



General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]



TUESDAY 26 FEBRUARY 2013, MORNING

TIME

1 hour 15 minutes.

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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.

Quality of written communication will be assessed in questions **3** and **8(a)**.

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 for your use.

Centre Number

71

Candidate Number

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	

Total
Marks

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- 1 The picture below shows a cyclist wearing a modern cycling suit.



© iStockphoto / Thinkstock

The following table gives some information about materials that could be used to make the cycling suit.

Material	Effect of washing	Can stretch	Effect of sunlight	Effect of sweat
cotton	can shrink	no	colour fades	stains
Lycra	does not shrink	yes	colour does not fade	does not stain
linen	shrinks	no	colour fades	stains
polyester	does not shrink	no	colour does not fade	does not stain

- (a) Use this information to decide on the best material to make a modern cycling suit. Explain your answer.

[3]

- (b) In Northern Ireland many people used to be employed in the linen industry.

Explain why the numbers employed have fallen.

[1]

Examiner Only

Marks Remark

- 2 The photograph below shows the Marble Arch Caves in County Fermanagh. The water in this area is described as being hard.



© Northern Ireland Tourist Board

- (a) What is meant by the term **hard water**?

[2]

The table below gives the results of an experiment to test the hardness of different water samples.

Water sample	Volume of soap solution needed to form a lather before boiling/cm ³	Volume of soap solution needed to form a lather after boiling/cm ³
A	20	15
B	4	3
C	14	2
D	24	11

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Marks Remark

(b) Use this information to answer the following questions.

(i) Which sample **A, B, C** or **D** of water is the least hard?

_____ [1]

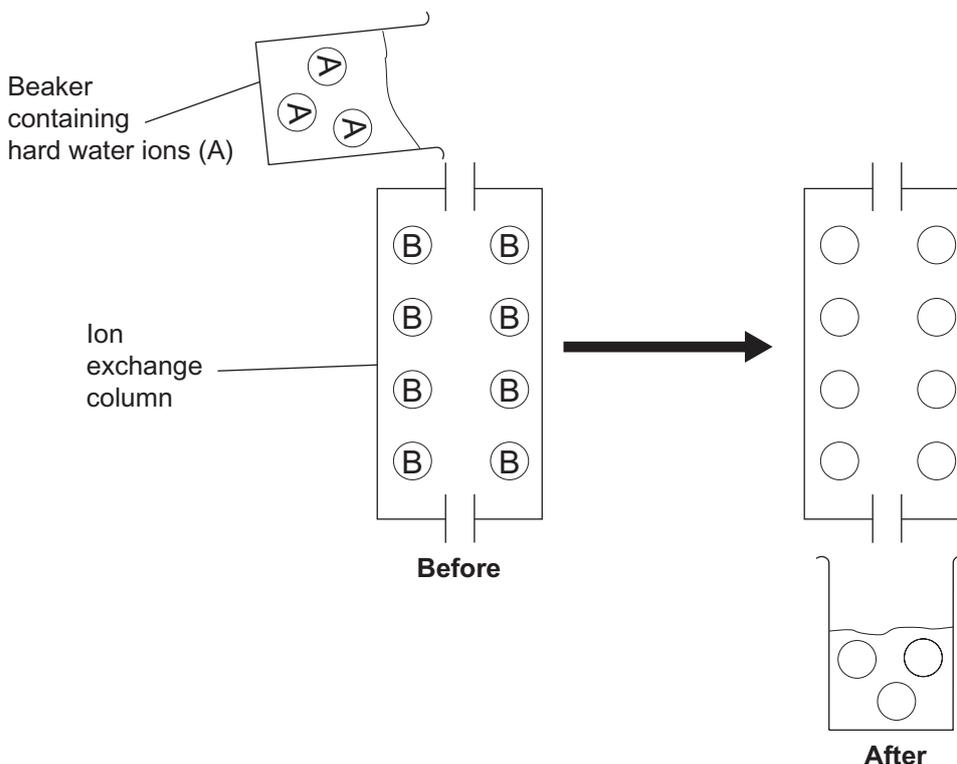
(ii) Which sample **A, B, C** or **D** contains only temporary hardness?

_____ [1]

(iii) Which **two** samples **A, B, C** or **D** contain both temporary and permanent hardness?

_____ and _____ [1]

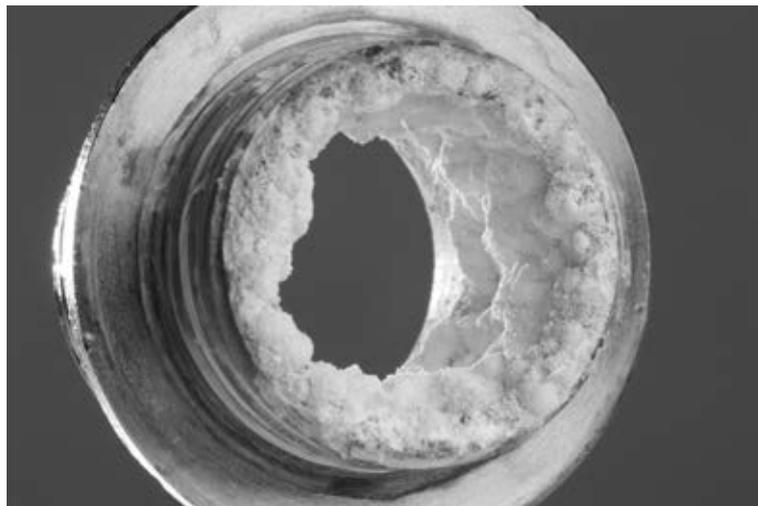
(c) Hard water can be softened by using an ion exchange column.



Complete the diagram to show the position of the ions after the water has passed through the column. [2]

Examiner Only	
Marks	Remark

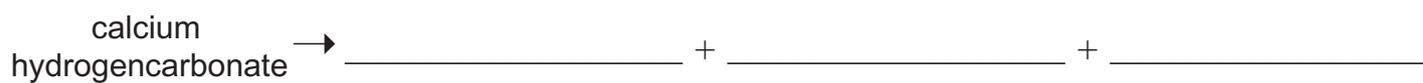
(d) Hard water can cause unwanted deposits in hot water pipes.



© Martyn F Chillmaid / Science Photo Library

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Marks	Remark

Complete the word equation for the reaction that forms the unwanted deposits.



[3]

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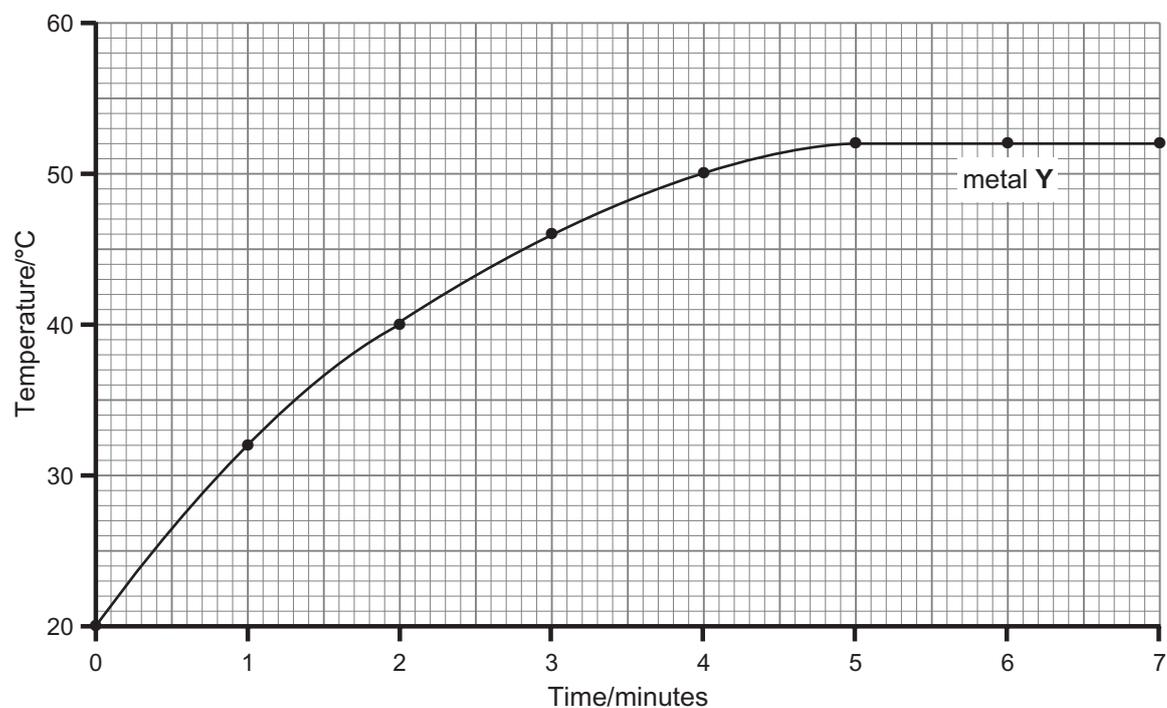
- 4 Karen carried out an experiment to investigate the reactivity of two metals X and Y. She added 2 grams of metal X to 20 cm³ of copper sulfate solution (in excess) in a boiling tube. She recorded the temperature of the mixture every minute for seven minutes. She repeated the procedure for metal Y.

The table of results is shown below.

Time/minutes	0	1	2	3	4	5	6	7
Temperature/°C metal X	20	35	44	51	56	58	59	59
Temperature/°C metal Y	20	32	40	46	50	52	52	52

The graph below shows the results for metal Y.

- (a) On the same grid plot the results for metal X and draw a line of best fit.



[3]

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Marks Remark

(b) (i) Describe the trend shown in the graph for metal Y.

 _____ [2]

(ii) Describe **one** difference between the results for metals X and Y.

_____ [1]

(c) (i) Calculate the total increase in temperature for metal X.

_____ °C [1]

(ii) What type of chemical reaction caused this increase in temperature?

Choose from:

combustion

displacement

neutralisation

_____ [1]

(iii) Using the information from the graph and your knowledge suggest an order of reactivity of the metals, **copper**, X and Y.

_____ [2]
 most reactive _____ least reactive

(d) Karen repeated the experiment using 4 grams of metals X and Y with excess copper sulfate. Suggest how this would have affected her results.

 _____ [1]

(e) One of the metals used was zinc. Name the **two** products formed when zinc reacts with copper sulfate solution.

 _____ [2]

Examiner Only

Marks Remark

5 (a) The table below gives information about three different indicators.

Chemical	Colour of Universal Indicator paper	Colour of red litmus paper	Colour of red cabbage dye	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
Sodium hydrogencarbonate	blue	blue	green	8–10

Use this information to answer the questions that follow.

- (i) Explain why red litmus paper is not suitable to show that a chemical is acidic.

_____ [2]

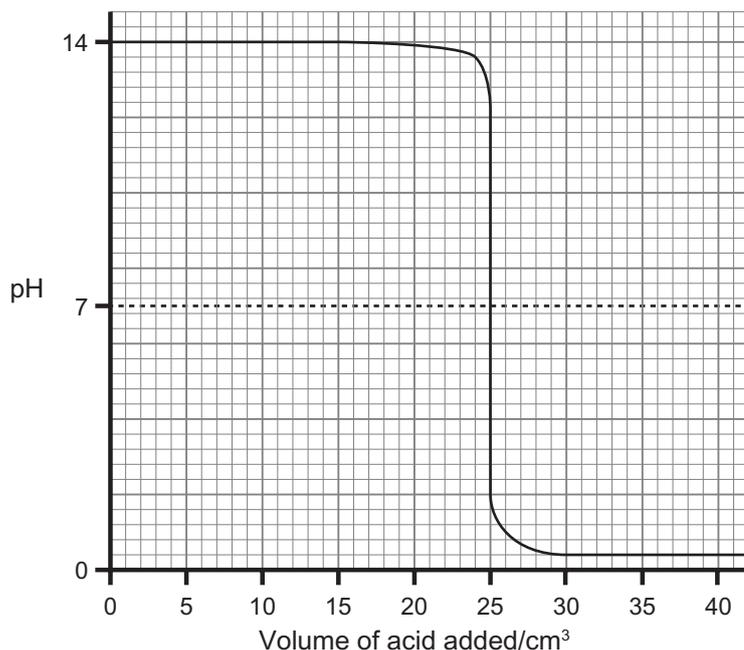
- (ii) Suggest which indicator would be most useful to give a full range of pH values. Explain fully your answer.

_____ [3]

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Marks Remark

- (b) The pH changes during the reaction between hydrochloric acid and sodium hydroxide were measured using a pH meter. The following graph was obtained.



- (i) What was the pH value of sodium hydroxide at the start of this experiment?

_____ [1]

- (ii) What volume of acid was needed to cause a sudden drop in the pH value?

_____ cm³ [1]

- (iii) Name a suitable piece of apparatus that could have been used to add the acid during this experiment.

_____ [1]

- (iv) Give the formula of hydrochloric acid and sodium hydroxide.

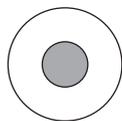
Hydrochloric acid: _____

Sodium hydroxide: _____ [2]

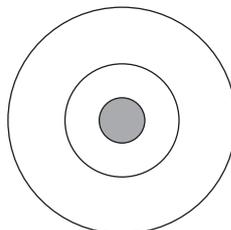
Examiner Only	
Marks	Remark

- 6 (a) Hydrogen reacts with oxygen to form water.

Complete the diagrams below to show the arrangement of all the electrons in an atom of hydrogen and an atom of oxygen.



hydrogen atom



oxygen atom

[2]

- (b) (i) Draw a diagram in the space below to show how the electrons are arranged in a molecule of **water** (H_2O).

[2]

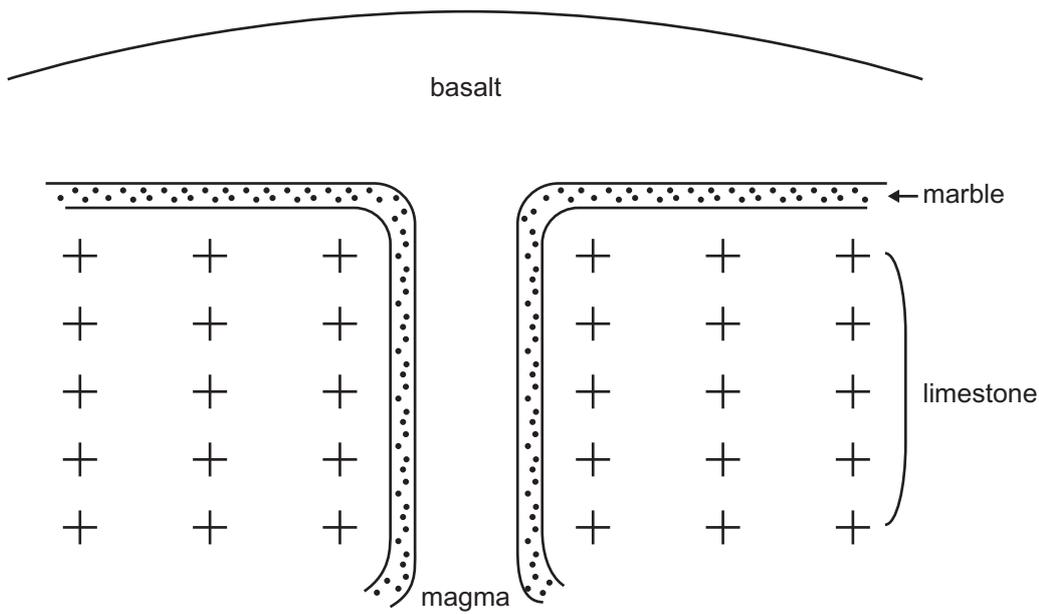
- (ii) In terms of electrons explain how the hydrogen and oxygen atoms are held together in a molecule of water.

[1]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

7 (a) The diagram below shows the position of three different rocks following a volcanic eruption.



(i) Complete the table below by naming the **type** of each rock.

Example	Type
basalt	Igneous
marble	
limestone	

[1]

(ii) Suggest why some of the limestone has changed into marble.

_____ [1]

(iii) Name the oldest rock in the diagram.

_____ [1]

(b) The age of the Earth can be estimated by radiometric dating. Describe this process.

 _____ [3]

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(c) Use the theory of plate tectonics to explain:

(i) how earthquakes happen.

[2]

(ii) how mountains form.

[2]

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Marks	Remark

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