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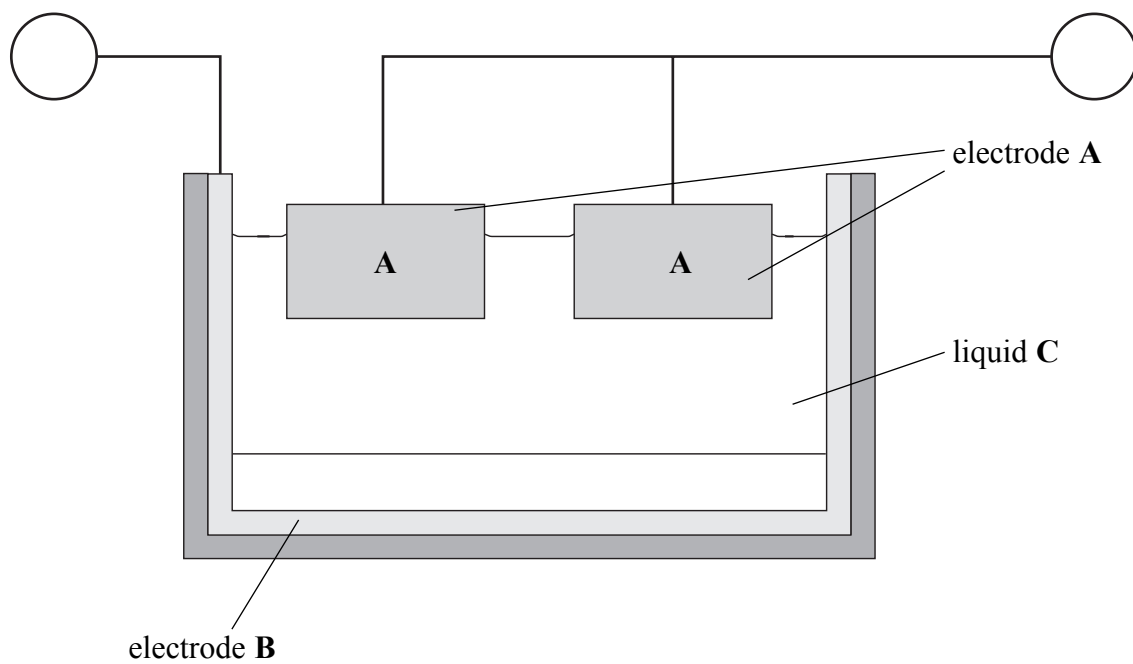
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3

**Turn over**

SECTION A

1. The diagram shows how aluminium is extracted on an industrial scale.



(a) (i) Name the process used to extract aluminium.

..... (1)

(ii) Name the material used for the electrodes **A** and **B**.

..... (1)

(iii) Using the symbols + and – identify the polarity of the electrodes **A** and **B**.

Write **one** symbol in each circle in the diagram above. (1)

(iv) Identify the **two** compounds present in liquid **C**.

1 .....  
 2 ..... (2)

(v) State **one** major cost that makes this process more expensive than the extraction of iron.

..... (1)



(b) The mixture of gases coming from electrodes A contains an element and a compound.

(i) Identify the element.

.....  
(1)

(ii) Identify the compound and explain how it forms.

Compound .....

Explanation of formation .....

.....  
(2)

(Total 9 marks)

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Q1



2. Ethene,  $C_2H_4$ , and methane,  $CH_4$ , are the first members of two different homologous series.

(a) One characteristic of a homologous series is that all its members have the same general formula.

(i) State **two** other characteristics of a homologous series.

1 .....

.....

2 .....

.....

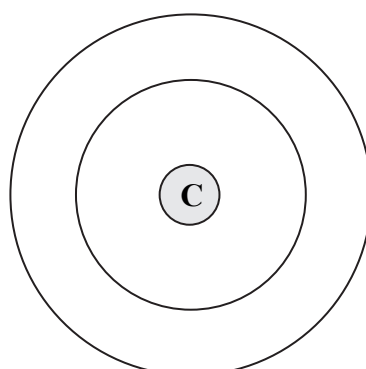
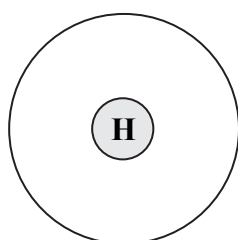
(2)

(ii) What is the name of the homologous series to which ethene belongs?

.....

(1)

(b) (i) Use the Periodic Table to help you complete the diagrams to show the electronic configuration of hydrogen and of carbon.



(2)



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(ii) Draw a dot and cross diagram to show the covalent bonding in a methane molecule.

(2)

(c) The alkane  $C_4H_{10}$  exists as two isomers.

(i) What are isomers?

.....  
.....

(2)

(ii) Draw the displayed formula of each isomer.

(2)

Q2

(Total 11 marks)

7

Turn over



3. Calcium and magnesium are metals in Group 2 of the Periodic Table.

(a) A student adds a piece of calcium to some cold water in a beaker. The products of the reaction are calcium hydroxide and hydrogen. Some of the calcium hydroxide dissolves in the water and some does not.

(i) Describe **two** observations that the student could make during the reaction.

1 .....

.....

2 .....

.....

(2)

(ii) Give the formula of calcium hydroxide.

.....

(1)

(iii) When the reaction is complete, a piece of litmus paper is added to the solution in the beaker. State the final colour of the litmus paper and what this colour indicates about the solution.

Final colour of litmus .....

What this colour indicates .....

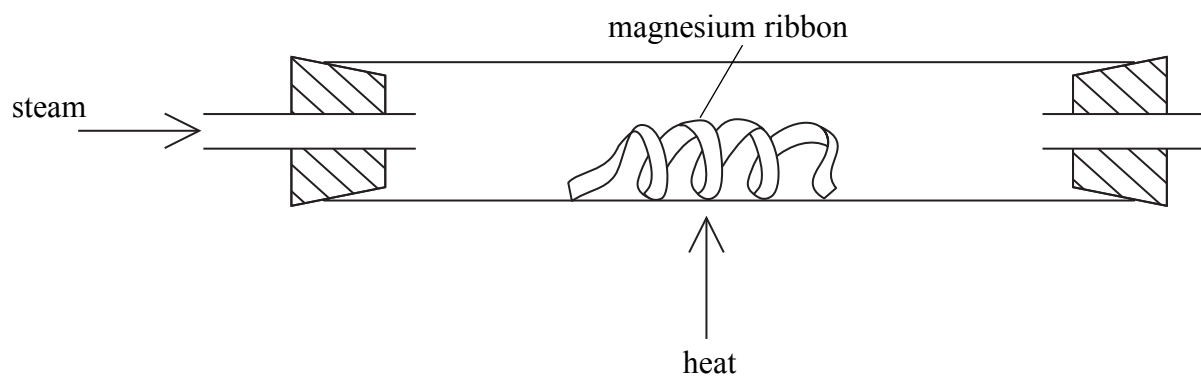
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(b) The diagram shows apparatus for reacting magnesium with steam.



The products of this reaction are magnesium oxide and hydrogen.

(i) State the colour of magnesium and of magnesium oxide.

Magnesium .....

Magnesium oxide .....

(2)

(ii) State **two** ways in which the hydrogen could be collected.

1 .....

.....

2 .....

.....

(2)

(iii) The hydrogen gas can be burned as it leaves the heated tube. Write a word equation for this reaction.

.....

(1)

Q3

(Total 10 marks)

TOTAL FOR SECTION A: 30 MARKS



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**SECTION B**

4. (a) A crystal of copper(II) sulphate is dropped into a test tube full of water. The crystal sinks to the bottom and starts to dissolve, turning the water blue.

(i) Name the process that occurs after the copper(II) sulphate has dissolved.

.....  
(1)

(ii) Describe how this process occurs.

.....  
.....  
(2)

(b) A sample of the solution is removed from the test tube. Dilute ammonia solution is slowly added to the sample until in excess.

(i) Describe what you would see as ammonia solution is added.

.....  
.....  
.....  
(3)

(ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.

.....  
(1)

Q4

(Total 7 marks)



5. (a) (i) Describe what is seen when a small piece of sodium is dropped onto water.

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

(3)

(ii) Write a chemical equation for the reaction.

.....

(2)

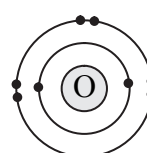
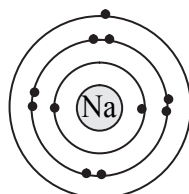
(iii) Give **one** observation that will be different if rubidium is used in place of sodium.

.....

(1)

(b) Sodium reacts readily with oxygen to form the ionic compound sodium oxide.

(i) The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms react with oxygen atoms.



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

(3)



(ii) Sodium oxide has a melting point of 1275 °C. Explain why sodium oxide has a high melting point.

.....

.....

.....

.....

.....

(3)

(Total 12 marks)

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Q5



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6. (a) Magnesium chloride is a soluble salt that can be made by reacting magnesium carbonate with dilute hydrochloric acid. Magnesium carbonate is insoluble in water.

Describe how you could make a dry sample of magnesium chloride crystals from magnesium carbonate and dilute hydrochloric acid.

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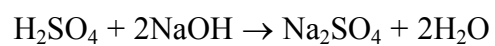
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(5)

- (b) Some dilute sulphuric acid is placed in a conical flask. A few drops of phenolphthalein indicator are added to the acid. Dilute sodium hydroxide solution is then added gradually.

The chemical equation for the reaction is



What colour change is seen when the acid is neutralised?

.....

(2)

Q6

(Total 7 marks)



7. A student notices a white solid around the top of a bottle of dilute sodium hydroxide solution. She suspects that the solid is sodium carbonate.

(a) (i) Describe the test, and the positive result expected, that she can do to see if the solid is a carbonate.

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

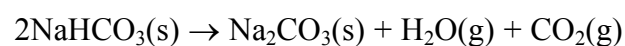
(2)

(ii) Carbon dioxide reacts with sodium hydroxide solution to form sodium carbonate and water. Write a chemical equation for this reaction.

.....

(2)

(b) Sodium carbonate is also formed when sodium hydrogencarbonate is heated strongly. The chemical equation for the reaction is



4.2 g of sodium hydrogencarbonate is heated until it is fully decomposed.

(i) Calculate the amount, in moles, of sodium hydrogencarbonate used.

(3)

(ii) Calculate the amount, in moles, of carbon dioxide formed.

(1)

(iii) Calculate the volume, in dm<sup>3</sup>, measured at room temperature and pressure (rtp), of carbon dioxide formed.

The volume of one mole of any gas at rtp is 24 dm<sup>3</sup>.

(1)

Q7

(Total 9 marks)



8. The table gives some information about elements in Group 7 of the Periodic Table.

Name	State at room temperature	Boiling point / °C
chlorine	gas	-35
bromine	liquid	
iodine	solid	184

(a) Use the information in the table to predict the boiling point of bromine.

.....  
(1)

(b) If a mixture of hydrogen and chlorine is exposed to sunlight a violent reaction takes place. The only product is hydrogen chloride.

(i) Write a chemical equation for the reaction.

.....  
(2)

(ii) A teacher bubbles hydrogen chloride gas into separate samples of water and methylbenzene. She then tests each liquid with universal indicator paper. Describe and explain what is seen in each case.

Hydrogen chloride in water

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

Hydrogen chloride in methylbenzene

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

(4)

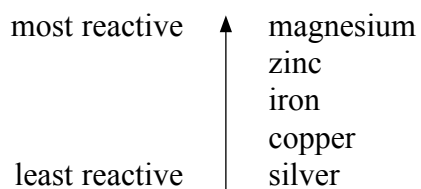
Q8

(Total 7 marks)





9. The list gives the order of reactivity of some metals.



(a) Iron is sometimes coated with zinc to prevent the iron rusting. The iron does not rust even if the coating of zinc becomes damaged.

(i) What is the name given to this method of rust prevention?

.....  
(1)

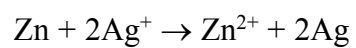
(ii) Give **one** example where this method of rust prevention is used.

.....  
(1)

(iii) Explain how this method of rust prevention works.

.....  
.....  
.....  
(2)

(b) The reaction that occurs when zinc is added to silver nitrate solution is



State, with a reason, which substance is oxidised.

.....  
.....  
(2)

(c) A student is given some solid nickel nitrate and several small pieces of magnesium, zinc, iron, copper and silver. Describe and explain how he can find the position of nickel in the reactivity series given above.

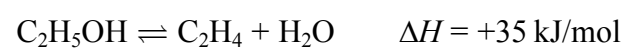
.....  
.....  
.....  
.....  
(3)

(Total 9 marks)

Q9



10. (a) Ethanol can be dehydrated to form ethene.



State, with a reason, the effect of increasing the temperature on the equilibrium yield of  $\text{C}_2\text{H}_4$ .

.....

.....

(2)

(b) Ethene forms an addition polymer, poly(ethene).

Draw the structure of poly(ethene), showing at least 4 carbon atoms in your structure.

(2)

(c) An organic compound has the composition 38.7% carbon, 9.70% hydrogen and 51.6% oxygen by mass. The relative formula mass of the compound is 62. Calculate the empirical and molecular formulae of the compound.

(5)

Q10

(Total 9 marks)

**TOTAL FOR SECTION B: 60 MARKS**

**TOTAL FOR PAPER: 90 MARKS**

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