Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]

GSD22

MONDAY 20 MAY 2013, AFTERNOON

TIME

1 hour.

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 down the right-hand side of pages 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.

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

Examiner Only	
Marks	Remark

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]

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

1. _____

_____

2. _____

_____ [2]

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

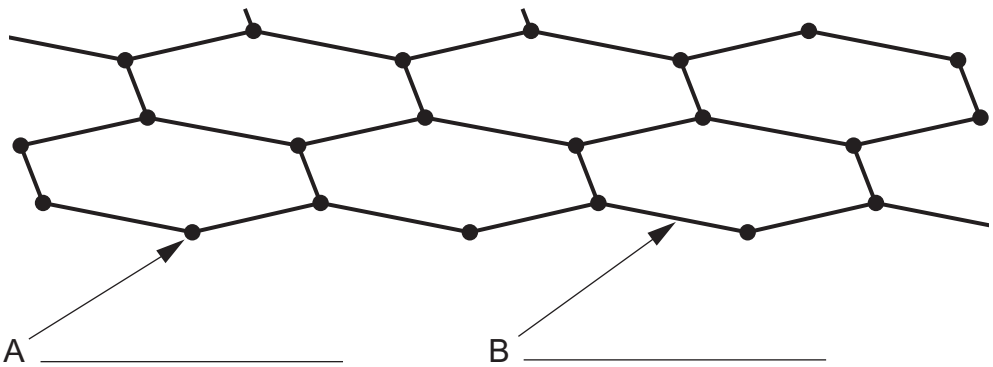
1. _____

_____

2. _____

_____ [2]

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



[2]

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

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]

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

_____ [1]

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

_____

_____

_____ [2]

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

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

bubbles of carbon dioxide gas form	☐	melts into a silvery ball	☐
burns with a lilac flame	☐	sinks to the bottom then floats to the top	☐
moves quickly across the surface of the water	☐	eventually disappears	☐

[3]

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]

Sodium is a Group 1 metal.

Examiner Only	
Marks	Remark

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

_____

_____ [1]

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

_____

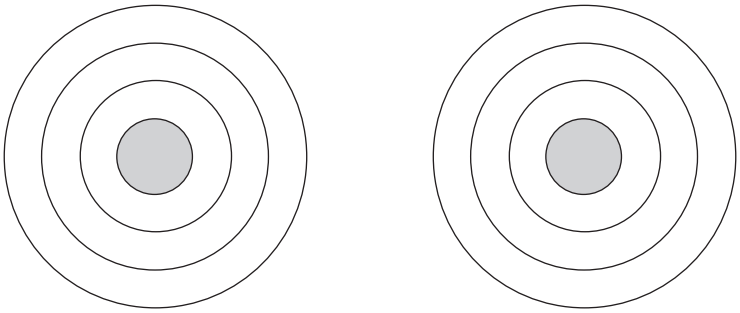
_____

_____ [1]

Examiner Only	
Marks	Remark

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.



magnesium atom chlorine atom [2]

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]

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

[2]

(d) Describe a test for hydrogen gas.

_____

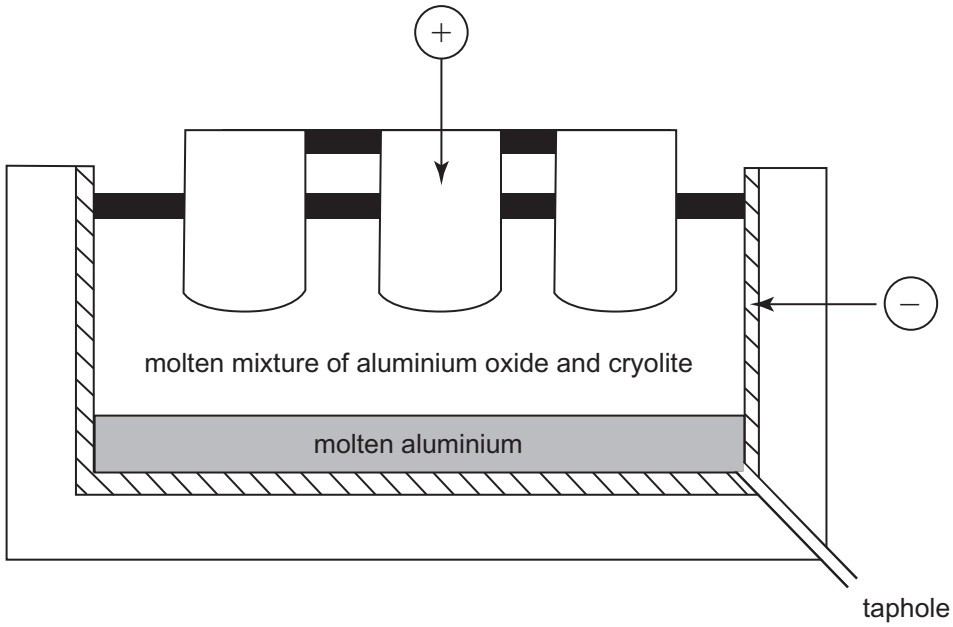
_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

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]

(b) Name the ore of aluminium which is purified to produce alumina.

_____ [1]

(c) Give two reasons why cryolite is added to the alumina.

1. _____

_____

2. _____

_____ [2]

Aluminium is produced at the cathode.

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

_____ [2]

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

_____

_____

_____

_____

_____

_____ [3]

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

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

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.

	Bonding	**Type of structure**	**Melting point /°C**
Diamond	covalent		3350
Carbon dioxide	covalent		–78

[2]

(b) What are allotropes?

_____

_____ [2]

(c) **(i)** **Suggest** a melting point for graphite.

_____ [1]

(ii) Explain your answer to **(c)(i)**.

_____

_____ [1]

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

_____

_____

_____ [3]

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

_____

_____

_____ [3]

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

_____

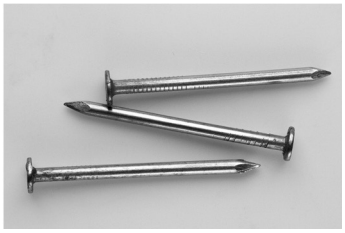
_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

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 ⟶ iron phosphate + water

(a) Name the **base** in the word equation above.

_____ [1]

(b) Explain why this reaction is a neutralisation reaction.

_____

_____ [2]

The symbol for the phosphate ion is PO_4^{3-}

(c) Use this information to write the formula for phosphoric acid.

_____ [2]

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

(d) What is an alloy?

_____

_____ [2]

Examiner Only	
Marks	Remark

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]

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

_____

_____

_____ [3]

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]

(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.

1. _____

2. _____ [2]

THIS IS THE END OF THE QUESTION PAPER

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