



General Certificate of Secondary Education
2015–2016

Centre Number

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Candidate Number

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Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]



THURSDAY 19 MAY 2016, 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 ten** questions.

INFORMATION FOR CANDIDATES

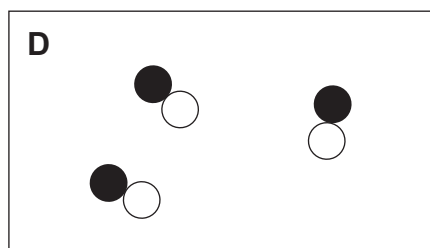
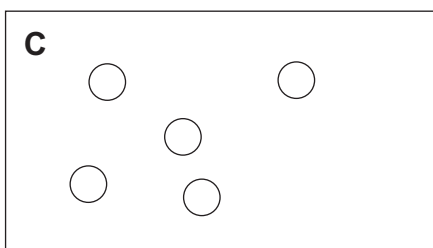
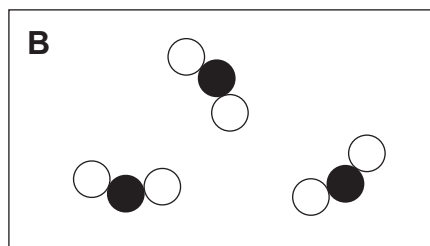
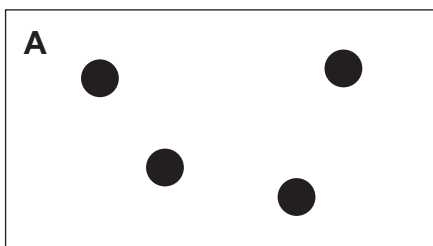
The total mark for this paper is 75.

Quality of written communication will be assessed in Questions **1** and **9**.

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.

2 Below are some particle diagrams. They represent elements or compounds.



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(a) Which of the diagram(s) (A, B, C or D) show elements? Explain your answer.

Diagram(s) _____

_____ [2]

(b) Suggest which diagram (A, B, C or D) could represent the compound carbon monoxide (CO).

_____ [1]

3 (a) The table below gives information about five hydrocarbon molecules.

Molecule	Number of carbon atoms	Melting point/°C	Boiling point/°C	Energy released per gram when burned/kJ
methane	1	- 182	- 162	56
ethane	2	- 183	- 89	52
propane	3	- 188	- 42	51
butane	4	- 138	0	50
pentane	5	- 130	36	49

(i) Calculate the energy released when 100 grams of propane is burned.

_____ kJ [1]

(ii) Calculate the difference between the melting points of the molecules with the most and least carbon atoms.

_____ °C [1]

(iii) Describe the relationship between the number of carbon atoms and a molecule's boiling point.

_____ [1]

(b) Complete the word equation below for the burning of propane.

propane + → carbon dioxide + water [1]



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- 4 The table below gives information about three different indicators and their colours at different pH values.

Indicator \ pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
methyl purple	P	P	P	P	G	G	G	G	G	G	G	G	G	G
thymol blue	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B
indigo carmine	B	B	B	B	B	B	B	B	B	B	B	Y	Y	Y

Key: B = blue G = green P = purple Y = yellow

Use the information in the table to answer the following questions.

- (a) 1. What colour is methyl purple indicator in a strong acid?

2. What colour is indigo carmine indicator in sodium hydroxide?

[2]

- (b) A scientist is going to add an acid to an alkali. He needs to stop adding the acid when the pH value is 7.

- (i) What name is given to this **type** of reaction?

[1]

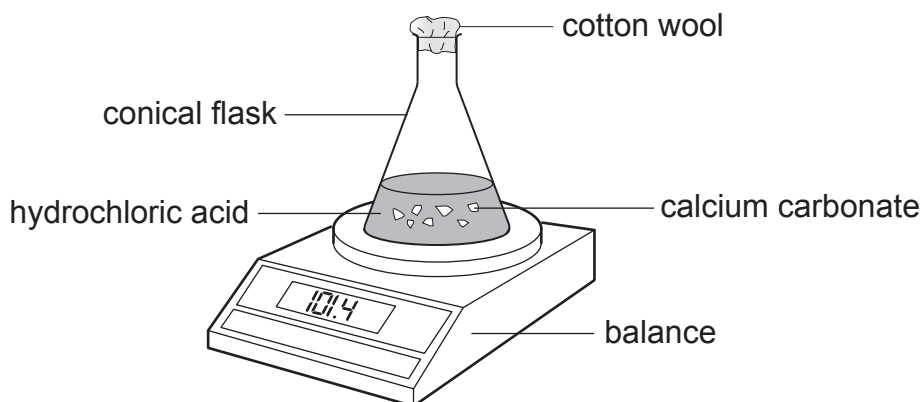
- (ii) Explain fully why the scientist would **not** find any of the indicators in the table useful for his experiment.

[2]

(c) Most indicators are made from plants. Describe how you would obtain an indicator from red cabbage.

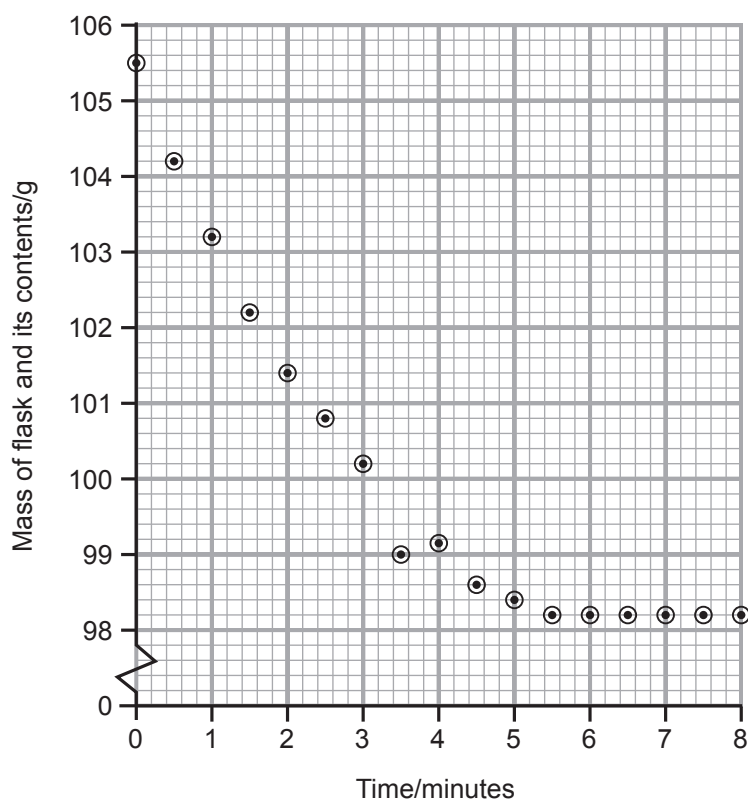
[3]

- 5 A student investigated the amount of carbon dioxide released during the reaction between hydrochloric acid and calcium carbonate. He used the apparatus shown below.



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The student measured the mass of the flask and its contents for 8 minutes. The results are shown in the graph below.

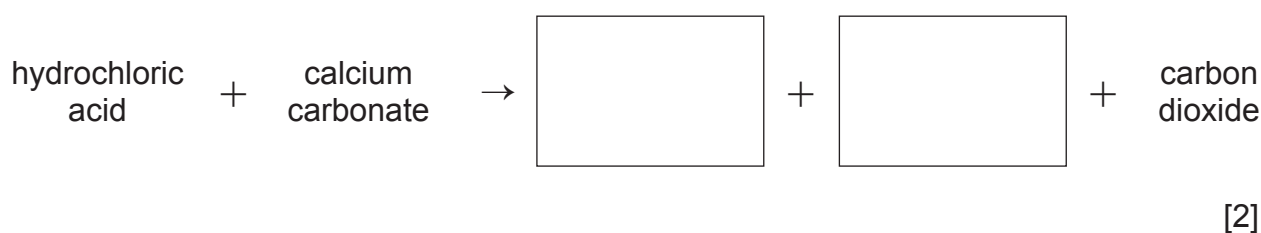


(a) Complete the graph opposite by adding a curve of best fit and ignoring any anomalous results. [1]

(b) Describe fully the trend shown in the graph.

_____ [2]

(c) Complete the word equation for this reaction.



(d) (i) Name the chemical used to test for carbon dioxide.
_____ [1]

(ii) Describe the colour change during this test for carbon dioxide.

_____ [2]

[Turn over

6 (a) Aluminium is extracted from its ore by the process of electrolysis.

(i) Define the term electrolysis.

_____ [2]

(ii) Complete the following sentences about the extraction of aluminium.

The chemical name for the ore of aluminium is aluminium _____.

During electrolysis the aluminium ions move to the negative electrode which is called the _____.

Here they gain three _____ to become aluminium atoms. [3]

(b) Another compound of aluminium is aluminium hydroxide; its formula is $\text{Al}(\text{OH})_3$.

(i) Name the **three** elements present in aluminium hydroxide.

_____ [1]

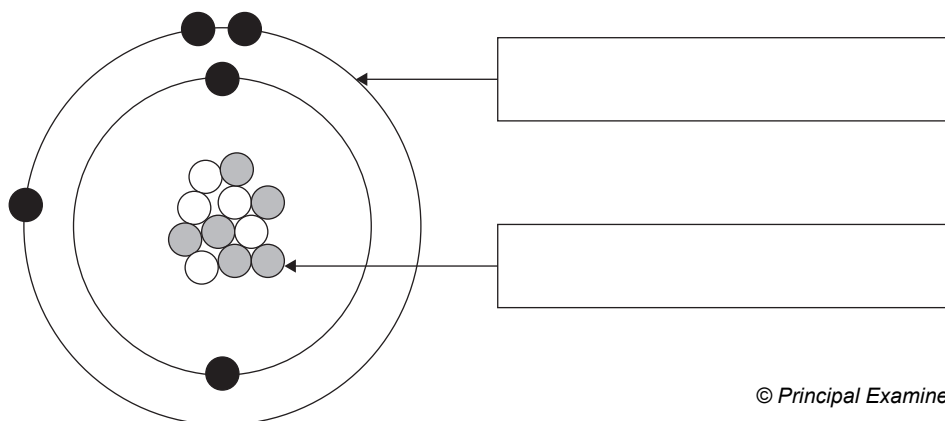
(ii) How many atoms in total are represented by the formula $\text{Al}(\text{OH})_3$?

_____ [1]



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7 (a) Label the diagram of the atom shown below.



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[2]

(b) Name the element shown above.
You may find your Data Leaflet helpful.

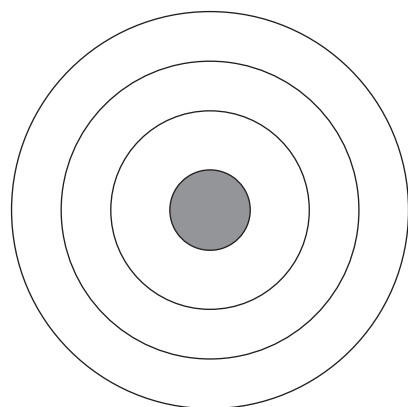
[1]

(c) Complete the table below about the particles in an atom.

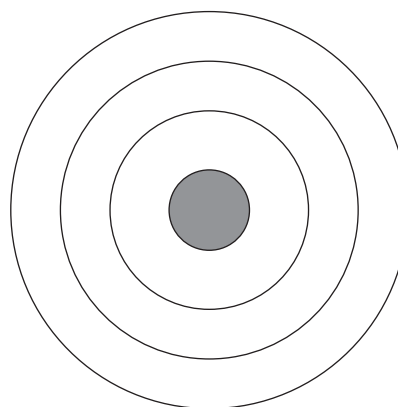
Particle	Relative charge	Relative mass
proton		
electron		
neutron		

[3]

(d) (i) Complete the diagrams below to show the electronic structures of sodium and chlorine. You may find your Data Leaflet helpful.



sodium



chlorine

[2]

(ii) Give **one** similarity and **one** difference between the electronic structures of sodium and chlorine.

Similarity _____

Difference _____

_____ [2]

(iii) Describe, in terms of electrons, how sodium and chlorine form the compound sodium chloride.

_____ [3]

(iv) Write the balanced symbol equation for the reaction between sodium and chlorine.

_____ [3]

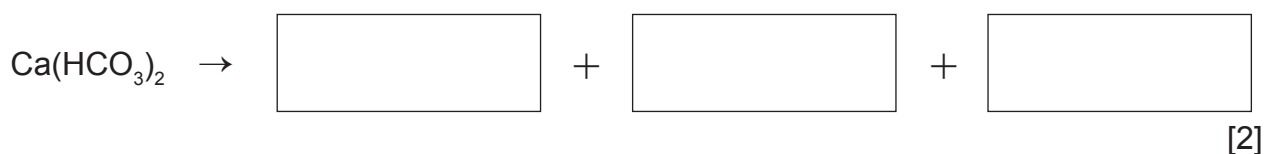
[Turn over

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

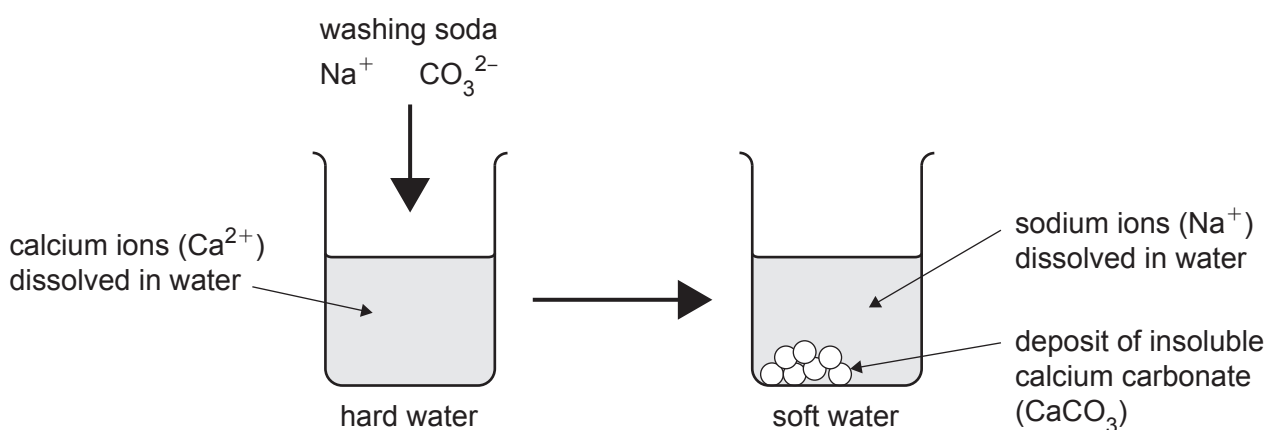
[1]

(b) Hard water can be described as either temporary or permanent.

(i) Temporary hard water can be softened by boiling. Complete the balanced symbol equation below for this reaction.



(ii) Permanent hard water can be softened using washing soda (sodium ions and carbonate ions).



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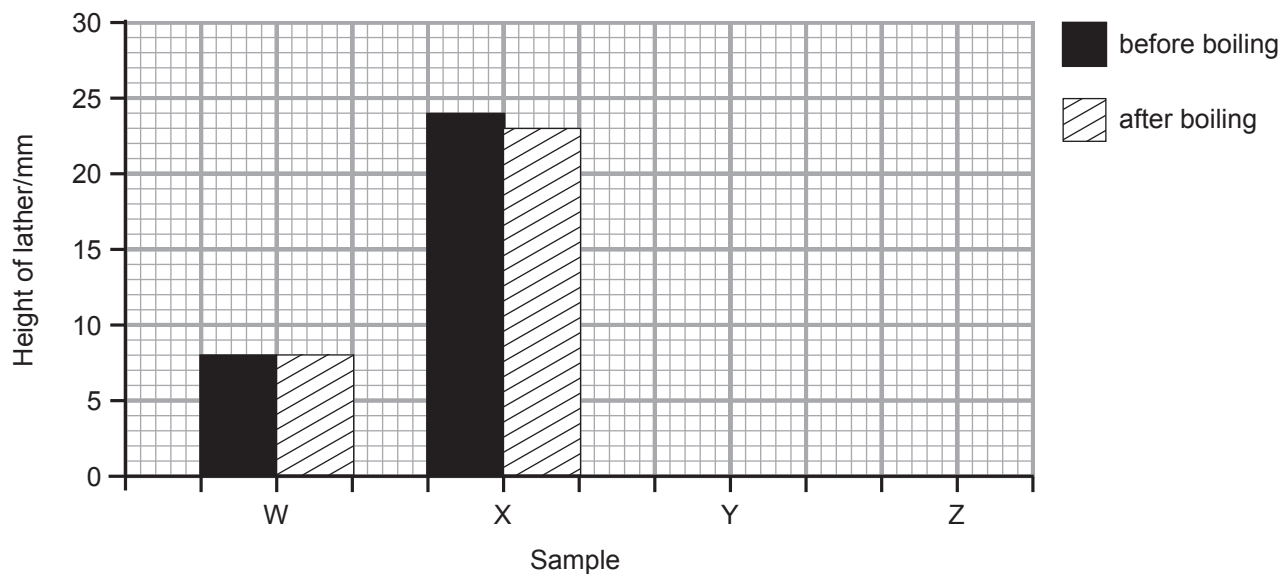
Using the diagram above explain how washing soda removes hardness from water.

[3]

(c) A scientist conducted an investigation into the hardness of different samples of water. He put 25 cm³ of four different samples (W, X, Y, Z) into separate flasks. He added soap solution to each flask and shook it until a lather was formed. He repeated the experiment with boiled samples. The results are shown below.

Sample	Height of lather before boiling/mm	Height of lather after boiling/mm
W	8	8
X	24	23
Y	20	23
Z	6	21

(i) Complete the bar chart below.



[2]

(ii) What does this tell you about the type of water in sample Z? Explain your answer.

[2]

[Turn over



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10 Crude oil produces many useful hydrocarbons.

(a) Define **hydrocarbon**.

_____ [1]

(b) Propane is one example of a hydrocarbon.

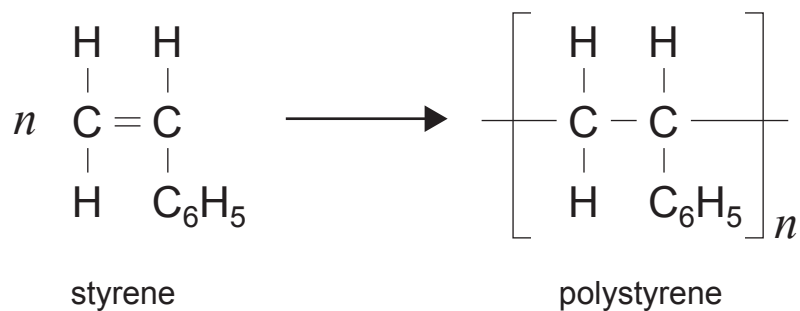
(i) In the space below, draw the structural formula for propane.

[1]

(ii) Name the family of hydrocarbons that propane belongs to.

[1]

(c) Polystyrene is a plastic that can be made from reacting styrene molecules together as shown below.



(i) What name is given to this process?

_____ [1]

(ii) Using the diagram and your knowledge, describe how styrene molecules react together to form polystyrene.

_____ [3]

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Question Number	Marks
1	
2	
3	
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5	
6	
7	
8	
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10	

Total Marks	
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Examiner Number

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