Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 2 (Chemistry)
Higher Tier

GSS22

[GSS22]

WEDNESDAY 25 FEBRUARY 2015, 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 **4** and **10(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.

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

1 **(a)** Stomach ache can be caused by too much hydrochloric acid in the stomach. Indigestion tablets can be used to reduce the amount of acid in the stomach as they contain calcium carbonate.

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(i) Complete the word equation for this reaction.

calcium carbonate	+	hydrochloric acid	→		+		+	carbon dioxide

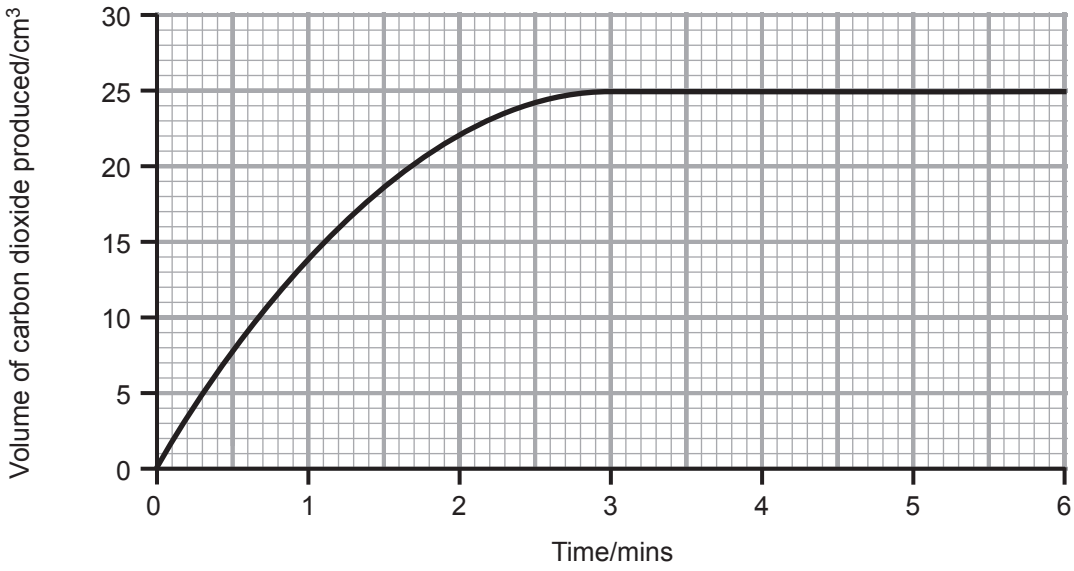
[2]

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

_____ [1]

Examiner Only	
Marks	Remark

Some hydrochloric acid is added to excess calcium carbonate.
The graph below shows how the volume of carbon dioxide produced changes with time.



(b) Describe fully the trend shown by these results.

_____

_____

_____ [2]

(c) Describe the test for carbon dioxide.

_____

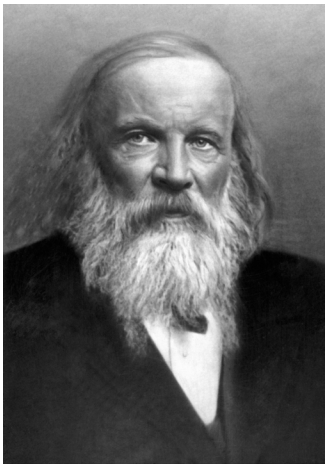
_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 In 1869 the scientist pictured below put the sixty known elements into a Periodic Table.



© Ria Novosti / Science Photo Library

(a) Name the scientist pictured above.

_____ [1]

(b) Name the unreactive **group** of elements not included in his table because they had not been discovered by 1869.

_____ [1]

(c) Sodium is in Group 1 of the modern Periodic Table.

(i) Complete the table below to show the number of each different particle in a sodium atom.

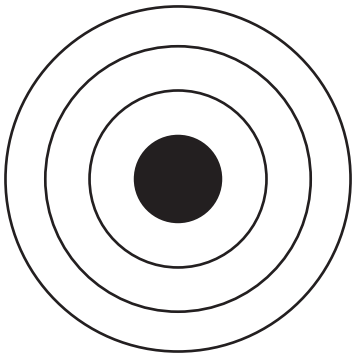
You may find your Data Leaflet helpful.

	Number of protons	**Number of neutrons**	**Number of electrons**
sodium (Na)			

[3]

Examiner Only	
Marks	Remark

(ii) Complete the diagram below to show the electronic structure of a sodium atom.



sodium atom

[1]

(d) When sodium is added to water there is a violent reaction during which it moves on the water surface.

(i) Give **two** other observations during this reaction.

1. _____

2. _____ [2]

(ii) Name the alkaline solution formed during this reaction.

_____ [1]

(e) Potassium and sodium are both in Group 1 of the Periodic Table. Give **two** reasons why these metals are in the same Group.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

3 **(a)** Some students investigated the hardness of water in four towns (**W**, **X**, **Y** and **Z**). The following method was used for each town.

1. Measure 25 cm^3 of water and add to a conical flask.

2. Add 1 cm^3 of soap solution and shake well.

3. Repeat step 2 until a permanent lather forms.

4. Record the volume of soap solution used.

5. Boil another 25 cm^3 of water and repeat steps 1 to 4.

The results are shown below.

	Volume of soap solution/cm^3	
Town	**before boiling**	**after boiling**
W	26	1
X	6	6
Y	24	17
Z	1	1

(i) Name a piece of apparatus the students could have used to measure 1 cm^3 of soap solution.

_____ [1]

(ii) Suggest **one** way in which the reliability of the results could have been improved.

_____ [1]

(b) What can you conclude about the hardness of the water from Town **Y**? Explain your answer.

_____

_____

_____

_____ [2]

(c) Apart from using more soap, give **one** disadvantage of using hard water.

_____ [1]

4 A student adds a piece of magnesium metal to a solution of copper sulfate. Describe the reaction between magnesium and copper sulfate solution.

Your answer should include:

- the name of this type of reaction
- an explanation of why this reaction happened
- three observations that could be made during this reaction

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

[6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 Steel is a common building material made from iron and carbon. Other metals can be added to make alloys of steel.

The table shows some information about iron and steel.

Material	What it contains	Properties	Relative cost
pure iron	iron	soft and weak, rusts easily	low
steel (low carbon)	iron and 0.1% carbon	harder and stronger than iron and easily shaped, rusts easily	low
steel (high carbon)	iron and 1% carbon	harder but more brittle than low carbon steel, rusts easily	low
stainless steel	iron and 18% chromium and 10% nickel	hard and very resistant to rusting	high
titanium steel	iron and 2% titanium	hard and able to withstand very high temperatures	very high
manganese steel	iron and 14% manganese	extremely hard	very high

Use the information in the table to answer the questions that follow.

(a) Name the alloy of steel that contains the lowest percentage of iron.

_____ [1]

(b) Titanium steel is used to make parts of a car engine. Give **one** reason why it is suitable for this use.

_____ [1]

Examiner Only	
Marks	Remark

(c) Paper clips are often used to hold sheets of paper together.

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Name the material from the table that would be best for making paper clips. Explain your answer.

_____

_____

_____ [2]

(d) Some cutlery is shown below.

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Name the material from the table that would be best for making cutlery. Explain your answer.

_____

_____

_____ [2]

(e) Using the information in the table opposite, explain fully why low carbon steel is described as a composite material but iron is not.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

6 During the twentieth century many scientists proposed ideas about the Earth's crust and the cause of earthquakes.

In 1912 Alfred Wegener proposed his theory of '*continental drift* '.

In 1930 Arthur Holmes suggested his theory of '*mantle dynamics*'. His theory was based on the idea that the Earth's mantle was made of molten rock and was slowly moving due to the heat from the core of the Earth.

(a) Describe Wegener's theory of continental drift.

_____

_____

_____ [2]

(b) Explain how Arthur Holmes's idea supported Wegener's theory.

_____

_____ [1]

(c) A fault is the boundary where two tectonic plates meet. Explain fully how earthquakes happen at a fault line.

_____

_____

_____

_____

_____ [3]

(d) Name the scale that measures the size of an earthquake.

_____ [1]

(e) Give **two** other natural events that happen at fault lines.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

7 Baking soda contains sodium hydrogencarbonate. When it is used in baking cakes, the sodium hydrogencarbonate thermally decomposes.

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(a) Complete the balanced symbol equation for this reaction.

$NaHCO_3 \longrightarrow Na_2CO_3 +$ ☐ $+$ ☐

[3]

(b) Explain fully why this reaction is important in baking cakes.

_____

_____

_____ [2]

8 **(a)** The table below gives information about the colours of four indicators made from plants.

pH / Indicator	1	2	3	4	5	6	7	8	9	10	11	12
Blueberry	R	R	V	V	G	G	G	G	G	G	G	G
Red Cabbage	P	P	P	V	V	B	B	B	G	G	Y	Y
Grape Juice	R	R	R	R	R	R	G	G	G	G	G	G
Litmus Solution	R	R	R	R	R	R	V	B	B	B	B	B

Key

P	Pink
R	Red
Y	Yellow
G	Green
B	Blue
V	Violet

Examiner Only	
Marks	Remark

(i) What colour would the blueberry indicator be in hydrochloric acid?

_____ [1]

(ii) Name the indicator which would allow you to distinguish between magnesium hydroxide and sodium hydroxide.

_____ [1]

(b) A student wants to add an acid to an alkali and stop at pH7. Name the indicator that they should use. Explain your answer.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(c) Litmus indicator, universal indicator and pH sensors can all be used to follow a neutralisation reaction.

(i) Put these methods in order of accuracy, the most accurate first.

_____ (most accurate)

_____

_____ [1]

(ii) Explain your answer to **(c)(i)**.

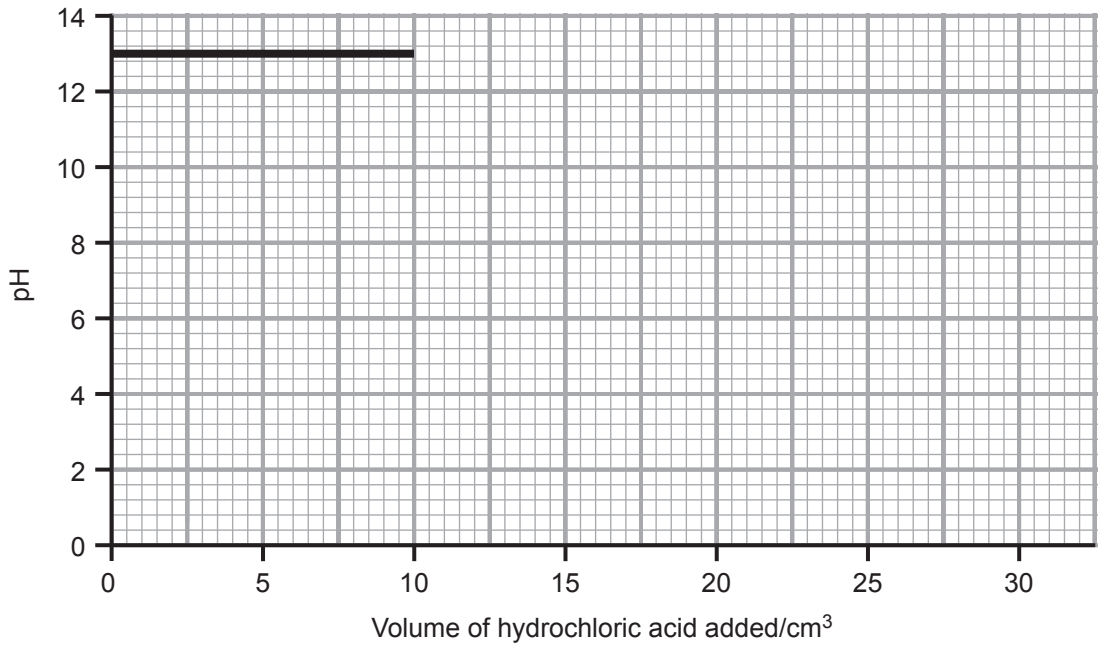
_____

_____

_____

_____ [3]

(d) Complete the graph below to show how the pH changes when hydrochloric acid is added to 20 cm^3 of sodium hydroxide.
The acid and alkali are of **equal strength**.

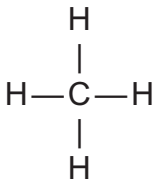
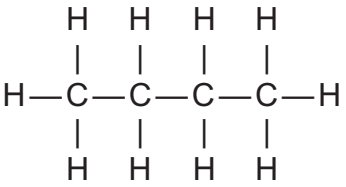


[2]

Examiner Only	
Marks	Remark

9 Some alkanes are hydrocarbon fuels.

(a) Complete the table below.

Name of alkane	Molecular formula	Structural formula
	CH_4	
propane	C_3H_8	
butane		

[3]

(b) Name the element that alkanes react with when they burn.

_____ [1]

(c) Name the process that makes many small molecules, such as propene, into longer chain molecules, such as polypropene.

_____ [1]

Examiner Only	
Marks	Remark

10 (a) Elements react in different ways to form compounds. During a reaction bonds are formed that hold atoms together.

Describe the different types of bonds between atoms when:

- sodium reacts with chlorine
- hydrogen reacts with oxygen

Your answer should include the names of the products formed.

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

[6]

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

[ ] + [ ] → [ ]

[3]

THIS IS THE END OF THE QUESTION PAPER

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