

Name.....Index No.....

Class.....Candidate's Signature.....

CHEMISTRY 233/2

FORM 4

PAPER2

TIME: 2 HOURS

Instructions to Candidates

1. Answer ALL the questions in the spaces provided
2. Mathematical tables and silent electronic calculators may be used.
3. All working must be clearly shown where necessary.

For Examiner's Only.

Question	Maximum	Candidate's
1.	12	
2.	12	
3.	10	
4.	12	
5.	14	
6.	11	
7.	9	
Total score	80	

This paper consists of 15 printed pages. Candidates should check the question paper to ensure that all pages are printed as indicated and no questions are missing.

1. The chart is a part of the periodic table. Study it and answer the questions that follow.

	A				B		C	
	D		E		F		G	
H								
							J	

a) i) Select the element in the period 3 that has the smallest atomic radius. Give a reason for your answer. (2marks)

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ii) Write the chemical formula of a compound between element D and J (1 mark)

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iii) Explain why the melting point of element J is higher than that of G. (2marks)

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iv) What type of structure will the chloride of element E have? (1mark)

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v) State one use of element C (1mark)

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vii) Element G reacts more vigorously with hot iron than element J. Explain? (2marks)

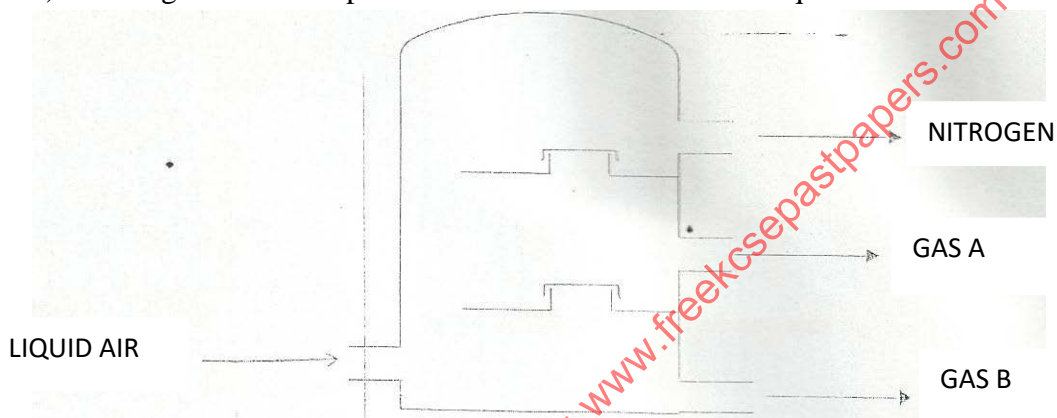
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b) What 3 litres of chloride gas were completely reacted with element, 10.0g of the product were formed. Determine the relative atomic mass of element A.

(Atomic mass of chlorine =35.5, Molar Gas Volume is 24 Litres). (2marks)

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2. a) The diagram below represents fractional distillation of liquid Air.



The boiling points of oxygen, orgon and nitrogen are -1830, 1860C and -193⁰C respectively.

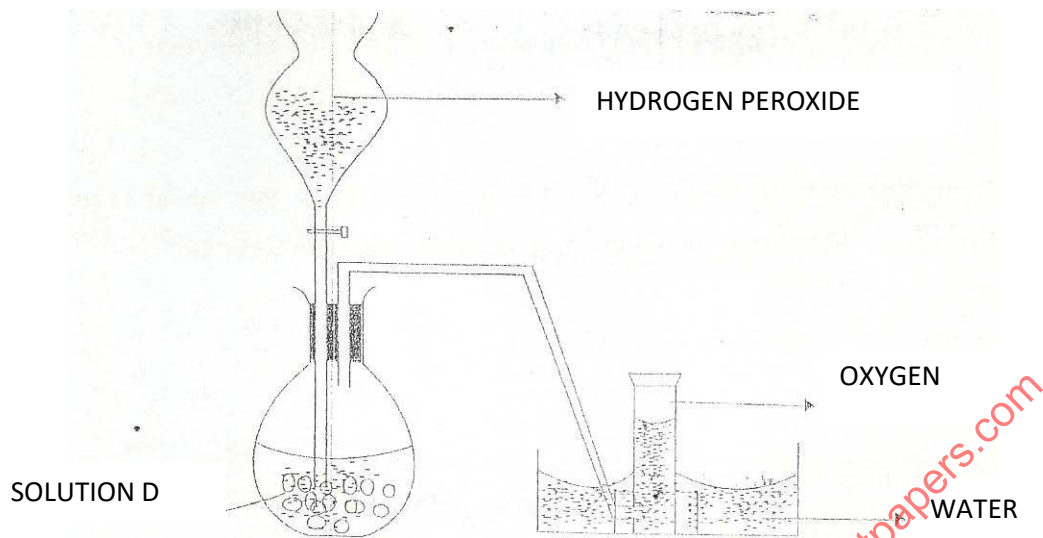
i) Identify gas A:..... (1mark)

B:..... (1mark)

ii) State why gas B is collected at the lower end of the fractionating column (1mark)

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iii) b) The set up below is used to prepare oxygen



i) Name solid A (1mark)

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ii) State the function of solid D (1mark)

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iii) Write an equation for the reaction that occurs in the round-bottomed flask (1mark)

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iv) Give two reasons why oxygen is collected as shown (2marks)

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v) Hot potassium metal was placed in a gas jar containing oxygen. State two observations made (2marks)

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vi) Give two uses of oxygen (2marks)

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3. In an experiment to determine water of crystallization in a commercial washing soda

- $\text{Na}_2\text{CO}_3 \cdot \text{XH}_2\text{O}$, a student was provided with;
- $\text{Na}_2\text{CO}_3 \cdot \text{XH}_2\text{O}$ Solution D containing 14.3g per litre of solution
- Hydrochloric acid solution K containing 7.3g per litre of solution

She pipette 25cm^3 of solution D into 250ml conical flask, then added 3 drops of phenolphthalein indicator and titrated using solution K and a burette.

She recorded her results in the table below:

Titration	1	2	3
Final Burette reading (cm^3)	12.4	24.8	24.8
Initial burette reading (cm^3)	0.0	12.40	37.2
Titre (cm^3)	12.4	12.4	12.4

a) Identify two mistakes from her table (2marks)

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b) Calculate the average volume of the acid D used (1mark)

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c) Write a balanced equation for the reaction between D and K (1mark)

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d) Calculate the number of moles of hydrochloric acid K that reacted (1mark)

(H=I, CL=35.5)

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e) Calculate the number of moles in 25cm³ of solution D (1mark)

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f) (i) Calculate the relative molecular mass of the washing soda (2marks)

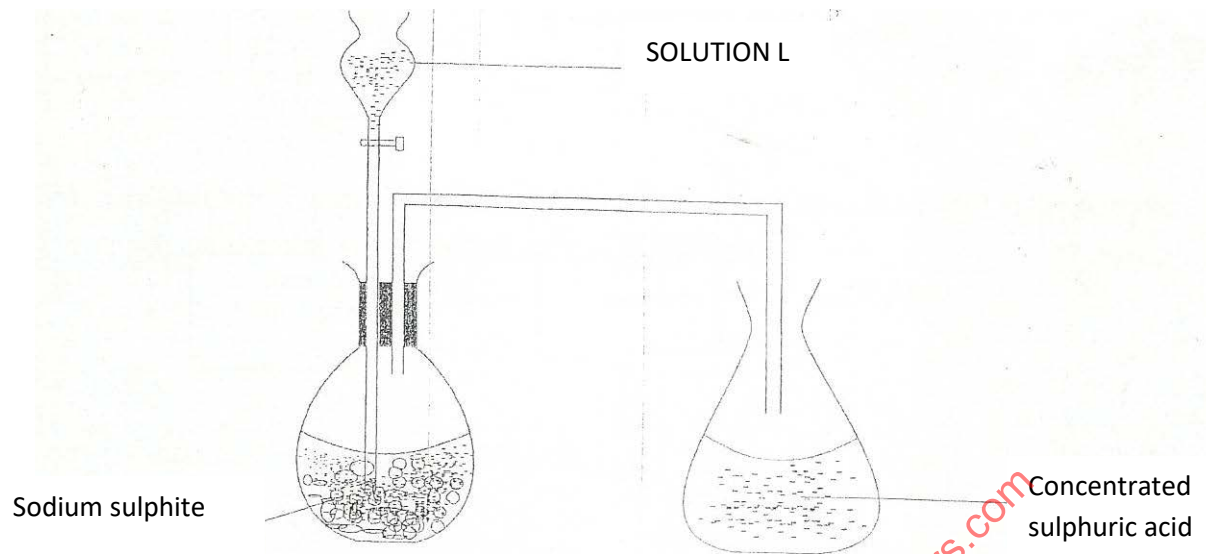
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(ii) Hence determine the value of X (1mark)

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4. a) A student assembled apparatus as shown below to prepare sulphure (IV) oxide gas in the laboratory. Study the diagram then answer the questions below.



i) Complete and label the diagram to show how dry sulphure (IV) oxide gas is produced and collected (2¹/₂ marks)

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ii) By use of a chemical equation, explain why fused calcium oxide is not a suitable drying agent for SO₂ (2marks)

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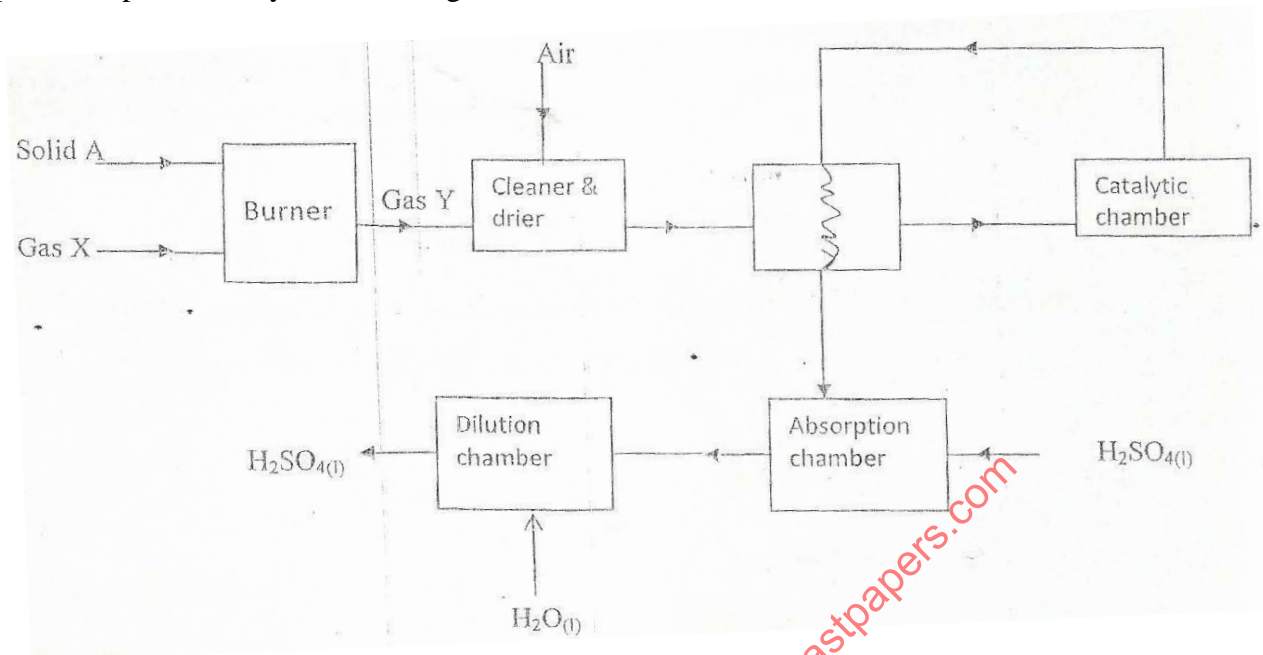
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b) Sulphuric (VI) Acid is an important industrial reagent. It is manufactured by the contact process represented by the flow diagram below.



i) Identify the substance

Solid A (1 1/2 marks)

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Gas X (1 1/2 marks)

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Gas Y (1 1/2 marks)

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ii) State the importance of

The cleaner (1 mark)

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The drier (1 mark)

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iii) Write an equation for the reaction that takes place in the dilution chamber (1 mark)

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iv) On the diagram above, draw a line that represents recycling of SO_2 (1mark)

v) Other than vanadium (V) oxide, state another catalyst that can be used in the catalytic chamber. Why is this catalyst not commonly used? (2marks)

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vi) State one use of sulphuric (VI) acid. (1mark)

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5. A student carried out an experiment to determine the molar enthalpy of neutralization of sodium hydroxide by 2M hydrochloric acid. 25cm^3 of the acid was placed in a beaker and the initial temperature of the solution measured and recorded. 5cm^3 of sodium hydroxide was added to the beaker and the mixture temperature recorded. The procedure was repeated and the temperature recorded as in the table below.

Volume of acid (cm^3)	25	25	25	25	25	25	25
Volume of NaOH added (cm^3)	0	5	10	15	20	25	30
Temp($^{\circ}\text{C}$) of solution	28.0	31.0	34.0	37.0	40.0	39.0	37.0

a) On the grid provided, plot a graph of temperature against volume of sodium hydroxide added. (3marks)

b) From the graph, determine:

i. The maximum expected temperature change ΔT (1mark)

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ii. The volume of sodium hydroxide required to neutralize the hydrochloric acid(1mark)

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- c) Calculate the heat change that occurred during the reaction ($C=4.2\text{kJ}^1\text{K}^{-1}$, assume density of solution = $1\text{g}/\text{cm}^3$) (1 mark)

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- d) Find the number of moles of sodium hydroxide that reacted (1mark)

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- e) Determine the molar enthalpy of neutralization for this reaction (1mark)

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- f) Suggest a reason why the above value in (e) could be lower than the actual value (1mark)

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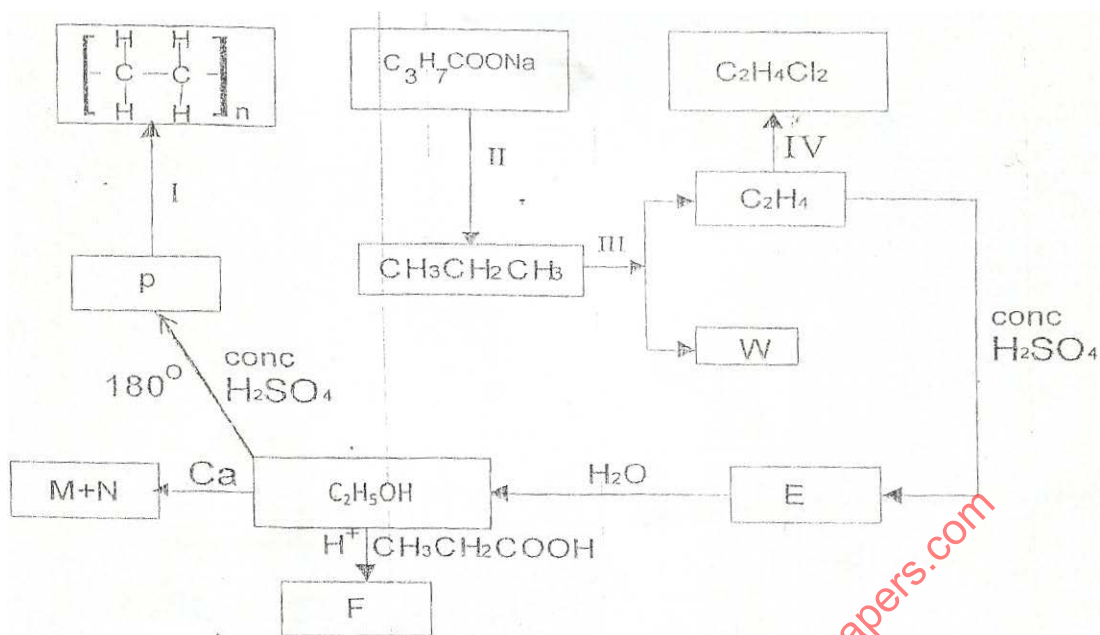
- g) (i) Give two points to be considered when choosing a fuel (2marks)

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- (ii) Give one precautions necessary when using a charcoal stove (1mark)

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



a) Write the name of the processes shown

I(1mark)

II(1mark)

III(1mark)

b) Write the equation leading to the formation of M and N (1mark)

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c) State the type of reaction in step IV (1mark)

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d) Write down the name of the compound E (1mark)

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e) Give the name and structural formula of compound F (1mark)

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f) Write the equation leading to the formation of compound F (1mark)

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g) Give an economic importance of F (1mark)

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h) Name compound

i) W (1mark)

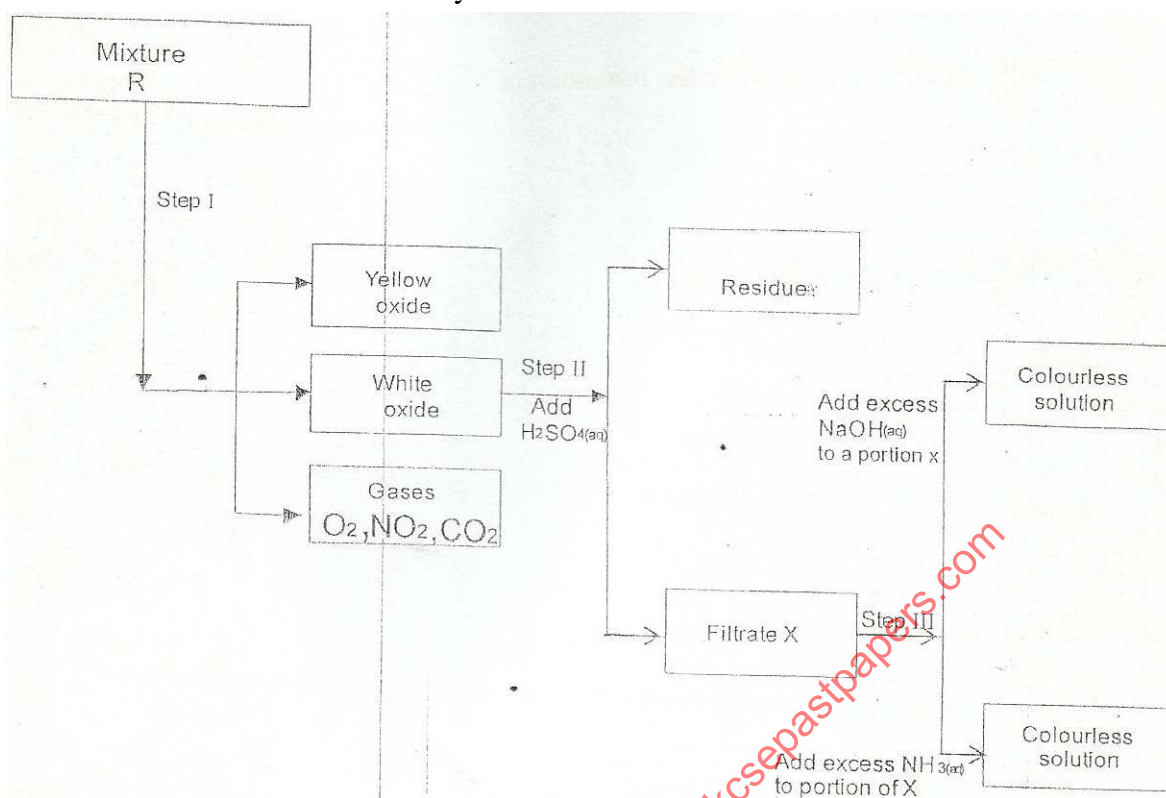
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ii) P (1mark)

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7. 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)

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(ii) Draw a labeled diagram of the set up that could be used to separate the mixture formed in step II (2marks)

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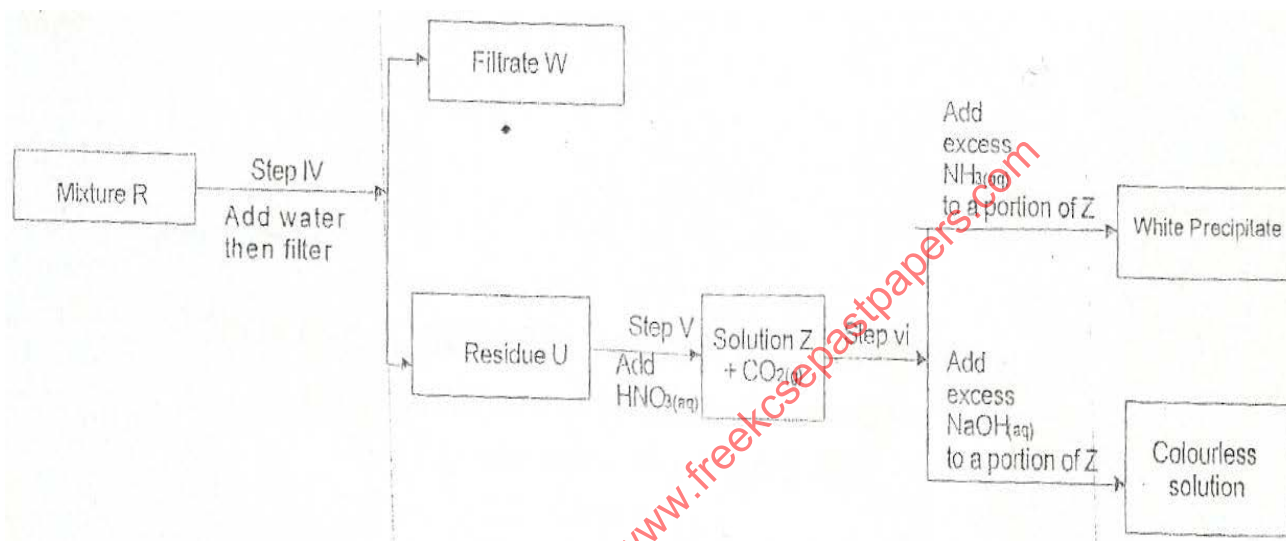
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(iii) Write an ionic equation for the reaction that produces a colourless solution when excess aqueous ammonia is added to filtrate X (1mark)

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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)

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(ii) Write the formula of an anion present in residue U. Explain (1mark)

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(iii) Suggest the identity of the cation present in solution Z (1mark)

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c) Name the two present in mixture R (1mark)

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