



Centre Number

71	
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Candidate Number

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General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

MV18

THURSDAY 15 MAY 2014, 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.

Write your answers in the spaces provided in this question paper.

Answer **all nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.

Quality of written communication will be assessed in Questions **3(a)** and **9**.

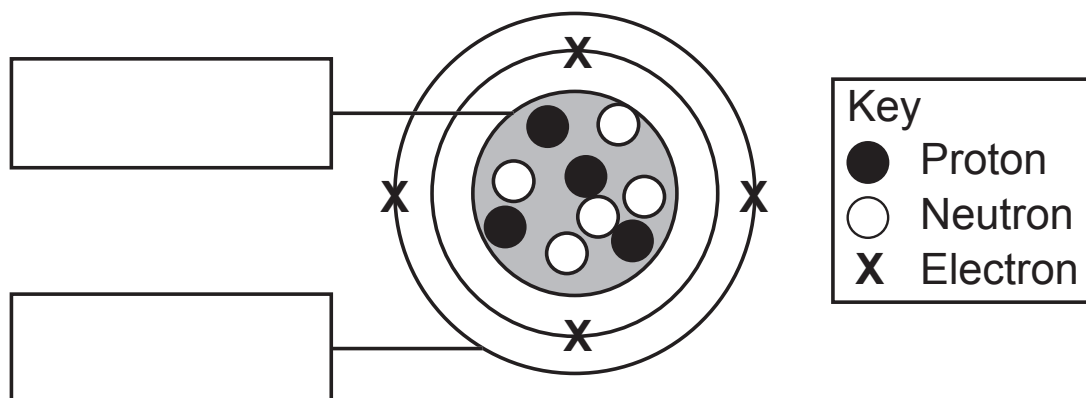
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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(Questions start overleaf)

1 The diagram below shows an atom of an element.



(a) Complete the diagram above by adding labels to the two boxes. [2 marks]

(b) What is the **atomic number** of this element? [1 mark]

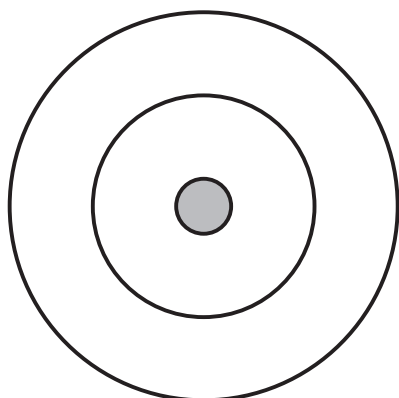
(c) What is meant by the term **mass number**? [1 mark]

(d) To which group of the Periodic Table does this element belong?

Explain your answer in terms of its electronic structure.

[2 marks]

- (e) Oxygen has eight electrons. Complete the diagram below to show the electronic structure of oxygen. [1 mark]



- (f) (i) Name the compound formed in the reaction between magnesium and oxygen. [1 mark]

- (ii) What is the name given to this type of reaction? [1 mark]

- 2 The table below shows the percentage of the most common elements found in the igneous rocks in the Earth's crust.

Element	Percentage
Aluminium	8.1
Calcium	3.6
Iron	5.0
Magnesium	2.1
Oxygen	47.0
Phosphorus	0.1
Potassium	2.6
Silicon	28.0
Sodium	2.9
Titanium	0.6

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

You may find your Data Leaflet helpful.

- (a) Igneous rocks are only one **type** of rock. Name the other two types. [2 marks]

and

(b) Name the most common **metal** in the Earth's crust.
[1 mark]

(c) Calculate the total percentage of alkaline earth metals in the Earth's crust. [1 mark]

_____ %

3 (a) Potassium and sodium are Group 1 metals. Compare their reactivity with water. [6 marks]

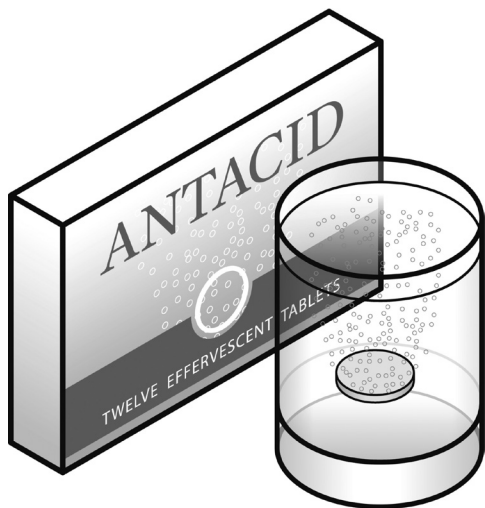
Your answer should include:

- two similarities between the reactions
- two differences between the reactions
- the products of one of the reactions

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

(b) Francium is another Group 1 metal. Explain fully why it is not used in the school laboratory to demonstrate the reactions of Group 1 metals with water. [2 marks]

- 4 Acid indigestion is caused by excess hydrochloric acid in the stomach.
It can be treated using antacid tablets which contain sodium hydrogencarbonate.



- (a) Complete the word equation for the reaction between stomach acid and the antacid tablet. [3 marks]

sodium hydrogencarbonate + hydrochloric acid →



- (b) Suggest one reason why antacid tablets do **not** contain sodium hydroxide. [1 mark]

(c) Sodium hydrogencarbonate is also found in baking soda.

The symbol equation showing the effect of heat on sodium hydrogencarbonate is given below. Balance this equation. [1 mark]



5 (a) Spinel (MgAl_2O_4) is a mineral that contains aluminium.

(i) How many elements are present in spinel? [1 mark]

(ii) Name the metals present in spinel. [1 mark]

(iii) How many atoms are represented in the formula for spinel? [1 mark]

(b) Bauxite is the most common mineral containing aluminium. It contains two aluminium atoms and three oxygen atoms. Write the chemical formula for bauxite. [1 mark]

(c) Below is a displacement reaction involving aluminium.

aluminium + iron sulfate \rightarrow iron + aluminium sulfate

Using this example, explain fully what is meant by the term **displacement**. [2 marks]

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(Questions continue overleaf)


- 6 (a) Aquavol is bottled natural spring water. The label from a bottle is shown below.

Aquavol Analysis

Bottle contents in 0.25 litres

ions	mg
calcium	2.5
magnesium	1.0
sodium	1.6
potassium	1.75
chlorides	2.0
nitrates	1.0
sulfates	1.5

Aquavol is suitable for a low sodium diet



9 781565 924796

- (i) Calculate the mass of sodium ions you would consume if you drank **one** litre of Aquavol water. [2 marks]

(Show your working out.)

_____ mg

- (ii) Name two metal ions from the label that are responsible for hard water. [1 mark]

and

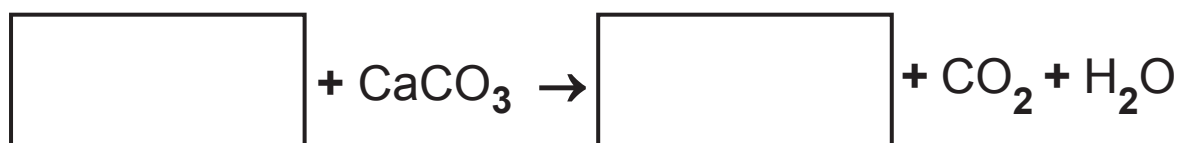
(b) (i) What is meant by the term hard water? [1 mark]

(ii) Give two ways that **permanent** hard water can be softened. [2 marks]

1. _____

2. _____

(c) Temporary hard water can form undesirable deposits of calcium carbonate on shower doors. This can be removed by cleaning products containing a dilute solution of hydrochloric acid. Complete the balanced symbol equation below to show this reaction. [3 marks]



(d) A student conducted a fair test to investigate the hardness of different samples of water. The results are shown below.

Sample	Height of lather before boiling/mm	Height of lather after boiling/mm
A	8	8
B	15	24
C	28	28

- (i) What can be concluded about the type of water in sample **B**? [2 marks]
Explain your answer.

- (ii) Suggest how the student could have carried out this investigation. [3 marks]

- (iii) Describe how the student could have ensured this investigation was valid (fair). [2 marks]

7 Compounds can be formed by two different types of bonds.

(a) (i) Describe in terms of electrons how the compound sodium chloride is formed from sodium and chlorine. [3 marks]

(ii) Name another compound that has the same type of bonding as sodium chloride. [1 mark]

(b) Water is a compound that has a different type of bond to sodium chloride.

(i) Draw a diagram (showing the outer electrons only) of the bonding in a molecule of water. [3 marks]

(ii) The bonding in a hydrogen molecule is the same type as in a water molecule. Why is the hydrogen molecule **not** described as a compound? [1 mark]

8 (a) The table shows some information about different plastics.

Plastic	Density kg/m ³	Maximum usable temperature/°C	Solubility in oil
low density polyethene	920	85	insoluble below 80 °C
high density polyethene	960	120	insoluble below 110 °C
polystyrene	1050	65	soluble
polychloroethene	1390	60	soluble
polypropene	900	150	soluble above 80 °C

(i) The boiling point of water is 100 °C. Explain which type of polyethene is most suitable to be used to make a kettle. [1 mark]

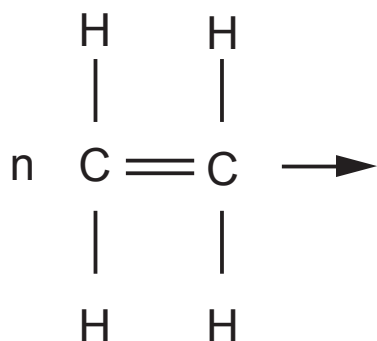
(ii) Which plastic would be the most suitable to make a pipe to carry oil at 90 °C? Explain your choice fully. [3 marks]

(b) Scientists are trying to make more plastics that are biodegradable. Explain fully why it is important to the environment to make such plastics. [2 marks]

(c) Polyethene is made from ethene.

(i) Name and explain fully the process used. [3 marks]

(ii) Complete the balanced symbol equation below for the reaction involved. [3 marks]

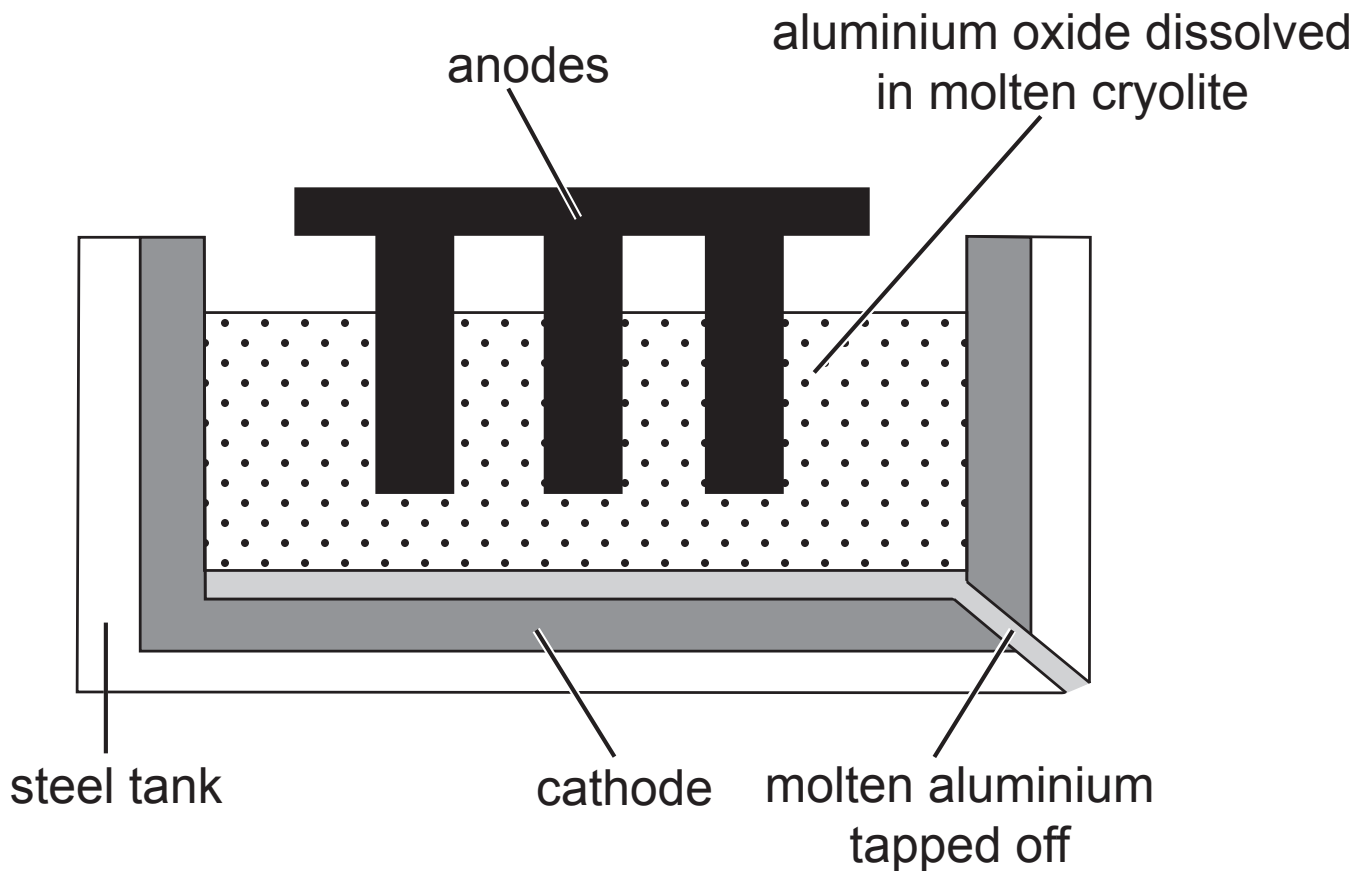


(d) Many useful chemicals can be extracted from crude oil. What name is given to the method of separating useful chemicals from crude oil? [1 mark]

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(Questions continue overleaf)

- 9 Aluminium metal can be extracted from aluminium oxide by electrolysis as shown in the diagram below.



SOURCES

Pg10, Q4, Antacid Tablets, Source: © ZernLiew/iStock/Thinkstock

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Question Number	Marks
1	
2	
3	
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5	
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Total Marks	

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