

FOR MARKING SCHEMES INBOX 0724351706

NAME..... INDEX NO.....

**233/1**  
**CHEMISTRY**  
**PAPER 1**  
**(THEORY)**  
**AUGUST, 2021**  
**TIME: 2 HOURS**

CANDIDATE'S SIGN.....

DATE.....

## **BUNYORE-MARANDA JOINT EXAMINATION - 2021**

**Kenya Certificate of Secondary Education**  
**CHEMISTRY**  
**PAPER 1**  
**(THEORY)**  
**TIME: 2 HOURS**

### **INSTRUCTIONS TO CANDIDATES:**

- (i) Write your **name** and **index number** in the spaces provided **above**.
- (ii) **Sign** and write the **date** of examination in the spaces provided **above**.
- (iii) Answer **ALL** the questions in the spaces provided.
- (iv) Mathematical tables and silent electronic calculators **may be** used.
- (v) All working **must be** clearly shown where necessary
- (vi) 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**

<b>Questions</b>	<b>Maximum Score</b>	<b>Candidate's Score</b>
<b>1 – 29</b>	<b>80</b>	

## Chemistry Paper 1

Turnover

1. Element **X** and **Y** have atomic numbers 12 and 8 respectively.
- (i) Write down the electron arrangement of the ions.
- (a) **X**<sup>+</sup> \_\_\_\_\_ (1mk)
- (b) **Y**<sup>-</sup> \_\_\_\_\_ (1mk)
- (ii) Write down the formula of the compound formed between **X** and **Y**. (1mk)
- \_\_\_\_\_
- \_\_\_\_\_
2. When hydrogen gas was passed over heated lead (II) oxide in a combustion tube and the gaseous products cooled, a colourless liquid was obtained.
- (i) Which chemical test would you use to confirm the colourless liquid above? (1mk)
- \_\_\_\_\_
- \_\_\_\_\_
- (ii) What observation was made in the combustion tube. (1mk)
- \_\_\_\_\_
- \_\_\_\_\_
- (iii) Write an equation for the reaction between hydrogen and lead (II) oxide. (1mk)
3. 15.0cm<sup>3</sup> of ethene were mixed with 50.0cm<sup>3</sup> of oxygen and the mixture was sparked to complete the reaction. If all volumes were measured at a pressure of one atmosphere and 25°C, calculate the volume of the resulting gaseous mixture. (3mks)

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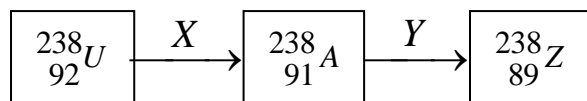
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## Chemistry Paper 1

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4. Below is a part of radioactive decay series which start with uranium 238. Study it and answer the following questions.

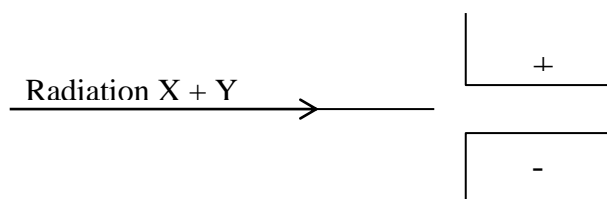


- (a) Identify radiations **X** and **Y**.

**X** \_\_\_\_\_ (½mk)

**Y** \_\_\_\_\_ (½mk)

- (b) The above identified radiations are passed through a field. Complete the diagram to clearly show how they are affected by magnetic field. (2mks)



5. The following two tests were carried out on chlorine water contained in two test tubes:

- (a) A piece of blue flower was dropped in the first test tube. Explain why the flower was bleached. (2mks)

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- (b) The second test tube was corked and exposed to sunlight. After a few days, it was found to contain a gas that rekindled a glowing splint. Write an equation for the reaction which produced the gas. (1mk)

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6. (a) Using dots (.) and crosses (X) to represent electrons in the outermost energy level, draw a diagram to show bonding in the compound formed between phosphorous and hydrogen. (H = 1, P = 15). (1mk)

## Chemistry Paper 1

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- (b) In what state would you expect the compound in (a) above to be at room temperature? Explain. (2mks)

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7. The table below shows results obtained from experiment carried out on a salt solution M.

	Experiment	Results
I	A few drops of barium nitrate added to solution M.	No white precipitate.
II	A few drops of lead (II) nitrate added to solution M.	White precipitate present.
III	Ammonia solution added drop wise until in excess.	White precipitate which dissolves to form a colourless solution.

- (a) Identify the cation and anion present in solution M.

Cation \_\_\_\_\_ (½mk)

Anion \_\_\_\_\_ (½mk)

- (b) Write an ionic equation for the formation of white precipitate in experiment II. (1mk)

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- (c) Write the formula of the ion responsible for the formation of colorless solution in experiment III. (1mk)

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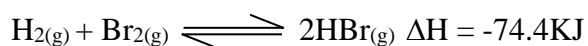


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8. Study the reaction equation given below.



- (a) Draw an energy level diagram showing the catalysed and uncatalysed reaction. (2mks)

## Chemistry Paper 1

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- (b) State the effect on formation of hydrogen bromide if pressure was increased in the equilibrium mixture above. Explain. (1mk)

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9. An organic compound has a formula of  $C_4H_{10}O$ .

- (a) Write the structural formula of the organic compound. (1mk)

- (b) To which homologous series does the compound belong? (1mk)

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- (c) Name the compound formed when this compound is reacted with propanoic acid. (1mk)

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10.  $X\text{cm}^3$  of 0.25m sodium chloride was added to lead (II) nitrate until in excess. 3.86g of a white precipitate were formed ( $\text{Na} = 23$ ,  $\text{Pb} = 207$ ,  $\text{Cl} = 35.5$ ,  $\text{N} = 14$ ,  $\text{O} = 16$ ).

- (i) Write an ionic equation for the formation of white precipitate. (1mk)

- (ii) Work out the value of X. (2mks)

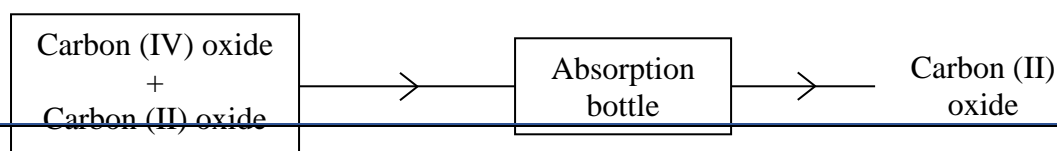
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11. The flow chart below shows part of the process of preparing and correcting carbon (II) oxide.



- (a) Name **two** reagents that are reacted to produce both carbon (IV) oxide and carbon (II) oxide. (1mk)

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- (b) Name the chemical substance in the absorption bottle. (1mk)

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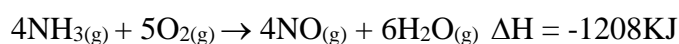
Chemistry Paper 1

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- (c) Write an equation for the reaction that takes place in the absorption bottle. (1mk)

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12. Ammonia reacts with oxygen as shown by the thermo chemical equation shown below.



- (a) Work out:

- (i) Energy evolved when one mole of ammonia reacts with oxygen. (1mk)

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- (ii) Enthalpy change when  $2.4\text{dm}^3$  of ammonia reacts as shown in the equation at r.t.p. (1mk)

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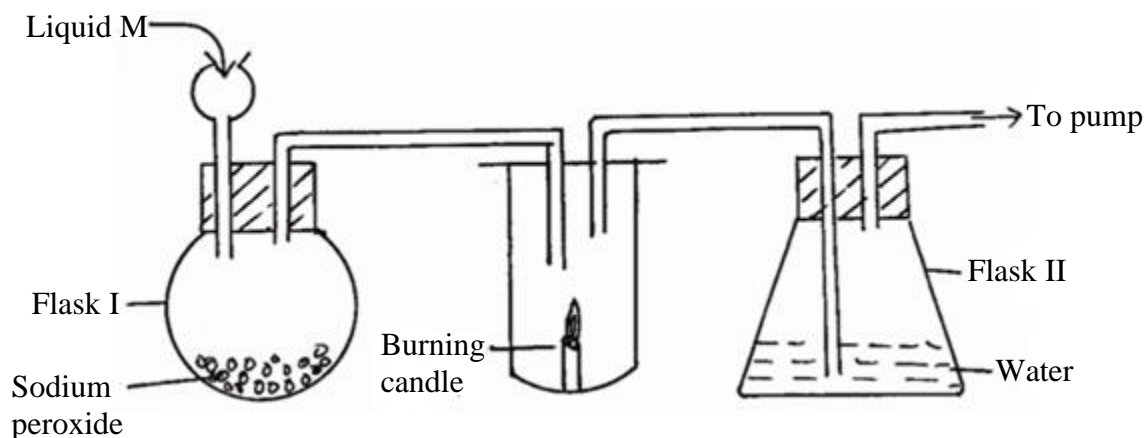
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- (b) Name the catalyst used in this reaction. (1mk)

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13. The diagram below shows a set up of apparatus used to prepare oxygen gas and pass it over burning candle. The experiment was allowed to run for several minutes.



- (i) Identify liquid M. (1mk)

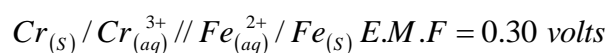
- (ii) The PH of the solution in flask **II** was found to be less than **7**. Explain. (2mks)

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- (iii) Write an equation for the reaction that forms oxygen gas in the set up. (1mk)

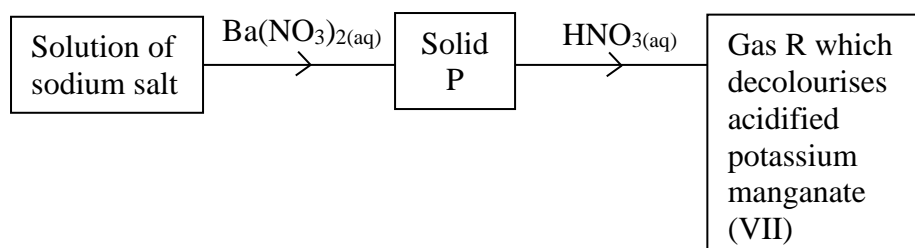
14. Study the cell representation below.



- (a) Write an overall cell reaction for the cell above. (1mk)

- (b) The  $E^0$  value of  $Fe_{(aq)}^{2+} / Fe_{(s)}$  is 0.44 volts calculate the  $E^0$  value of  $Cr_{(aq)}^{3+} / Cr_{(s)}$ . (2mks)

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



- (a) Name the solid **P**. (1mk)

- (b) Give the formula of the sodium salt. (1mk)

- (c) Name gas **R**. (1mk)

16. One mole of hydrogen chloride gas was reacted with one mole of ethyne.  
(i) Write a balanced equation for the reaction that occurred. (1mk)

- (ii) Name the product formed in (i) above. (1mk)
- 

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- (iii) Name the product that would be formed when the product name in (ii) above undergoes self addition reaction. (1mk)
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17. The solubility of potassium nitrate is 85g/100g of water at 50°C and 32g/100g of water at 25°C.  
(a) Define the term solubility. (1mk)

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- (b) Calculate the mass of crystals formed if a saturated solution of potassium nitrate in 50g of water at 50°C is cooled to 25°C. (2mks)

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18. A mixture of kerosene and water was shaken and left to stand; ammonia gas was then bubbled into the mixture followed by a few drops of phenolphthalein indicator. State and explain the observations. (2mks)

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19. A compound W reacts with dilute sulphuric (VI) acid producing a colourless gas that turns a filter paper soaked in lead (II) ethanoate black. The solution obtained formed a white precipitate with aqueous ammonia that dissolves in excess ammonia to form a colourless solution.

- (a) Name compound W. (1mk)



- (b) Write an ionic equation for the formation of the black substance. (1mk)

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- (c) What is the formula of the ion in the colourless solution formed when the white precipitate was dissolved? (1mk)

20. A given mass of a gas occupies  $240\text{cm}^3$  at  $91^\circ\text{C}$  and  $78\text{mmHg}$ . What volume will the gas occupy at s.t.p? (2mks)

21. (a) What are isotopes? (1mk)

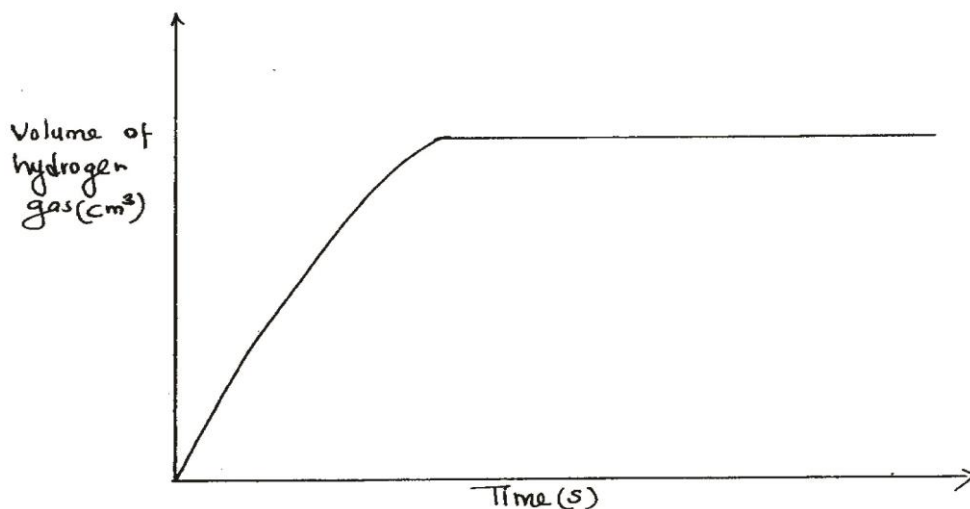
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- (b) The R.A.M of element P is 63.5. It has two isotopes of masses 63 and 65 respectively. Determine the percentage abundance of each isotope. (2mks)

22. In an experiment to monitor the rate of reaction of magnesium and hydrochloric acid a student recorded the volume of hydrogen at regular time intervals and obtained the graph shown below.



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- (a) On the same set of axes sketch the curve expected if the experiment is repeated with a few crystals of copper (II) sulphate added to the reactants. (1mk)
- (b) Explain the shape of the curve drawn in (a) above. (1mk)

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23. (a) Write the formula of the chief ore from which aluminium is extracted. (1mk)

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- (b) Explain the role of molten cryolite in extraction of aluminium. (1mk)

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- (c) Aluminium does not apparently react with dilute nitric (V) acid. Explain. (1mk)

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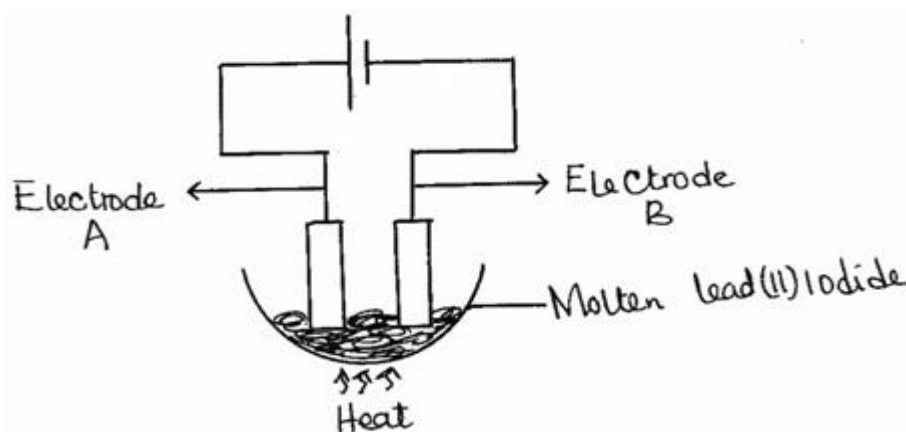
24. (a) What is a binary electrolyte? (1mk)

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- (b) The set-up below was used to electrolyse molten lead (II) iodide.



- (i) State the observation that was made during electrolysis at electrode **B**. (1mk)

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- (ii) Write the ionic equation for the reaction that took place at the anode. (1mk)

25. Calculate the oxidation number of chromium in the ion  $\text{CrO}_4^-$ . (1mk)

26. The table below shows the formula of elements **P**, **Q**, **R** and **S** (not actual symbols) and their chlorides.

Element	P	Q	R	S
Formula of chloride	$\text{PCl}$	$\text{QCl}_2$	$\text{PCl}_3$	$\text{SCl}_5$

- (a) State the group to which each of the elements belongs.

**P** \_\_\_\_\_ (½mk)

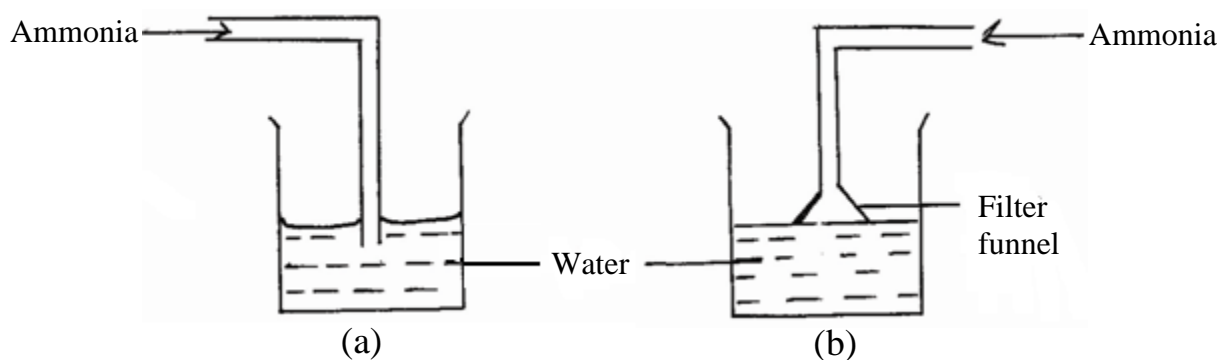
**Q** \_\_\_\_\_ (½mk)

**R** \_\_\_\_\_ (½mk)

**S** \_\_\_\_\_ (½mk)

- (b) Write down the formula of the oxide of element **R**. (1mk)

27. You are provided with the following two set-ups to prepare aqueous ammonia in the laboratory.



Which of the two set-ups **(a)** and **(b)** would you prefer? Explain.

(2mks)

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*Chemistry Paper 1*

*11*

28. State the property of argon that makes it suitable for filling filament lamps.

(1mk)

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29. A solution of sodium hydroxide containing 2g of the alkali in 200cm<sup>3</sup> of the solution required 28cm<sup>3</sup> of nitric (V) acid for complete neutralization. Calculate:

(a) the concentration of the alkali solution in moles per litre.

(2mks)

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(b) the concentration of the acid in moles per litre.

(1mk)

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NAME: ..... INDEX NO: .....

DATE: .....CLASS: ..... SIGNATURE: .....

233/2

CHEMISTRY

PAPER 2

(Theory)

AUGUST/SEPTEMBER 2021

2 HOURS

BUNYORE-MARANDA (BUMA (II) JOINT EXAMINATIONS

Kenya Certificate of Secondary Examinations

**INSTRUCTIONS TO CANDIDATES**

1. Write your name, Index number in the spaces provided
2. Sign and write the date of the examination in the spaces provided
3. Answer all the questions in the spaces provided in the question paper
4. Mathematical tables and silent electronic calculators may be used
5. All working must be clearly shown where necessary
6. Slovenly work will be penalized.

**FOR EXAMINER'S USE ONLY**

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	11	
2	12	
3	10	

FOR MARKING SCHEMES INBOX 0724351706

4	10	
5	15	
6	10	
7	12	
	80	

1. Study the table below and answer the questions that follow. The letters do not represent the actual symbols of the element.

Formula of ion	Electronic configuration
$E^{2+}$	2
$D^-$	2.8
$C1^-$	2.8.8
$B^{3+}$	2.8
$A^{2+}$	2.8

- (a) Select elements found in: -

- (i) The same group ..... (1 mark)  
 (ii) Period three..... (1 mark)  
 (iii) What is the family name given to the group number to which element E belongs  
 (1 mark)

.....  
 .....

- (b) With reasons compare the atomic radius of elements B and A. (2 marks)

.....  
 .....

- (c) State two industrial uses of element B. (2 marks)

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 .....

- (d) With reasons, compare the reactivity of E and A. (2 marks)

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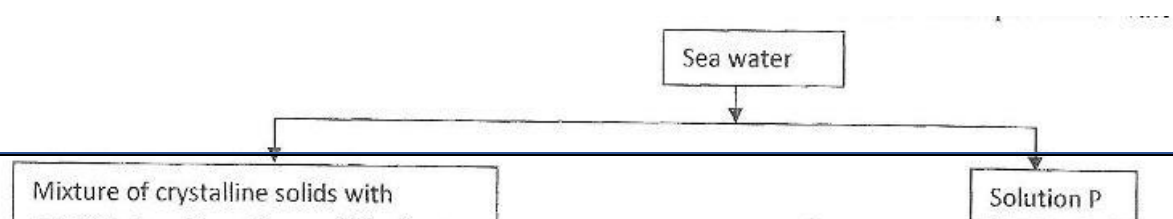
- (e) Write the formula of the compound formed when D and A react. (1 mark)

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 .....

- (b) What type of bond is formed when element E reacts with oxygen. Give a reason or your answer.  
 (2 marks)

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 .....

2. Study the flow chart and information in the table below it and answer the questions that follow. The chart shows how certain chemicals can be obtained from a sample of sea water.



Salt	MgSO <sub>4</sub>	CaSO <sub>4</sub>	MgCl <sub>2</sub>	CaCl <sub>2</sub>	KCl	NaCl	K <sub>2</sub> SO <sub>4</sub>	KBr	NaI
Solubility g/10g water	22	0.21	55	83	35	35.6	12	56	160

(a) Write the formulae of two anions in solution W. (1 mark)

.....  
(i) Identify elements Q and R (1 mark)

Q .....

R .....

(ii) Write an ionic equation for the reaction which produces Q and R.

.....  
(iii) Name salt X .....

(iv) Name solid T and write the equation for the reaction which produces it.

Solid T ..... (1 mark)

Equation..... (1 mark)

.....  
(v) Write the formulae of the precipitate V. (1 mark)

.....  
(vi) Name two salts present in solution W. (2 marks)

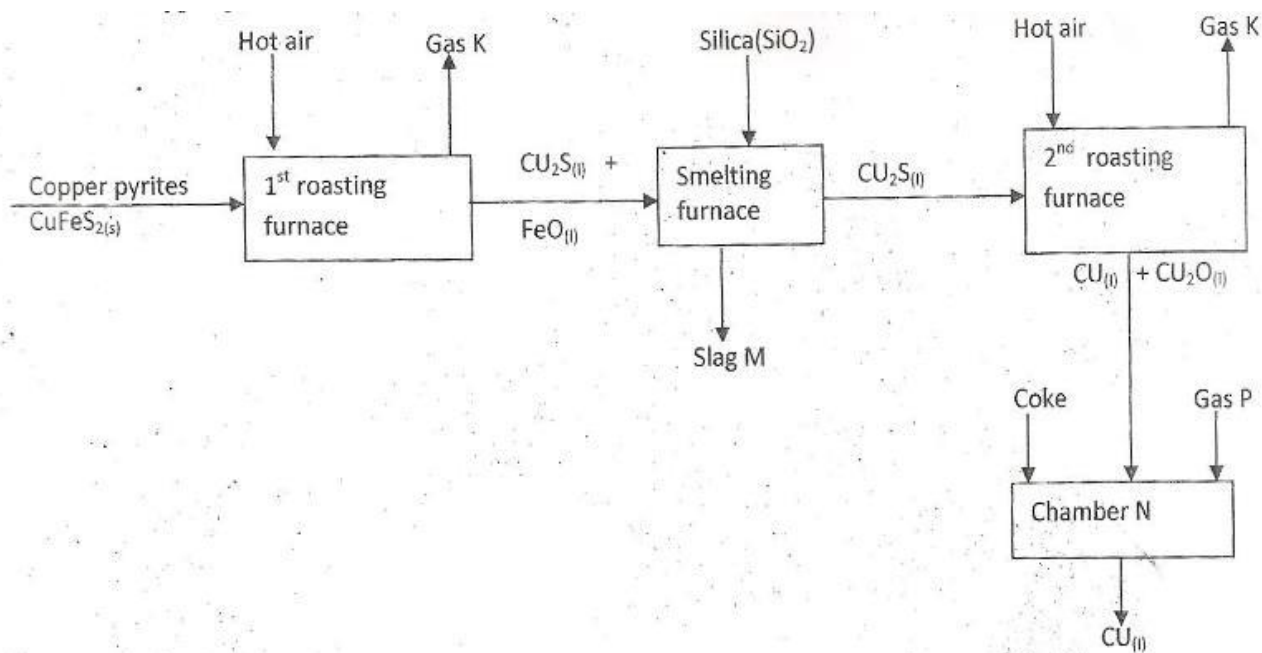
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(b) Explain why sea water is not suitable for washing clothes. (2 marks)

.....  
(c) Explain why motor vehicles based in Mombasa rust much faster than those based in Nairobi.

(1 mark)



3. (a) The chief ore for the extraction of lead metal is galena. Describe how the presence of lead can be identified in an ore. (2 marks)



(i) Name gas K ..... (1/2 mk)

(ii) Write an equation for the reaction that takes place in the 1<sup>st</sup> roasting furnace.  
(1 mark)

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(iii) Write the formulae of the cation present in Slag M (1 mark)

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(iv) Identify gas P (1/2 mk)

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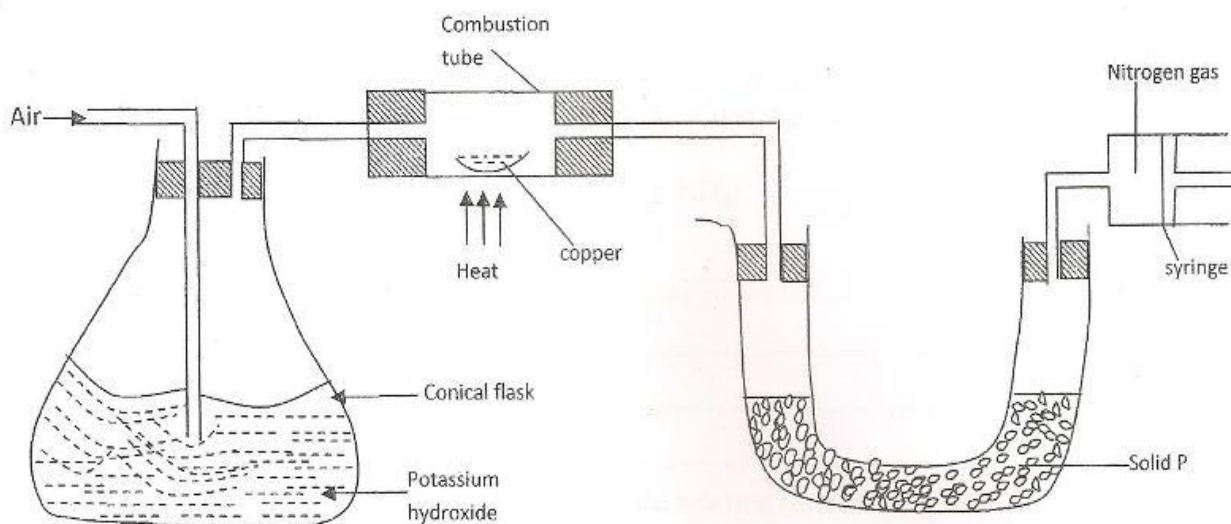
(v) What name is given to the reaction that takes place in chamber N? Give a reason for the answer.  
(1 mark)

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.....

(c) 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. (2 mark)

- (d) 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 first roasting furnace. (CU = 63.5, Fe = 56.9, S = 32.1) (3 marks)

4. The diagram below represents a set up that was used to obtain dry nitrogen from air. Study it and answer the questions that follow.



- (a) (i) Name solid P. (1 mark)

- (ii) State the observations in the combustion tube. (1 mark)

- (iii) Write down the equation occurring in the conical flask. (1 mark)

- (iv) Explain why a high temperature is required for nitrogen to react with oxygen. (1 mark)

- (v) How would the volume nitrogen gas collected in the syringe if magnesium turnings were used in the combustion tube instead of zinc granules? Explain (2 marks)

(c) Nitrogen forms many compounds in which its oxidation states varies.

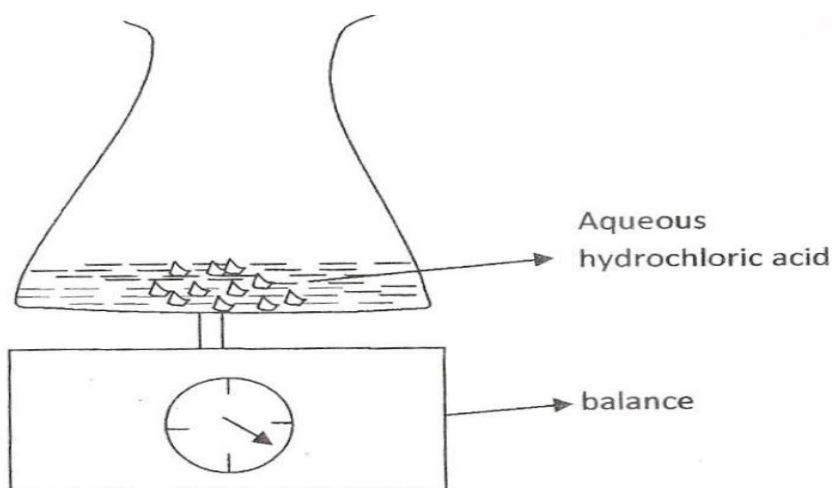
(i) What is meant by oxidation state? (1mark)

(ii) Below is an equation for the reaction between an oxide of sulphur and an oxide of nitrogen.

Using the oxidation number of sulphur or nitrogen, show that the reaction is a redox.



5. During an experiment, a form four student studied the reaction between 120g of pellets of brass and aqueous hydrochloric acid at 25<sup>0</sup>C as shown; and readings on the balance were recorded at regular intervals.



The results are given in the table below

Time in seconds	Reading on the balance (g)	Total loss in mass (g)
0	600	0.00
20	599.50	0.50
40	598.84	0.88
60	598.66	1.16
80	598.54	1.34
100	598.50	1.46
120	598.50	1.50
140	598.50	1.50
160	598.50	1.50

- (a) Explain why the readings on the balance decreased with time during the first 120 seconds and then remained constant. (1 mark)

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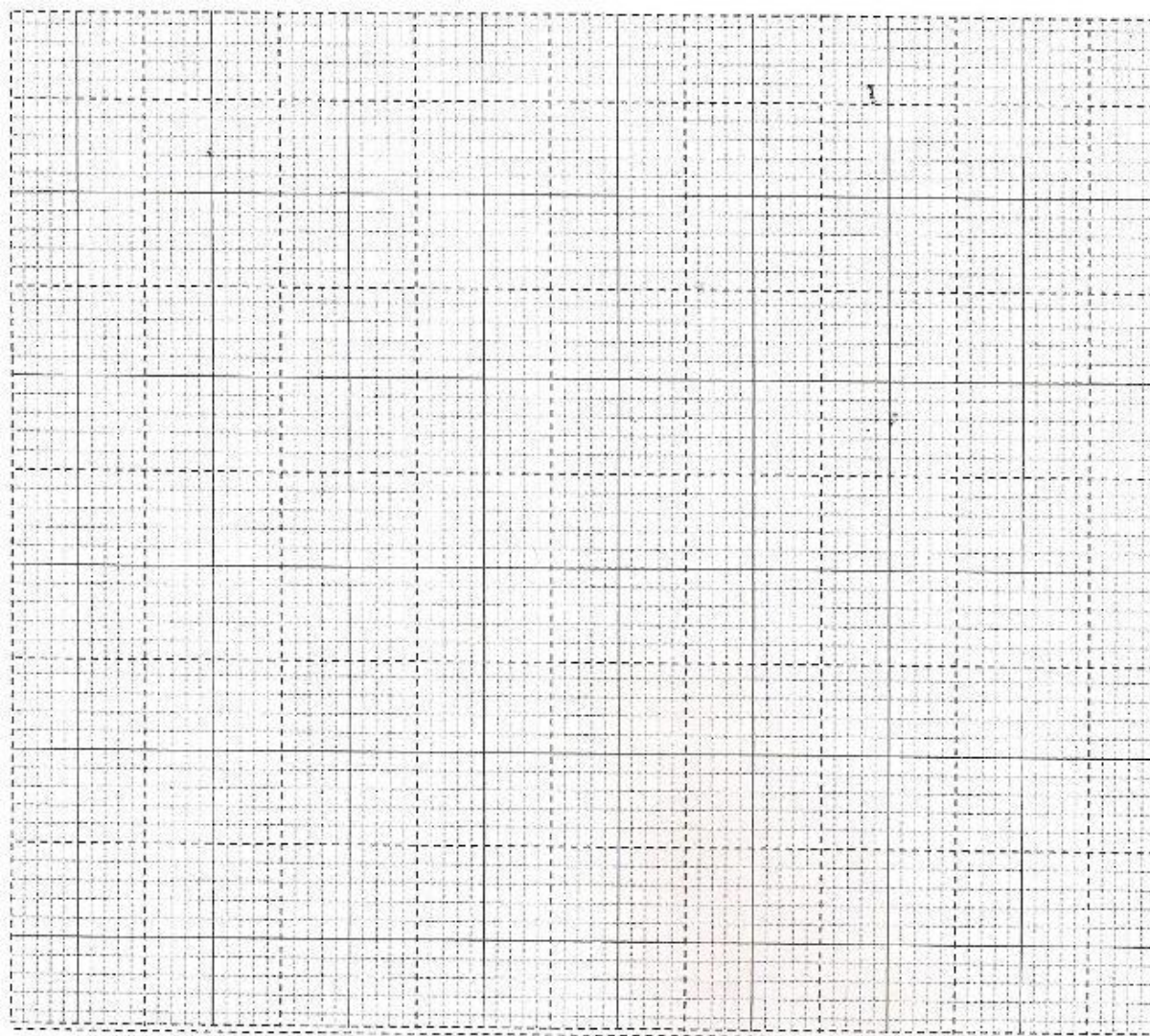
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- (b) Show how a gaseous product of the reaction is collected on the diagram. (2 marks)

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- (c) (i) Draw a graph of total loss in mass against time. (3 marks)



- (ii) From the graph determine the rate of reaction 50 seconds after the start. (2 marks)

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- (d) Write an equation for the reaction in the flask. (1 mark)

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- (e) Calculate the mass of copper contained in brass ( $H = 1$ ,  $Zn = 65.4$ ) (3 marks)

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- (f) Calculate the total mass in grams that was left after the experiment in the conical flask.

(1 mark)

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- (g) Apart from temperature change, state two other ways in which the reaction in the experiment can be speeded up. (2 marks)

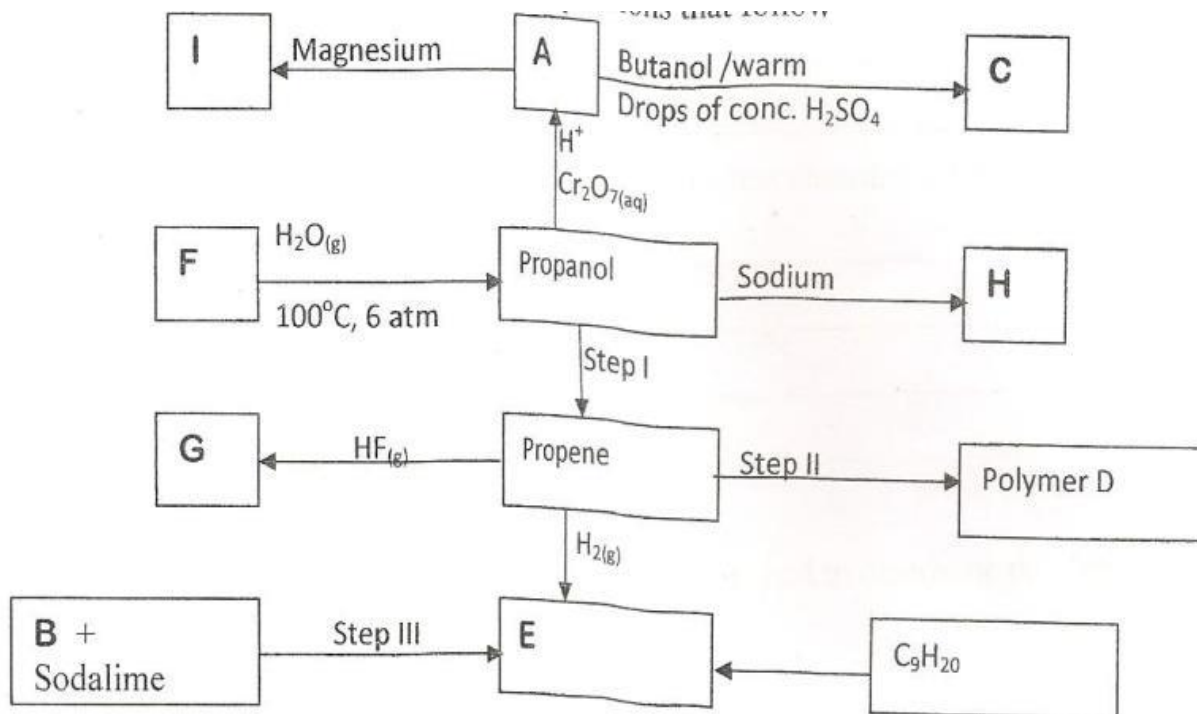
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6. Study the scheme below and answer the questions that follow.



- (a) Name the following compounds. (1 mark)

F .....

I .....

- (b) Name and draw the structural formula of compounds G and H. (2 marks)

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- (c) Write down chemical equations for;

- (i) Reaction of compound A and butanol (1 mark)

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- (ii) Reaction in step II (1 mark)

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- (d) Name the process that takes place in step IV (1 mark)

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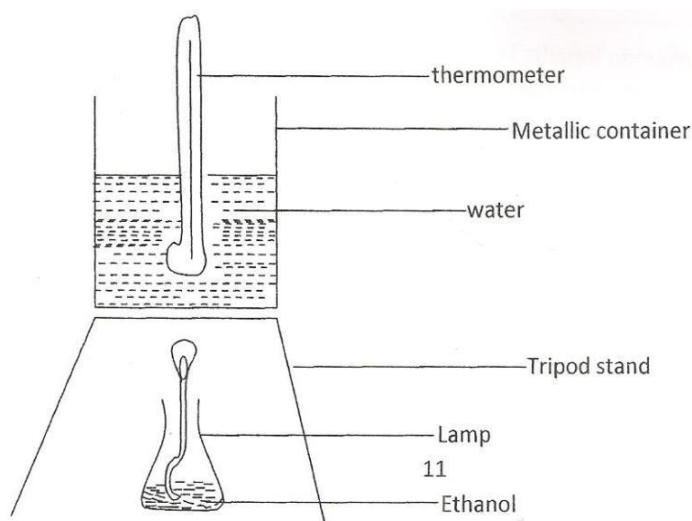
- (e) Name the conditions necessary for propene to form compound E. (1 mark)

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(f) Describe how you can distinguish between compound A and propanol. (3 marks)

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7. (a) (i) Apart from ethanol, name two liquid fuels. (1 mark)

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

(2 marks)





During the experiment, the data given below was recorded.

Volume of water =  $500\text{cm}^3$

Initial temperature of water =  $25^\circ\text{C}$

Final temperature of water =  $46.5^\circ\text{C}$

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 =  $1\text{g/cm}^3$ , specific heat capacity of water =  $4.2\text{J/g/K}$ ).  
(3 marks)

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- (ii) Molar heat of combustion of ethanol (C = 12.0, O = 16.0, H = 1.0) (2 marks)

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- (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) (ii) above is lower than the theoretical value. Give two reasons for this variation. (2 marks)

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- (c) Why is the water in the container continuously stirred with thermometer? (1 mark)

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===== END =====

NAME: .....INDEX NO:.....

SCHOOL: .....STREAM:.....

233/3

CHEMISTRY

THEORY

PAPER 3

AUGUST/SEPTEMBER 2021

TIME: 2 HOURS

**BUNYORE – MARANDA (BUMA) JOINT EXAMINATIONS  
CHEMISTRY PAPER 1 2021**

**INSTRUCTIONS TO CANDIDATES**

- Write your name and index number in the spaces provided above.
- Answer ALL the questions in the spaces provided in the question paper.
- You are NOT allowed to start working with the apparatus for the first 15 minutes of the 2 ½ hours allowed for this paper. This time is to enable you to read the question paper and make sure you have all the chemicals and apparatus that you may need.
- All working MUST be clearly shown where necessary
- Mathematical tables and electronic calculators may be used.

FOR EXAMINER'S USE ONLY

QUESTION	MAX. SCORE	SCORE-----
1	20	
2	14	
3	6	
TOTAL SCORE	40	

1. You are provided with: -
- 4.5g of solid A in a boiling tube.
  - Solution B, 0.06M acidified Potassium manganate (VII)

You are required to determine

- (1) The solubility of solid A at different temperatures.
- (2) The number of moles of water of crystallization in solid A.

### PROCEDURE

- (a) Using a burette, add 4cm<sup>3</sup> of distilled water to solid A in the boiling tube. Heat the mixture while stirring with the thermometer to about 70°C. When the entire solid has dissolved, allow the solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid A first appear. Record this temperature in table 1.
- (b) Using the burette, add 2cm<sup>3</sup> of distilled water to the contents of the boiling tube. Warm the mixture while stirring with the thermometer until all the solid dissolves. Allow the mixture to cool while stirring. Note and record the temperature at which crystals of solid A first appear.
- (c) Repeat procedure (b) two more times and record the temperatures in table I. Retain the contents of the boiling tube for use in procedure (e)
- (d) (i) Complete table 1 by calculating the solubility of solid A at the different temperatures. The solubility of a substance is the mass of the substance that dissolves in 100cm<sup>3</sup> (100g) of water at a particular temperature. (6 marks)

Table 1

Volume of water in the boiling tube (cm <sup>3</sup> )	Temperature at which crystals of solid A first appear (°C)	Solubility of solid A (g/100g water)
4		
6		
8		
10		

- (ii) On the grid provided, plot a graph of the solubility of solid A (vertical axis against temperature). (3 marks)

- (iii) Using your graph, determine the temperature at which 100g of solid A would dissolve in 100cm<sup>3</sup> of water. (1 mark)

- .....
- .....
- (e) (i) Transfer the contents of the boiling tube into a 250ml volumetric flask. Rinse both the boiling tube and the thermometer with distilled water and add to the volumetric flask. Add more distilled water to make up to the mark. Label this solution A. Fill a burette with solution B. Using a pipette and a pipette filler, place 25.0cm<sup>3</sup> of solution A into a conical flask. Warm the mixture to about 70°C. Titrate the hot solution A with solution B until a permanent pink colour persists. Record your readings in table 2. Repeat the titration two more times and complete table 2. (Retain the remaining solution B for use in question 3).

Table 2

	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution B used (cm <sup>3</sup> )			

(3 marks)

- (ii) Calculate the:

I. Average volume of solution B used.

(1 mark)

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

II. Number of moles of potassium manganate (VII) used. (1 mark)

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

III. Number of moles of A  $25\text{cm}^3$  of solution A given that 2 moles of potassium manganate (VII) react completely with 5 moles of A. (1 mark)

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

VI. Relative formula mass of A. (2 marks)

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

(a) Add 20cm<sup>3</sup> of 2M aqueous sodium hydroxide to all of solution P provided. Shake well filter the mixture into conical flask. Retain both and the residue.

Observations	Inferences
(1 mark)	(1 mark)

Observations
(1 mark)

(ii) To the first portion, add aqueous sodium hydroxide dropwise until in excess.

Observations	Inferences
(1 mark)	(2 marks)

Observations	Inferences

(1 mark)	(1 mark)
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(c) To 2cm<sup>3</sup> of the filtrate, add 3 drop of potassium iodide solution.

Observations	Inferences
(1 mark)	(1 mark)

(d) To 2cm<sup>3</sup> of filtrate, add 3 drops of acidified barium nitrate solution.

Observations	Inferences
(1 mark)	(1 mark)

(e) To the residue in (a) add 8cm<sup>3</sup> of dilute nitric acid and allow it to filter into a boiling tube.

(i) To 2cm<sup>3</sup> of this filtrate, add aqueous ammonia dropwise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

3. Dissolve all of solid G in about 10cm<sup>3</sup> of distilled water in a boiling tube. Use the solution for tests (a) to (c) below.

- (a) Place  $2\text{cm}^3$  of the solution in a test tube and add 2 drops of acidified potassium manganate (VII), solution B from the burette.

Observations	Inferences
(1 mark)	(1 mark)

- (b) To  $2\text{cm}^3$  of the solution in another test-tube, add 2-3 drops of bromine water.

Observations	Inferences
(1 mark)	(1 mark)

- (c) To  $2\text{cm}^3$  of the solution in a third test-tube add a spatula full of the sodium hydrogen powder provided.

Observations	Inferences
(1 mark)	(1 mark)

