



Rewarding Learning

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 25 FEBRUARY 2016, 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 eleven** questions.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 75.  
Quality of written communication will be assessed in Questions **3** and **10**.  
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.

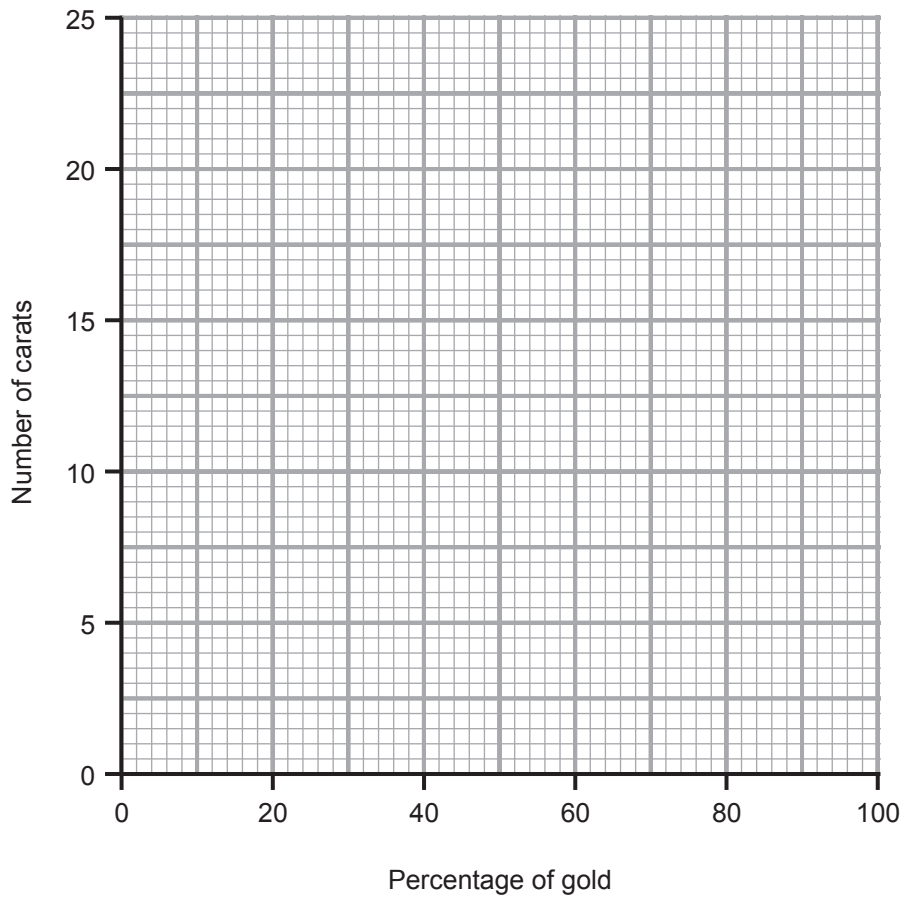
For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
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9	
10	
11	
<b>Total Marks</b>	

- 1 (a) Gold is a metal element used in jewellery. The purity of gold is often measured in carats.

The table below shows how the number of carats is related to the percentage of gold.

Percentage of gold	Number of carats
100	24
92	22
75	18
38	9

- (i) On the grid below plot and draw a line graph for this information.



[2]

- (ii) State the trend shown by this information.

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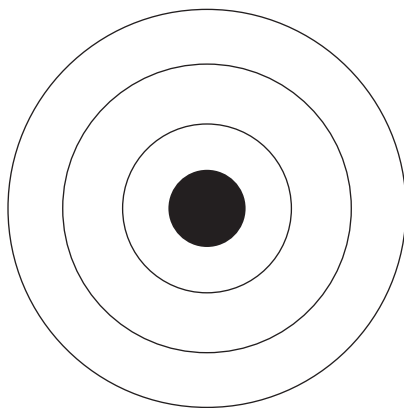
[1]

Examiner Only	
Marks	Remark

(iii) Use the graph to find the percentage of gold in a 14 carat gold ring.

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

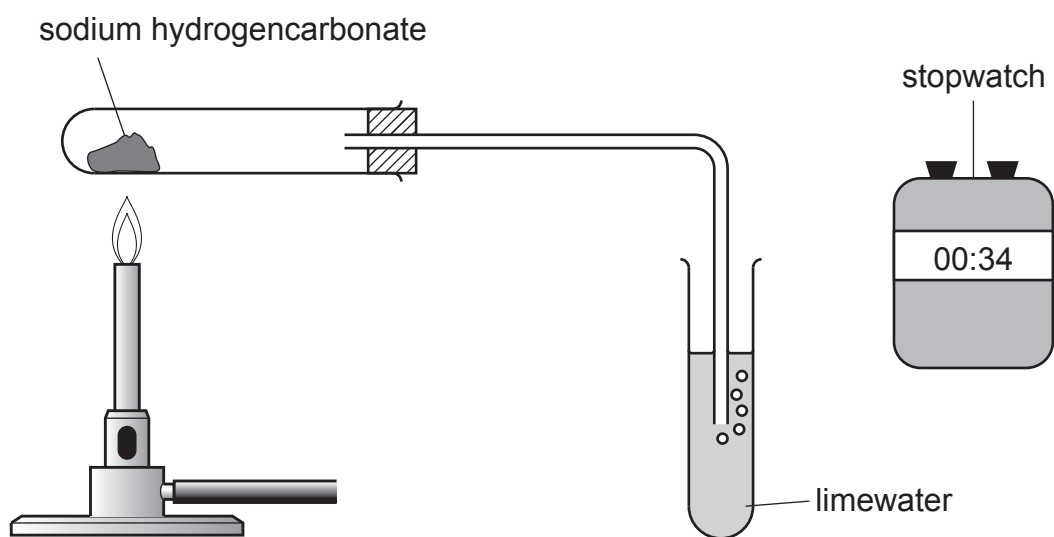
(b) Aluminium is often added to gold in jewellery. An atom of aluminium has 13 electrons. Complete the diagram below to show how all these electrons are arranged.



[1]

Examiner Only	
Marks	Remark

- 2 Sarah investigated the effect of heating a **small** amount of sodium hydrogencarbonate using the apparatus shown below.



Sarah's observations are shown in the table below.

Time interval/ seconds	Observations
0 to 30	Small number of gas bubbles observed in limewater. The limewater remained colourless
31 to 60	A large number of gas bubbles. The limewater turned cloudy
61 to 90	No bubbles

(a) In this investigation:

(i) name the gas produced.

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

(ii) name the type of reaction that produced this gas.

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

Examiner Only

Marks Remark

(b) Suggest **one** reason for Sarah's observations between 0 and 30 seconds.

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[1]

(c) Explain fully Sarah's observation between 61 and 90 seconds.

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[2]

Examiner Only	
Marks	Remark

3 The fingerprint shown below was found on the door of a stolen black car.



© Science Source / Science Photo Library

Describe how the fingerprint can be taken from the black car and kept as evidence.

Your answer should include:

- the type of fingerprint shown above,
- why the fingerprint may be useful in helping solve the crime.

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

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[6]

Examiner Only	
Marks	Remark

- 4 The reactivity of three metals, copper, zinc and magnesium, was investigated by adding a small amount of each to sulfate solutions of the other metals.

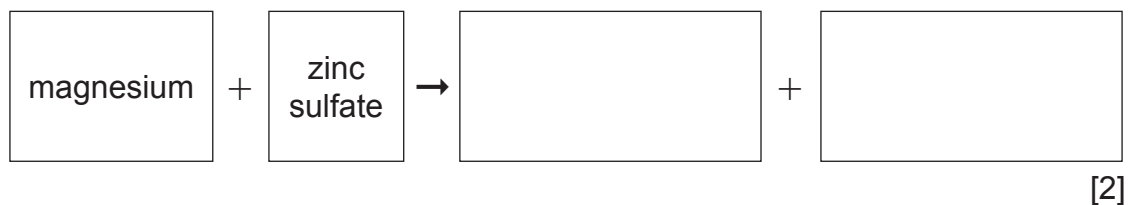
Some results are shown below.

If there was a reaction a tick (✓) was used; for no reaction a cross (X) was used.

<b>Solution</b> <b>Metal</b>	Copper sulfate	Zinc sulfate	Magnesium sulfate
Copper		X	
Zinc			
Magnesium		✓	

- (a) Use your knowledge of the reactivity series to complete the table above. [2]

- (b) Complete the word equation for the reaction between magnesium and zinc sulfate.



- (c) Name this type of reaction.
- \_\_\_\_\_ [1]

Examiner Only	
Marks	Remark

- 5 The table shows some chemicals that can be separated from **one** barrel of crude oil.

Chemicals	Amount in one barrel/gallons
petrol	2.2
jet fuel	4.8
fuel oil	2.8
diesel	8.0
others	7.4

- (a) Name the process used to separate crude oil into these different chemicals.

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

- (b) Name **one** other chemical that can be separated from crude oil.

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

- (c) A plane needs 4800 gallons of **jet fuel** for one journey. Calculate how many barrels of crude oil are needed for this journey.

(Show your working out.)

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

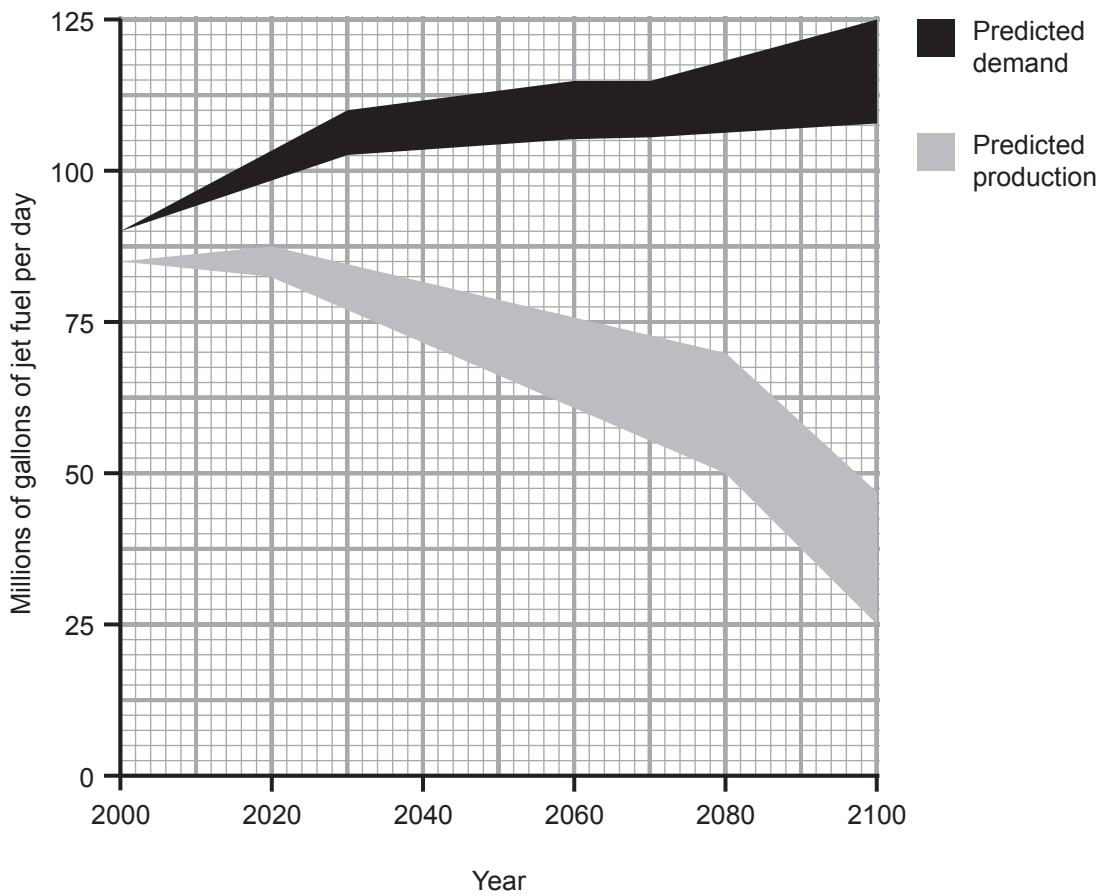
Examiner Only

Marks

Remark



The graph below shows the predicted demand for jet fuel. It also shows the predicted production of jet fuel from crude oil.



(d) Use the graph to explain why airline companies are investing large amounts of money to find alternative sources of fuel for their aircraft.

\_\_\_\_\_

\_\_\_\_\_

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

(e) Suggest **two** reasons why these predictions may not be accurate.

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

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

Examiner Only	
Marks	Remark

6 The Bank of England plans to change its paper bank notes to a plastic polymer material. It is thought that plastic rather than paper will help reduce counterfeiting.

(a) Define fully the term polymer.

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[2]

Shown below is a copy of a paper £10 note.



© Louise Murray / Science Photo Library

(b) Give **one** way that a shop owner can test for counterfeit bank notes.

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[1]

(c) Paper and some modern plastics are biodegradable. Explain fully the term 'biodegradable'.

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[2]

Examiner Only	
Marks	Remark

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**(Questions continue overleaf)**

7 (a) The table below gives the properties of five materials.

Examiner Only	
Marks	Remark

Material	Density/ $\text{kg/m}^3$	Relative strength	Relative stiffness	Cost
Nylon	1100	0.08	3	medium
Steel	7800	1	210	low
Polythene	960	0.02	0.6	low
Kevlar	1250	3	190	high
Carbon fibre-reinforced plastic	1600	1.8	200	high

Using **only** the information in the table answer parts (i) and (ii) below.

(i) Give **one** disadvantage of using steel for car bodies.

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

(ii) Bulletproof vests are worn like a coat and are designed to stop a bullet hitting a person's body. Name the material that would be most suitable to make a bulletproof vest. Explain your answer.

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

(b) Carbon fibre-reinforced plastic can be described as a composite material.

(i) Using carbon fibre-reinforced plastic as an example, explain what is meant by a composite material.

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

(ii) Name **one** other composite material.

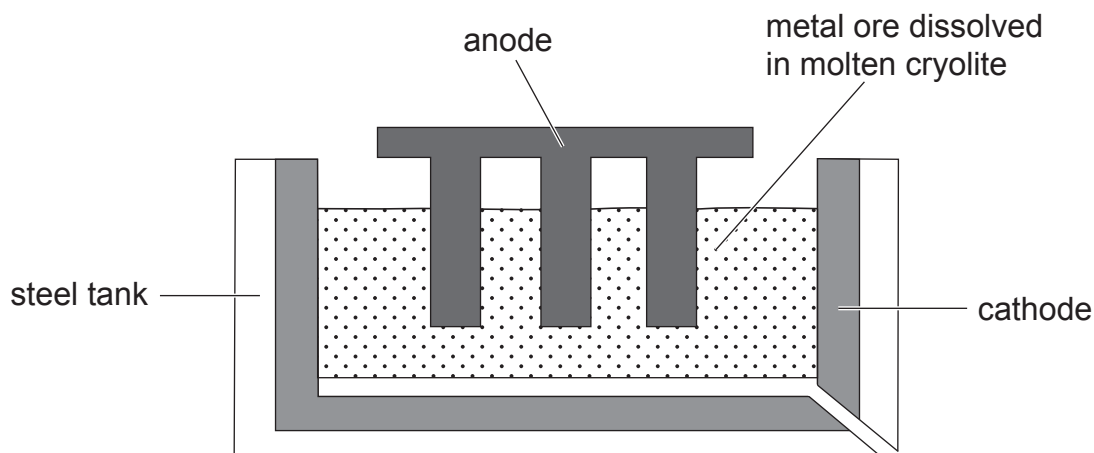
\_\_\_\_\_ [1]

(c) Electrolysis plays an important part in extracting some metals from their ores.

(i) Name **one** metal that is obtained from its ore by electrolysis.

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

The apparatus shown below is used for electrolysis.



Source: CCEA

(ii) Name **one** material often used to make the anode and the cathode. Explain your choice.

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

(iii) Complete the following sentence.

In this extraction process the cathode is

the \_\_\_\_\_ charged electrode. [1]

Examiner Only	
Marks	Remark

- 8 (a) The element magnesium reacts with oxygen to form the compound magnesium oxide.

- (i) Balance the symbol equation for this reaction.



- (ii) Explain in terms of electrons how magnesium forms bonds with oxygen in magnesium oxide.

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[3]

- (iii) Choose **one** chemical compound that has the same type of bonding as magnesium oxide.

Circle the correct answer.



- (b) Magnesium hydrogencarbonate has the chemical formula Mg(HCO<sub>3</sub>)<sub>2</sub>.

- (i) How many different elements does magnesium hydrogencarbonate contain?

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[1]

- (ii) How many carbon atoms are represented by the formula Mg(HCO<sub>3</sub>)<sub>2</sub>?

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[1]

- (iii) What is the total number of atoms represented by the formula Mg(HCO<sub>3</sub>)<sub>2</sub>?

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[1]

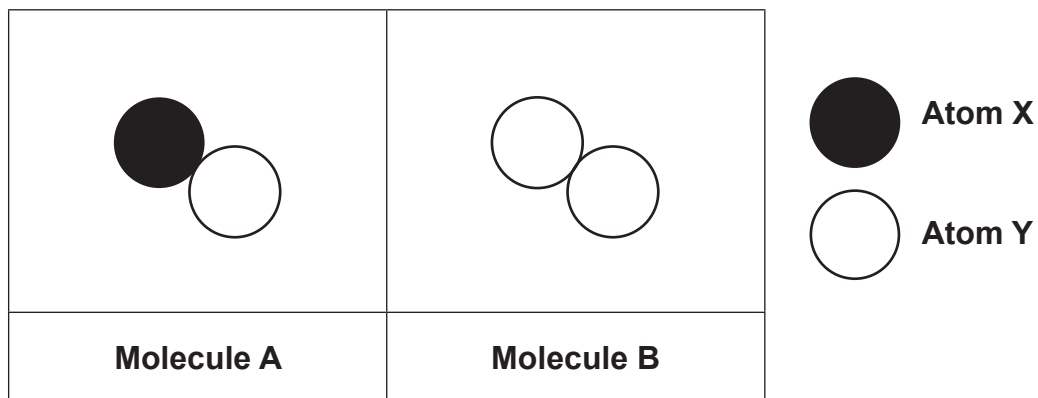
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Marks Remark

During a lesson on elements and compounds a student made the following statement.

*“Since all compounds are molecules, then all molecules must be compounds.”*

(c) Explain with reference to **both** molecules **A** and **B** shown below why this statement is incorrect.



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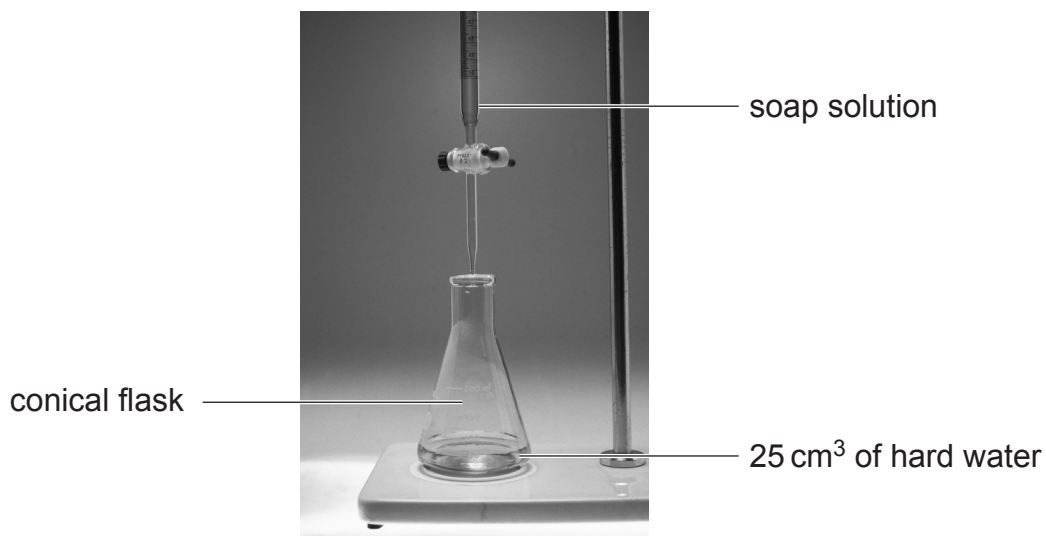
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[3]

Examiner Only	
Marks	Remark

- 9 (a) Some students investigated the hardness of water using the apparatus below.



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- (i) Name a piece of apparatus that could be used to **accurately** measure 25 cm<sup>3</sup> of hard water.

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

- (ii) Explain why it is better to use a conical flask rather than a beaker.

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

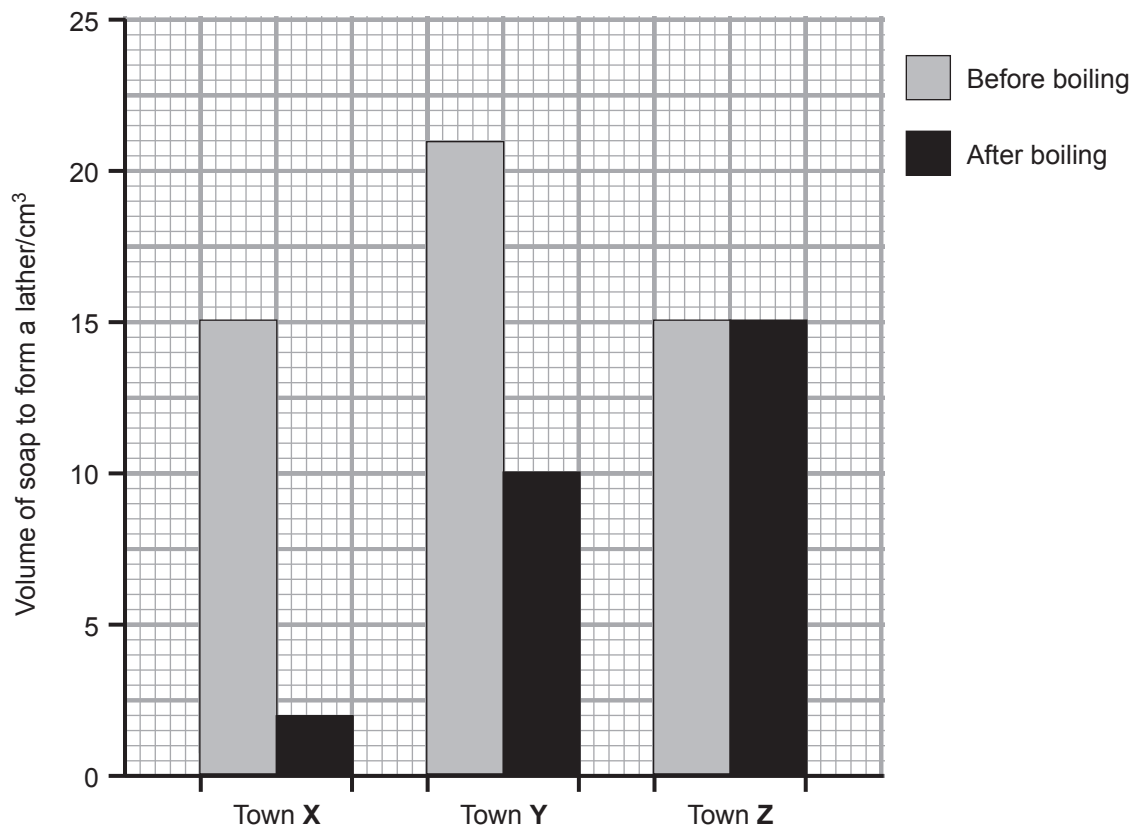
- (iii) What is meant by the term hard water?

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

Examiner Only	
Marks	Remark



The students used the same apparatus to compare the hardness of water in three towns (X, Y and Z) before and after boiling. The results are shown below.



(b) From the results which town (X, Y or Z) has both temporary and permanent hard water? Explain your answer fully.

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[3]

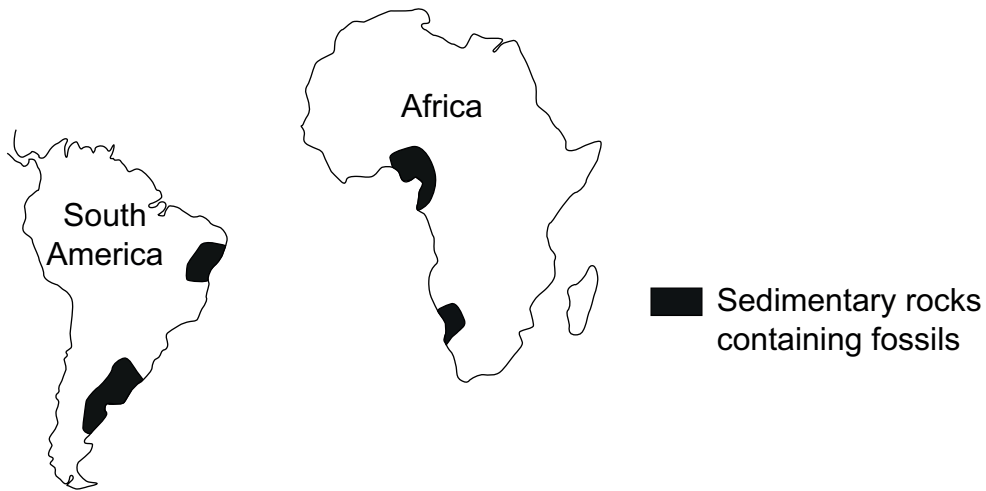
(c) Name a compound which causes permanent hardness in water.

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[1]

Examiner Only	
Marks	Remark

10 In 1912 Alfred Wegener proposed a theory to explain the formation of the continents. However, other scientists at the time did not agree that his theory was the correct explanation.



Referring to the diagram above, describe Wegener's theory, including evidence that supports it and reasons why scientists at the time thought he was wrong.

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

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[6]

Examiner Only	
Marks	Remark

11 (a) The following chemical compounds are all hydrocarbons.

ethane

propane

ethene

butane

(i) Which of the above compounds is **not** an alkane?

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

(ii) Complete the table below about two hydrocarbons.

Name of hydrocarbon	Molecular formula	Structural formula
methane	CH <sub>4</sub>	
butane		$\begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & \text{H} & & \\ &   &   &   &   & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{H} & \\ &   &   &   &   & & \\ & \text{H} & \text{H} & \text{H} & \text{H} & & \end{array}$

[2]

Polypropene is made by a process involving propene molecules.

(b) Name the process used to make polypropene.

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

The word equation for the combustion of propane is given below.

**propane + oxygen → carbon dioxide + water**

(c) Write the **balanced symbol** equation for the combustion of propane.

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

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

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