

New
Specification



Centre Number

71	
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Candidate Number

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General Certificate of Secondary Education
2011–2012

Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]



MONDAY 21 MAY 2012, MORNING

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 eight** 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 **2(c)**.

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



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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total
Marks

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1 (a) Two common isotopes of chlorine are $^{35}_{17}\text{Cl}$ and $^{37}_{17}\text{Cl}$.

(i) Complete the table below to show the numbers of protons, neutrons and electrons in the $^{37}_{17}\text{Cl}$ isotope.

Isotope	Protons	Neutrons	Electrons
$^{37}_{17}\text{Cl}$			

[3]

(ii) What are isotopes?

_____ [2]

(b) (i) Complete the table below which gives information about electronic structures and their relation to the Group number of the Periodic Table.

Element	Atomic number	Electronic configuration	Group of Periodic Table
A	17		7
B	5	2,3	
C		2,8,5	5
D	6		4

[4]

(ii) What is the name of the element in Group 2 Period 3?

_____ [1]

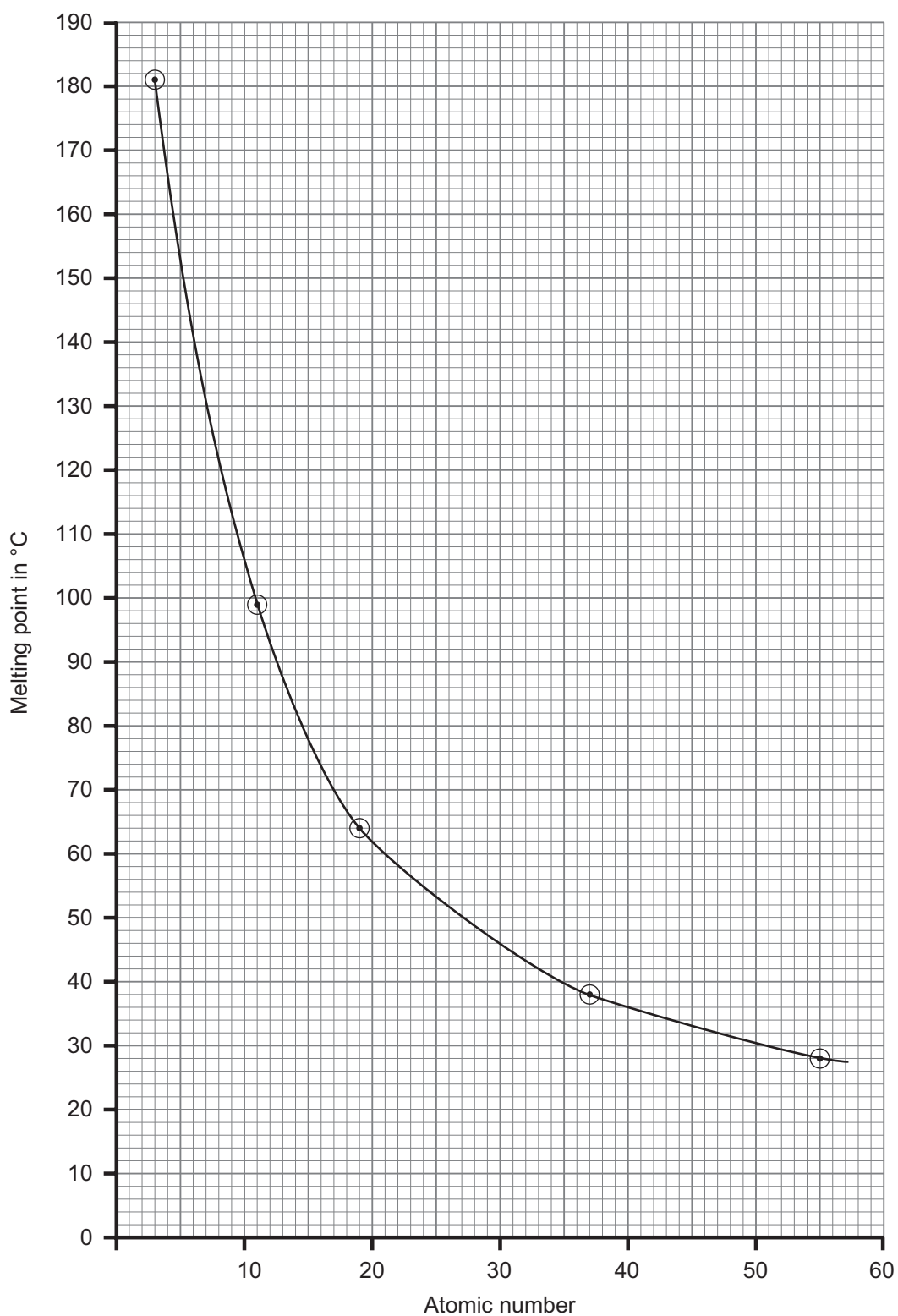
Examiner Only

Marks Remark

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(Questions continue overleaf)

- 2 The graph below shows how the melting points of the alkali metals change with increasing atomic number.



- (a) Name the alkali metal with the highest melting point.

_____ [1]

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Marks	Remark

(b) What happens to the melting point of the alkali metals as the atoms increase in size?

_____ [1]

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

(c) Describe how potassium is stored in the laboratory and the steps that need to be taken before adding it to water. Include in your answer its appearance at each stage and any safety precautions that need to be taken.

_____ [6]

(d) (i) Suggest why rubidium (Rb) is **not** used in the school laboratory to show the reactions of the alkali metals.

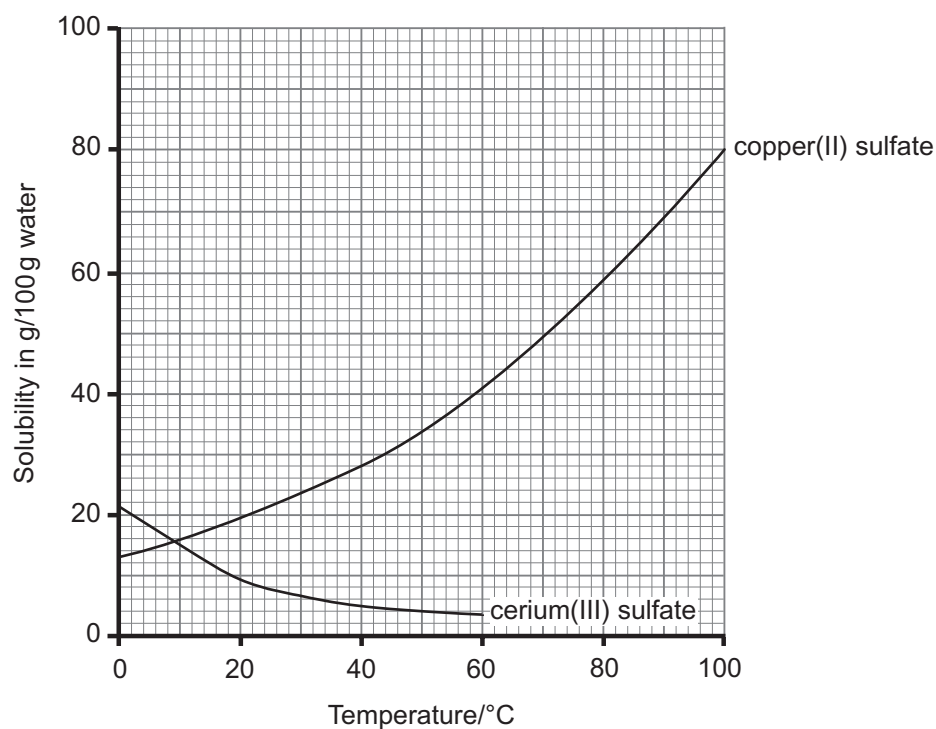
_____ [1]

(ii) How many electrons would you expect rubidium to have in its outer shell?

_____ [1]

Examiner Only	
Marks	Remark

- 3 The solubility curves for the solids copper(II) sulfate and cerium(III) sulfate are drawn below.



Use the solubility curves to answer the following questions.

- (a) How does the solubility of the cerium(III) sulfate change as the temperature increases?

_____ [1]

- (b) What is the solubility of copper(II) sulfate at 26 °C?

_____ g/100g water [1]

- (c) At what temperature is the solubility of cerium(III) sulfate 8 g/100g water?

_____ °C [1]

- (d) At what temperature is the solubility of the cerium(III) sulfate equal to the solubility of copper(II) sulfate?

_____ °C [1]

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Marks	Remark

4 Copper(II) oxide reacts with sulfuric acid to form a solution of copper(II) sulfate in water.

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

_____ [2]

(b) What is the colour of copper(II) oxide?

_____ [1]

(c) What is the colour of the solution of copper(II) sulfate?

_____ [1]

(d) Write the formula of the ion which is always produced when an acid dissolves in water.

_____ [1]

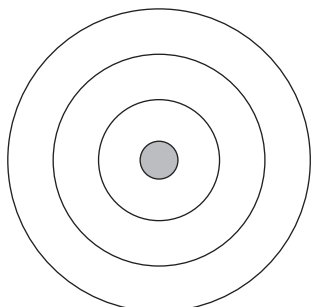
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Marks	Remark

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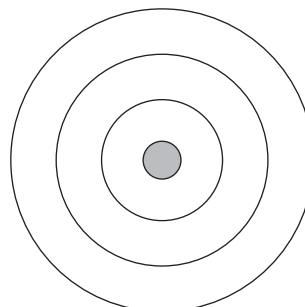
(Questions continue overleaf)

5 Magnesium reacts with chlorine to form an ionic compound, magnesium chloride. Hydrogen reacts with chlorine to form a covalent compound, hydrogen chloride.

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



magnesium atom



chlorine atom

[2]

(ii) Explain how the atoms of magnesium and chlorine form **ions**.

[2]

(iii) How many chlorine atoms react with one atom of magnesium?

[1]

(iv) How are the ions held together in the compound magnesium chloride?

[1]

(b) The elements hydrogen and chlorine exist as **diatomic** molecules.

Explain the meaning of the term **diatomic**.

[1]

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Marks Remark

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

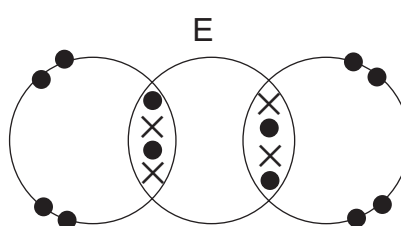
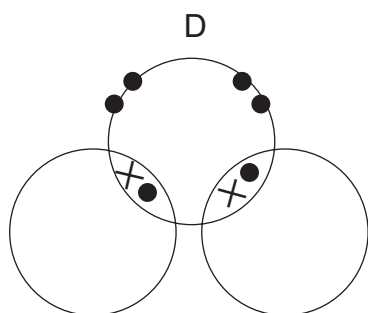
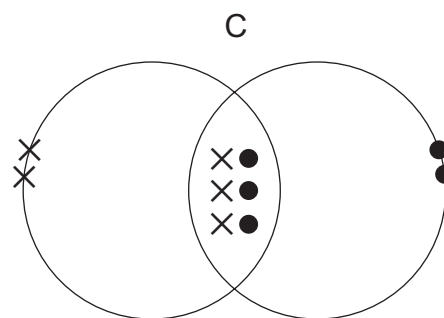
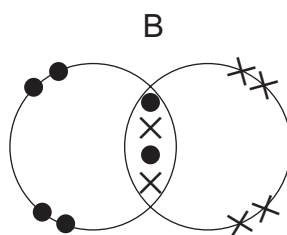
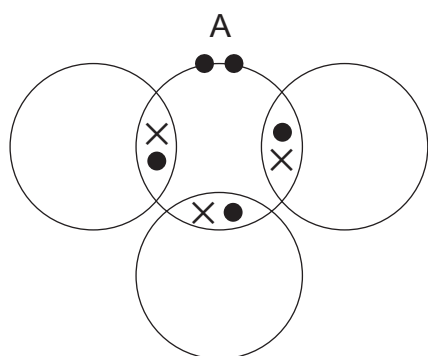
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Marks	Remark

[3]

(ii) Label a lone pair of electrons in your diagram of hydrogen chloride.

[1]

(d) The dot and cross diagrams below show the outer electrons in the atoms of five covalent molecules, A, B, C, D and E.



Choose the diagram, A, B, C, D or E, which shows a molecule with

(i) two single covalent bonds. _____

[1]

(ii) one double covalent bond. _____

[1]

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[Turn over

6 Aluminium is a metal which is used in overhead cables because it is a good conductor of electricity and it is ductile.

(a) Describe the structure of a metal such as aluminium.

[3]

(b) Explain why aluminium is a good conductor of electricity.

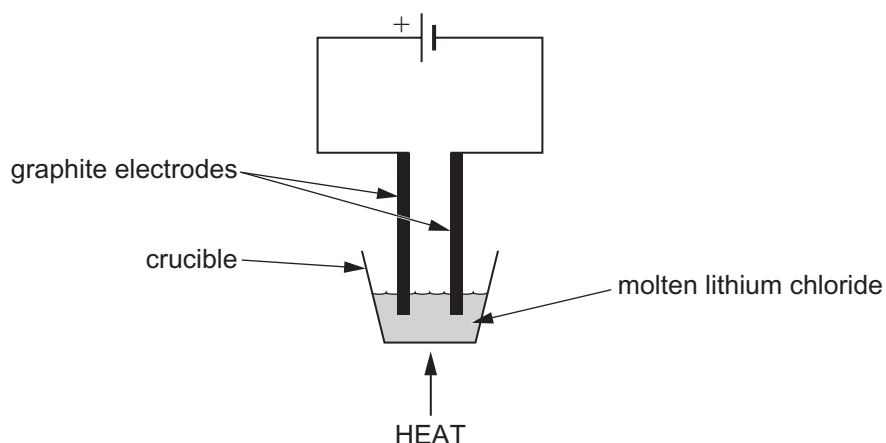
[2]

(c) The term ductile means that the metal can be stretched or drawn into thin wires.
Explain, in terms of its structure, why aluminium is ductile.

[1]

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Marks	Remark

- 7 Chlorine can be produced by passing an electric current through molten lithium chloride as shown in the diagram below.



- (a) Explain why the lithium chloride will only conduct electricity when it is molten or in solution.

_____ [3]

- (b) Give **two** reasons why graphite is used to make the electrodes.

1. _____

2. _____ [2]

- (c) (i) Write an ionic equation to show the production of chlorine.

_____ [2]

- (ii) Name the electrode at which chlorine is produced.

_____ [1]

- (iii) Give **two** observations which can be made **at this electrode** during the electrolysis of lithium chloride.

1. _____

2. _____ [2]

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Marks Remark

8 The elements of Group 7 of the Periodic Table, the halogens, all react in a similar way.

(a) Explain, in terms of electrons, why the halogens all react in a similar way.

_____ [1]

(b) In an experiment to compare the reactivity of the halogens, a solution of a halogen is added to a solution of a compound containing a different halogen. The more reactive halogen will displace a less reactive halogen from its compound.

The results of the experiment are shown in the table below.

Solution of potassium halide	Solution of halogen		
	chlorine	bromine	iodine
potassium chloride		no reaction	no reaction
potassium bromide	colourless solution darkens to orange brown		no reaction
potassium iodide	colourless solution darkens to brown	colourless solution darkens to brown	

(i) Using the information in the table write a reactivity series of the halogens beginning with the most reactive.

Most Reactive: _____

Least Reactive: _____ [2]

(ii) Explain why a colour change occurs when chlorine is added to a solution of potassium bromide.

_____ [1]

(iii) Write a balanced chemical equation for the reaction between potassium bromide and chlorine.

_____ [3]

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THIS IS THE END OF THE QUESTION PAPER

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