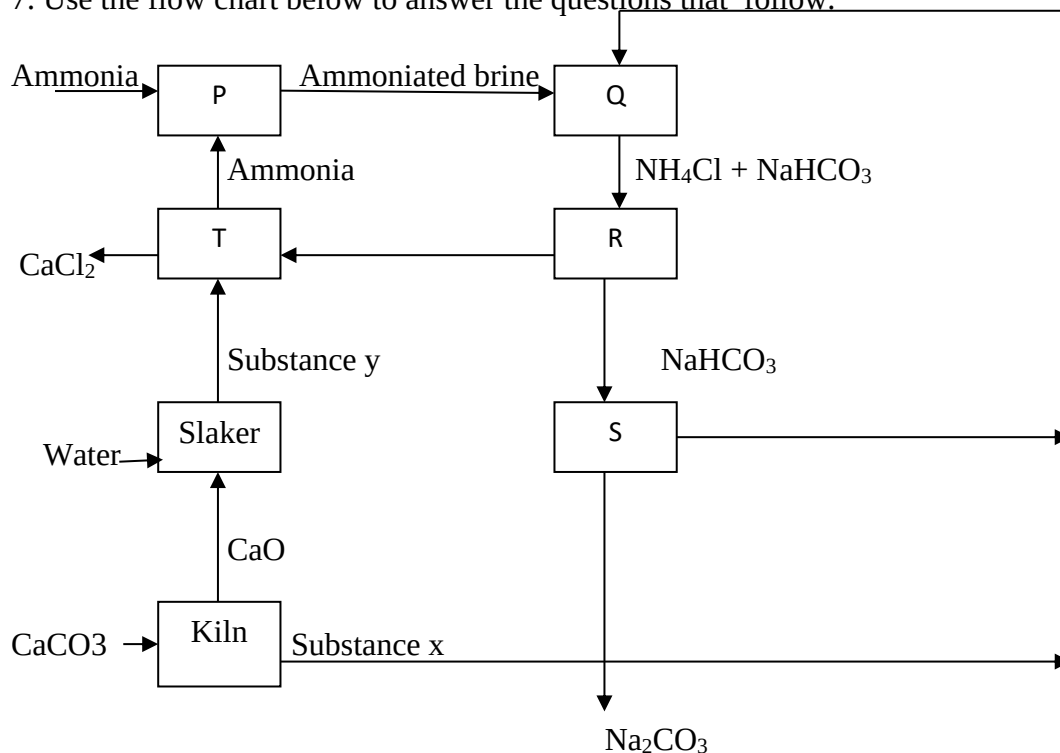
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iii. The relative molecular mass of one of the fullerenes is 720. What is the molecular formula of this fullerene ($C=12$). (1 mark)

.....

.....

7. Use the flow chart below to answer the questions that follow.



(a). Name the substance labeled . (2 marks)

X

Y

(b). Identify two substances that are recycled in the process (1 mark)

.....
.....

(c). Name the process that takes place in chamber

S..... (1 mark)

R..... (1 mark)

(d). Write an equation for the reaction taking place in the chamber labeled

Q (1 mark)

T (1 mark)

(e). Give any two uses of calcium chloride. (2 marks)

.....
.....

(f). With the aid of an ionic equation, explain how sodium carbonate can be used to soften hard water.

(2 marks)

.....
.....
.....
.....

(g). Other than softening of hard water, state two other uses of sodium carbonate. (2 marks)

.....
.....
.....
.....

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KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name Admission number
Candidate's Signature.....Date.....

MASENO SCHOOL TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.*
- b) Sign and write the date of examination in the spaces provided above*
- c) Answer all the questions in the spaces provided below each question. .*
- d) KNEC Mathematical tables and silent electronic calculators may be used.*
- e) All working must be clearly shown where necessary.*
- f) Candidates should answer the questions in English.*

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Questions	Max-score	Candidates score
1	13	
2	10	
3	08	
4	14	
5	11	
6	13	
7	11	
Total score = 80		

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

				D		G		
	B			E	F		H	J
A	C							
							I	

a) State the elements that can form ions with a charge of -1. Give a reason for your answer.

.....(2 marks)

b) What type of structure exists in the oxide of A. Give a reason for your answer? (1 mark)

.....

c) How does the reactivity of I compare with that of H. Explain. (1 mark)

.....

.....

d) The oxide of D has a low melting point than the oxide of element C. Explain. (1 mark)

.....

.....

e) With a reason choose the most;

i) Electropositive element (2 marks)

.....

.....

ii) Electronegative element (2 marks)

.....

.....

f) Compare the atomic radius of;

i) B and H (1 mark)

.....

.....

ii) D and E (1 mark)

.....

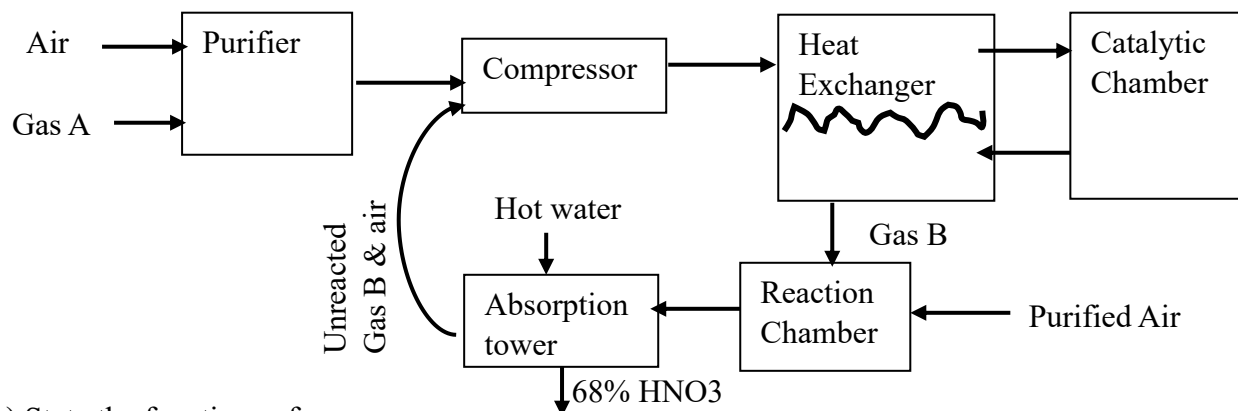
.....

g) State and explain the observations made when concentrated Nitric (V) acid is added to turnings of copper. (2 marks)

.....

.....

2. The flow chart below shows how nitric (v) acid is produced on a large scale. Study it and answer the questions that follow.



a) State the functions of:

(i) Purifier

(1mark)

.....

(ii) Heat exchanger

(1mark)

.....

b) Identify

(i) Gas A

(½mark)

.....

(ii) Catalyst C

(½mark)

.....

c) Write equations for the reaction that take place;

(i) in catalytic chamber.

(1mark)

.....

(ii) in absorption tower.

(1mark)

.....

d) Calculate the molarity of the commercial nitric (v) acid, given that it is 68% pure and has a density of 1.42g/cm^3 . (N=14, H=1, O=16) (3mark)

.....

.....

.....

(e).(i) State the observation made when concentrated nitric (v) acid is added to acidified sulphur powder and warmed.

(1mark)

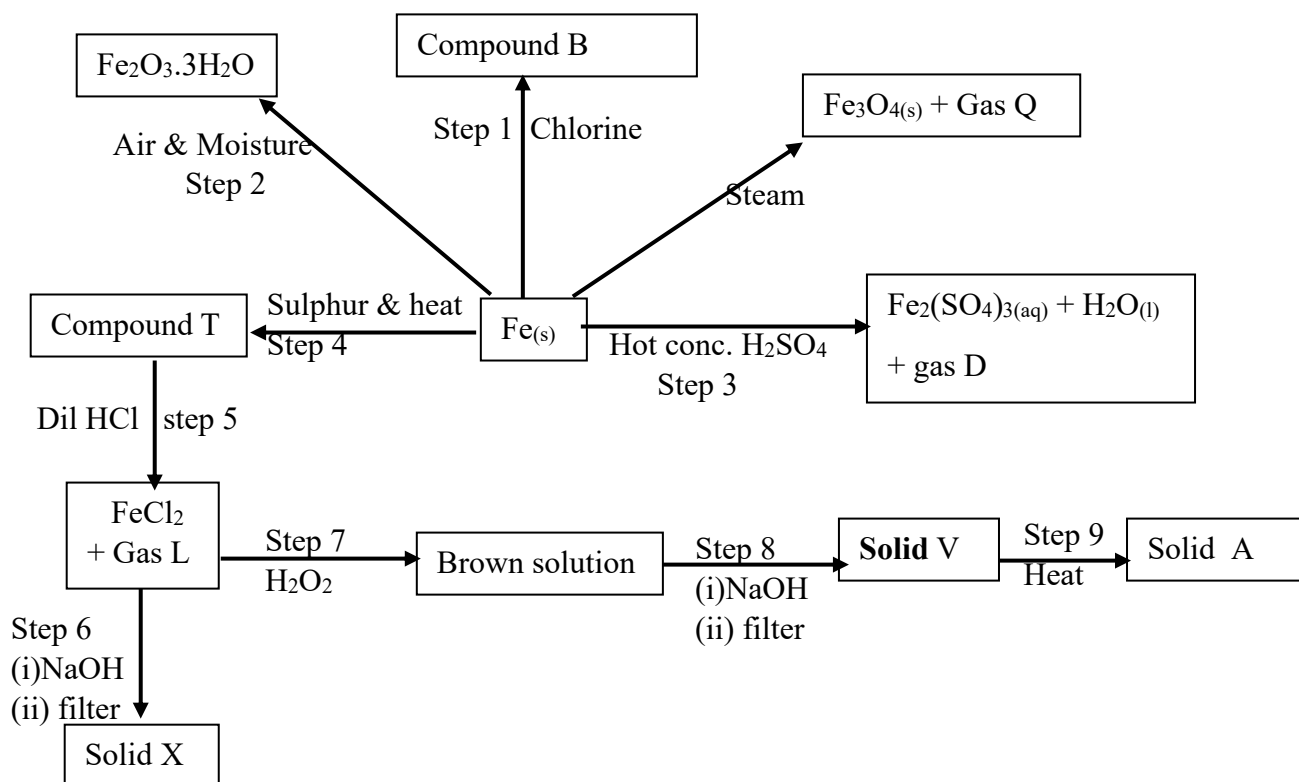
.....

ii) Give a reason for the answer given in c (i) above.

(1mark)

.....

3. Study the flow chart below starting from iron metal.



(a) Name gases (1½mk)

D.....

L.....

V.....

(b) Identify the following substances. (2 ½mk)

(i) Compound B.....

(ii) Compound T.....

(iii) Solid A.....

(iv) Solid V.....

(v) Solid X.....

c) What name is given to the reaction in step 2? (½mk)

.....

d) State the colour of solid X (½mk)

.....

e) Write balanced equations for the reactions that occurred in:- (2mks)

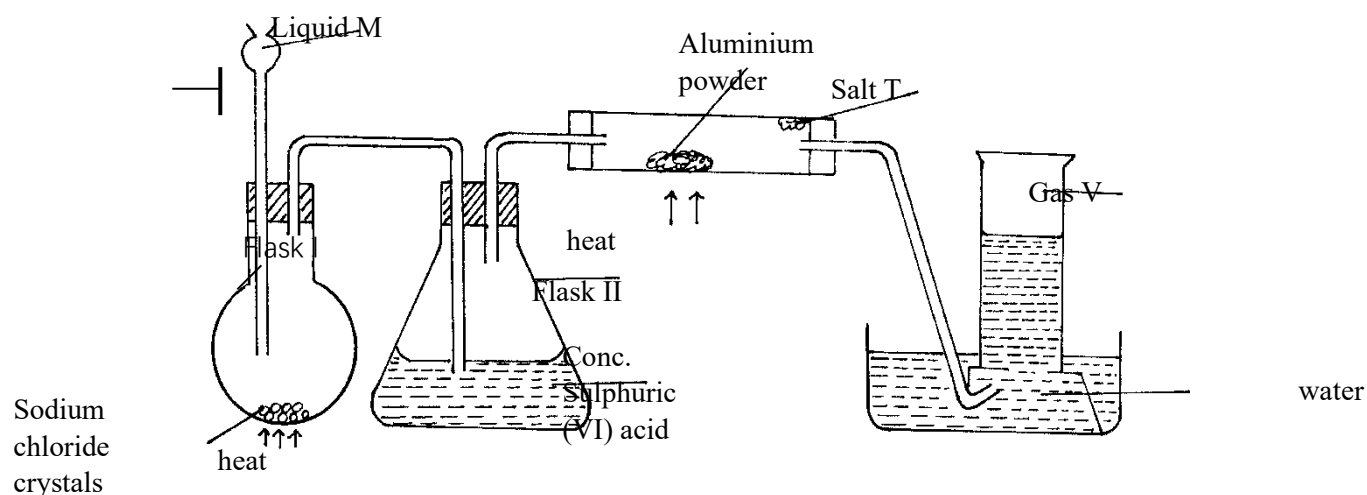
Step 1.....

Step 5.....

f) What property of hydrogen peroxide (H₂O₂) is indicated in step 7 of the flow chart? (1mk)

.....

4. The set up below was used to prepare hydrogen chloride gas and salt T.



a) **I.** Name the following

i) Liquid M (½ mark)

ii) Gas V (½ mark)

II. Write the formula of Salt T (1mark)

b) Write balanced chemical equations for reactions that occur at

i) Flask I (1mark)

ii) Combustion tube. (1mark)

c) Name the process that formed salt T as shown in the diagram. (1mark)

d) Sulphuric (VI) acid is used as a drying agent in this experiment. Explain why calcium oxide is unsuitable for the same purpose in this reaction (2marks)

e) The water in the trough was found to have a pH of 2.0 at the end of the experiment. Explain. (1mark)

f) Calculate the mass of salt T formed if 480cm³ of hydrogen chloride gas measured at r.t.p was reacted with aluminium powder. (Al=27, Cl = 35.5, MGV=24dm³) (2marks)

.....
.....
.....
g) In the space provided below, draw a well labelled diagram showing how you would dissolve hydrogen chloride gas in water. (1mark)

h) A solution of hydrogen chloride in methylbenzene does not react with carbonates. However, on adding water and then shaking the resulting mixture, there is vigorous effervescence. Explain the above observation. (2marks)

.....
.....
.....

i) Using equation, state the observation made when a gas jar containing hydrogen chloride gas is opened near an open bottle of liquid ammonia. (1mark)

.....
.....

5. Name each of the processes described below which takes place when salts are exposed to air for sometime.

(i) Anhydrous copper (II) sulphate becomes wet. (1 mark)

.....

(ii) Common table salt forms an aqueous solution (1 mark)

.....

(iii) Fresh crystals of sodium carbonate $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ becomes covered with white powder of formula $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ (1mark)

.....

(b) Write the formula of the complex ion formed in each of the reactions described below.

(i) Zinc metal dissolves in hot potassium hydroxide solution (1mark)

.....
.....

(ii) Copper hydroxide dissolves in excess ammonia solution (1mark)

.....
.....

(c) A hydrated salt has the following composition by mass. Iron 20.2%, Oxygen 23%, Sulphur 11.5% and water 45.3%. Its relative formula mass is 278. Determine the formula of the hydrated salt. (Fe = 56, S = 32, O = 16, H = 1) (3marks)

.....

.....

.....

.....

.....

(d) Describe how a solid sample of lead (II) chloride can be prepared using the following reagents:- dilute nitric acid, dilute hydrochloric acid and lead carbonate. (3marks)

.....

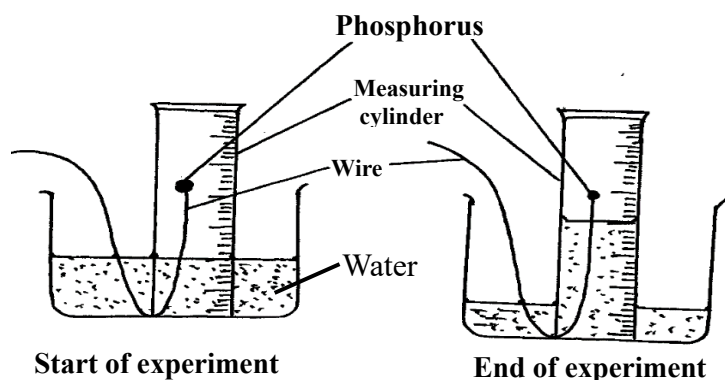
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.....

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.....

6. A student set-up the apparatus shown below in order to determine the percentage by volume of oxygen in the air. Study it and answer the questions that follow.



(a)(i) State one observations made in the measuring cylinder at the **start** of the experiment. Explain. (2mks)

.....

.....

(ii) The PH of the contents of the beaker at the end of the experiment was found to be 4. Explain the observation. (2marks)

.....

.....

(iii) The volume of air in the measuring cylinder at the end of the experiment was measured. study the data given below and answer the questions that follow.
-Volume of air at start of the experiment = 30.65 cm^3

-Volume of air at the end of the experiment = 24.28 cm³

Determine the percentage volume of oxygen in the air.

(2marks)

.....
.....
.....
(b) State and explain the observation made when a mixture of zinc powder and copper (II) oxide is heated in a crucible.

(2marks)

.....
.....
.....
(c) State **two** air pollutants produced by motor vehicles.

(1mark)

.....
.....
(d) A group of students burnt a piece of magnesium ribbon in air and its ash collected in a Petri dish. The ash was found to comprise of magnesium Oxide and Magnesium nitride

(i) Write an equation for the reaction leading to formation of the magnesium nitride. (1mk)

.....
(ii) A little water was added to the products in the Petri dish. State and explain the observation made.

(2mks)
.....
.....
(iii) A piece of **blue** litmus paper was dipped into the solution formed in (b) above. State the observation made.

(1mk)

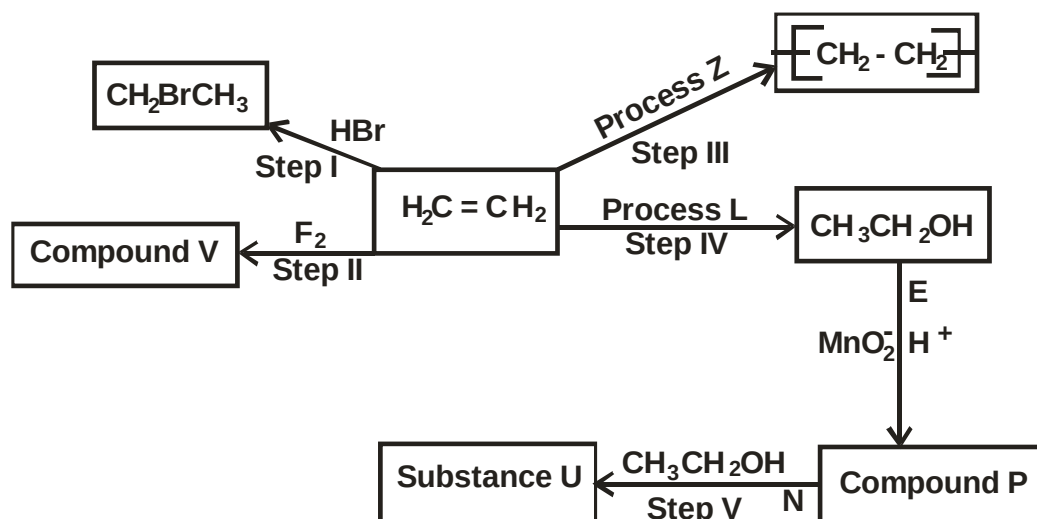
.....
7(a) A compound has an empirical formula **C₃H₆O** and a relative formula mass of 116.

i) Determine its molecular formula. (H =1, C = 12, O =16)

(2 marks)

.....
.....
ii) Calculate the percentage composition of carbon by mass in the compound. (1 mark)

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



I. State the conditions for process in step V.

(1 mark)

.....

II. Name the **reaction** represented by process.

i) Z

(1 mark)

.....

ii) L

(1mark)

.....

iii) E

1 mark)

.....

iv) N

(1 mark)

III. Draw and name the structure of the substance.

i) V

(1 mark)

.....

ii) P

(1 mark)

.....

iii) U

(1 mark)

.....

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KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name Admission number

Candidate's Signature.....Date.....

PANGANI GIRLS TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.
- b) Sign and write the date of examination in the spaces provided above
- c) Answer all the questions in the spaces provided below each question. .
- d) KNEC Mathematical tables and silent electronic calculators may be used.
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	80
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MARKS SCORED

OUT OF

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

								Q
C	E		G			L	N	
D	F							

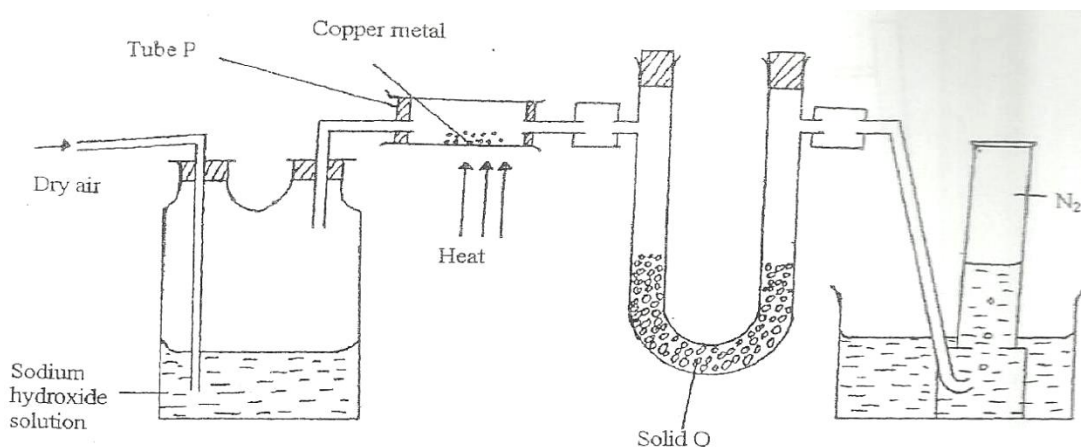
- a. i. State and explain the difference in the melting points of D and F (2mks)
- ii. Explain the difference in the atomic radii of G and N. (2mks)
- iii. Select the element that is the strongest reducing agent. Explain. (2mk)
- iv. Compare the nature of the aqueous solution of the oxide of C and that of L. explain.(2mks)

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

SUBSTANCE	M.P(K)	B.P(K)	ELECTRICAL CONDUCTIVITY	
			SOLID	MOLTEN
J	365	463	NIL	NIL
K	1323	2773	GOOD	GOOD
L	1046	1680	NIL	GOOD
M	2156	2776	NIL	NIL

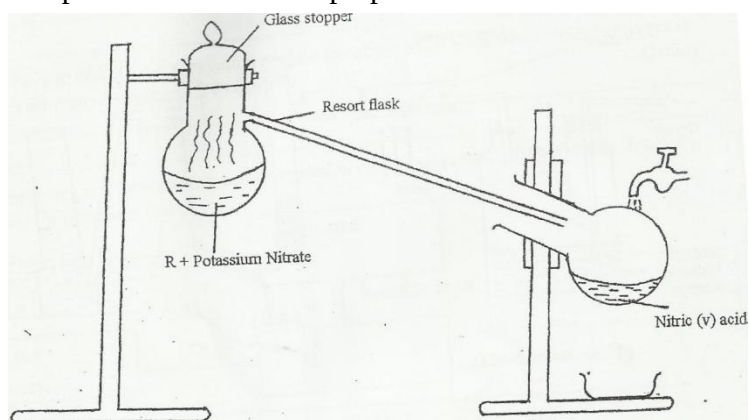
Which of the substances J, K, L and M represent the following;

- i. Silicon (IV) oxide (1mk)
- ii. Barium sulphate (1mk)
- b. In terms of structure and bonding, explain why silicon (IV) Chloride (SiCl_4) is a liquid at room temperature while Magnesium (MgCl_2) is a solid. (3mks)
2. (a) The diagram below represents a set-up that was to obtain dry nitrogen from air. Study it and answer the questions that follow.



- i. Name solid Q (1mk)
- ii. What is the purpose of $\text{NaOH}_{(\text{aq})}$? (1mk)
- iii. Write an equation for the reaction which took place in tube P (1mk)
- iv. Give the name of one impurity in the nitrogen gas obtained. (1mk)
- v. Why is liquid nitrogen used for storage of semen for artificial insemination? (1mk)

b. The set-up below was used to prepare nitric acid



- i. Give the name of liquid R (1mk)
 - ii. Write an equation for the reaction which took place in the glass retort. (1mk)
 - iii. Explain the following
 - a. Nitric acid is not stored in transparent glass. (2mks)
 - b.** The reaction between copper metal with 50% nitric acid (one volume of acid added to an equal volume of water) in an open test tube forms brown fumes. (2mks)
3. (I) Define solubility of a salt. (1mk)

(II) The table below shows the solubility of ammonium phosphate in water at different temperatures.

Temperature

10
20
30
40
50
60

Solubility in g/100g of water

63
69
75
82
89
97

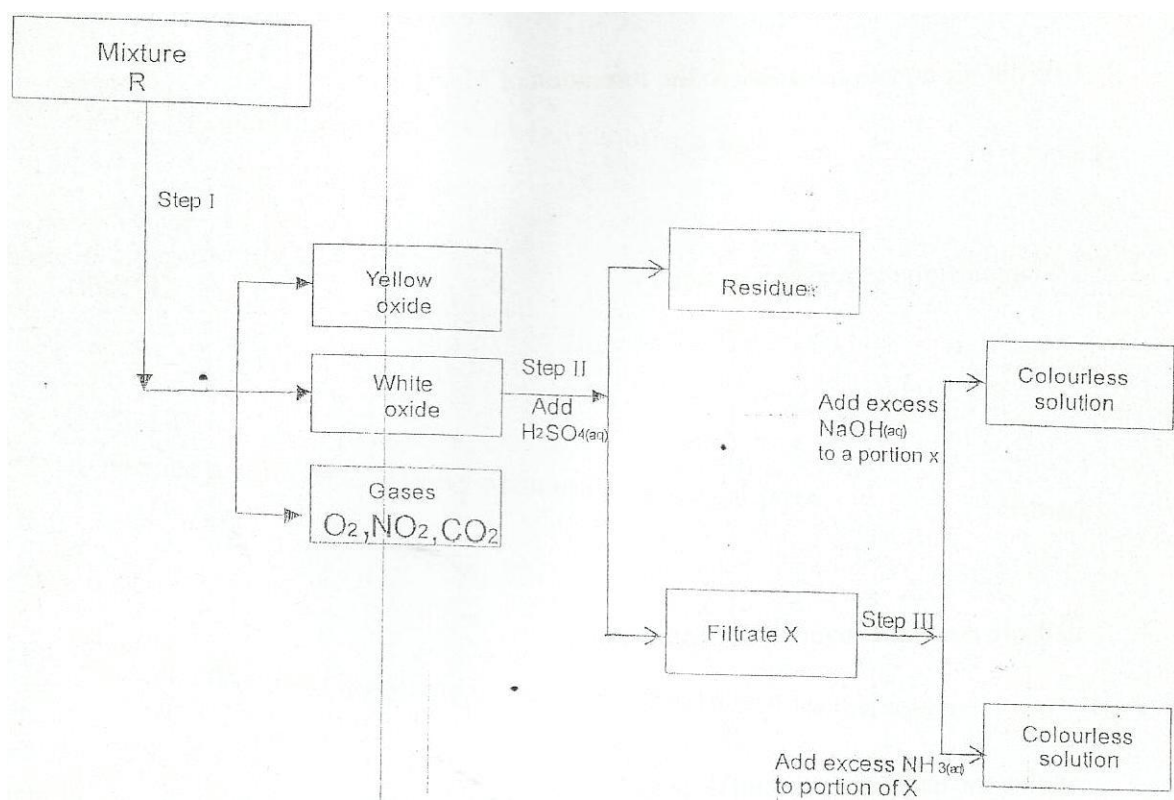
(i) On the graph paper provided, plot the graph of solubility against temperature.(3 mks)

(ii) Using the graph

(a) Determine the solubility of ammonium sulphate at 35°C

(1 mrk)

III) The flow chart below shows analysis of mixture 'R' that contains two salts



a) Study the analysis and answer the questions that follow.

(i) What condition is necessary for the process in step 1 to take place?

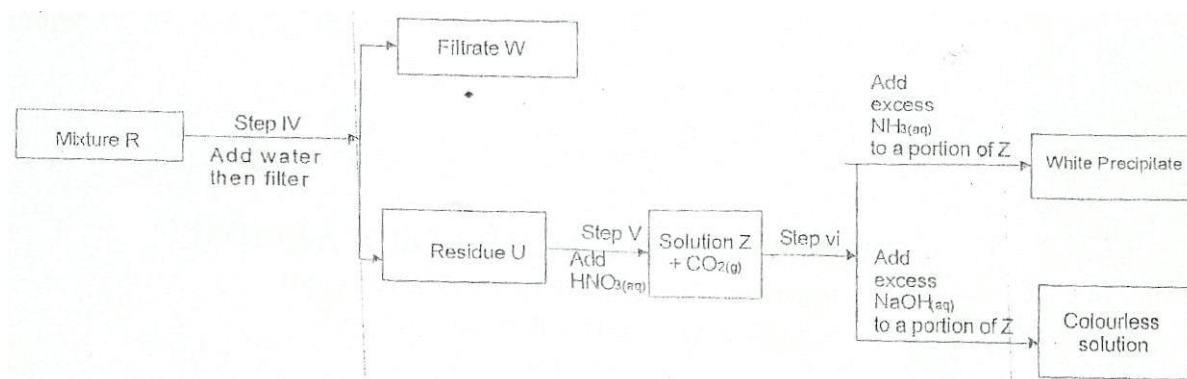
(1mark)

(ii) Draw a labeled diagram of the set up that could be used to separate the mixture formed in step II

(2mks)

(iii) Write an ionic equation for the reaction that produces a colourless solution when excess aqueous ammonia is added to filtrate X
(1mark)

iv) What observation would indicate the presence of $\text{NO}_2(\text{g})$ in step 1
(1mark)



b) (i) What conclusion can be drawn from step(IV) only? Explain
(1mark)

(ii) Write the formula of an anion present in residue U. Explain
(1mark)

(iii) Suggest the identity of the cation present in solution Z
(1mark)

c) Name the two salts present in mixture R
(1mark)

4. (a) In an experiment to determine the molar heat of reaction when magnesium displaces copper, excess magnesium powder was added to 25.0cm^3 of 2.0M copper (II) chloride solution at 23°C . The temperature rose to 38°C .

(i) Apart from increase in temperature, state and explain the observations which were made during the reaction

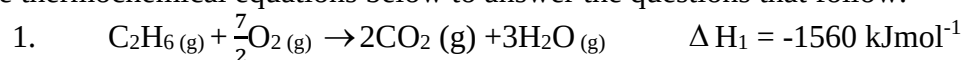
(2marks)

(ii) Calculate the heat change during the reaction. (3 marks)
(Specific heat capacity of the solution = $4.2 \text{ J g}^{-1} \text{ K}^{-1}$, density of the solution = 1 g/cm^3).

(iii) Write the ionic equation for the reaction. (1mark)

(iv) Determine the molar heat of displacement of copper by magnesium. (2marks)

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



(i) Name two types of heat changes represented by ΔH_3 . (2marks)

(ii) Draw an energy level diagram for the reaction represented by equation 1 (2marks)

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

5.(a) A hydrocarbon contains 85% carbon. Its molecular mass is 68g.

(i) Determine its empirical and molecular formula. (C = 12, H = 1). (3 mks)

(ii) Draw two positional isomers of the hydrocarbon. (1mk)

(iii) Write an equation for the reaction between one of the isomers with chlorine and name the products formed. (2mks)

Equation.

Name _____

- b) In an experiment an organic compound was reacted with absolute ethanol in the presence of concentrated sulphuric (VI) acid to form a compound whose formula is $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_3$

(i) Name

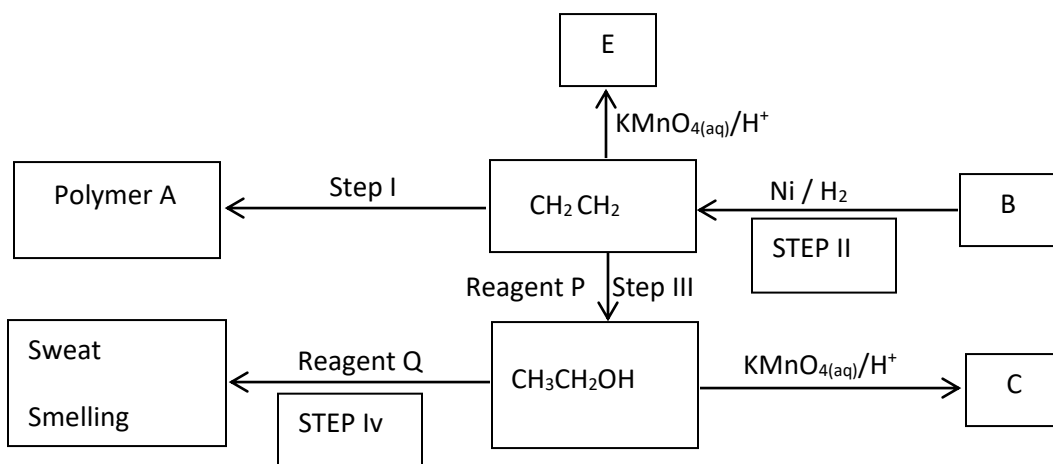
I. The type of reaction that took place.

(1mk)

II. The name of the organic compounds to which the compound belonged. (1mk)

(ii) Write the structural formula and give the systematic name of the acid used in the above experiment. (1mk)

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



(i) Identify the following compounds.

B- (1mk)

C - (1mk)

A- (1mk)

E- (1mk)

(ii) Name the process in steps.

I- (1mk)

II - (1mk)

IV- (1mk)

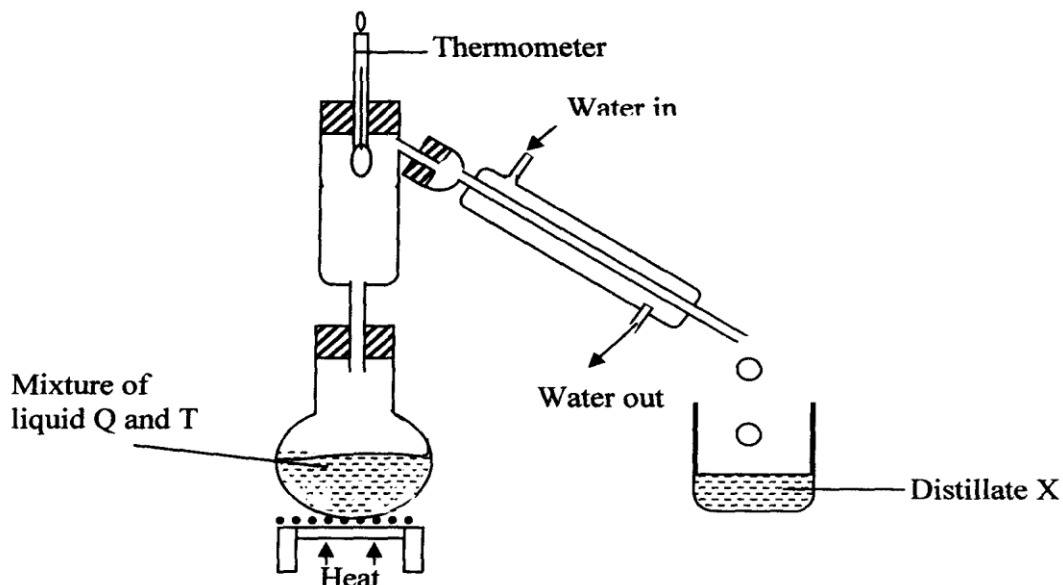
(iii) Reagent **P** (1mk)

Q

(1mk)

6. The setup below was used to separate two miscible liquids Q and T

(Boiling points; Q =98° C, T=78°C)



(a) Identify this method of separation

(1 mrk)

(b) Identify the mistakes in the setup above

(2 mrks)

(c) Identify Distillate X
mrk)

(1

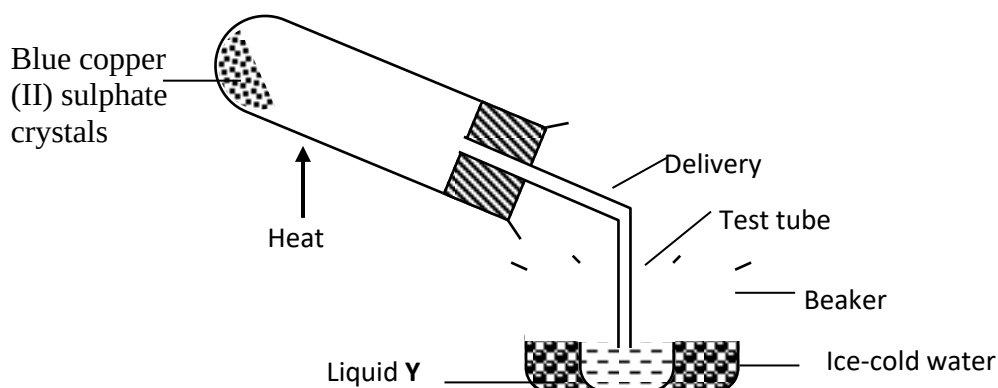
(d) What is a mixture

(1 mrk)

(e) Name one industrial application of this method

(1 mrk)

7.a) The diagram below shows a set – up used by a student to find out what happens when Copper (II) sulphate crystals are heated.



- (i) State and explain the observations made when the blue copper (II) sulphate crystals are heated.(2 mrks)
- (ii)** Identify liquid Y (1 mrk)

b) Pellets of sodium hydroxide were put in separate Petri- dishes and left in the open for two hours. Explain the observation in each Petri-dish. (1 mrk)

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STAREHE BOYS CENTER TRIALS

233/2

CHEMISTRY

PAPER 2

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

- a) Write your name , Adm No and Class in spaces provided above.
- b) Sign and write the date of examination in the spaces provided above
- c) Answer all the questions in the spaces provided below each question. .
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- f) Candidates should answer the questions in English.

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QUESTIONS	EXPECTED SCORE	CANDIDATES SCORE
1	11	
2	12	
3	10	
4	12	
5	13	
6	12	
7	10	
TOTAL	80	

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1. The figure below represents a section of the periodic table. Study it and answer questions (a) to (h). Note that the letters do not represent the actual symbols of the elements.

A							D	
B			G	J		F	H	E
C							I	

(a) Consider elements D, H and I.

- (i) Give the chemical family of these elements. (1 mk)

.....

- (ii) How do their ionic size compare. (1 mk)

.....

.....

- (iii) Compare and explain the reactivity of the three elements. (2 mks)

.....

.....

.....

(b) (i) Write the electronic configuration of:

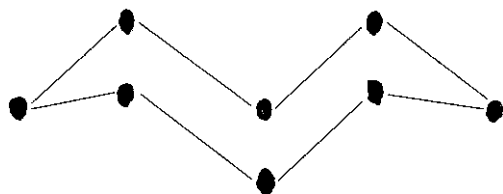
Element H (1 mk)

.....

- (ii) The ion of element G. (1 mk)

.....

(c) A molecule of one of the elements is shown below. (2 mks)



- (i) **Identify** this element from the section of the periodic table and give its actual **symbol** and **name**. (2 mks)

.....

- (ii) Explain why this element has a higher boiling point compared to that of oxygen. (2 mks)

(2 mks)

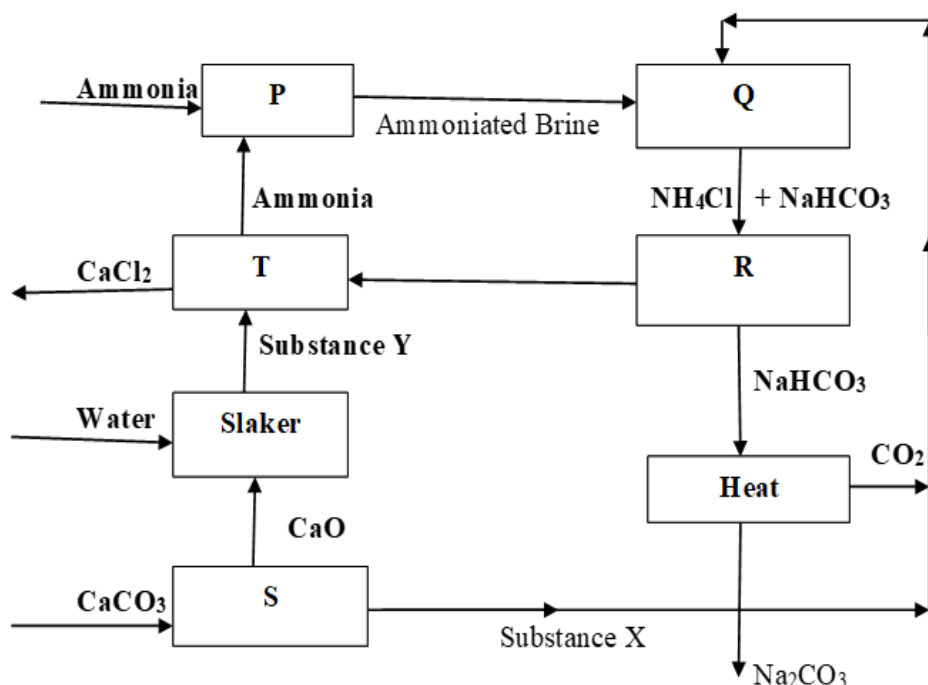
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.....

 (iii) Write an equation to show the reaction between the element named above with oxygen. (1 mk)

(iv) Predict the pH of the oxide of the above element when in water. (1 mk)

2. Use the flow chart below to answer the questions that follow.



(a) Name the substances labelled:

(2 mks)

X.....

Y.....

(b) Name 2 substances being recycled in the process represented by the flow chart. (2 mks)

.....

(c) Name the process that takes place in:

(2 mks)

S.....

R.....

(d) Give 2 uses of calcium chloride.

(1 mk)

.....

.....
 (e) Write equations for the reaction that take place in: (2 mks)

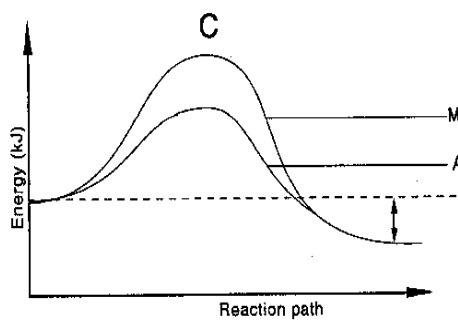
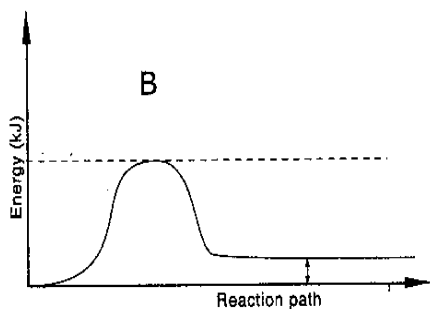
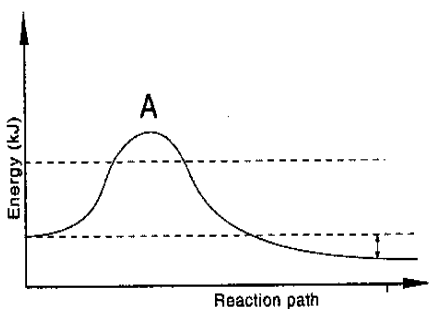
Q.....

T.....

.....
 (f) Using ionic equation explain how sodium carbonate can be used to soften hard water. (2mks)

(g) Other than softening of hard water give 2 other uses of sodium carbonate. (1 mk)

.....
 3. Consider this group of reaction energy profiles for some different reactions (A, B, C).



(a) Which reaction(s) is: (2 mks)

(i) exothermic

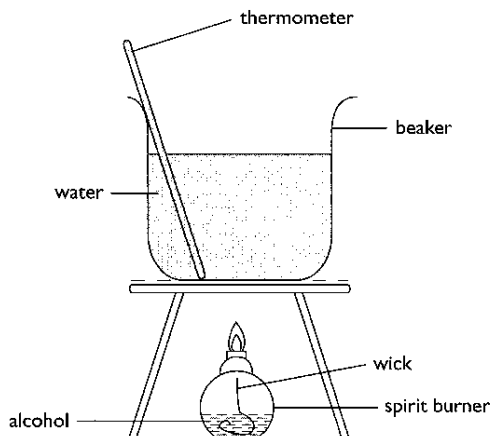
(ii) Endothermic.....

- (b) Explain why the activation energy of A in diagram C is lower than the activation energy of M in the same diagram. (1 mk)

.....

.....

- (c) In an experiment to determine the heat of combustion of methanol, CH_3OH , a student set up apparatus as shown in the diagram below. Study the set up and the data and answer the questions that follow.



Volume of water	=	100cm^3
Final temperature of water	=	22.0°C
Initial temperature of water	=	36.0°C
Final mass of lamp and methanol	=	84.75g
Initial mass of lamp and methanol	=	85.10g
Density of water	=	1 g/cm^3
(S.H.C of water = $4.2\text{ g}^{-1}\text{K}^{-1}$)		

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

- (ii) Calculate:
- (a) Number of moles of methanol used in this experiment. (1 mk)

- (b) The heat change for this experiment. (1 mk)

(c) The heat of combustion per mole of methanol.

(1 mk)

(d) Explain why the molar heat of combustion for methanol obtained above is different from the theoretical value. (1 mk)

.....
.....

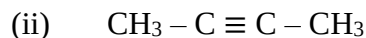
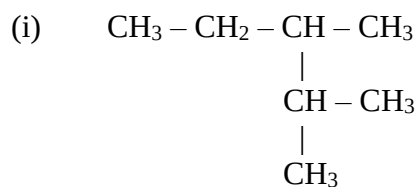
(e) State two factors to consider when choosing a fuel. (1 mk)

.....
.....
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.....

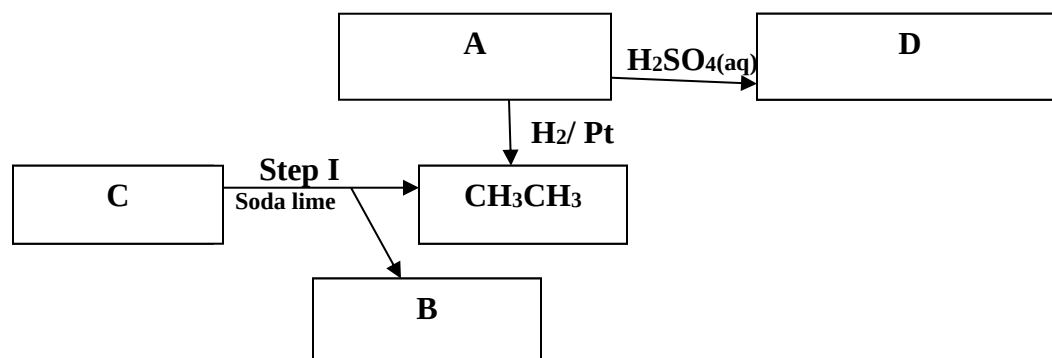
(f) Outline two disadvantages of using hydrogen as a source of fuel. (1 mk)

.....
.....
.....

4. (a) Give the IUPAC names of the following organic compounds. (2 mks)



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



(i) Identify (2 mks)

A.....

B.....

C.....

D.....

(ii) Explain how substance A and CH_3CH_3 could be distinguished by burning. (1 mk)

.....

.....

(iii) Give one reason why soda lime is preferred to pure sodium hydroxide in step I.
(1 mk)

.....

.....

(c) Write down the equation for the reaction between substance A and hydrogen when equal numbers of moles are used. (1 mk)

(d) A student found a bottle containing $\text{CH}_3\text{CH}_2\text{COO CH}_3$.

(i) Name the process of formation of the substance above. (1 mk)

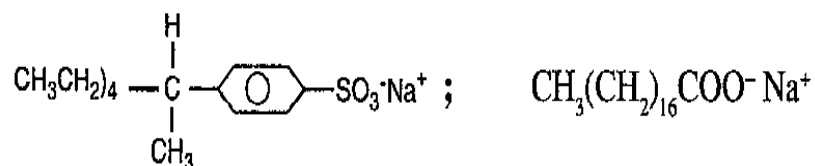
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(ii) Identify the two substances from which the substance in (d) (i) is derived. (1 mk)

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(e) The formulae below represents the active ingredients in a soapless detergent and in soapy detergents respectively.



(i) Give one advantage and one disadvantage of using soapless detergent. (1 mk)

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- (ii) Explain briefly how the soapy detergents given above may be manufactured.
(2 mks)

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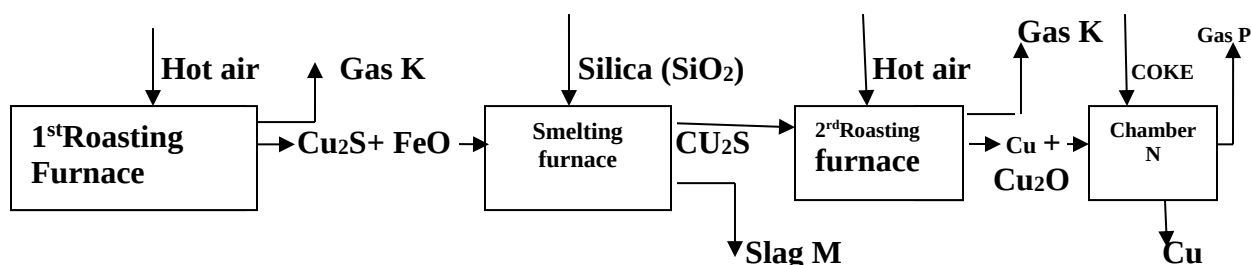
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5. (a) The flow chart below outlines some of the processes involved during extraction of copper from copper pyrites. Study it and answer the questions that follow.



- (i) Name gas K.
(1 mk)

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- (ii) Write an equation for the reaction that takes place in the 1st roasting furnace.
(1 mk)

- (iii) Write the formula of the cation present in the slag M.
(1 mk)

- (iv) Identify gas P.
(1 mk)

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- (v) What name is given to the reaction that takes place in chamber N? Give a reason for the answer.
(2 mks)

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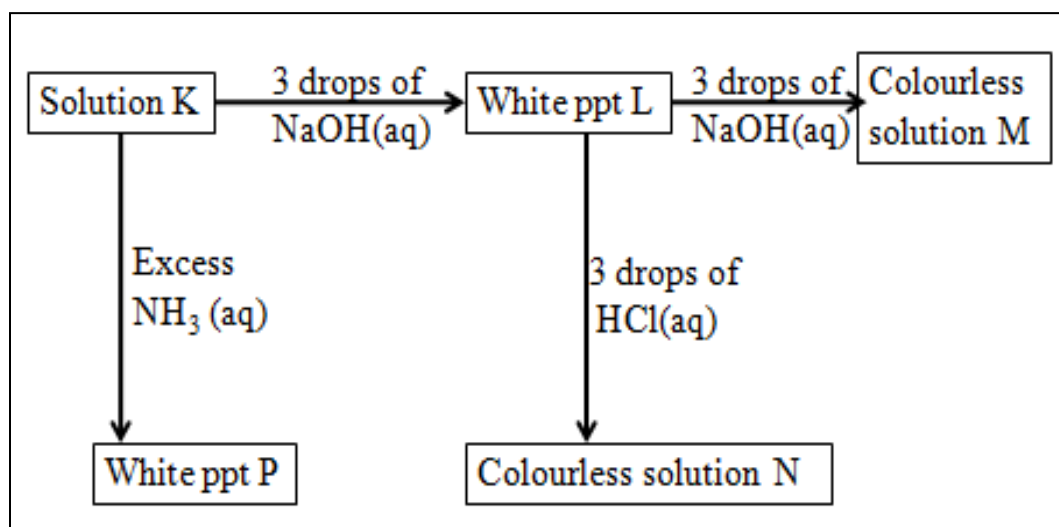
- (b) The copper obtained from chamber N is not pure. Draw a labeled diagram to show the set up you would use to refine the copper by electrolysis.
(3 mks)

- (c) Given that the mass of copper obtained from the above extraction was 210kg, determine the percentage purity of the ore (copper pyrites) if 810kg of it was fed to the 1st roasting furnace. (Cu = 63.5, Fe = 56, S = 32.0) (2 mks)

- (d) Give 2 effects that this process could have on the environment. (2 mks)

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6. Study the scheme below and use it to answer the questions that follow:



- (a) Write the formula of:

(i) Cation in solution K (1 mk)

(ii) White precipitate L (1 mk)

(iii) Colorless solution M (1 mk)

(iv) Colorless solution N (1 mk)

(v) White precipitate P

(1 mk)

(b) Write the ionic equation for the reaction for the formation of white precipitate L. (1 mk)

(c) What property of **L** is illustrated in the formation of colorless solution M and N. (1 mk)

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(d) Electrical conductivity decreases when temporary hard water is heated. Explain. (2 mks)

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(e) When excess iron fillings were dissolved in dilute sulphuric (IV) acid, a pale green solution was obtained. The solution was filtered and divided into two portions.

(i) Write an equation for the reaction

(1 mk)

(ii) To the first portion aqueous ammonia was added till in excess. State observation made.

(1 mk).

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(iii) Write an ionic equation for the reaction in (ii) above.

(1 mk)

7. a) State the Faraday's law of electrolysis

(1mk)

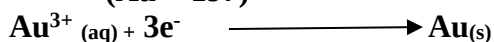
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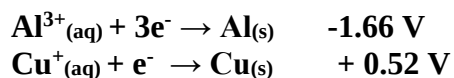
b) Calculate how long it would take an aqueous gold (III) chloride cell to coat 2.5 g of gold on a bracelet using a current of 2.5 A. The half reaction has been provided for you.

(Au = 197)

(3mks)



- c) Two half-cells are connected under standard conditions to make an electrochemical cell. The two half-cells are a copper-copper (I) ion (**Cu/Cu⁺**) and an aluminum-aluminum ion (**Al/Al³⁺**). Using your the Standard Reduction Potentials below answer.



- (i) Write the cell representation for the cell obtained when the two half cells are connected. (2mks)

- (ii) Identify the reaction that takes place at the anode and at the cathode. (2mks)

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- (iii) Calculate the emf for the above cell (1mk)

- (iv) Write the overall balanced redox reaction for the electrochemical cell. (1mk)

- d) An excess of copper solid is dropped into a solution which contains AgNO₃ , Fe (NO₃)₃ and Zn (NO₃)₂. Write the equations for any reduction **half-reactions** that occur over time under standard conditions. (1mk)