



Centre Number

71	
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Candidate Number

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General Certificate of Secondary Education  
2014–2015

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## Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]

MV18

THURSDAY 13 NOVEMBER 2014, MORNING

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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 **6**.

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

1 The element carbon has 3 naturally occurring isotopes,  $^{12}\text{C}$ ,  $^{13}\text{C}$  and  $^{14}\text{C}$ .

(a) Draw a **labelled** diagram of an atom of the  $^{13}\text{C}$  isotope showing the **number and position** of the protons, neutrons and electrons. [4 marks]

(b) Explain why an atom of  $^{13}\text{C}$  has no electrical charge. [2 marks]

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(c) The electronic configurations of the atoms of 5 different elements, A, B, C, D and E, are shown below.

element	electronic configuration
A	2,8,8
B	2,8,8,1
C	2,6
D	2,1
E	2,8,2

Using the letters A, B, C, D or E choose:

(i) an unreactive element [1 mark]

\_\_\_\_\_

(ii) two elements found in the same Group of the Periodic Table [1 mark]

\_\_\_\_\_ and \_\_\_\_\_

(iii) an element whose atoms will form ions with a charge of  $2^-$ . [1 mark]

\_\_\_\_\_

- 2 Sulfuric acid is a strong acid. It reacts with sodium hydroxide according to the word equation below:

sodium hydroxide + sulfuric acid  $\rightarrow$  sodium sulfate + water

- (a) Write a balanced symbol equation to describe the reaction between sodium hydroxide and sulfuric acid.  
[3 marks]

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- (b) Why is this reaction described as a **neutralisation** reaction? [2 marks]

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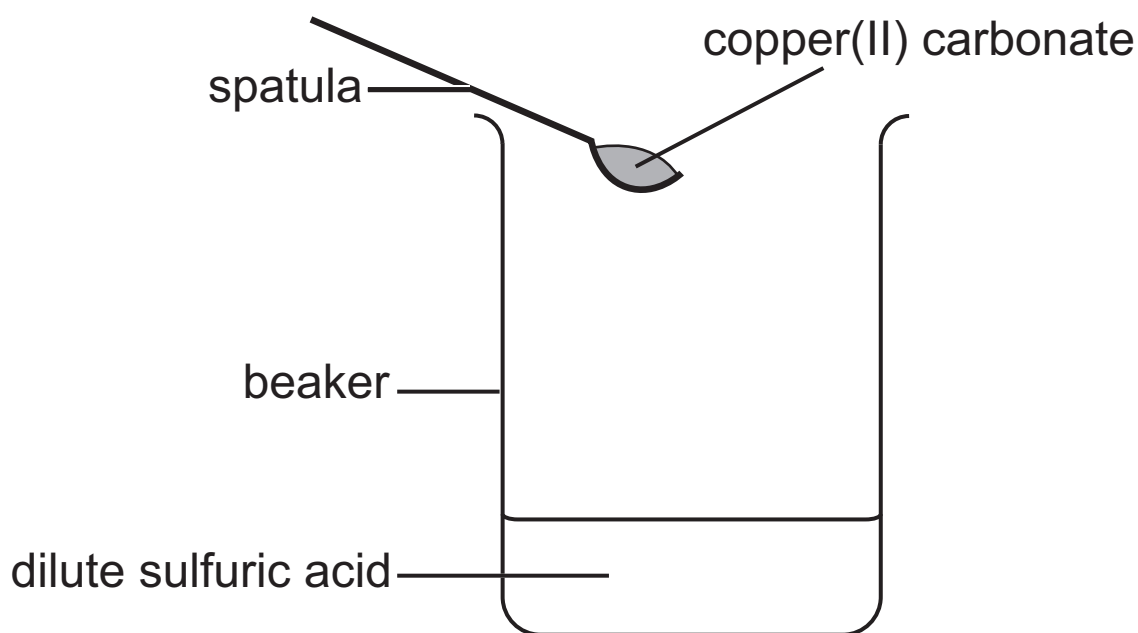
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- (c) Why is sulfuric acid described as a **strong** acid?  
[1 mark]

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(d) A sample of solid copper(II) carbonate is added to dilute sulfuric acid as shown in the diagram below.



(i) What is the colour of solid copper(II) carbonate?  
[1 mark]

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(ii) Describe what can be observed happening in the beaker after the copper(II) carbonate is added to the dilute sulfuric acid. [4 marks]

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(e) Sulfuric acid reacts with magnesium to produce hydrogen gas. Describe a test for hydrogen gas.  
[2 marks]

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- 3 (a) Describe the structure and bonding in a metal such as calcium. [4 marks]

Structure: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Bonding: \_\_\_\_\_

\_\_\_\_\_

- (b) Calcium reacts with fluorine to form the ionic compound, calcium fluoride.

- (i) Ions are either cations or anions. Explain what is meant by the term **cation**. [1 mark]

\_\_\_\_\_

- (ii) What is the electronic structure (electronic configuration) of a calcium ion and of a fluoride ion? [2 marks]

calcium ion: \_\_\_\_\_

fluoride ion: \_\_\_\_\_

- (iii) What is the formula of the compound calcium fluoride? [1 mark]

\_\_\_\_\_



**(c) (i)** Draw a dot and cross diagram to show the bonding in a **molecule** of oxygen. [3 marks]

**(ii)** Explain why oxygen has a low boiling point.  
[3 marks]

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4 The solubility of a substance is defined as the maximum mass of a substance which will dissolve in 100 g of water at a given temperature.

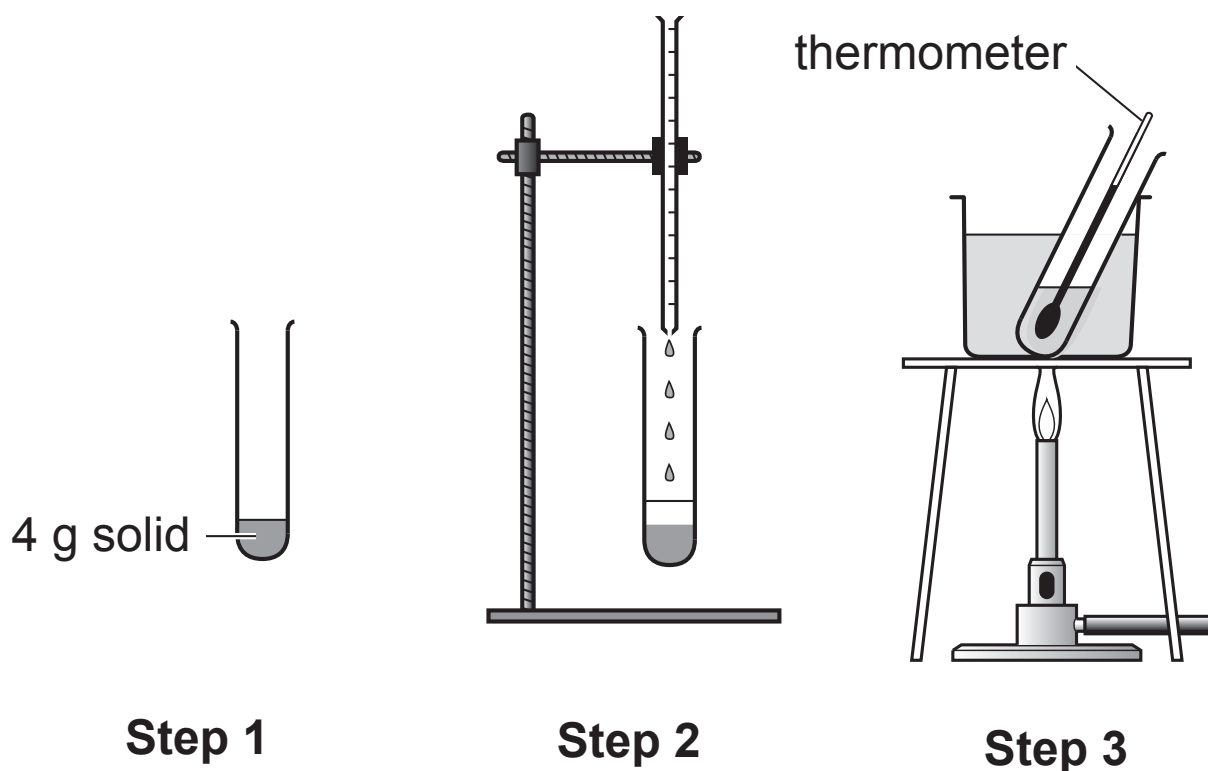
(a) Why is it essential to state the **temperature of the water** when giving the solubility of a substance?  
[1 mark]

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(b) The first three steps in an investigation to find the solubility of a solid in water at different temperatures are shown in the diagrams below.

Complete the instructions which set out the seven practical steps needed to carry out the investigation.



Step 1 Place 4 g of solid into a boiling tube.

Step 2 Add \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[2 marks]

Step 3 Place the boiling tube into a water bath and heat until all the solid has dissolved.

Step 4 Remove the boiling tube from the water bath and then wait until \_\_\_\_\_  
\_\_\_\_\_

[1 mark]

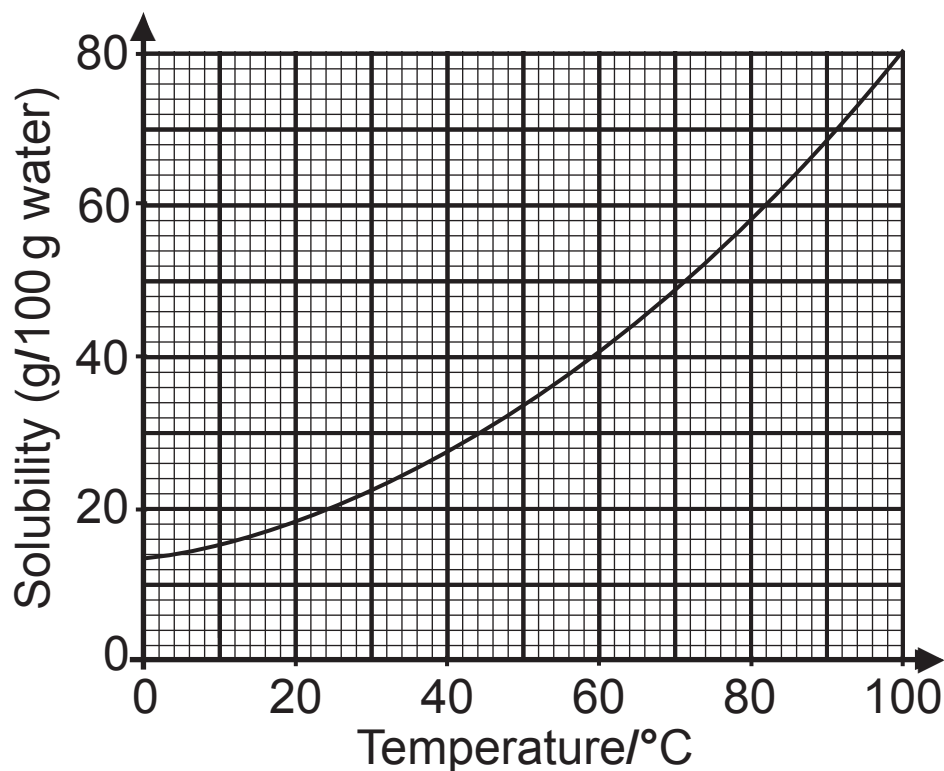
Step 5 Record the temperature.

Step 6 Add \_\_\_\_\_  
\_\_\_\_\_

[2 marks]

Step 7 Repeat steps 3 to 6 five times.

(c) Use the solubility curve for copper(II) sulfate shown below to answer the questions which follow.



(i) What is the solubility of copper(II) sulfate at 60 °C?  
[1 mark]

\_\_\_\_\_ g/100 g H<sub>2</sub>O

(ii) State whether the following mixture contains a **saturated** or **unsaturated** solution and explain your answer.

**Mixture: 18 g of copper(II) sulfate added to 50 g of water at 40 °C.**

Saturated or unsaturated? \_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

[3 marks]

- 5 The table below gives information about the melting point, boiling point and electrical conductivity of 4 substances, A, B, C and D. Use the information in the table to answer the questions which follow.

substance	melting point/°C	boiling point/°C	electrical conductivity	
			solid	molten
A	-182	-161	does not conduct	does not conduct
B	660	2500	conducts	conducts
C	808	1465	does not conduct	conducts
D	3652	4200	conducts	conducts

(a) Identify the substance A, B, C or D which:

(i) is a gas at room temperature [1 mark]

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(ii) exists as oppositely charged ions in a giant ionic lattice [1 mark]

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(iii) exists as small molecules [1 mark]

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(iv) could be aluminium [1 mark]

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**(b)** Graphite has a giant covalent structure.  
Explain why the melting point of graphite is extremely high. [3 marks]

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**(c)** Explain why graphite can conduct electricity. [2 marks]

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**(d)** Diamond and graphite are allotropes of the element carbon.

What are allotropes? [2 marks]

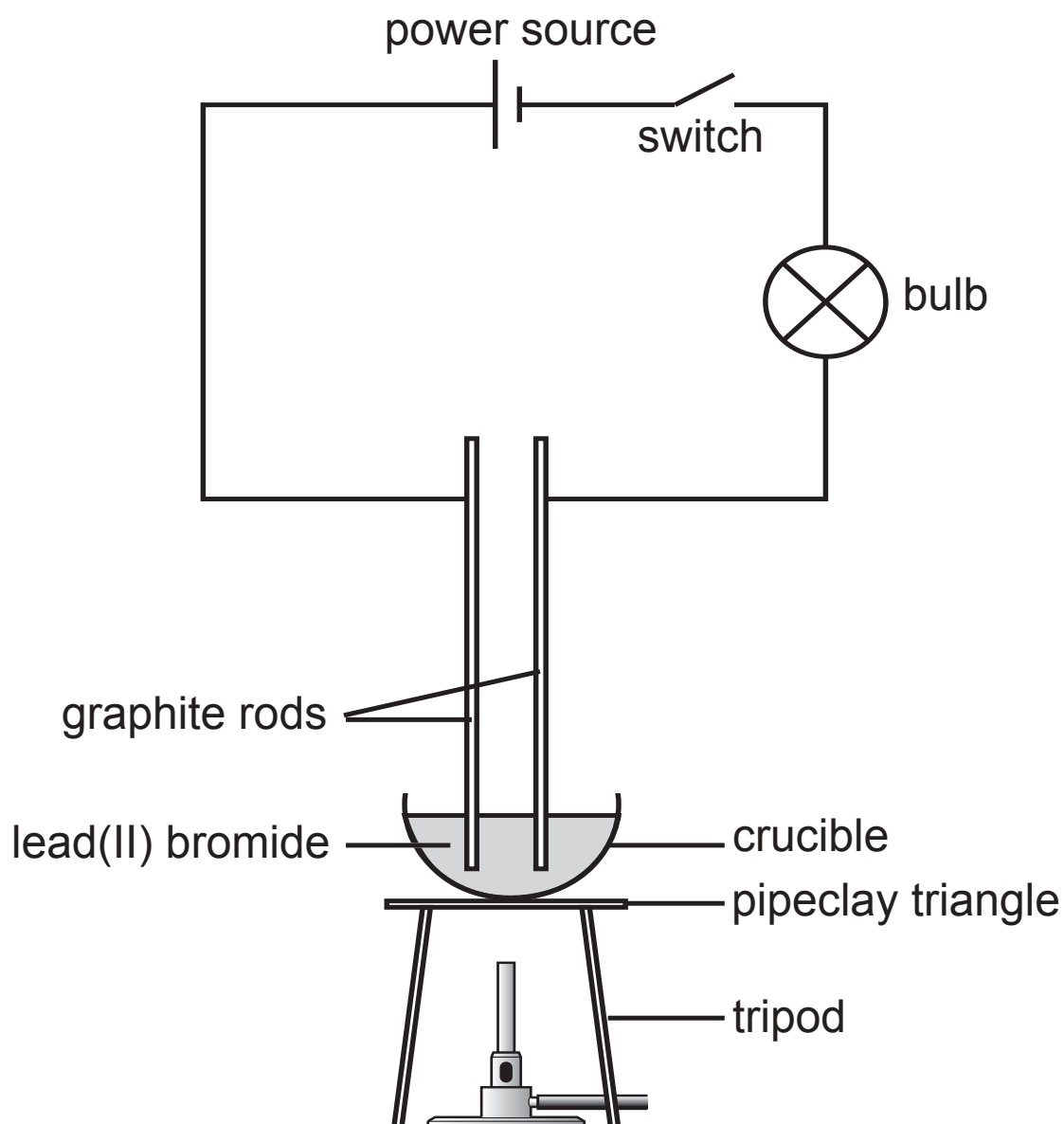
Allotropes are \_\_\_\_\_

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- 6 The diagram below represents the assembled apparatus used to investigate the conductivity of lead(II) bromide.







7 When chlorine gas is bubbled into a colourless solution of potassium iodide, a coloured solution is formed.

(a) Name the **type** of reaction which takes place between chlorine and potassium iodide. [1 mark]

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(b) Explain why a coloured solution is formed in the reaction. [3 marks]

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(c) Write an **ionic** equation for the reaction between chlorine and potassium iodide. [3 marks]

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

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
<b>Total Marks</b>	

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