Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

ML

[GSS22]

THURSDAY 14 MAY 2015, MORNING

TIME

1 hour 15 minutes, 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.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in blue or black ink only.
Answer **all eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **5** and **11**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

1 Look at the table below. It shows some information about different metals.

Metal	Melting point / °C	Density/ g/cm^3	Strength	Cost
Aluminium	661	2.7	medium	medium
Copper	1083	9.0	medium	high
Gold	1065	19.3	medium	very high
Lead	328	11.4	very low	low
Iron	1535	7.9	very high	low
Tungsten	3407	19.4	very high	high

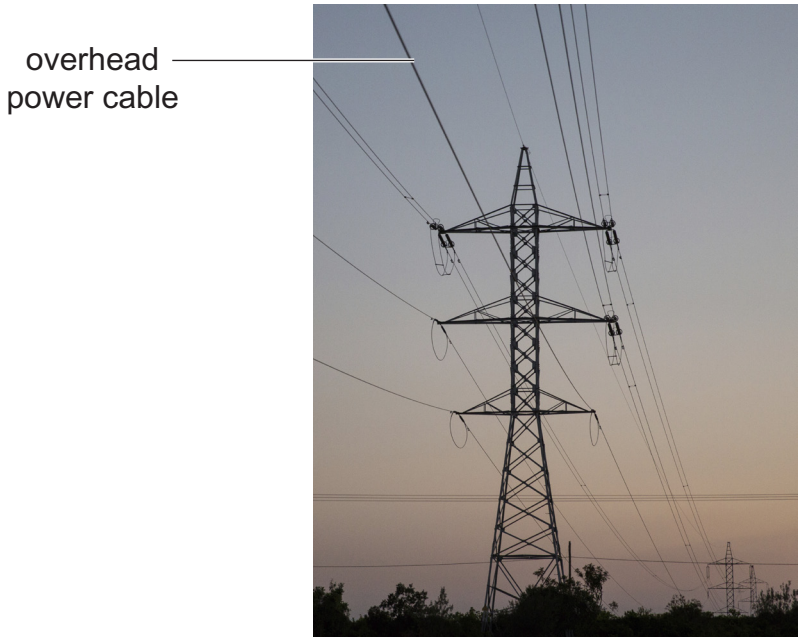
Use the information in the table and your knowledge to answer the following questions.

(a) Iron is used to make bridges. State **two** reasons why iron is suitable for building bridges.

1. _____

2. _____ [2]

(b) Look at the picture below. Overhead power cables carry electricity from power stations to homes and factories.



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Gold is a very good conductor of electricity. Because of the very high cost of gold, it is **not** used to make overhead power cables. Give one other reason why gold is **not** used. Explain your answer.

_____

_____

_____ [2]

(c) Choose a metal from the table that would be most suitable for making aeroplanes. Explain your choice, giving only the **most important** reason.

_____

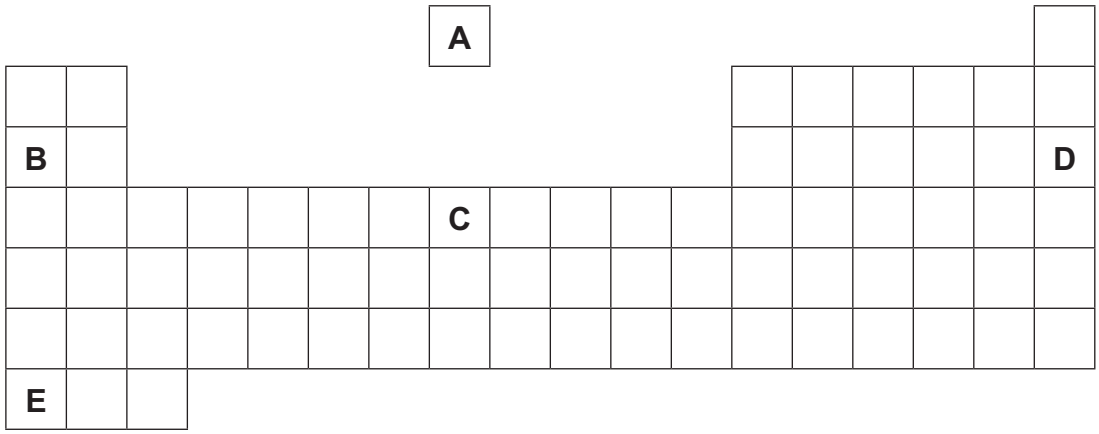
_____

_____ [2]

[Turn over

2 Look at the diagram below. It shows an outline of the modern Periodic Table. The letters **A**, **B**, **C**, **D** and **E** represent the positions of some elements.

Your Data Leaflet will be useful.



(a) On the outline above, write the letter **X** to show **one** position of an element that is a halogen. [1]

(b) **(i)** Which element **A**, **B**, **C**, **D** or **E** is a noble gas?

_____ [1]

(ii) Which element **A**, **B**, **C**, **D** or **E** is hydrogen?

_____ [1]

(c) What is the atomic number of element **D**? _____ [1]

(d) Complete the following sentences.

There were two main scientists involved in developing the Periodic Table.

John Newlands was responsible for the law of _____.

A scientist called _____ then developed this work further. He left gaps for elements that were not known at that time. [2]

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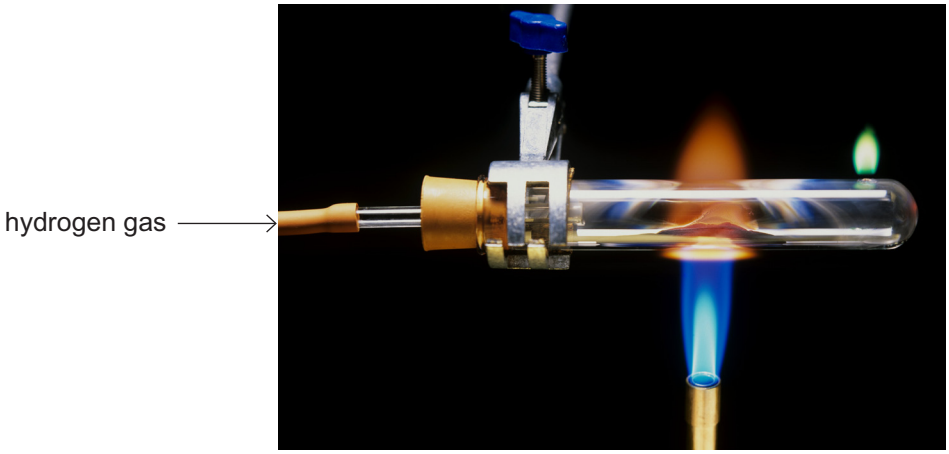
(Questions continue overleaf)

3 **(a)** Look at the apparatus below. A student heated some copper oxide with hydrogen using this apparatus.



(i) Complete the word equation for this reaction.

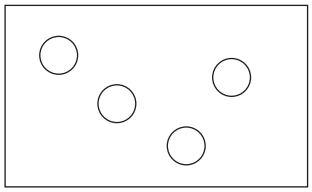
copper oxide	+	hydrogen	→		+	

[2]

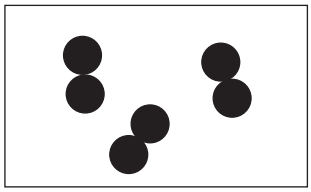
(ii) What name is given to this type of reaction?

_____ [1]

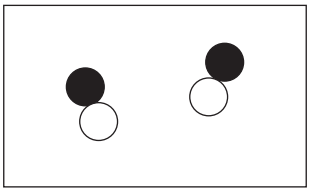
(b) Look at the particle diagrams below. The particle diagrams represent elements or compounds.



X



Y



Z

Which diagram **X**, **Y** or **Z** represents hydrogen (H_2)? Explain your answer.

_____

_____

_____ [2]

(c) The chemical formula for potassium hydrogencarbonate is $KHCO_3$.

How many atoms are represented in this formula?

_____ [1]

[Turn over

4 **(a)** Bone is a natural composite material. It contains calcium phosphate, collagen and water. Calcium phosphate is hard but very brittle. Collagen is softer and more flexible.

Explain what is meant by **composite material**. Use bone as an example.

[3]

(b) **(i)** Calcium phosphate contains two non-metal elements, phosphorus and oxygen.

Complete the table below showing the numbers of protons and neutrons in the atoms of each element.

Your Data Leaflet will be useful.

Element	Number of protons	Number of neutrons
Phosphorus		16
Oxygen	8	

[2]

(ii) The electron is another particle in an atom.

Complete the following sentence.

An electron has a relative mass of _____ and a

relative charge of _____. [2]

5 Flame tests can be used to identify the metal in a compound. Explain how you would carry out a flame test experiment on solid samples of copper sulfate and lithium chloride.

Your answer should include:

- a detailed description of your method
- the flame colour you would expect from copper
- the flame colour you would expect from lithium.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

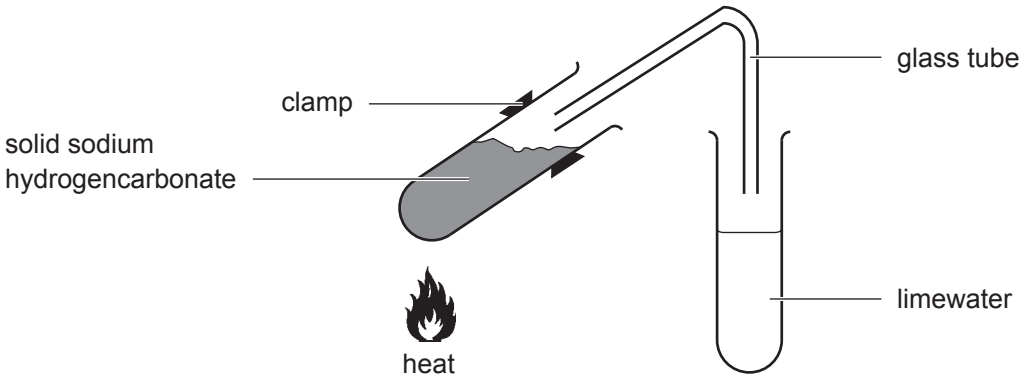
[Turn over

6 When baking soda (sodium hydrogencarbonate) is heated strongly it breaks down, releasing carbon dioxide.

(a) What is the name of this type of chemical reaction?

_____ [1]

(b) The carbon dioxide released during this reaction can be tested by bubbling it through limewater. However, the apparatus shown below has been set up incorrectly and will not work.



(i) Suggest two reasons why the apparatus will **not** work.

1. _____

2. _____ [2]

(ii) Describe how the limewater will change if carbon dioxide is present.

_____ [1]

(iii) How does the mass of the sodium hydrogencarbonate change during this reaction? Explain why this happens.

_____

_____

_____ [2]

(iv) How would you know when the reaction had finished?

_____ [1]

(v) Complete the word equation below for the breaking down of sodium hydrogencarbonate.

sodium hydrogencarbonate	→		+		+	carbon dioxide

[2]

(c) Name the chemical added to baking soda to make baking powder.

_____ [1]

[Turn over

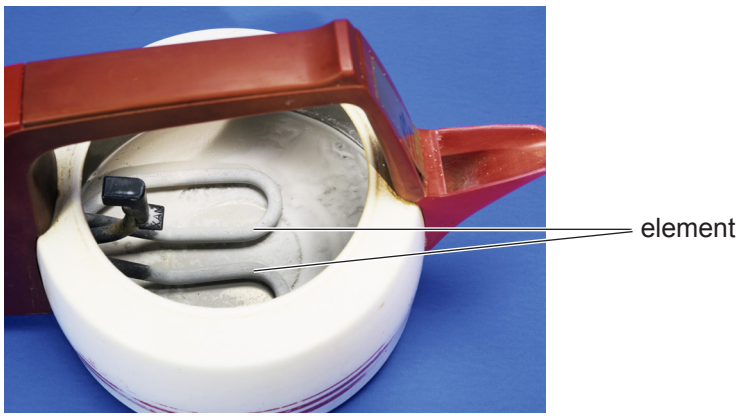
7 David lives in London. London is a hard water region.

(a) What is meant by **hard water**?

_____

_____ [1]

(b) David's kettle had **fur** on the element.



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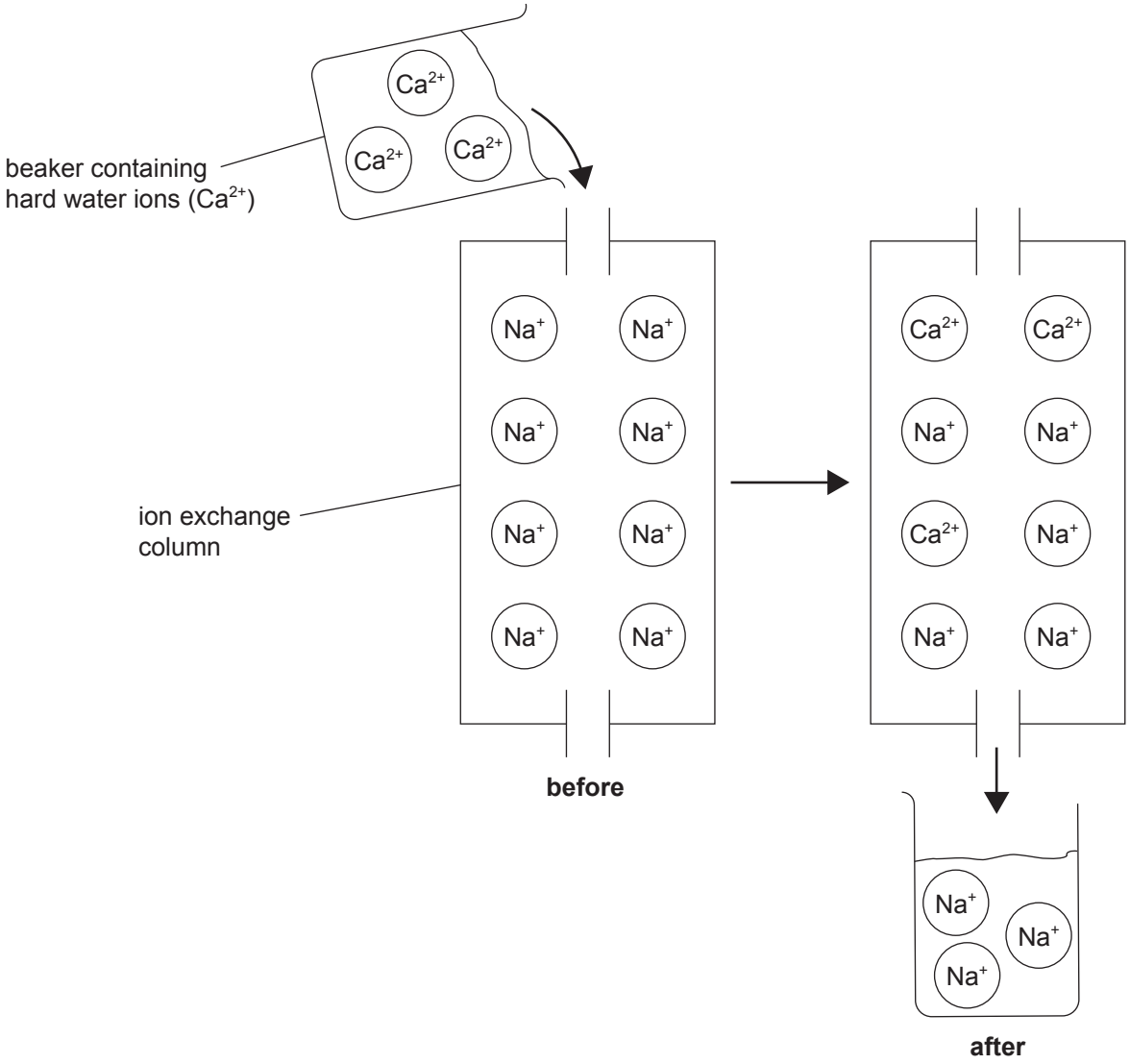
(i) What does this suggest about the **type** of hard water in London?

_____ [1]

(ii) What is the chemical name for **fur** in a kettle?

_____ [1]

(c) Look at the diagram below. Hotels in London will often pass hard water through an ion exchange column as represented by the diagram.



Use the diagram and your knowledge to explain how an ion exchange column produces soft water.

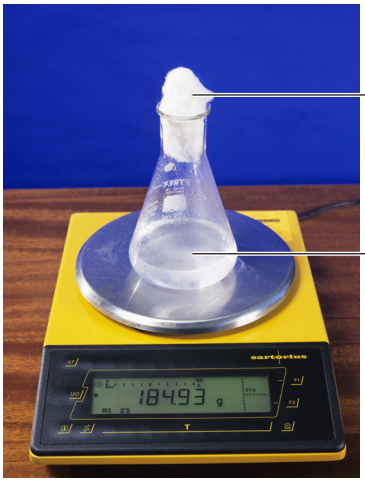
[3]

[Turn over

8 Sophie investigated the reaction between zinc and sulfuric acid.

sulfuric acid + zinc → zinc sulfate + hydrogen

The mass of hydrogen gas lost was measured using the apparatus shown below.



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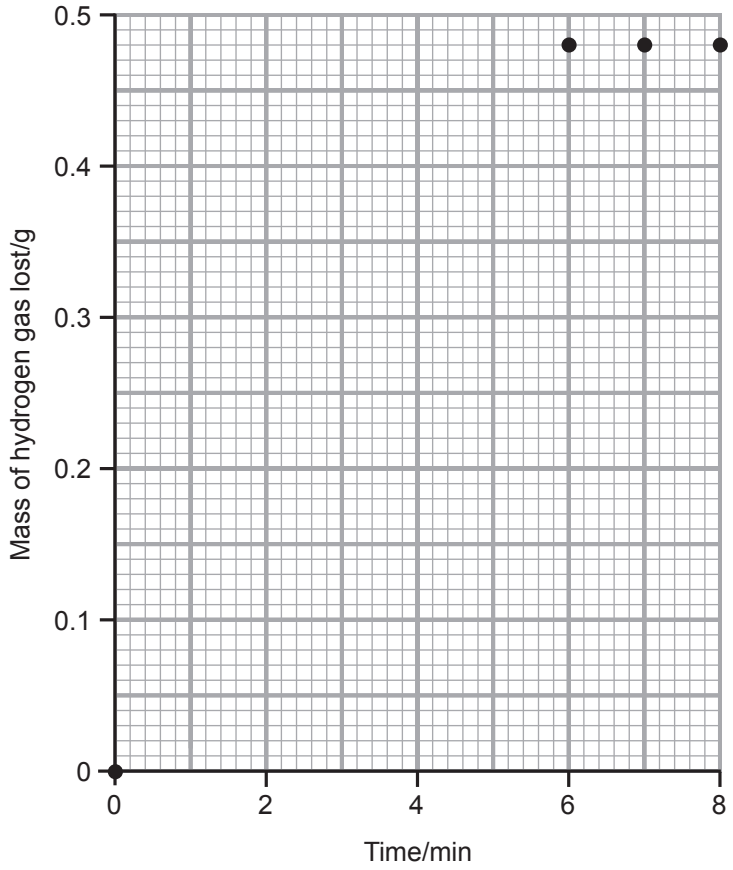
Her results are shown below.

Time/min	0	1	2	3	4	5	6	7	8
Mass of hydrogen gas lost/g	0	0.23	0.34	0.41	0.45	0.47	0.48	0.48	0.48

(a) On the grid below complete the graph for these results.



[3]

(b) **(i)** Use your graph to find the mass of hydrogen lost at 3.5 minutes.

_____ g [1]

(ii) Use your graph to find the time the reaction finished.

_____ min [1]

(c) Name a metal which could be safely used in this investigation to produce hydrogen gas **faster**.

_____ [1]

[Turn over

9 Alfred Wegener believed that all continents on Earth were once joined together as a **supercontinent**. He suggested that the continents gradually moved apart over millions of years.

(a) What name did Wegener give to this theory?

_____ [1]

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A volcano can occur at the boundary of two tectonic plates.

(b) Name **one** other natural event that can occur at the boundary of tectonic plates.

_____ [1]

(c) Name the **type** of rock formed by the lava from a volcano.

_____ [1]

Look at the table below. It gives the percentage of each gas produced during a typical volcanic eruption.

Name of gas	Formula	Percentage
carbon dioxide	CO_2	15.00
hydrogen	H_2	1.00
helium	He	0.25
methane	CH_4	0.75
sulfur dioxide	SO_2	3.00
water vapour	H_2O	80.00

(d) Using the information above, calculate the percentage of gases that are compounds.

_____ % [1]

(e) Scientists have found that the Earth is 4500 million years old, using radiometric dating.

Describe the method of radiometric dating.

_____

_____

_____

_____

_____ [3]

[Turn over

10 Potassium is in Group One of the Periodic Table. Potassium reacts vigorously with water. Rubidium (Rb) is also a Group One element.

85
Rb
37

(a) How will rubidium react with water compared to potassium? Explain your answer.

_____

_____

_____ [2]

(b) **(i)** In terms of electrons, explain why sodium is also placed in Group One.

_____ [1]

(ii) Write a balanced symbol equation for the reaction between sodium and water.

_____ [3]

(c) Sodium reacts with chlorine to form the compound sodium chloride.
In terms of electrons, describe how the bond in sodium chloride is formed.

_____

_____

_____

_____

_____ [3]

11 Polymers are made when many small molecules react together in a certain way.

Name and describe the process by which these small molecules are made into polymers.

Your answer should include the name given to these small molecules and two examples of polymers.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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For Examiner's use only	
Question Number	Marks
1	
2	
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Total Marks	

Examiner Number