New Specification

Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

GSS22

TUESDAY 13 NOVEMBER 2012, 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.
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 provided for your use.
Quality of written communication will be assessed in questions **4** and **8**.

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

Examiner Only	
Marks	Remark

1 Some students compared the reactivity of four metals (cobalt, iron, copper and magnesium) by adding a small amount of each to sulfate solutions of the other metals. If there was a reaction they used a tick (✓), for no reaction they used (✘).

The results are shown below.

Solution / Metal	Cobalt sulfate	Iron sulfate	Copper sulfate	Magnesium sulfate
Cobalt		✘	✓	✘
Iron	✓		✓	✘
Copper	✘	✘		✘
Magnesium	✓	✓	✓	

(a) Use the information in the table and your knowledge to answer the following questions.

(i) Which metal is the most reactive? _____ [1]

(ii) Which metal is the least reactive? _____ [1]

(iii) Give **two** observations you would make when magnesium is added to copper sulfate solution.

1. _____

_____

2. _____

_____ [2]

(b) Complete the word equation for the reaction of magnesium with iron sulfate.

magnesium + iron sulfate ⟶ [ ] + [ ]

[2]

(c) Elements and compounds can be represented by chemical symbols, but they must be written correctly. Give the correct formula for the compounds copper sulfate and magnesium chloride.

(You may find your Data Leaflet helpful.)

Circle the correct answers.

(i) copper sulfate

$CuSO_4$ **CoSu** **$CuSO_2$** **$CUSO_4$** [1]

(ii) magnesium chloride

MGCl **$Mgcl_2$** **MC** **$MgCl_2$** [1]

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Marks	Remark

2 The table below shows some information about the elements that are found in Period 3 of the Periodic Table.

Name of element	Sodium	Magnesium	Aluminium	Silicon	Phosphorus	Sulfur	Chlorine	Argon
Symbol	Na	Mg	Al	Si	P	S	Cl	Ar
Atomic number	11	12	13	14	15	16	17	18
Melting point/°C	98	639	660	1410	44	113	–101	–189
Boiling point/°C	883	1090	2467	2680	280	445	–35	–186
Metallic character	Metal	Metal	Metal	Semi-metal	Non-metal	Non-metal	Non-metal	Non-metal

Use this information and your knowledge to answer the following questions.

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Marks	Remark

(a) Name the **metal** which has the highest melting point.

_____ [1]

(b) Describe the trend in the metallic character across Period 3.

_____

_____ [1]

(c) Name an element from the table that is a **gas** at room temperature (25 °C).

_____ [1]

(d) Name the element which is an **alkali metal**.

_____ [1]

(e) What is the electronic configuration of the **semi-metal**?

Circle the correct answer.

2.8.4 : **2.4.8** : **2.8.6** [1]

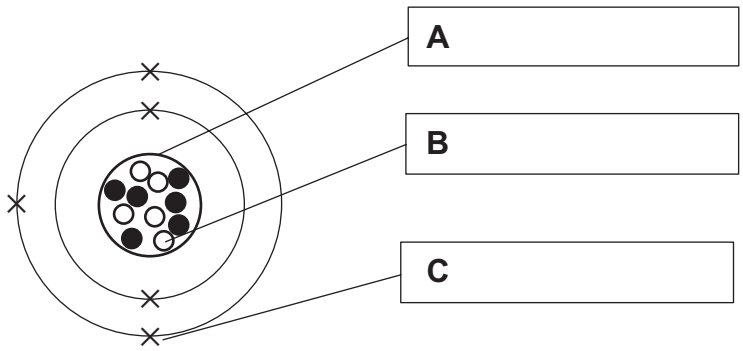
(f) Sodium reacts with chlorine to form the compound sodium chloride. What is the formula for **sodium chloride**?

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 The diagram shows an atom of boron.



(a) Name the parts labelled **A**, **B** and **C** on the diagram above. [3]

(b) A fluorine atom has nine electrons.

In the space below draw a diagram to show how all the electrons are arranged in an atom of fluorine.

[2]

(c) What is meant by the term **atomic number**?

_____

_____ [1]

(d) The table below contains information about the structure of four elements **W**, **X**, **Y** and **Z**.

Element	Number of protons	Number of neutrons	Number of electrons
W	2	2	2
X	11	12	11
Y	20	20	20
Z	8	8	8

(You may find your Data Leaflet helpful.)

(i) Calculate the mass number of element **Y**.

_____ [1]

(ii) Name the element **X**.

_____ [1]

(iii) Which element (**W**, **X**, **Y**, **Z**) has six electrons in its outer shell?

_____ [1]

(iv) Which element (**W**, **X**, **Y**, **Z**) is a noble gas?

_____ [1]

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Marks	Remark

4 Flame tests can be used to identify the metal in a compound.

Explain how you would carry out a flame test experiment on solutions of potassium chloride and sodium chloride.

Your answer should include:

- any safety precautions
- the results you would expect to see

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

[6]

Examiner Only	
Marks	Remark

5 The table below gives information about some materials.

Material	Relative heaviness	Relative strength	Relative stiffness	Relative cost
Steel	7800	10	105	low
Kevlar	1500	30	95	very high
Carbon fibre reinforced plastic	1600	18	100	high
Glass fibre reinforced plastic	1900	15	10	high

(a) Using the information in the table and your knowledge of materials, give **two** reasons why carbon fibre reinforced plastic has replaced traditional metals such as steel in manufacturing golf clubs.

1. _____

_____

2. _____

_____ [2]

(b) Carbon fibre reinforced plastic can be used as supporting cables in the structure of suspension bridges. Using the information in the table and your knowledge of materials, choose a material that may be more suitable and explain your choice.

_____

_____

_____

_____ [2]

(c) Glass fibre reinforced plastic and carbon fibre reinforced plastic are both described as composite materials. What is meant by the term **composite material**?

_____

_____

_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

6 The Marble Arch Caves are found in Fermanagh which is a hard water area.

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(a) Give an **economic** benefit that the caves bring to the Fermanagh area.

_____ [1]

(b) Other than taste, give an **advantage** of drinking hard water.

_____ [1]

(c) Hard water forms undesirable deposits of calcium carbonate in kettles and hot water pipes. Complete the **balanced symbol equation** for this reaction.

$Ca(HCO_3)_2 \longrightarrow$ _____ + _____ + _____ [3]

(d) The deposits of calcium carbonate inside a kettle are often described as 'fur'. Kettle 'fur' can be removed by reacting it with an acid. Complete the word equation below for this reaction.

calcium carbonate + hydrochloric acid → [ ] + water + [ ]

[2]

(e) A student conducted the following investigation into the hardness of different samples of water. She put 25 cm^3 of four different samples **P**, **Q**, **R**, **S** into separate flasks. She added soap solution to each flask and shook until a lather was formed. She repeated the experiment with boiled samples. The results are shown below.

Sample	Height of lather before boiling/mm	Height of lather after boiling/mm
P	5	5
Q	20	19
R	28	28
S	4	20

(i) The student concluded that samples **Q** and **R** were soft water. Using the information in the table explain why she is correct.

_____

_____

_____ [2]

(ii) What can be concluded about the type of water in sample **S**? Explain your answer.

_____

_____

_____ [2]

Examiner Only

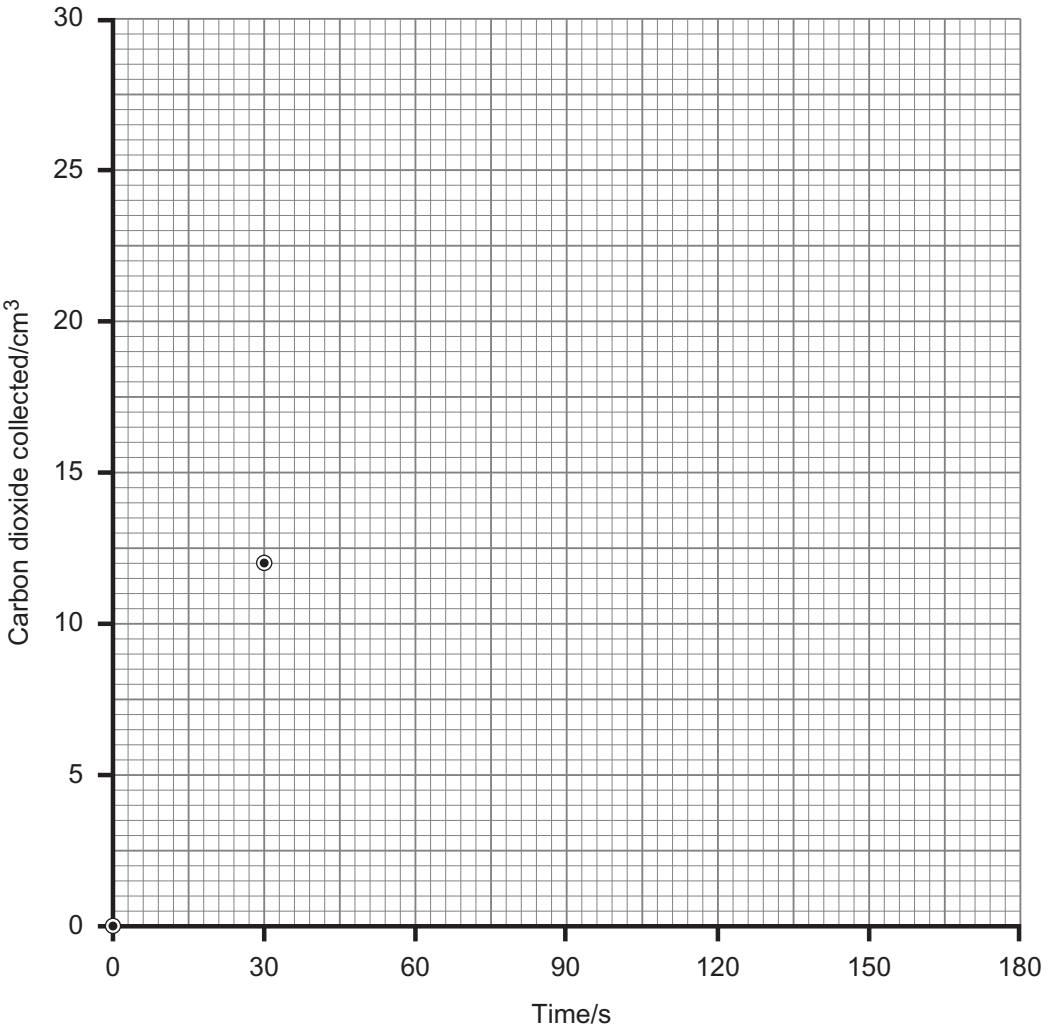
Marks	Remark

Examiner Only	
Marks	Remark

7 James added sodium hydrogencarbonate to a conical flask that contained acid. He measured the amount of carbon dioxide gas produced over a period of 180 seconds. His results are shown below.

Time/s	0	30	60	90	120	150	180
Carbon dioxide collected/cm^3	0	12	18	22	25	27	27

(a) Plot and draw a line graph for these results on the grid below.
The first two points are plotted for you.



[3]

(b) At what time did the reaction finish?

_____ s [1]

(c) To improve the reliability of the results James should do which of the following?

Tick (✓) the correct box.

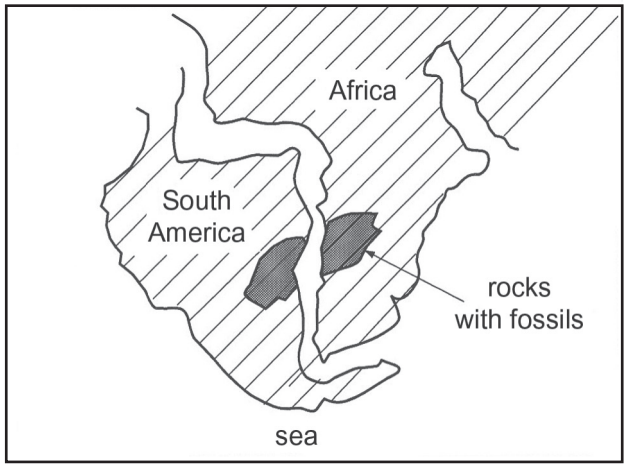
Repeat the experiment at least once ☐

Do the experiment for a longer period ☐

Use stronger acid ☐ [1]

Examiner Only	
Marks	Remark

8 Ideas on the formation of the continents have been debated since 1597 but a full explanation wasn't developed until 1915 when Alfred Wegener put forward his theory of continental drift. However, it wasn't until 1960 that scientists accepted his theory as being correct.



Map showing the relative positions of South America and Africa millions of years ago.

Use the information above and your knowledge to explain Alfred Wegener's theory including the evidence that supports it and reasons why other scientists rejected it.

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

9 When hydrocarbon fuels burn, oxygen from the air combines with atoms of carbon and hydrogen.

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

propane + oxygen ⟶ carbon dioxide + water

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

_____ [3]

(b) During the combustion of any fuel, carbon dioxide is formed. Describe a **chemical** test that could be carried out to identify carbon dioxide including the results you would expect.

_____

_____

_____ [2]

(c) Magnesium burns in air to form magnesium oxide.

(i) As well as a combustion reaction, this reaction can be described as an oxidation reaction. What is meant by the term 'oxidation'?

_____ [1]

(ii) Describe in terms of **electron transfer** how the bond in magnesium oxide is formed.

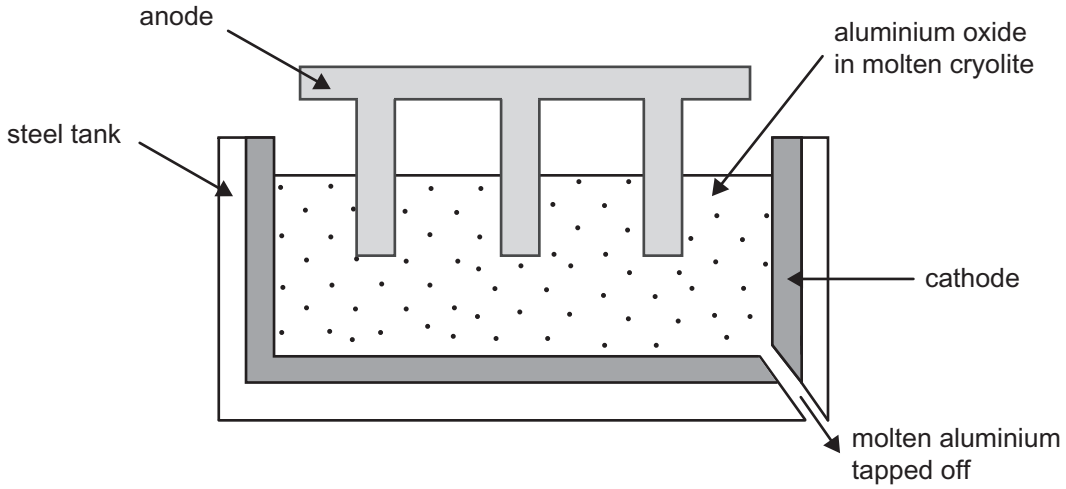
_____

_____

_____

_____ [3]

10 Aluminium is extracted from aluminium oxide using electrolysis. The apparatus is shown below.



(a) What is the meaning of the term 'electrolysis'?

_____

_____ [2]

(b) Name the electrode at which aluminium is formed.

_____ [1]

(c) Write an **ionic equation** for the formation of aluminium.

_____ [3]

(d) Name a suitable material for the anode and explain why it is used.

_____

_____ [2]

Examiner Only

Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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