



General Certificate of Secondary Education
2010

Science: Double Award (Modular)

Paper 2
Higher Tier

[G8205]



WEDNESDAY 26 MAY, MORNING

Centre Number

71	
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Candidate Number

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TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 110.

Quality of written communication will be assessed in question **1(b)**.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

A Data Leaflet which includes a Periodic Table of the Elements is provided.

For Examiner's
use only

Question Number	Marks
1	
2	
3	
4	
5	
6	

Total
Marks

--



(ii) Explain how the electron arrangements change when calcium chloride is formed from calcium and chlorine.

[3]

Quality of written communication

[1]

Examiner Only	
Marks	Remark

(c) Strontium (Sr) is a typical Group II element.

- (i) Would you expect strontium to react more vigorously or less vigorously than calcium when put in water? Give a reason for your answer.

_____ [2]

- (ii) When strontium reacts with water an alkaline solution is formed and a gas is given off.

(1) Name the alkaline solution.

_____ [1]

(2) What gas is given off?

_____ [1]

- (iii) What formula would you expect for the oxide formed when strontium reacts with oxygen?

_____ [1]

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Marks Remark

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(Questions continue overleaf)

2 Aluminium is used to make electrical wiring because aluminium is ductile and a good conductor of electricity.

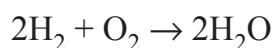
(a) (i) Draw a **labelled** diagram to show the structure of a metal such as aluminium.

[4]

(ii) Explain, in terms of metallic structure, why aluminium is ductile.

[2]

(b) The reaction between hydrogen gas and oxygen gas is exothermic, i.e., heat is given out. The equation below describes the reaction



Explain, in terms of the bonds involved, why the reaction between hydrogen and oxygen is exothermic.

[4]

Examiner Only	
Marks	Remark

(c) Magnesium nitrate decomposes on heating according to the equation:



(i) What is the relative formula mass of MgO?

(Relative atomic masses Mg = 24 O = 16)

Relative Formula Mass = _____ [1]

(ii) What is the relative formula mass of $\text{Mg}(\text{NO}_3)_2$?

(Relative atomic masses Mg = 24 N = 14 O = 16)

Relative Formula Mass = _____ [1]

(iii) Use your answer to part (i) to calculate the number of moles in 5.0 grams of magnesium oxide.

Answer _____ moles [1]

(iv) Use your answer to part (iii) and the equation below to calculate the mass of magnesium nitrate required to be heated to produce 5.0 grams of magnesium oxide.



Answer _____ g [2]

Examiner Only

Marks Remark

- 3 (a) The table below gives some information about atomic and electronic structures.

Complete the table. You may find your Data Leaflet useful.

atom	number of protons	number of electrons	number of neutrons	atomic number	mass number
magnesium	12		12	12	
potassium		19		19	39
boron	5		6		11

[6]

- (b) Chlorine is a reactive Group 7 element and is composed of **diatomic** molecules. It has two isotopes, ^{35}Cl and ^{37}Cl .

- (i) Explain the meaning of the term **diatomic**.

_____ [1]

- (ii) Chlorine has two isotopes, ^{35}Cl and ^{37}Cl . Complete the table below to show the atomic structure of these two isotopes.

Isotope	Number of electrons	Number of neutrons	Number of protons
^{37}Cl	17	20	17
^{35}Cl			

[3]

Examiner Only

Marks

Remark

- (iii) When chlorine is passed into a solution of potassium bromide a displacement reaction takes place and potassium chloride and bromine are formed.

Describe the colour change which would be observed in this reaction.

Colour of solution at the start _____

Colour of solution at the end _____ [2]

- (c) Burning fossil fuels containing sulphur produces a gas, **Z**, which causes acid rain.

- (i) Name this gas, **Z**, that causes acid rain to be formed.

_____ [1]

- (ii) Give **two** reasons why acid rain is a serious environmental problem.

1. _____

2. _____ [2]

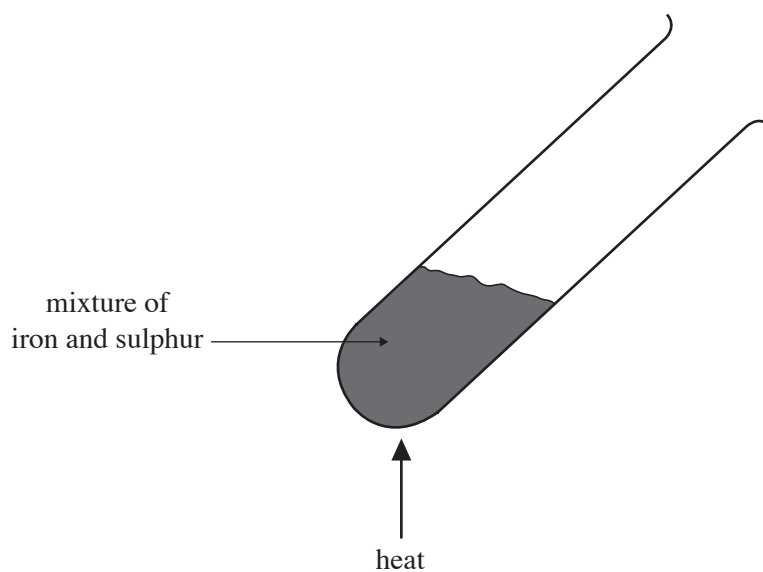
- (iii) Give **one** way that fossil fuel power stations can reduce the amount of gas, **Z**.

_____ [1]

Examiner Only

Marks Remark

- (d) When sulphur and iron are heated they react to form a compound, iron(II) sulphide.



- (i) Describe the appearance of sulphur.

_____ [2]

- (ii) Give **two** things you would observe when iron reacts with sulphur.

1. _____

2. _____ [2]

Examiner Only

Marks Remark

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(Questions continue overleaf)

(c) Magnesium reacts very slowly with water but it reacts quite vigorously with steam.

(i) What gas is formed when magnesium reacts with steam?

_____ [1]

(ii) What is the other product of the reaction of magnesium with steam?

_____ [1]

(d) Copper sulphate can be made by reacting solid green copper carbonate powder with dilute sulphuric acid.

(i) Describe **two** things you would observe happening when copper carbonate reacts with sulphuric acid.

1. _____

2. _____ [2]

(ii) Why can copper sulphate not be prepared by adding dilute sulphuric acid directly to copper?

_____ [1]

(e) Magnesium powder reacts quickly when stirred with copper(II) sulphate solution. Describe the colour change of the solution in this reaction.

(i) From _____ to _____ [2]

(ii) Write a balanced **symbol** equation for the reaction of magnesium with copper(II) sulphate.

_____ [2]

(iii) What **type** of chemical reaction is the reaction between magnesium and copper sulphate?

_____ [1]

Examiner Only

Marks Remark

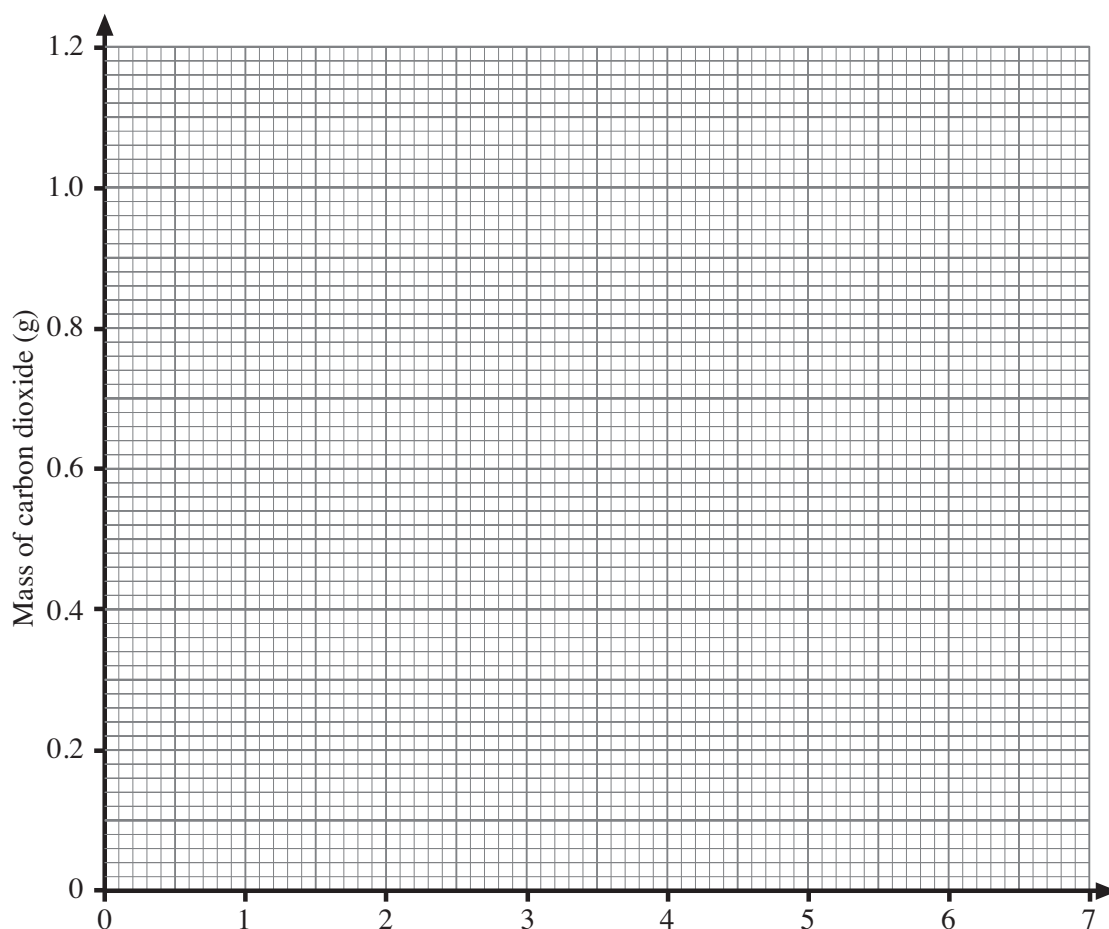
5 (a) Marble chips react with dilute hydrochloric acid as shown below:



A student measured the mass of carbon dioxide being produced over a period of time when very small marble chips were added to dilute hydrochloric acid. The marble chips were in excess.

The results are shown in the table below.

Mass of carbon dioxide (g)	0.0	0.40	0.68	0.85	0.96	1.02	1.04	1.04
Time (mins)	0	1	2	3	4	5	6	7



(i) Label the x-axis on the grid above. [1]

(ii) On the grid above plot a curve to show the results. [3]

(iii) At what time did the reaction stop?

_____ [1]

Examiner Only

Marks Remark

(iv) From your graph, how long did it take for 0.5 grams of carbon dioxide to be formed?

_____ [1]

(v) Use the idea of collisions to explain the effect of **increasing** the size of the marble chips on the rate of reaction.

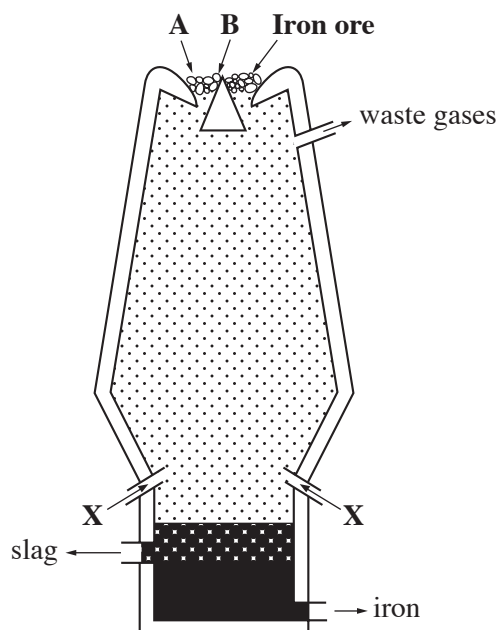
_____ [3]

(vi) The student repeated the reaction using the same volume and concentration of dilute hydrochloric acid as before but this time using larger marble chips. How would using larger marble chips affect the **total mass** of carbon dioxide formed?

_____ [1]

Examiner Only	
Marks	Remark

(b) Iron is obtained in the Blast Furnace from its ore, iron(III) oxide.



(i) Complete the table below about the raw materials, **A** and **B**, which are added at the top of the Blast Furnace.

substance	common name	chemical name
A		carbon
B		calcium carbonate

[2]

(ii) Name the substance **X**, that is blasted in lower down the Blast Furnace.

_____ [1]

(iii) Carbon monoxide is the reducing agent in the Blast Furnace. Write a balanced symbol equation to show how carbon dioxide produced in the Blast Furnace is converted into carbon monoxide.

_____ [3]

Examiner Only

Marks Remark

(iv) Use a balanced symbol equation to show how carbon monoxide reduces iron(III) oxide to iron in the furnace.

_____ [3]

(v) Give **one** environmental problem which can arise from iron manufacture.

_____ [1]

Examiner Only	
Marks	Remark

6 Ethane and ethene are two important organic chemicals. They are both hydrocarbons but they belong to two different homologous series.

(a) (i) What does the term hydrocarbon mean?

_____ [2]

Ethene can be obtained by **thermal cracking**.

(ii) Ethane is a saturated organic molecule. What does the term **saturated** mean?

_____ [1]

(iii) What is meant by **thermal cracking**?

_____ [2]

(iv) Name the homologous series to which ethene belongs.

_____ [1]

(b) Complete the table below to show the molecular and structural formulae and physical state at room temperature of both ethane and ethene.

hydrocarbon	molecular formula	structural formula	physical state at room temperature
ethane			
ethene			

[4]

Examiner Only

Marks

Remark

- (c) Describe a chemical test which you could carry out in the laboratory to distinguish between ethane and ethene. State what you would observe.

test	
observations with ethane	
observations with ethene	

[4]

- (d) Ethene can be used to make ethanol, which can be used as a fuel.

- (i) What does ethene react with to make ethanol?

_____ [1]

- (ii) What chemicals are formed when ethanol is burned in a plentiful supply of air?

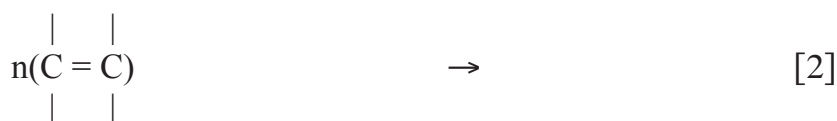
_____ [2]

- (e) Polythene is a useful plastic made from ethene molecules.

- (i) What plastic is made from propene molecules?

_____ [1]

- (ii) Complete the diagram below which represents addition polymerisation.



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Marks	Remark

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