



Rewarding Learning

General Certificate of Secondary Education  
2012–2013

## Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]



TUESDAY 26 FEBRUARY 2013, MORNING

Centre Number

71

Candidate Number

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### 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 **3(b)**.

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	
7	
8	

Total  
Marks

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- 1 (a) Indicators can change colour in acid and alkaline solutions. Indicators can be made from plant material such as red cabbage.

The table below gives information about three different indicators. Use this information to answer the questions that follow.

Substance	Colour of universal indicator paper	Colour of red litmus paper	Colour of red cabbage solution	pH range
hydrochloric acid	red	red	red	1–2
sodium hydroxide	dark blue	blue	yellow	12–14
water	green	red	purple	7
ethanoic acid	orange	red	red	3–6

- (i) Why is red litmus paper **not** a suitable indicator for testing pH?

\_\_\_\_\_  
\_\_\_\_\_ [1]

- (ii) Explain why red cabbage solution can be described as an indicator.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

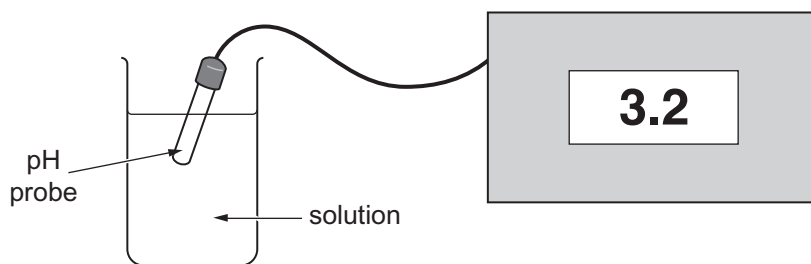
- (iii) Why is universal indicator a better indicator than red cabbage solution for testing acids?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [1]

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Marks Remark

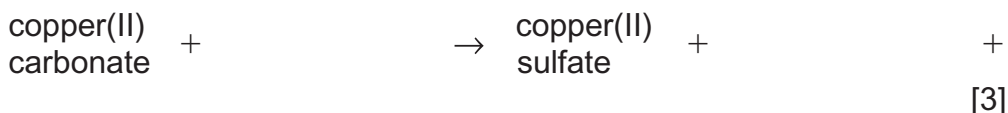
(b) The diagram below shows a way of measuring pH.



Give an advantage of using a pH probe instead of an indicator solution to measure pH.

\_\_\_\_\_ [1]

(c) When copper(II) carbonate reacts with an acid it forms copper(II) sulfate. Complete the word equation for this reaction.



(d) The colour of copper(II) sulfate crystals changes as they are heated.

The colour and formulae of three types of copper(II) sulfate are given in the table below.

Colour	Formula
blue	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
green	$\text{CuSO}_4 \cdot \text{H}_2\text{O}$
white	$\text{CuSO}_4$

(i) Give the formula of the type of copper(II) sulfate that would be best to test for the presence of water. Explain your answer.

Formula: \_\_\_\_\_ [1]

Explanation: \_\_\_\_\_

\_\_\_\_\_ [2]

(ii) What word is used to describe white copper(II) sulfate?

\_\_\_\_\_ [1]

Examiner Only	
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3 (a) Give an accurate definition of the term solubility.

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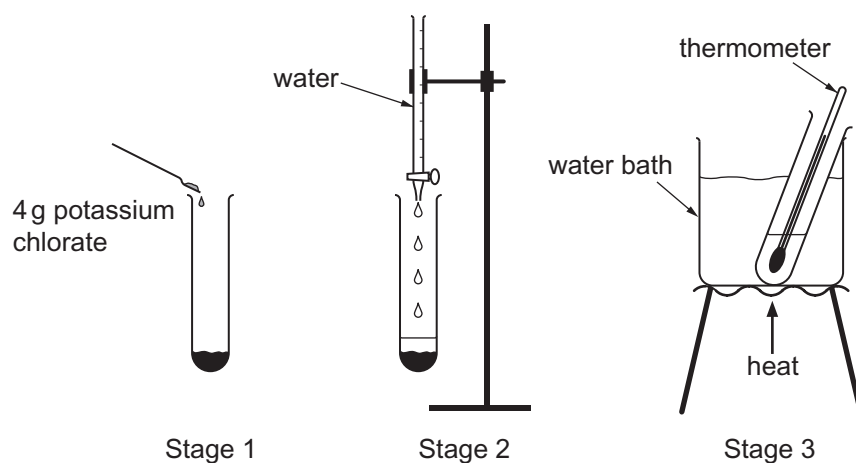
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[4]

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

(b) A student wanted to obtain results to plot a solubility graph for potassium chlorate. The first three stages of the method used are shown below.



Stage 1: 4 g of potassium chlorate are placed in a boiling tube.

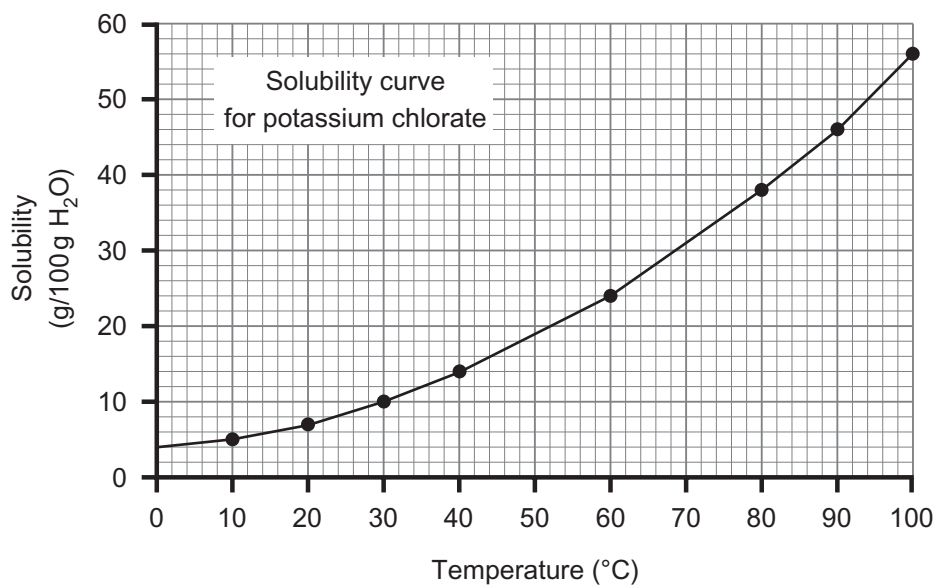
Stage 2: 10 cm<sup>3</sup> of water are added.

Stage 3: The boiling tube is placed in a water bath and heated until all the potassium chlorate has dissolved. The boiling tube is then removed from the water bath.

Examiner Only	
Marks	Remark



(d) A solubility curve for potassium chlorate is shown below.



(i) Describe the trend in solubility shown by the graph above.

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[2]

(ii) What is the solubility of potassium chlorate at 69°C?

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[1]

Examiner Only	
Marks	Remark



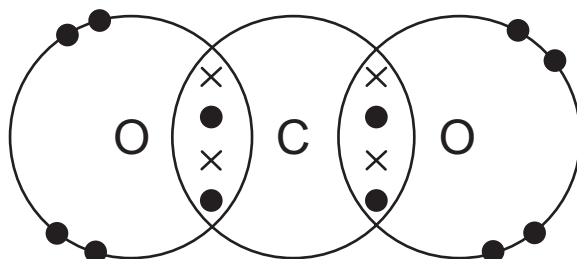
4 Complete the table below about chemical formulae.

Chemical formula	Name of non-metal ion	Number of oxygen atoms in the formula	Total number of atoms in the formula
$\text{Na}_2\text{CO}_3$	carbonate	3	
$\text{Fe}(\text{OH})_3$	hydroxide		7
$\text{Cu}(\text{NO}_3)_2$		6	9
$\text{Mg}(\text{HCO}_3)_2$	hydrogencarbonate		

[5]

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Marks	Remark

- 5 Covalent bonds form when atoms share electrons.  
The diagram below shows the outer electrons in a molecule of carbon dioxide.



(a) On the diagram above, label using arrows:

(i) a double covalent bond

(ii) a lone pair.

[2]

(b) Draw a dot and cross diagram for a molecule of ammonia  $\text{NH}_3$ . Show only the **outer** electrons.

[2]

(c) Most molecular covalent substances are insoluble in water. Give **two** other typical properties of molecular covalent substances.

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

2. \_\_\_\_\_ [2]

Examiner Only

Marks

Remark

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**(Questions continue overleaf)**

6 John Newlands was a chemist who organised the chemical elements into a table.

(a) Part of Newlands' table is shown below. Use this table to help you answer parts (a)(ii) and (a)(iii).

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe

(i) What name is given to the repeating pattern that was noticed by John Newlands?

\_\_\_\_\_ [1]

(ii) Give the symbols of **three** elements that Newlands correctly placed together in the same column.

\_\_\_\_\_ [1]

(iii) Newlands' table had seven groups. Which group of elements is missing?

\_\_\_\_\_ [1]

(iv) Give one other uncertainty or limitation of Newlands' theory.

\_\_\_\_\_ [1]

(b) Dmitri Mendeleev developed a more detailed Periodic Table.

What were the main features of his Periodic Table?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

Examiner Only

Marks Remark

(c) What does the position of an element in the modern Periodic Table tell you about its detailed atomic structure?

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

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

3. \_\_\_\_\_  
\_\_\_\_\_

[3]

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Marks

Remark

7 Substances can be classified by their structures as ionic lattice, molecular covalent, giant covalent or metallic.

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Marks Remark

Substance	Melting point (°C)	Boiling point (°C)	Electrical conductivity	
			Solid	Liquid
A	-210	-196	does not conduct	does not conduct
B	600	2350	conducts	conducts
C	808	1465	does not conduct	conducts
D	114	184	does not conduct	does not conduct
E	3550	4827	does not conduct	does not conduct

(a) Which substance, A, B, C, D or E, is a gas at room temperature?

\_\_\_\_\_ [1]

(b) Which substance, A, B, C, D or E, has an ionic lattice structure?

\_\_\_\_\_ [1]

(c) Which substances, A, B, C, D or E, have a molecular covalent structure?

\_\_\_\_\_ and \_\_\_\_\_ [1]

(d) Which substance, A, B, C, D or E, is most likely to be soluble in water?

\_\_\_\_\_ [1]

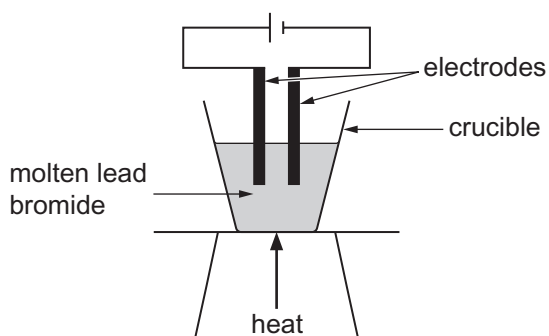
(e) Substance E can be used in cutting tools.

Name substance E and give a **physical** property which makes it suitable for use in cutting tools.

name: \_\_\_\_\_ [1]

physical property: \_\_\_\_\_ [1]

- 8 The diagram below shows the apparatus used to pass an electric current through molten lead bromide.



- (a) What name is given to the process shown in the diagram?

\_\_\_\_\_ [1]

- (b) The electrodes are made of graphite. Explain fully why graphite is a suitable material for this reaction.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

- (c) Write a half equation (ionic equation) for the reaction that takes place at the **anode**.

\_\_\_\_\_ [2]

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Marks Remark

(d) The table below gives the melting points of four metal halides.

Metal halide	Melting point (°C)
sodium chloride	801
potassium chloride	772
lead bromide	367
calcium chloride	782

Suggest why lead bromide is chosen, in preference to the other three halides, to demonstrate the process shown in the diagram on the previous page.

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[2]

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

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Marks	Remark









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