

MATUNGU JOINT EVALUATION TEST (MAJET)

Kenya Certificate of Secondary Education

233/ 2 - CHEMISTRY PAPER 2 - FORM 4

JULY - 2024 - 2 Hours

Name.....Index number.....

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

Instructions to Candidates

- (a) Write your name class and class number in the spaces provided above
- (b) Sign and write the date of the examination in the spaces provided above
- (c) Answer ALL questions in the spaces provided.
- (d) Mathematical tables and electronic calculators may be used.
- (e) All working must be shown clearly where necessary.
- (f) This paper consists of 12 printed pages
- (g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and no questions are missing

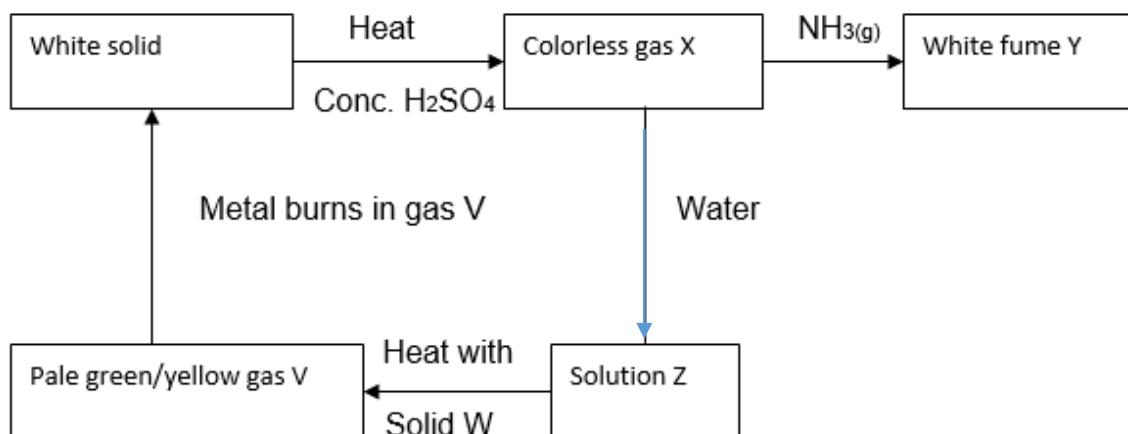
For examiner's use only

Questions	Maximum score	Candidates score
1	10	
2	13	
3	12	
4	11	
5	08	
6	14	
7	12	
	80	

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233/2

1.a) Study the scheme below and answer the questions that follow.



i) Write an equation for the formation of white fumes Y. (1 mark)

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ii) What is the function of solid W in the reaction? (1 mark)

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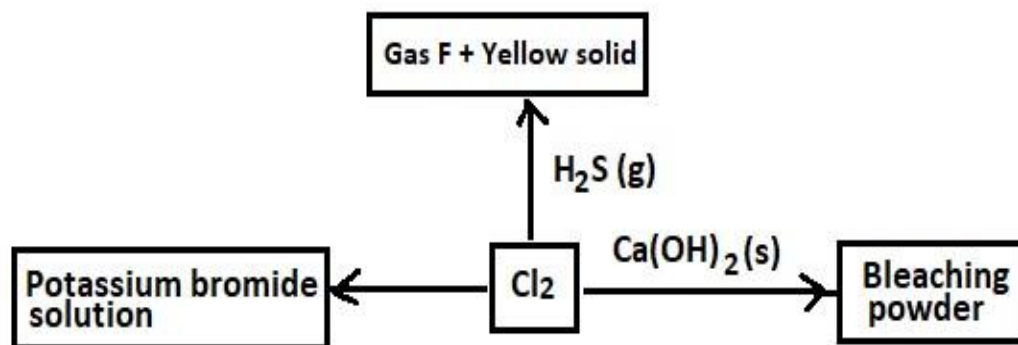
iii) Identify gas V. (1 mark)

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b) Xg of potassium hydroxide was dissolved in water to make 500cm³ of solution. 40cm³ of the solution required 100cm³ of 2M Sulphuric (VI) acid for complete neutralization. Calculate the mass X of potassium hydroxide. (K=39, O=16, H=1) (3mks)

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d) Study the diagram below and answer the questions that follow;



i) Write chemical equation for the formation of bleaching powder (1mk)

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ii) When exposed to the atmosphere, bleaching powder smells strongly of chlorine. Explain (1mk)

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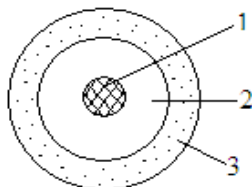
iii) State and explain the observation made when chlorine gas is bubbled in potassium bromide (2mrks)

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2.) The diagram below represents pipes used in Frasch pump for the extraction of sulphur



Which substance passes through tube?

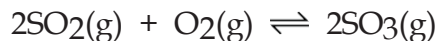
(3 marks)

- 1
- 2
- 3

b) White sugar changes to black solid when mixed with excess concentrated sulphuric acid explain. (1 mark)

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c) One of the equations for the contact process is shown below.



The forward reaction is exothermic.

The reaction is carried out at a temperature of 450 °C and a pressure of 2 atm. Using explanations that do **not** involve cost:

i) Explain why a temperature greater than 450 °C is **not** used. (1 mark)

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ii) Explain why a pressure lower than 2 atm is **not** used. (1 mark)

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d) Gaseous phosphorus(V) chloride decomposes into gaseous phosphorus(III) chloride and gaseous chlorine.

When the three gases are present in a closed container the system reaches equilibrium.



Complete the table using only the words *increases*, *decreases* or *no change*. (2mrks)

	effect on the rate of the forward reaction	effect on the equilibrium yield ($PCl_3(g)$ and $Cl_2(g)$)
increasing the temperature		increases
decreasing the pressure		
adding a catalyst		no change

ii) Phosphorus oxychloride has the formula $POCl_3$.

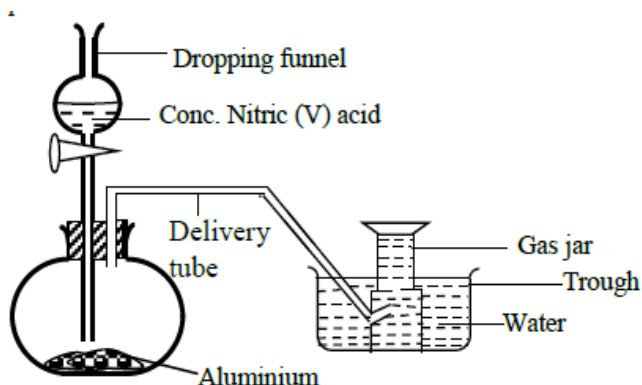
Phosphorus oxychloride is the only product of the reaction between phosphorus(V) chloride, PCl_5 , and phosphorus(V) oxide, P_4O_{10} . Write a chemical equation for the reaction between phosphorus(V) chloride and phosphorus(V) oxide. (1mrk)

.....

iii) Explain why Sulphur has a higher melting temperature than phosphorus. (1mark)

.....

e) In order to prepare hydrogen gas in the laboratory a student set-up the apparatus shown in the diagram below. Study it and answer the questions that follow.



i) Suggest why the student did not collect hydrogen gas. (1 mark)

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ii) In a separate experiment the student reacted iron and hydrochloric acid to prepare hydrogen gas. Write an ionic equation for the reaction. (1 mark)

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.....

iii) The hydrogen gas produced was found to have a foul smell. Suggest an explanation for this. (1 mark)

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.....

3.) The table below gives information about particles **A, B, C, D, E** and **F**.

particle	number of electrons	number of neutrons	number of protons
A	5	6	5
B	10	11	10
C	10	14	13
D	15	17	15
E	18	17	17
F	15	16	15

a) Give the letters of **all** the particles which are: (3mrks)

i) atoms

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.....

ii) cations.

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.....

iii) Isotopes.

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

A				E			H
	C		D		G		K
B				F			J

(i) Giving reason, select the element which is

I. Most reactive non-metal

(1mark)

.....

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

(2 marks)

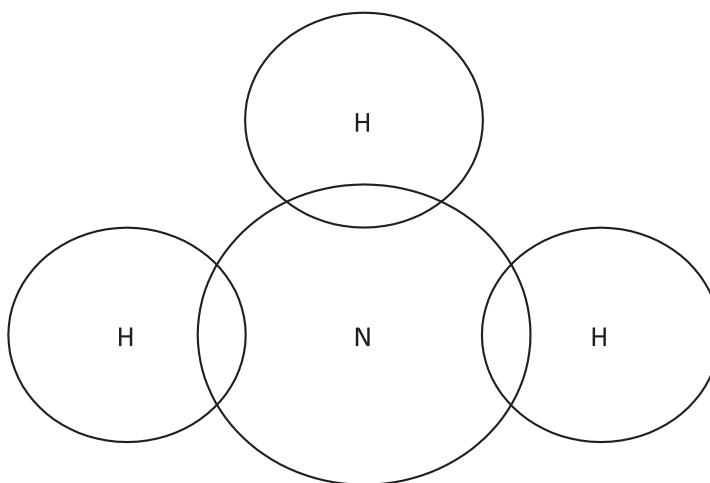
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(iii) Explain why the atomic radius of **K** is smaller than that of **G**

(1 mark)

.....

c) The structure shown below shows how bonding is formed in ammonia molecule Complete it by use of dot and cross diagram and on the same diagram show the NH_4^+ (1mrk)



ii) What is Dative covalent bond

(1mrk)

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d) The table below gives some properties of three metals: Aluminium, iron and copper. Use it to answer the questions that follow.

Metal	Density	Tensile Strength 10^{10} pa	Electrical conductivity
Aluminium	2.70	7.0	0.38
Iron	7.86	21.1	0.10
Copper	8.92	13.0	0.59

Assuming that steel and stainless steel have similar properties to iron.

i) Why do some stainless-steel sauce pans have a copper base? (1 mark)

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ii) Aluminium with a steel core is used for overhead power cables in preference to copper. Why is aluminium preferred? (1 mark)

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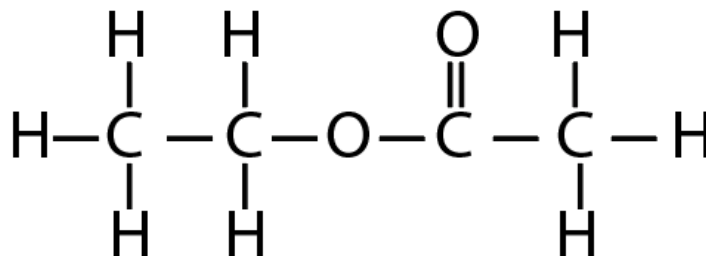
iii) Apart from overhead power cables copper is chosen for almost all other electrical uses. Suggest two reasons for the choice of copper. (1 mark)

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4.) Esters and fats and polyesters all contain the ester linkage. The structural formula of the ester is given below.



a) Write equation for the reaction if water is added to ester. (1mrk)

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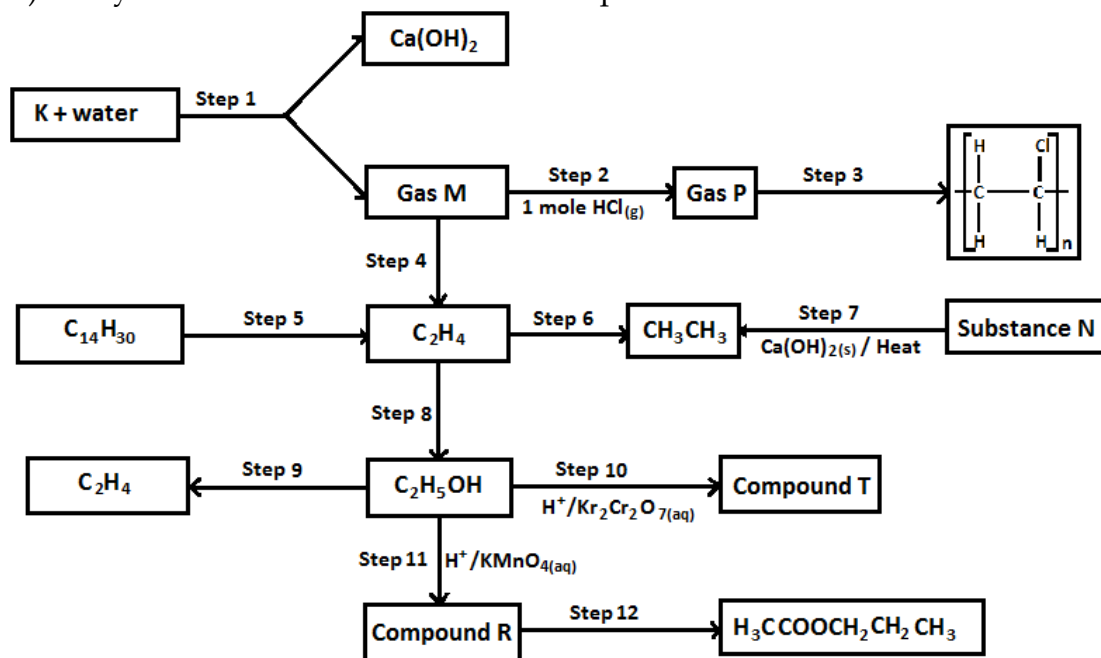
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b) Give one observation that would be made during formation of the substance above. (1mrk)

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.....

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



(i) Name reagents K and gas M. (1mark)

K

M

(ii) Write an equation for the reaction in step 2. (1mark)

.....

.....

(iii) Name the reactions in steps 4 and 5. (1mark)

Step 4

Step 5

(iv) Name the reagent and conditions necessary for step 6. (1mark)

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.....

(v) I. Identify substance N..... (½ mark)

II. Write an equation for the reaction in step 7. ..(1mark)

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.....

(vi) State the reagents and conditions necessary for the reaction in step 8. (1mark)

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.....

(vii) I. Name the type of reaction in step 9.....(½ mark)

Give the reagents and conditions needed for the reaction in (vii) I above. (1mark)

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II. State the observation made in reaction 10. (1mark)

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II. One industrial application of the reaction in step 6. (1 mark)

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5.) An iron sculpture was produced to commemorate the anniversary of founder of a certain village. To prevent it from rusting, the village elder attached it by a wire to a block of zinc which was stored underground out of sight.

i) Explain how the village elder's action would prevent the rusting of the sculpture. (1mrk)

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ii) What name is given to this method of preventing rusting? (1 mark)

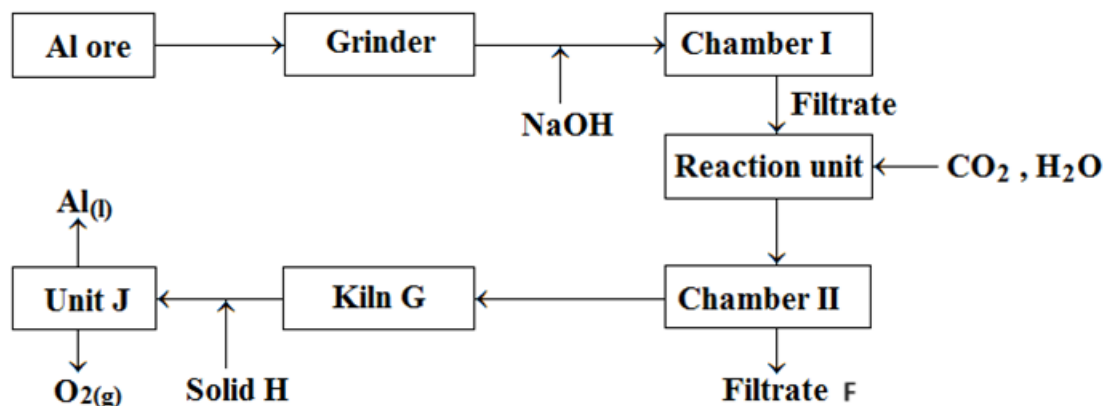
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iii) List down two other ways in which rusting of the statue could be prevented.

(1 mark)

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b.) Aluminium metal is extracted from its ore according to the scheme shown below. Study the scheme and answer the questions that follow.



i) Explain the functions of sodium hydroxide solution.

(1mark)

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ii) Write the formula of the anion present in filtrate F.

(1mark)

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(iv) Write the equation for the reaction in Kiln G.

(1mark)

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(v) Give the name of solid H and state its function.

(2 marks)

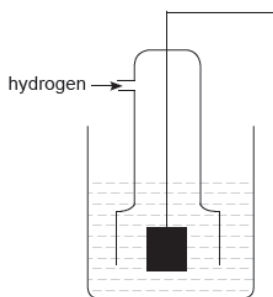
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6.) Electrode potentials are measured using a standard hydrogen half-cell.

(a) State **two** conditions required for a standard hydrogen half-cell. (1mark)

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(b) Complete and label the diagram below to show a cell in which the standard electrode potential of a zinc half-cell can be determined using a standard hydrogen half-cell. (2 marks)



(b) Consider the following table and answer the accompanying questions:

Reduction half-reaction	E^\ominus at 25°C/V
$\text{Cl}_2(\text{aq}) + 2\text{e}^- \rightarrow 2\text{Cl}^-(\text{aq})$	+1.36
$\text{Br}_2(\text{l}) + 2\text{e}^- \rightarrow 2\text{Br}^-(\text{aq})$	+1.09
$\text{Hg}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Hg}(\text{l})$	+0.85
$\text{Sn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Sn}(\text{s})$	-0.14
$\text{Al}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Al}(\text{s})$	-1.66

i) Which is the least reactive metal? Explain. (1mark)

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(ii) Will hydrogen gas be given off if tin is added to dilute hydrochloric acid? Explain. (1mark)

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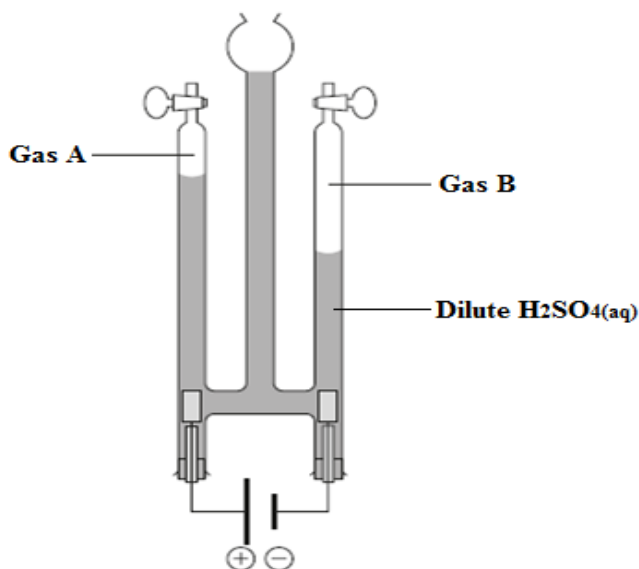
(iii) Can aluminium metal be oxidized by bromine? Explain. (1mark)

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(iv) Calculate the Emf of the two half cells which when combined will give the lowest value. (1mark)

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(c) The apparatus below is used to break down water into hydrogen and oxygen using an electric current.



(i) Identify gases A and B. (1mark)

A..... B.....

(ii) Account for each of the following at the end of the process. (1 mark)

I. the change in pH of the electrolyte.

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II. the change in concentration of the electrolyte. (1mark)

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III. the change in electrical conductivity of the electrolyte. (1mark)

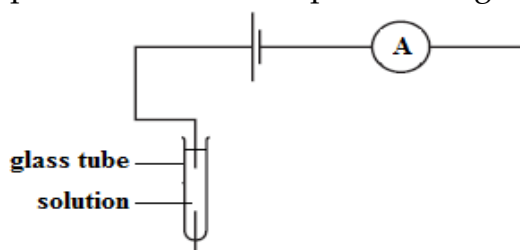
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(iii) Explain why the volume of gas A is twice the volume of gas B. (1 mark)

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(d) What mass of copper is produced at the cathode when 3.20 amps of current are passed through a solution of copper (II) sulphate for 30 min? (2 marks)

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7. (a) State **one** difference between the two types of water hardness. (1mark)

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(b) Write an equation to show how ammonia solution can be used in removal of water hardness. (1mark)

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(c) In an experiment a solution of 10cm³ 2M hydrochloric acid was used in the apparatus shown below. The experiment was then repeated using 10cm³ of 2M ethanoic acid.



(i) Explain the observations. (2 marks)

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(ii) Explain the observations that would be made if a solution of ammonia in toluene was used.

(1mark)

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d) In an experiment three separate samples of water were tested using soap solution to find out the volume of soap needed to form a permanent lather with 100cm³ of the water sample. Each sample was boiled and again the amount of soap required was determined. The following were obtained.

	SAMPLE		
	I	II	III
Volume of soap required before boiling	27	3.0	10.6
Volume of soap required after boiling	27	3.0	3.0

i) Explain the change in the volume of soap solution in sample III (1mark)

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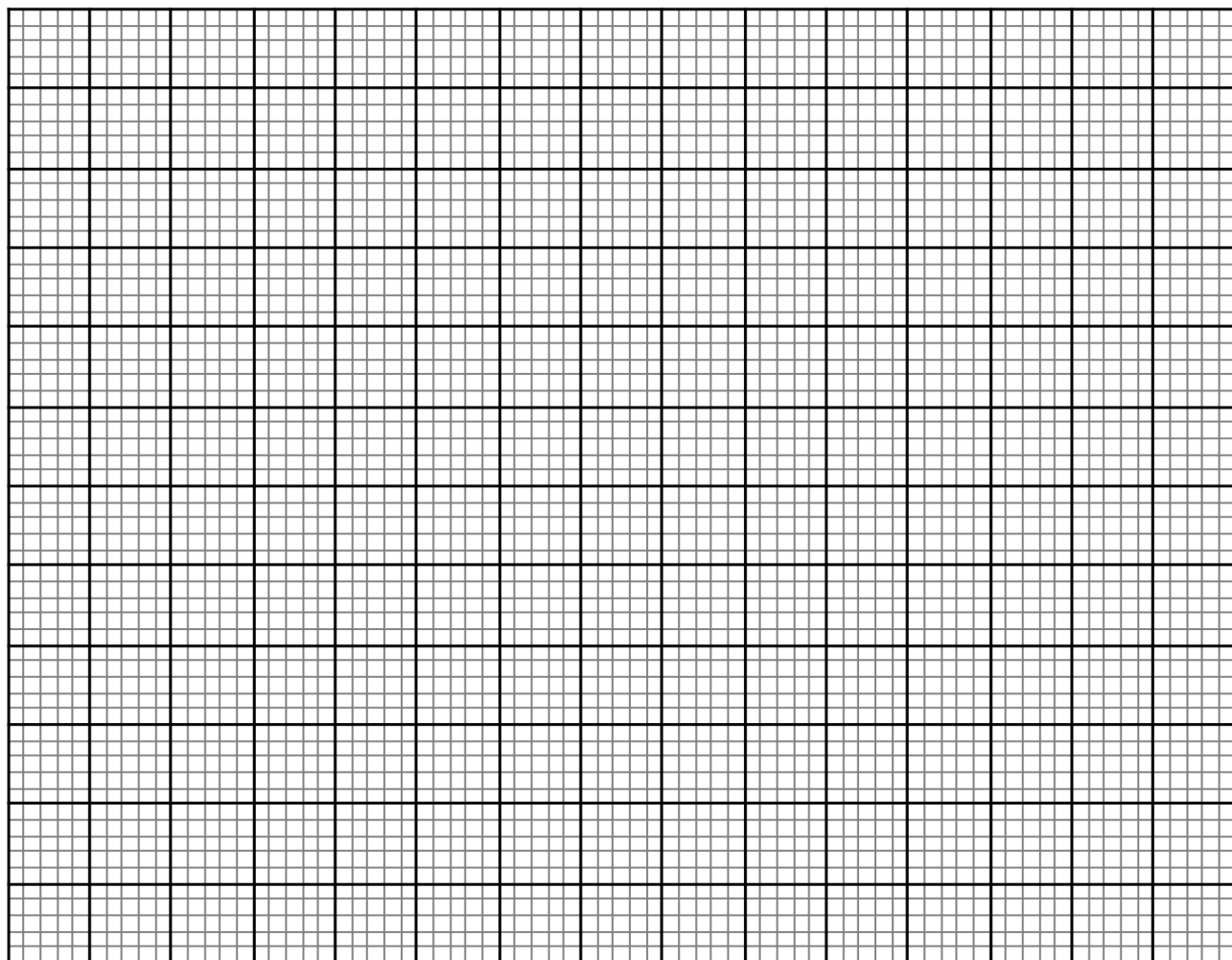
ii) Write down the formula of the ions present in sample I. (1 mark)

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e) The table below shows how hydrogen gas is evolved with time as shown below.

Time (Seconds)	0	10	20	30	40	50	60	70
Volume of hydrogen gas (cm³)	0	24	38	48	52	53	53	53

i) Plot a graph of volume of hydrogen gas produced (cm³) against time (seconds) (3mrks)



ii) From the graph labeled A, determine the rate of reaction:

(i) At the 20th minute.

(1mark)

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iii) within the first 20 minutes.

(1mark)

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