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**SECTION A**

1. Some metals react with cold water to form a solution of the metal hydroxide and a gas.

(a) How many electrons are in the outer shell of an atom of these metals?

Sodium.....

Magnesium.....

**(2)**

(b) (i) Write a **word** equation for the reaction between sodium and water.

.....

.....

**(1)**

(ii) Describe **two** observations that you could make during this reaction.

1.....

.....

2.....

.....

**(2)**

(c) Litmus is used to test for one of the products of this reaction.

(i) What type of substance is litmus?

.....

**(1)**

(ii) How does it show that this product is present?

.....

**(1)**



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(d) Magnesium reacts very slowly with cold water but more quickly when it is heated in steam, forming an oxide instead of a hydroxide.

(i) Write a chemical equation for the reaction of magnesium with steam.

.....  
(1)

(ii) What colour is the oxide formed?

.....  
(1)

(e) The reactivities of sodium, potassium and magnesium are different.  
State which of the three is the

most reactive .....

least reactive .....

(2)

Q1

(Total 11 marks)

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2. Crude oil is a source of useful chemicals.

(a) Complete the sentence.

Most of the compounds in crude oil are composed of the elements

..... and .....  
**(1)**

(b) During refining, crude oil is first separated into fractions.

(i) What is the name of the process used to obtain fractions from crude oil?

.....  
**(1)**

(ii) What is meant by the term **fraction**?

.....  
.....  
**(1)**

(iii) Describe how the fractions are obtained.

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



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(c) Many substances obtained from the fractions are used as fuels. It is important that the combustion of fuels is complete.

(i) Name the gas produced when combustion is **incomplete**.

.....

(1)

(ii) Explain why this gas can be dangerous.

.....

.....

.....

(2)

(Total 9 marks)

Q2



N 2 4 3 8 7 A 0 7 2 0

3. Aluminium is extracted from its oxide by electrolysis.

(a) Give two reasons why cryolite is used in the electrolysis of aluminium oxide.

1 .....

2 .....

(2)

(b) The same material is used for both the positive and negative electrodes.

(i) What is this material?

.....

(1)

(ii) Which gas is produced by electrolysis at the positive electrodes?

.....

(1)

(iii) Explain why these electrodes are replaced at regular intervals.

.....

(1)

(c) Explain why aluminium cannot be extracted using coke in a blast furnace.

.....

(1)

(d) State **one** major cost involved in the extraction of aluminium but **not** in the extraction of iron.

.....

(1)





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(e) The uses of aluminium are related to its properties. Complete the table by giving a **different** property for each use.

Use	Property
aeroplanes	
drinks cans	easily moulded
overhead power cables	
pans for cooking food	

(3)

Q3

(Total 10 marks)

**TOTAL FOR SECTION A: 30 MARKS**



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**SECTION B**

4. Iron can be extracted in a blast furnace. The raw materials include coke and hot air.

(a) Give the chemical equation for the reaction that is the main source of heat in a blast furnace.

.....  
(2)

(b) In a blast furnace the metal oxide is reduced by carbon monoxide, CO. Write a chemical equation for the reduction of iron(III) oxide, Fe<sub>2</sub>O<sub>3</sub>.

Iron(III) oxide .....  
(2)

(c) In the extraction of iron, limestone is added to remove acidic impurities such as silicon dioxide, SiO<sub>2</sub>. How does limestone remove silicon dioxide from the iron?

.....  
.....  
.....  
.....  
(4)

(d) Blocks of zinc are sometimes attached to the bottom of steel ships. Explain why.

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

**(Total 11 marks)**

**Q4**

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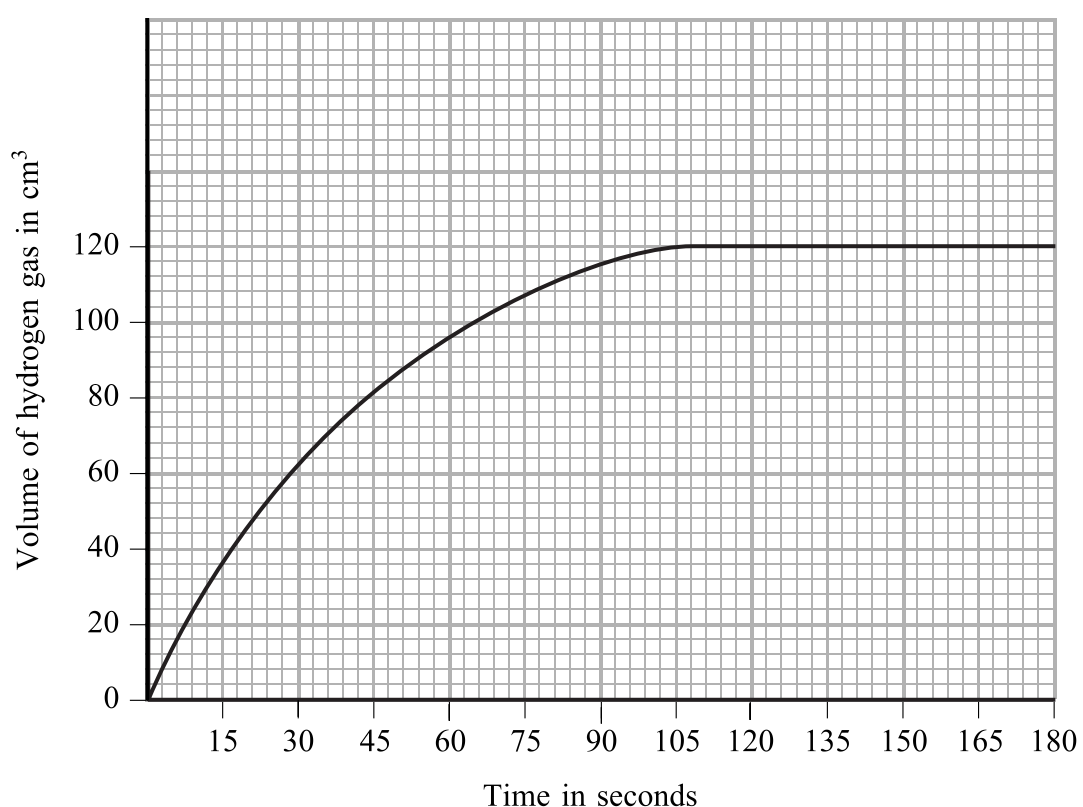


5. A student added a 20 cm length of magnesium ribbon to 50 cm<sup>3</sup> of 0.1 mol dm<sup>-3</sup> hydrochloric acid. The magnesium was in excess. Hydrogen gas and magnesium chloride were formed. The volume of hydrogen gas formed was measured every 15 seconds.

(a) Write a chemical equation, with state symbols, for this reaction.

.....  
(3)

(b) The graph shows the results of the experiment.



(i) The student repeated the original experiment using 50 cm<sup>3</sup> of 0.1 mol dm<sup>-3</sup> hydrochloric acid and the same mass of magnesium **powder**. On the graph, sketch a line to show the results obtained. Label your line **A**.

(2)

(ii) The student repeated the original experiment using 50 cm<sup>3</sup> of 0.05 mol dm<sup>-3</sup> hydrochloric acid and the same length of magnesium ribbon. On the graph, sketch a line to show the results obtained. Label your line **B**.

(2)



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(c) Explain why increasing the temperature of the acid makes the reaction faster.

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

**(3)**

(d) Describe a test to show that the solution formed contains chloride ions.

Test.....  
.....  
.....

Result.....  
.....

**(3)**

**Q5**

**(Total 13 marks)**

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6. (a) How is chlorine manufactured?

.....  
(2)

(b) Chlorine reacts with potassium bromide solution. The word equation for the reaction is  
chlorine + potassium bromide → bromine + potassium chloride

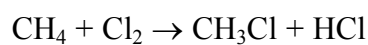
(i) Write the chemical equation for the reaction.

.....  
(2)

(ii) What type of reaction is this?

.....  
(1)

(c) Chlorine reacts with methane. An equation for the reaction is



(i) What is seen when a strip of damp blue litmus paper is put into the reaction mixture **before** the reaction starts?

.....  
(1)

(ii) What is seen when a strip of damp blue litmus paper is put into the reaction mixture **after** the reaction is complete?

.....  
(1)



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(d) When chlorine reacts with ethane the composition by mass of one of the compounds formed is 24.24% carbon, 4.04% hydrogen and 71.72% chlorine. The relative formula mass of this compound is 99.

(i) Calculate the empirical formula of the compound.

(3)

(ii) Calculate the molecular formula of the compound.

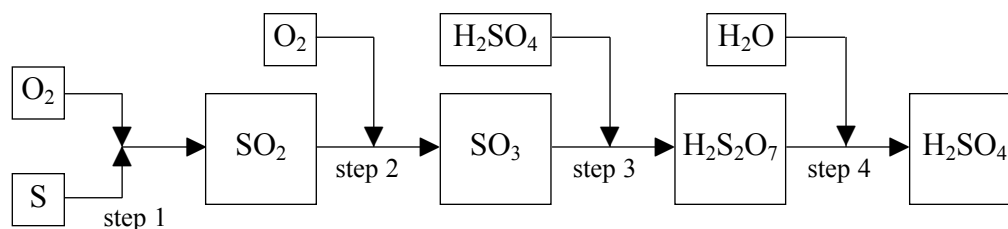
(1)

Q6

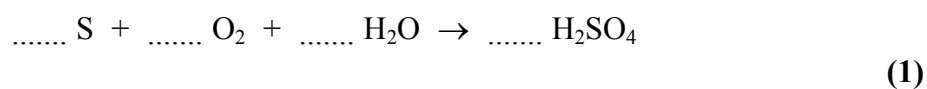
(Total 11 marks)



7. The flow chart shows the steps in the manufacture of sulphuric acid.



(a) Balance the equation to give the overall reaction that occurs.



(b) Step 2 is a **reversible** reaction.

All of the substances in step 2 are gases.

The conversion of sulphur dioxide,  $\text{SO}_2$ , to sulphur trioxide,  $\text{SO}_3$ , is **exothermic**.

The normal conditions for this step are  $450^\circ\text{C}$  and 2 atmospheres pressure.

(i) What does the term **exothermic** mean?

.....  
(2)

(ii) Write a balanced chemical equation for step 2.

.....  
(1)

(iii) Sulphur trioxide,  $\text{SO}_3$ , is formed in step 2. Predict the effect on the amount formed if

- the temperature is increased to  $600^\circ\text{C}$

.....

- the pressure is increased to 5 atmospheres.

.....

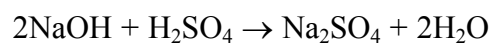
(2)





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(c) Sodium hydroxide solution reacts with dilute sulphuric acid according to the equation



Describe how you would find accurately the volume of sulphuric acid that reacts with 10.0 cm<sup>3</sup> of sodium hydroxide solution.

Your answer should include how you would

- measure the volumes of the solutions
- accurately determine the end point.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

Q7

(Total 10 marks)

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8. Alkenes are **unsaturated hydrocarbons**. Alkenes can form **isomers**.

(a) (i) What is meant by the term **unsaturated hydrocarbon**?

.....  
.....

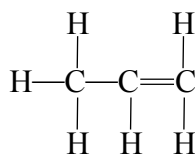
(2)

(ii) What are **isomers**?

.....  
.....

(2)

(b) The displayed formula of propene is



Suggest displayed formulae for three hydrocarbons that have the molecular formula  $\text{C}_5\text{H}_{10}$ .

(3)



(c) Alkenes can form addition polymers. Complete the table.

Name of alkene	Structure of alkene	Structure of polymer	Name of polymer
propene	$\begin{array}{c} \text{CH}_3 \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$		
		$\left[ \begin{array}{c} \text{H} \quad \text{C}_6\text{H}_5 \\   \quad   \\ -\text{C} - \text{C}- \\   \quad   \\ \text{H} \quad \text{H} \end{array} \right]_n$	poly(styrene)

(4)

(d) Ethene reacts with bromine water.

(i) State the colour change seen in this reaction.

.....

(2)

(ii) Draw the displayed formula of the product of the reaction of bromine with ethene.

(1)

(iii) Poly(ethene) does not react with bromine in the same way as ethene. Explain why.

.....

.....

(1)

Q8

(Total 15 marks)

TOTAL FOR SECTION B: 60 MARKS

TOTAL FOR PAPER: 90 MARKS

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