(c) Place about $2cm^3$ of liquid **F** in a test-tube, add about $1cm^3$ of acidified potassium dichromate (VI) and warm the mixture.

Observations	**Inferences**
(1 mark)	(1 mark)

K.C.S.E.

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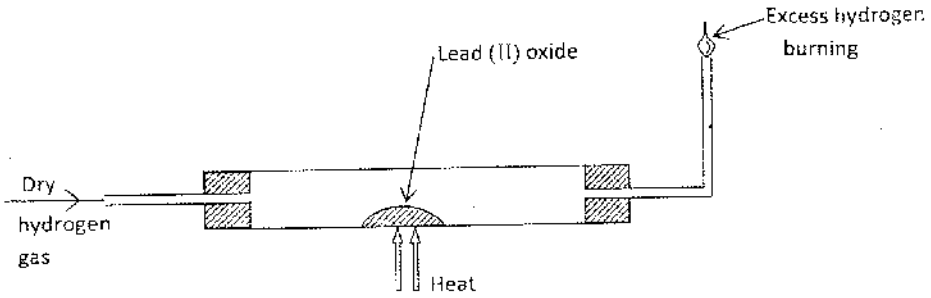
1 Charcoal is a fuel that is commonly used for cooking. When it burns it forms two oxides.

(a) Name the **two** oxides. (2 marks)

(b) State **one** use of any of the two oxides. (1 mark)

2 Iron (III) oxide was found to be contaminated with copper (II) sulphate. Describe how a pure sample of iron (III) oxide can be obtained. (3 marks)

3 In an experiment, dry hydrogen gas was passed over heated Lead (II) Oxide as shown in the diagram below.



State and explain the observations made in the combustion tube. (3 marks)

4. The table below shows properties of some elements A, **B,** C and **D** which belong to the same period of the periodic table. The letters are not the actual symbols of the elements.

Element	A	**B**	c	**D**
Mp (°C)	1410	98	-101	660
Atomic radii (nm)	0.117	0.186	0.099	0.143
Electrical conductivity	**Poor**	Good	**Non conductors**	Good

(a) Arrange the elements in the order they would appear in the period. Give a reason. (2 marks)

(b) Select the metallic element which is the better conductor of electricity. Give a reason.

(1 mark)

5. A sample of water in a beaker was found to boil at 101.5°C at 1 atmospheric pressure. Assuming that the thermometer was not faulty, explain this observation. (1 mark)

6. Study the information in the table below and answer the questions that follow:

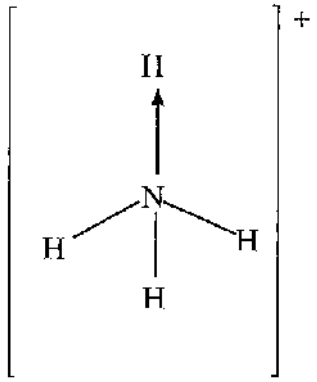
Salt	Solubility (g/100g water)	
	at 40°C	at 60°C
$CuSO_4$	28	38
$Pb(NQ_3)_2$	79	98

A mixture containing 35g of $CuS0_4$ and 78g of $Pb(N0_3)_2$ in l00g of water at 60°C was cooled to 40°C.

(a) Which salt crystallised out? Give a reason (2 marks)

(b) Calculate the mass of the salt that crystallised out. (1 mark)

7. Ammonium ion has the following structure:



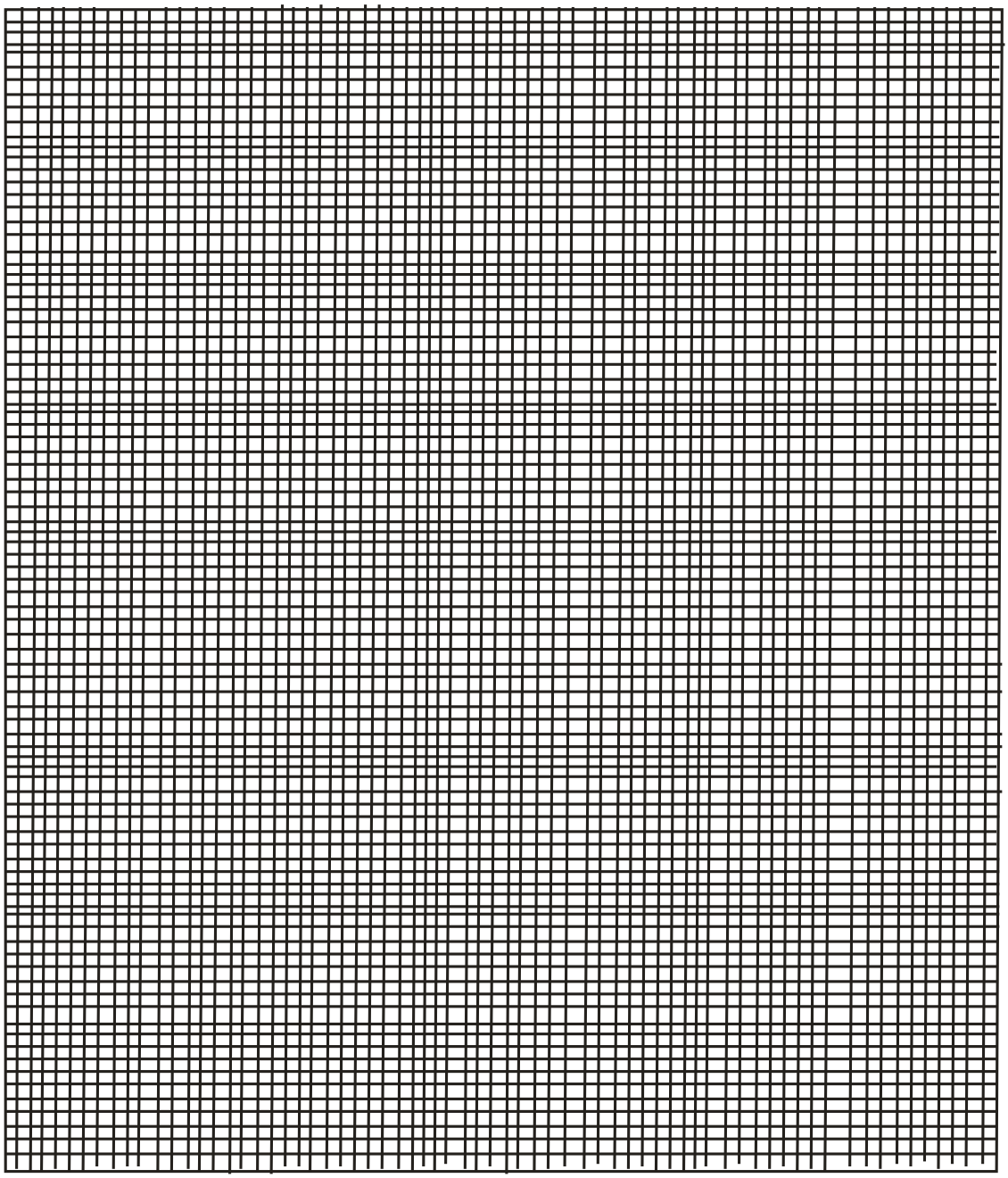
Label on the structure:

(a) covalent bond; (1 mark)

(b) coordinate (dative) bond. (1 mark)

8. 10cm³ of concentrated sulphuric (VI) acid was diluted to 100cm³. 10cm³ of the resulting solution was neutralised by 36cm³ of 0.1M sodium hydroxide solution. Determine the mass of sulphuric (VI) acid that was in the concentrated acid (S = 32.0; H = 1.0; O = 16.0). (3 marks)

9 120g of iodine - 131 has a half life of 8 days and decays for 32 days. On the grid provided, plot a graph of the mass of iodine - 131 against time. (3 marks)

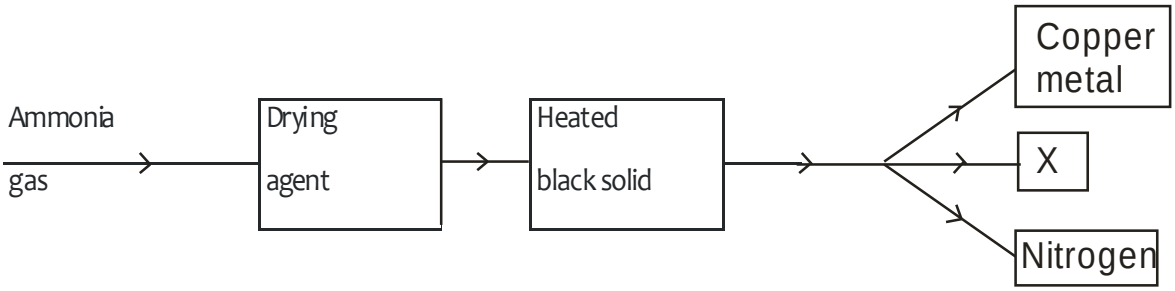


10(a) Name **two** cations that are present in hard water. (1 mark)

(b) Explain how the ion exchange resin softens hard water. (2 marks)

11. The empirical formula of A is CH_2Br. Given that 0.470g of A occupies a volume of $56cm^3$ at 546K and 1 atmospheric pressure, determine its molecular formula.
(H = 1.0, C = 12.0, Br = 80.0, molar gas volume at STP = 22.4 dm^3). (3 marks)

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



(a) Name a suitable drying agent for ammonia. (1 mark)

(b) Describe one chemical test for ammonia. (1 mark)

(c) Name X. (1 mark)

13 A dynamic equilibrium is established when hydrogen and carbon (IV) oxide react as shown below:

$$H_{2(g)} + C0_{2(g)} \rightleftharpoons H_2O(g) + CO_{(g)}$$

What is the effect of adding powdered iron catalyst on the position of the equilibrium? Give a reason. (2 marks)

14 Distinguish between ionisation energy and electron affinity of an element. (2 marks)

15 Below is a representation of an electrochemical cell.

$$Pb(s) / Pb^{2}(aq) // Ag^{+}(aq) / Ag(s)$$

(a) What does // represent? (1 mark)

(b) Given the following:

	$E^{\ominus}V$
$Pb^{2+}_{(aq)} + 2e \longrightarrow$	Pb(s); - 0.13
$Ag^{+}_{(aq)} + e \longrightarrow$	Ag(s); - 0.80

Calculate the E.M.F of the electrochemical cell. (2 marks)

16 Use the following information on substances S, T, V and hydrogen to answer the questions that follow:

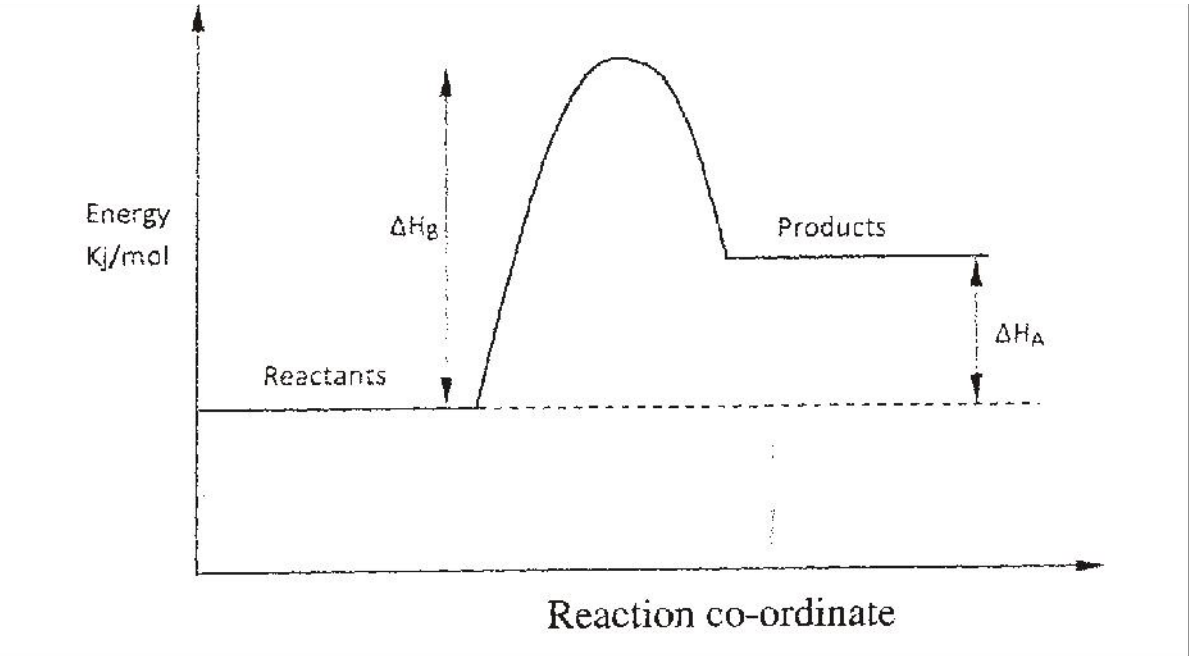
(i) T displaces V from a solution containing V ions.

(ii) Hydrogen reacts with the heated oxide of S but has no effect on heated oxide of V.

(a) Arrange substances S, T, V and hydrogen in the order of increasing reactivity. (2 marks)

(b) If T and V are divalent metals, write an ionic equation for the reaction in (i) above. (1 mark)

17 Study the energy level diagram below and answer the questions that follow.



(a) Give the name of ΔH_A (1 mark)

(b) How can ΔH_B be reduced? Give a reason. (2 marks)

18 Acidified potassium manganate (VII) solution is decolourised when sulplur (IV) oxide is bubbled through it. The equation for the reaction is given below.

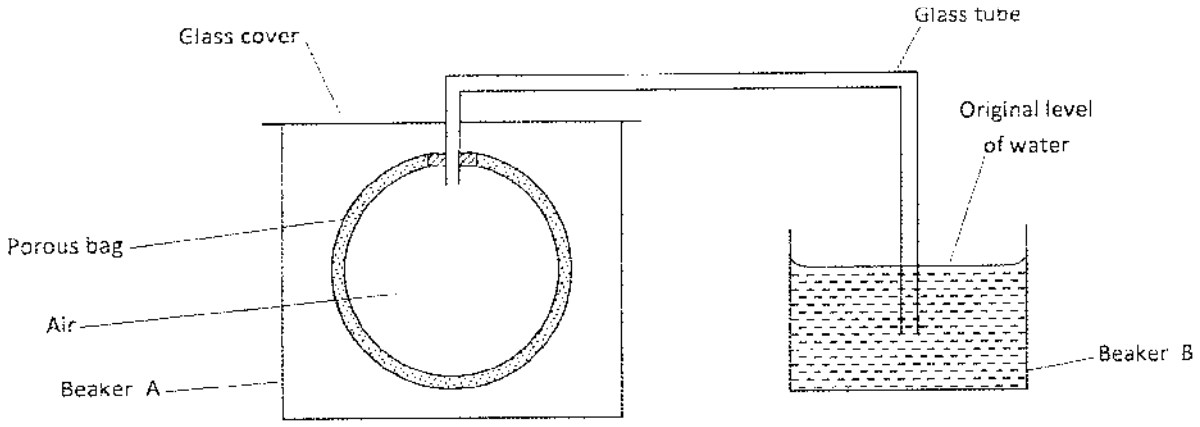
$$2H_2O_{(1)} + 5SO_{2(g)} + 2KMnO_{4(aq)} \longrightarrow K_2SO_{4(aq)} + 2MnSO_{4(aq)} + 2H_2SO_{4(aq)}$$

(a) Which reactant is oxidised? Explain. (2 marks)

(b) Other than the manufacture of sulphuric (VI) acid, state one other use of sulphur (IV)

oxide. (1 mark)

19 The set up shown below was used to investigate a property of hydrogen gas.



State and explain the observation that would be made in the glass tube if beaker A was filled with hydrogen gas. (3 marks)

20 Draw and name the isomers of pentane. (3 marks)

21 Give **two** uses of the polymer polystyrene. (1 mark)

22 Aluminium is both malleable and ductile,

(a) What is meant by?

(i) malleable; (1 mark)

(ii) ductible. (1 mark)

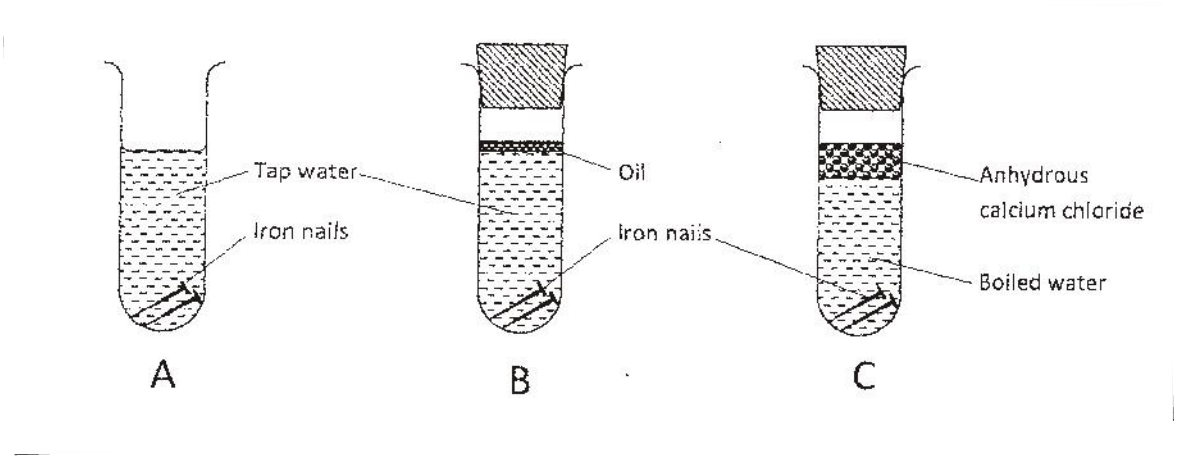
(b) State **one** use of aluminium based on:

(i) malleability (1mark)

(ii) ductility (1mark)

23 Describe how the percentage by mass of copper in copper carbonate can be determined. (3 marks)

24 The following set up of three test-tubes was used to investigate rusting of iron. Study it and answer the questions that follow.



(a) Give a reason why rusting did not occur in test-tube C. (1 mark)

(b) Aluminium is used to protect iron sheets from rusting.
Explain **two** ways in which aluminium protects iron from rusting. (2 marks)

25 Describe how a solid sample of potassium sulphate can be prepared starting with 200cm^3 of
2M potassium hydroxide. (3 marks)

26 Describe **two** chemical tests that can be used to distinguish ethanol from ethanoic acid. (3 marks)

27 (a) The electronic arrangement of the ion of element Q is 2.8.8. If the formula of the ion is Q^3,state the group and period to which Q belongs.

Group: ($^1/_2$ mark)

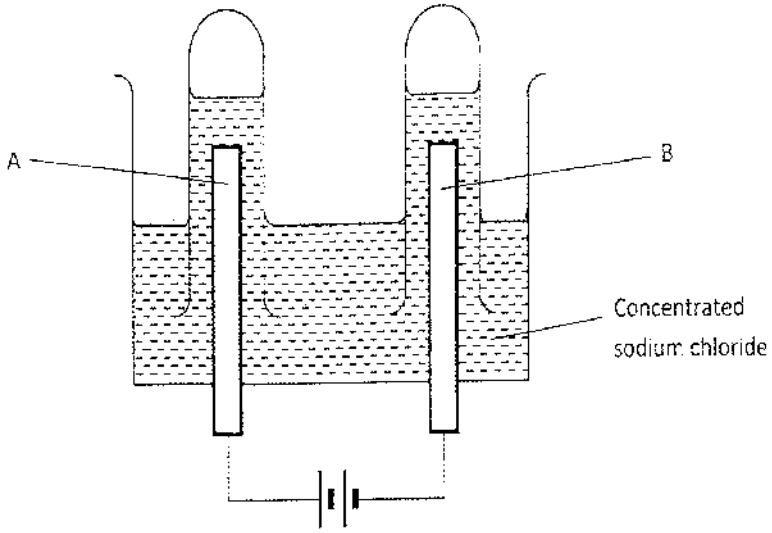
Period: ($^1/_2$ mark)

(b) Helium, neon and argon belong to group 8 of the periodic table. Give:

(i) the general name of these elements; (1 mark)

(ii) one use of these elements. (1 mark)

28 The apparatus shown in the diagram below were used to investigate the products formed when concentrated sodium chloride was electrolysed using inert electrodes.



(a) Write the equation for the reaction that takes place at electrode A. (1 mark)

(b) If the concentrated sodium chloride was replaced with dilute sodium chloride, what product would be formed at electrode A? Explain. (2 marks)

29. a) State and explain what would happen if a dry blue litmus paper was dropped in a gas. (1mark)

b) By using only dilute hydrochloric acid, describe how a student can distinguish between barium sulphite from barium sulphate. (2marks)