



Centre Number

71	
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Candidate Number

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General Certificate of Secondary Education  
2012–2013

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## Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]

MV18

MONDAY 20 MAY 2013, AFTERNOON

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### TIME

1 hour, plus your additional time allowance.

### 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 seven** questions.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in

Question **3(b)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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**(Questions start overleaf)**

1 Graphene is a form of the element carbon. It consists of a single layer of carbon atoms joined together by covalent bonds. It is 200 times stronger than steel. It conducts electricity as efficiently as copper and is a good conductor of heat. It is almost completely transparent with possibly the highest melting point known.

(a) Explain why graphene is said to be an element. [1]

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(b) Give two pieces of information from the passage which suggest that graphene might be thought to be **metallic**. [2]

1. \_\_\_\_\_

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2. \_\_\_\_\_

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(c) Give two pieces of information from the passage which suggest graphene might be thought to be **non-metallic**. [2]

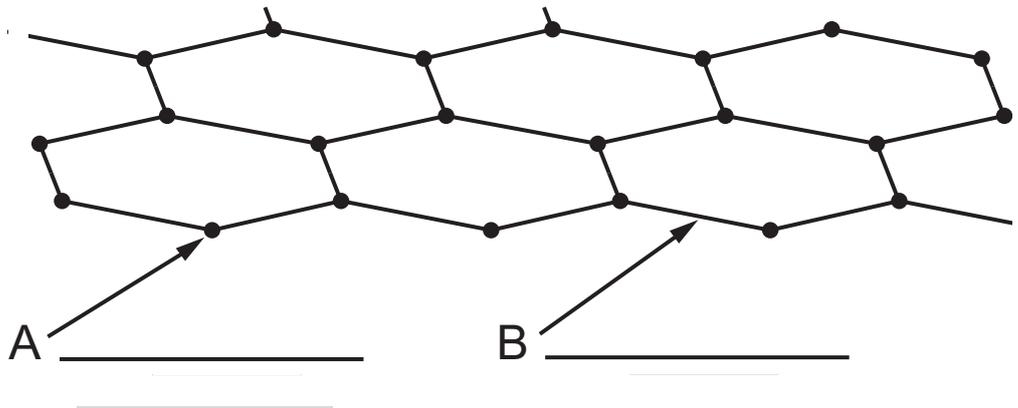
1. \_\_\_\_\_

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2. \_\_\_\_\_

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(d) Using the information in the passage, label A and B in the diagram of graphene below. [2]



2 A small piece of sodium metal was added, using tongs, to a trough of water to which a few drops of universal indicator had been added.

(a) How is sodium stored in the laboratory? [1]

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(b) Why was a **small** piece of sodium added to the water? [1]

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(c) Why was the sodium handled with tongs instead of using fingers to lift it? [2]

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(d) Choose **three** statements which describe what happens when sodium is placed into the water.

Put a tick (✓) in the three correct boxes. [3]

bubbles of carbon dioxide gas form <input type="checkbox"/>	melts into a silvery ball <input type="checkbox"/>
burns with a lilac flame <input type="checkbox"/>	sinks to the bottom then floats to the top <input type="checkbox"/>
moves quickly across the surface of the water <input type="checkbox"/>	eventually disappears <input type="checkbox"/>

At the end of this reaction the universal indicator had turned purple.

(e) What does this tell you about the product of the reaction? [1]

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Sodium is a Group 1 metal.

(f) Explain, in terms of electrons, why all Group 1 metals react in a similar way. [1]

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(g) Suggest why rubidium is **not** used in the school laboratory instead of sodium to demonstrate the reaction of Group 1 metals with water. [1]

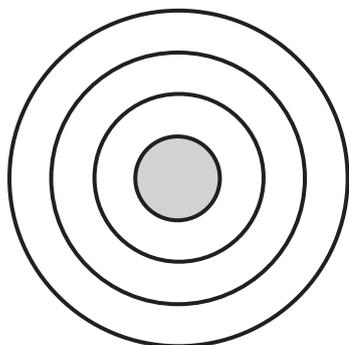
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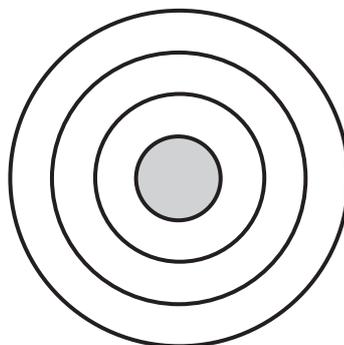
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3 Hot magnesium metal will burn in chlorine gas to form magnesium chloride.

(a) Complete the diagrams below to show **all** the electrons in a magnesium atom and a chlorine atom. [2]



magnesium atom



chlorine atom

**In part (b) you will be assessed on your written communication skills including the use of specialist scientific terms.**

(b) Explain fully, **in terms of electrons**, how the atoms of magnesium and chlorine react together to form magnesium chloride.

Include in your answer the charges on the ions and an explanation of how the ions are held together in the compound. [6]

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**(c)** Using a **dot and cross** diagram, draw a molecule of hydrogen. [2]

**(d)** Describe a test for hydrogen gas. [2]

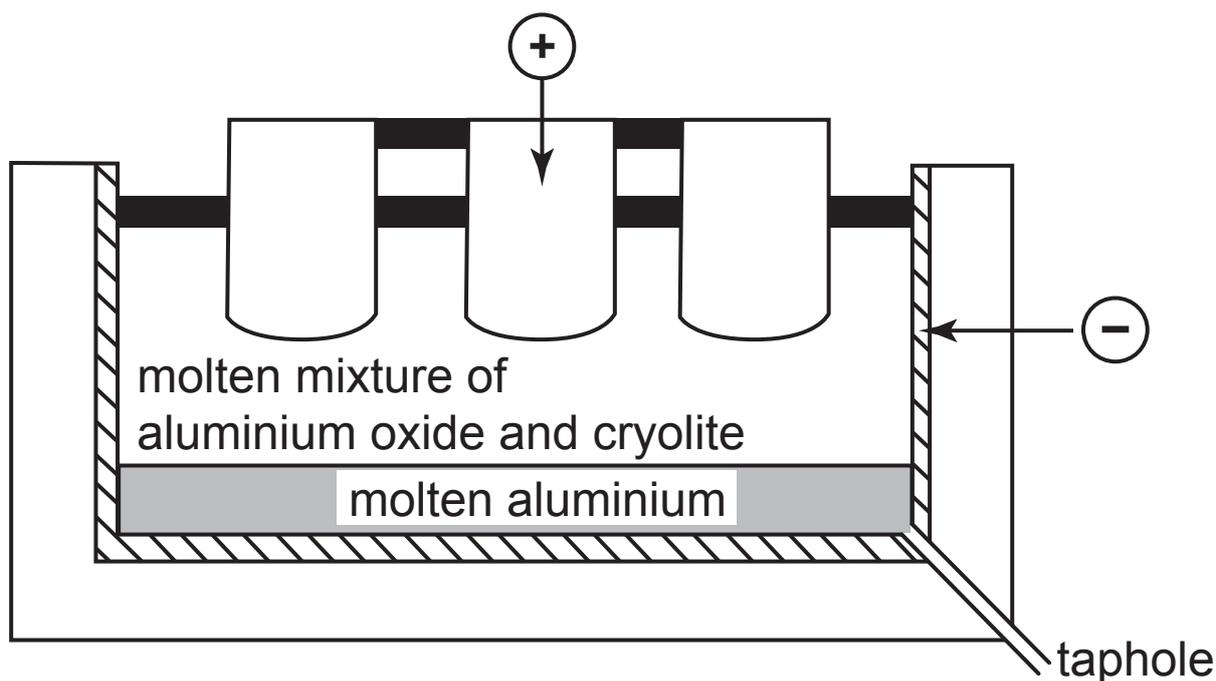
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- 4 Aluminium is extracted from its ore by the electrolysis of a molten mixture of alumina (aluminium oxide) and cryolite.



- (a) Explain what is meant by the term electrolysis. [2]

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- (b) Name the ore of aluminium which is purified to produce alumina. [1]

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- (c) Give two reasons why cryolite is added to the alumina. [2]

1. \_\_\_\_\_

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2. \_\_\_\_\_

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Aluminium is produced at the cathode.

(d) Write a half equation for the production of aluminium at the cathode. [2]

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(e) Explain, in words, what happens to the oxide ions at the anode in the **electrolysis process**. [3]

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(f) Explain why the anodes need to be replaced regularly. [2]

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- 5 Diamond and graphite are two allotropes of carbon.  
Carbon dioxide is one of the many compounds of carbon.

(a) Complete the table below which gives information about the bonding, structure and melting points of diamond and carbon dioxide. [2]

	<b>Bonding</b>	<b>Type of structure</b>	<b>Melting point /°C</b>
Diamond	covalent		3350
Carbon dioxide	covalent		-78

(b) What are allotropes? [2]

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(c) (i) Suggest a melting point for graphite. [1]

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(ii) Explain your answer to (c)(i). [1]

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**(d)** Explain, in terms of its structure, why diamond has an extremely high melting point. [3]

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**(e)** Explain, in terms of its structure, why carbon dioxide has a very low melting point. [3]

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**(f)** Explain, in terms of its structure, why diamond cannot conduct electricity. [1]

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- 6 Nails made from iron rust easily. The rust can be removed using phosphoric acid.



rusty nails

nails after using  
phosphoric acid

The word equation for the reaction is given below.

phosphoric acid + iron oxide  $\rightarrow$  iron phosphate + water

- (a) Name the **base** in the word equation above. [1]

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- (b) Explain why this reaction is a neutralisation reaction. [2]

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The symbol for the phosphate ion is  $\text{PO}_4^{3-}$

- (c) Use this information to write the formula for phosphoric acid. [2]

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Aluminium can be added to the iron to make an **alloy** which will not rust.

**(d)** What is an alloy? [2]

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7 Copper(II) oxide reacts with sulfuric acid to form copper(II) sulfate and water.

(a) Write a balanced symbol equation for the reaction between copper(II) oxide and sulfuric acid. [2]

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(b) Describe what you observe happening during this reaction. [3]

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Copper(II) sulfate can also be produced by the reaction of copper(II) carbonate with sulfuric acid.

(c) Write a balanced symbol equation for the reaction between copper(II) carbonate and sulfuric acid. [2]

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(d) Describe two ways in which the reaction of copper(II) carbonate with sulfuric acid is different to the reaction of copper(II) oxide with sulfuric acid. [2]

1. \_\_\_\_\_

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2. \_\_\_\_\_

\_\_\_\_\_

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**THIS IS THE END OF THE QUESTION PAPER**

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## SOURCES

Pg 14, Q6, Photograph of three rusty nails and a photograph of three nails with rust removed,  
Source: © Charles D. Winters / Science Photo Library

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
<b>Total Marks</b>	

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