



General Certificate of Secondary Education
2016–2017

Centre Number

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Candidate Number

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Science: Single Award

Unit 2 (Chemistry)
Higher Tier



[GSS22]

THURSDAY 10 NOVEMBER 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 ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.

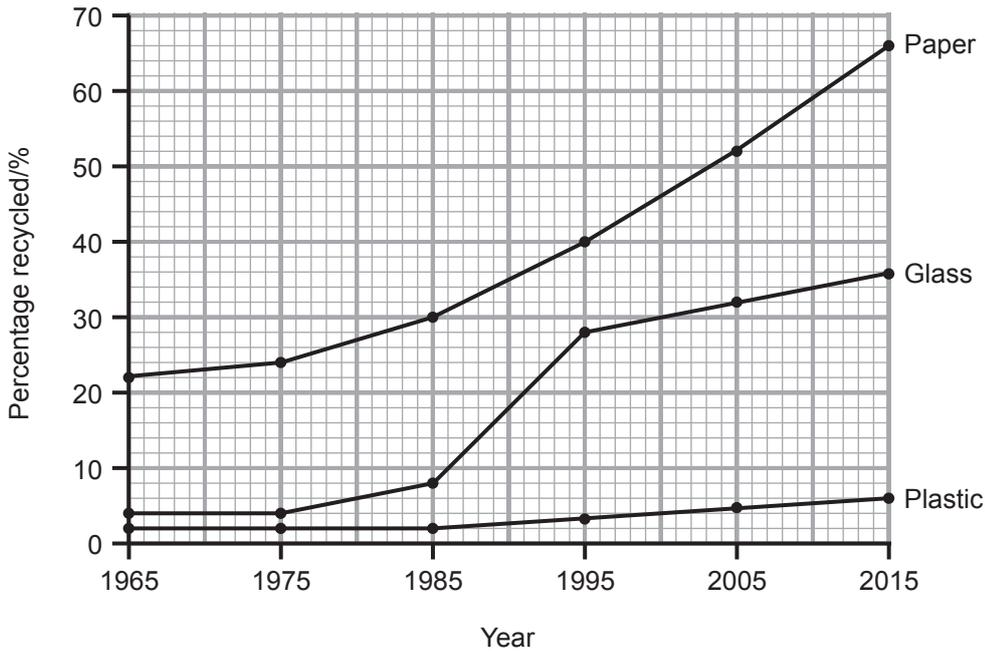
Quality of written communication will be assessed in Questions **2** and **9**.

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 for your use.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

- 1 (a) The graph below shows the percentage of plastic, glass and paper recycled in a country between the years 1965 to 2015.

Examiner Only	
Marks	Remark



Source: Principal Examiner

- (i) Which material shows the biggest percentage increase between the years **1985** to **1995**?

_____ [1]

- (ii) Calculate the percentage increase for paper recycling from **1965** to **2015**.

(Show your working out.)

_____ % [2]

- (iii) Describe the steps in recycling glass after it has been delivered to a factory.

[3]

(b) Waste that does not get recycled often ends up in landfill sites.



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Waste items found in landfill include: aluminium cans, food waste, glass bottles, newspapers and plastic bags. Many items will remain in landfill sites for hundreds of years. Some of the waste gives off polluting gases and can produce foul-smelling liquids that leak into water supplies. A recent survey suggests that many new landfill sites need to be found each year due to the large volume of waste being produced.

Use **only** the information provided to answer parts (i) and (ii) below.

(i) Apart from food waste, suggest **one** other material which is biodegradable.

_____ [1]

(ii) Suggest **two** disadvantages of living near a landfill site.

1. _____

2. _____ [2]

(c) Some materials are non-biodegradable. Explain fully the term 'non-biodegradable'.

_____ [2]

(d) Suggest **one** way local authorities can encourage people to recycle more waste.

_____ [1]

Examiner Only

Marks Remark

3 (a) Some tap water contains dissolved metal ions which can make it hard.

(i) Give the name of **one** metal ion that causes tap water to be hard.

_____ [1]

(ii) Give **one** advantage and **one** disadvantage of hard water.

Advantage _____

Disadvantage _____

_____ [2]

(b) The hardness of three samples of water **X**, **Y** and **Z** was measured using soap solution. New samples were boiled and the experiment repeated.

The results are shown below.

Sample of water	Volume of soap solution needed to form a permanent lather/cm ³	
	Before boiling	After boiling
X	2	2
Y	17	17
Z	13	2

State the type of water in samples **Y** and **Z**. Explain your answers.

(i) Sample **Y** _____

_____ [2]

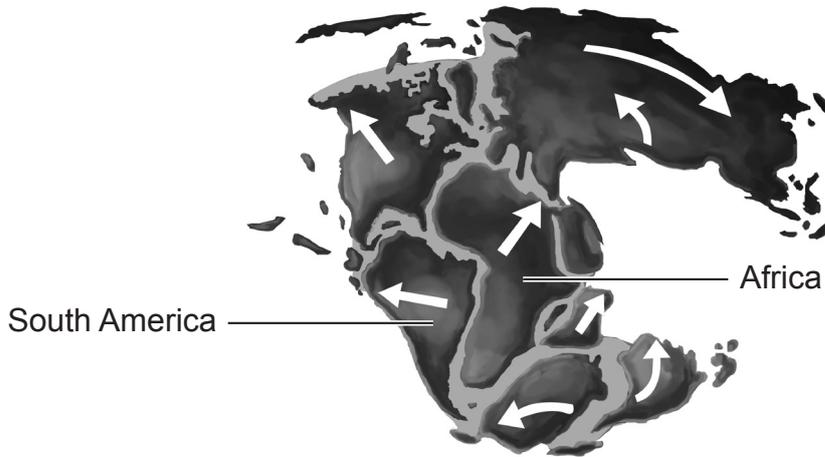
(ii) Sample **Z** _____

_____ [2]

Examiner Only

Marks Remark

- 4 In 1912 the German scientist Alfred Wegener suggested that the continents were once joined as one super-continent as shown in the diagram below. Wegener proposed that this super-continent then broke up and drifted apart. He called this the theory of continental drift.



© Spencer Sutton / Science Photo Library

- (a) One piece of evidence to support his theory was that similar fossils were found in South America and Africa.

(i) What is a 'fossil'?

[2]

(ii) Give two **other** pieces of evidence that suggested that continents were once closely joined.

1.

2.

[2]

(b) Give **one** reason why Wegener's theory of continental drift was rejected in 1912.

[1]

Examiner Only	
Marks	Remark

- 5 The table below gives information about the colours of three indicators in different chemicals.

Indicator Chemical	Colour		
	red litmus	Universal Indicator	beetroot juice
citric acid	red	orange	red
water	red	green	purple
sodium hydroxide	blue	purple	yellow
hydrochloric acid	red	red	red
sodium hydrogencarbonate	blue	blue	green

- (a) Use this information and your knowledge to answer the questions below.

- (i) From the table name the strong acid.

_____ [1]

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

 _____ [2]

- (iii) Name the indicator which would **not** show that water is neutral. Explain your answer.

 _____ [2]

- (b) State the chemical formulae for hydrochloric acid and sodium hydrogencarbonate.

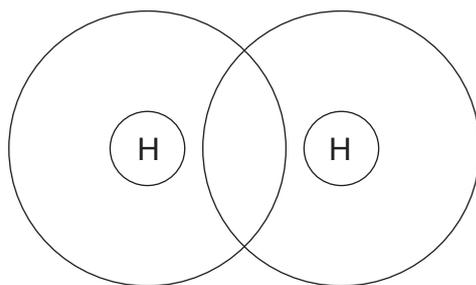
Hydrochloric acid _____

Sodium hydrogencarbonate _____ [2]

Examiner Only

Marks Remark

6 (a) Below is a diagram showing a molecule of hydrogen.



(i) On the diagram show how the electrons are arranged in this molecule. [1]

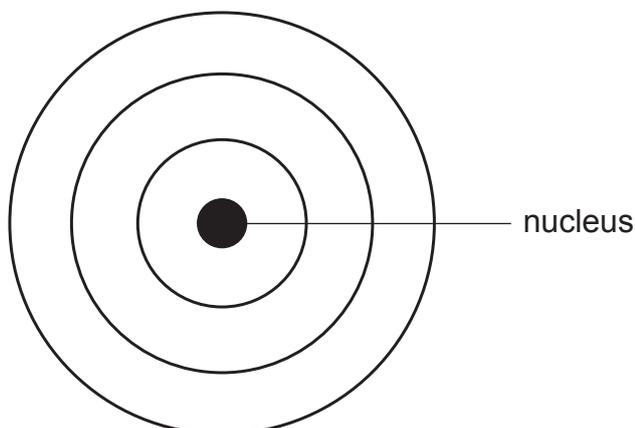
(ii) Name **one** other molecule that forms bonds in a similar way to hydrogen.

_____ [1]

(b) The table below shows information about five elements found in Period 3 of the Periodic Table.

Element	Sodium	Magnesium	Aluminium	Silicon	Phosphorus
Symbol	Na	Mg	Al	Si	P
Atomic number	11	12	13	14	15
Melting point/ $^{\circ}\text{C}$	98	639	660	1410	44
Metallic character	metal	metal	metal	semi-metal	non-metal

(i) Complete the diagram below to show how the electrons are arranged in phosphorus.



Source: Chief Examiner

[1]

Examiner Only	
Marks	Remark

- (ii) Describe how the metallic character changes across Period 3 of the Periodic Table.

_____ [1]

- (iii) Describe the trend in melting points for the **metal** elements shown in the table.

_____ [1]

- (c) Magnesium oxide is a compound. What is meant by the term 'compound'?

_____ [2]

- (d) Shown below is the word equation for a reaction involving magnesium.

magnesium + copper sulfate → copper + magnesium sulfate

Name the **type** of reaction shown and explain why this reaction happens.

_____ [2]

Examiner Only

Marks Remark

7 (a) Composite materials are widely used in the manufacture of aircraft.

(i) Explain fully the term 'composite material'.

[2]

Below is information about the materials used to manufacture two aircraft **A** and **B**.

Aircraft A	Aircraft B
Steel – 14% Titanium – 15% Aluminium – 50% Composite – 12% Other – 9%	Steel – 9% Titanium – 14% Aluminium – 21% Composite – 50% Other – 6%
Cost to manufacture £462 million	Cost to manufacture £1646 million

(ii) Using the information above, suggest **one** reason why aircraft **B** is much more expensive to manufacture than aircraft **A**.

[1]

(b) Give **one** example of:

(i) a naturally occurring composite.

[1]

(ii) a man-made composite.

[1]

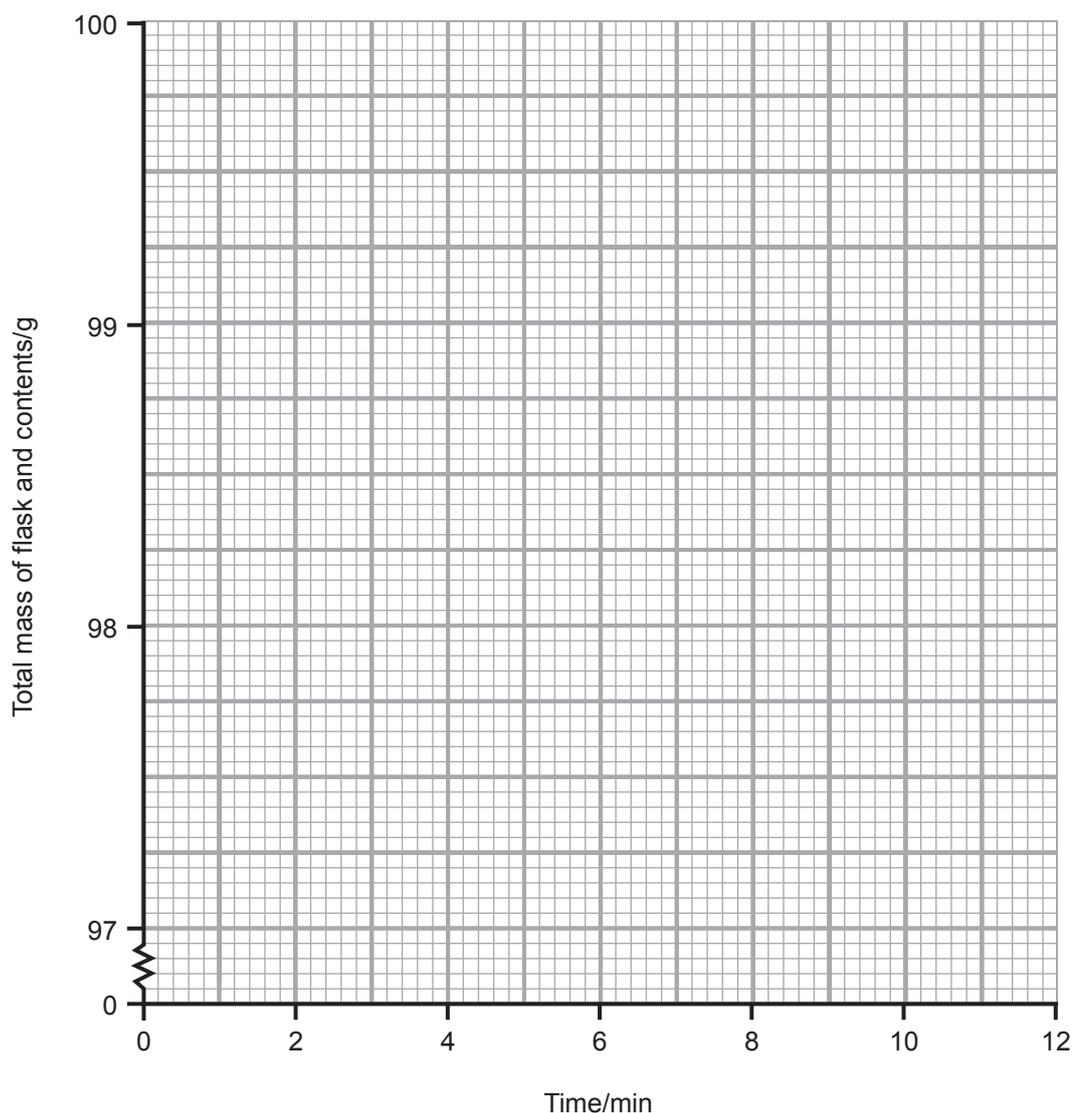
Examiner Only	
Marks	Remark

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(Questions continue overleaf)

- 8 (a) A student investigated the reaction between magnesium carbonate and excess hydrochloric acid. She carried out the reaction in a flask placed on a balance and measured the mass every two minutes. Her results are shown below.

Time/min	0	2	4	6	8	10	12
Total mass of flask and contents/g	100	99.1	98.5	98.0	97.7	97.5	97.5

- (i) On the grid below plot and draw a line graph of these results.



[3]

- (ii) Describe the trend shown by these results.

_____ [1]

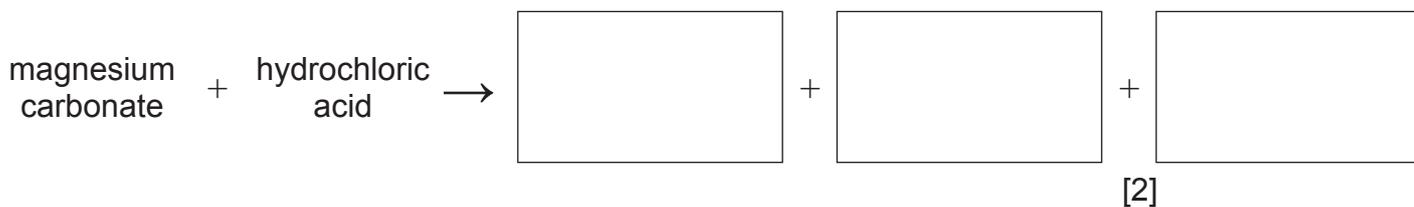
(iii) Why does the mass change in this reaction?

_____ [1]

(b) At what time had all the magnesium carbonate reacted?

_____ min [1]

(c) Complete the word equation for this reaction.



(d) The student repeated the experiment using ethanoic acid which is weaker than hydrochloric acid.

Describe **one** similarity and **one** difference that would be observed during the reactions of each of these acids with magnesium carbonate.

Similarity _____

Difference _____

_____ [2]

Examiner Only	
Marks	Remark

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10 (a) The following compounds are hydrocarbons.

butane

methane

ethene

propane

ethane

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

_____ [1]

(ii) Butane has the chemical formula C_4H_{10} .

In the space below draw the **structural** formula for butane.

[1]

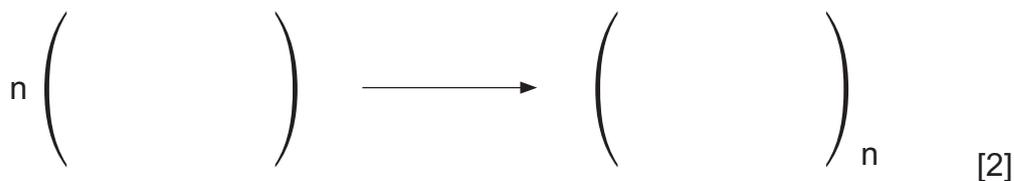
(iii) Give the chemical formula for methane.

_____ [1]

(iv) Write a balanced symbol equation for the combustion of propane (C_3H_8).

_____ [3]

(b) Polythene is a plastic that is made by a process involving ethene molecules. Complete the symbol equation to show how polythene is made from ethene.



THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark

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SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

DATA LEAFLET

For the use of candidates taking
 Science: Chemistry,
 Science: Double Award
 or Science: Single Award

Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations.

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble

Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

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chemistry double award single award

