Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 2 (Chemistry)

Higher Tier

[GSS22]

ML

THURSDAY 13 NOVEMBER 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 eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **3** and **11**.
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 in this question paper.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total Marks	

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1 Below is an outline of the modern Periodic Table.

																	He
Li																	
	Mg															Cl	Ar
										Cu							
										Ag							

(a) Answer the questions below using only the elements shown above and your own knowledge.

(i) Write down the symbol of an element that is in **Group 2**.

_____ [1]

(ii) Write down the name of **two** elements that are in the same **period**.

_____ and _____ [1]

(iii) Write down the name of the element that has **only one** electron in its outer shell.

_____ [1]

(iv) Write down the name of a gas shown on the Periodic Table above.

_____ [1]

(b) What name is given to elements in Group 7?

_____ [1]

(c) Write the symbol for hydrogen in its correct position on the outline Periodic Table above. [1]

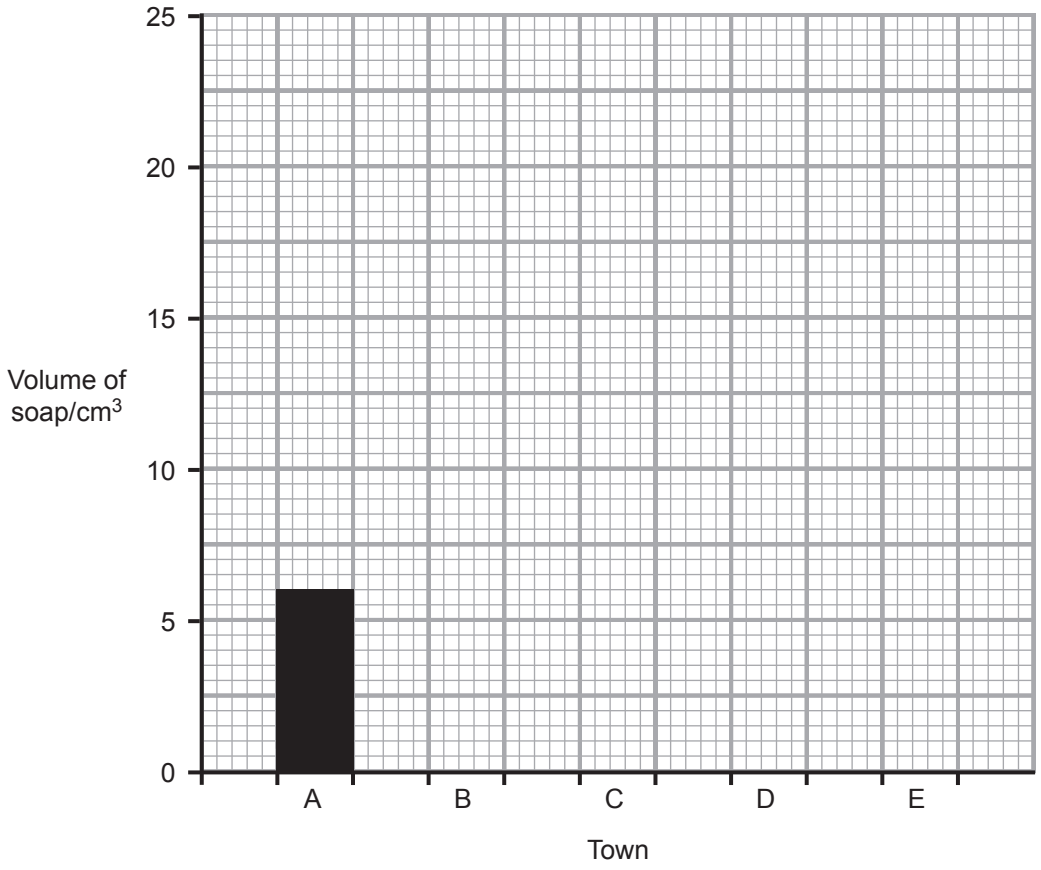
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 **(a)** A scientist collected water samples from five towns (**A**, **B**, **C**, **D** and **E**). The table below gives the volume of soap solution needed to produce a lather with each of the samples.

Town	Volume of water/ cm^3	Volume of soap/ cm^3
A	50	6
B	50	17
C	50	24
D	50	20
E	50	11

(i) Use the information in the table to complete the bar chart below.



[2]

(ii) Which town (**A**, **B**, **C**, **D** or **E**) has the hardest water? Explain your answer.

Town _____

Explanation _____

_____ [2]

(iii) Scientists found that they needed 11 cm^3 of soap to produce a lather after shaking the water sample from **town E**.
Describe how they could continue their investigation to prove that the water is temporary hard water. Make sure you include how the results should show this.

_____

_____

_____

_____

_____ [3]

(b) **(i)** Write down the name of **two** metal ions that cause hard water.

_____ and _____ [2]

(ii) Hard water has a better taste. Write down **one** other advantage of drinking hard water.

_____ [1]

(c) Hard water can cause undesirable deposits (fur) in kettles.

(i) Complete the word equation to show how these undesirable deposits form in kettles.

calcium hydrogencarbonate	→		+		+	

[3]

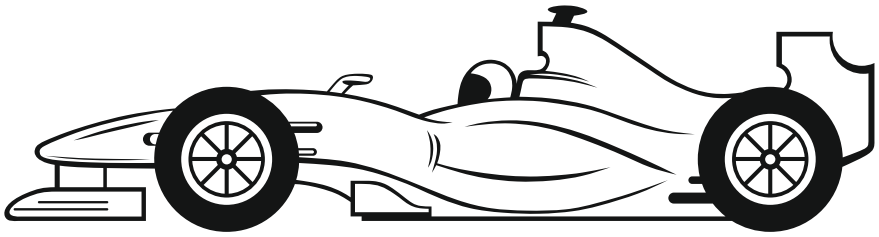
(ii) Write down **one** reason why these deposits cause problems in kettles.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 The first racing cars were built using aluminium. Around 1990 this was replaced with glass fibre, a composite material.



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Explain why the makers of modern Formula One cars choose glass fibre instead of aluminium to make the car bodies.

Your answer should include:

- a full explanation of what a composite material is
- the advantages of using glass fibre in Formula One car bodies
- a disadvantage of glass fibre.

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

[6]

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(Questions continue overleaf)

4 Below there is information about the reactions of some metals.

Metal	**Reaction with water**	**Reaction with hot water or steam**	**Reaction with air (when heated)**
Zinc	No reaction	Reacts slowly giving off a gas	Burns slowly to form a white powder
Magnesium	Very slow reaction	Reacts readily giving off a gas	Burns with a bright white light
Potassium	Violent reaction. It floats on the water surface, burning with a coloured flame	Extremely violent reaction. Burns with a coloured flame	Burns violently with a coloured flame
Copper	No reaction	No reaction	Reacts very slowly
Lead	No reaction	Reacts very slowly	Reacts slowly

Examiner Only	
Marks	Remark

(a) Use the information to put the metals in order of decreasing reactivity. The first one has been done for you.

Potassium

_____

_____

_____

_____

_____

[2]

(b) What colour is the flame produced by potassium in water?

_____ [1]

(c) Why do you think the reaction of potassium with hot water is not normally carried out in schools?

_____

_____ [1]

(d) Complete the word equation for the reaction of potassium with water.

potassium + water → [ ] + [ ]

[2]

(e) Choose a metal from the table opposite that would be most suitable for making water pipes in houses. Explain your answer.

_____

_____

_____ [2]

(f) Recent nanotechnology research has found that nano-sized particles of copper can be used to remove bacteria from drinking water. Explain fully what is meant by the term 'nanotechnology'.

_____

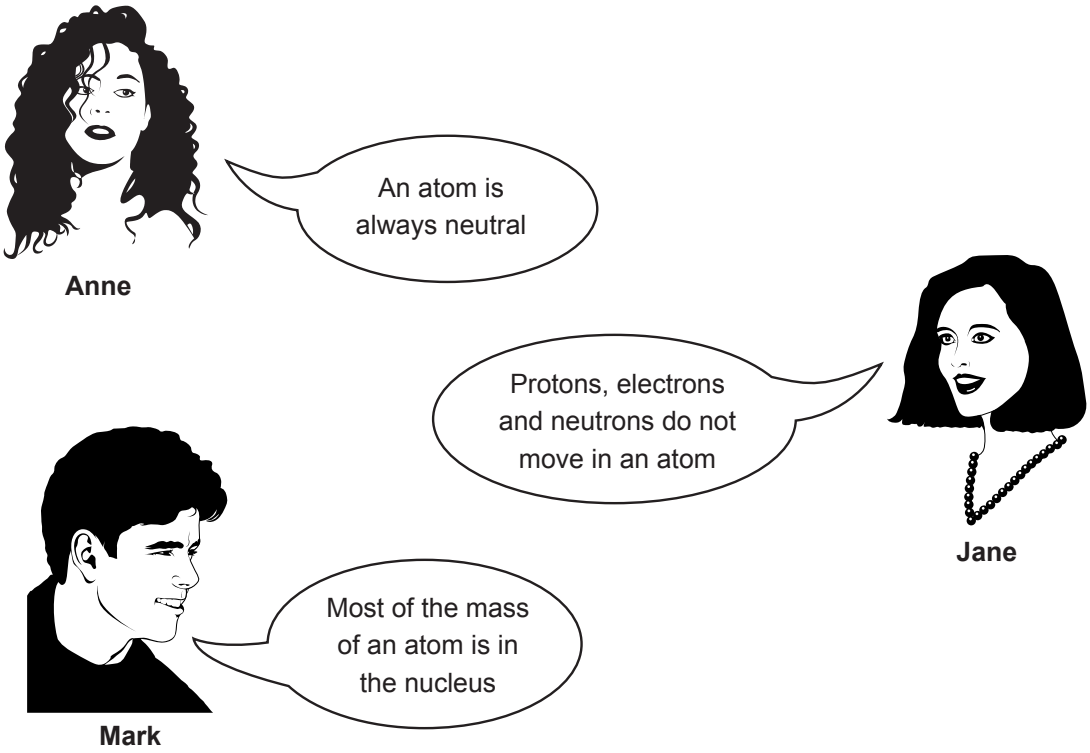
_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 Below there are three statements made by pupils in a class discussion about atoms. However, **one** of these statements is incorrect.



Write down the name of the pupil who gave the **incorrect** statement.
Explain why this statement is incorrect.

_____

_____

_____

_____ [2]

BLANK PAGE

(Questions continue overleaf)

6 Below is information about some gases that can pollute the atmosphere.

Examiner Only	
Marks	Remark

Gas	Formula	Lifetime in upper atmosphere /years	Contribution to greenhouse effect/%	Source of gas
Carbon dioxide	CO_2	7	50	Burning fossil fuels
CFC	CF_2Cl_2	100	14	Coolants in fridges
Methane	CH_4	10	18	Breakdown of organic waste Cows
Nitrous oxide	N_2O	170	6	Fertilisers Exhaust fumes Burning fossil fuels

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

(a) Write down the name of the gas that is a hydrocarbon.

_____ [1]

(b) Write down the name of the gas that contains three elements.

_____ [1]

(c) Write down the name of the gas(es) with five atoms in their formula.

_____ [1]

(d) Governments have made targets to reduce the greenhouse effect over the next twenty years.
Explain why using less fossil fuels would be the best way to reduce the greenhouse effect.
Use the table to help you answer this question.

_____

_____

_____

_____ [2]

(e) Methane burns to produce carbon dioxide. Complete the balanced symbol equation for the burning of methane.

CH_4 + ☐ → CO_2 + ☐

[3]

Examiner Only	
Marks	Remark

7 Below are the symbol equations for some chemical reactions.

Examiner Only	
Marks	Remark

A $HCl + NaOH \rightarrow NaCl + H_2O$

B $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$

C $CuO + H_2 \rightarrow Cu + H_2O$

D $2Mg + O_2 \rightarrow 2MgO$

(a) Which reaction (**A**, **B**, **C** or **D**) represents a displacement reaction?

_____ [1]

(b) Which reaction (**A**, **B**, **C** or **D**) represents a neutralisation reaction? Explain your answer.

_____

_____ [2]

(c) One of these reactions represents reduction. Explain what is meant by 'reduction'.

_____

_____ [1]

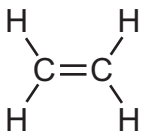
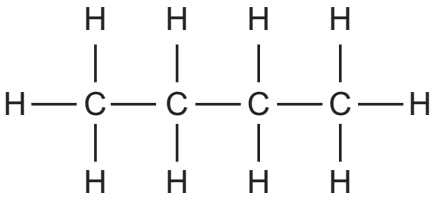
8 The compounds below are all hydrocarbons.

butane **ethane** **propene** **propane**

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

_____ [1]

(b) The table below is about some hydrocarbons.
Fill in the missing answers.

Name of hydrocarbon	Molecular formula	Structural formula
propane	C_3H_8	
ethene		
	C_4H_{10}	

[3]

(c) Propene can undergo polymerisation to form polypropene. Explain what is meant by 'polymerisation'.

_____

_____ [2]

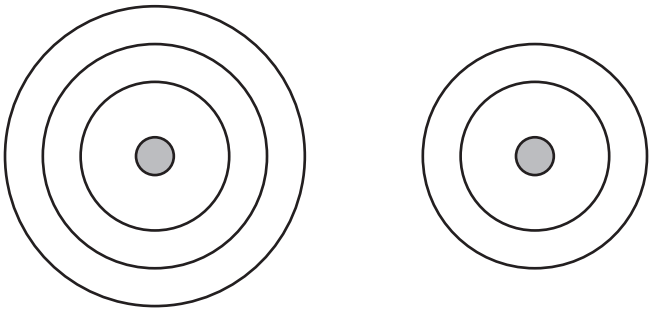
Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 **(a)** Magnesium can react with oxygen to produce magnesium oxide.

(i) Complete the diagrams below to show the electronic structures of magnesium and oxygen.

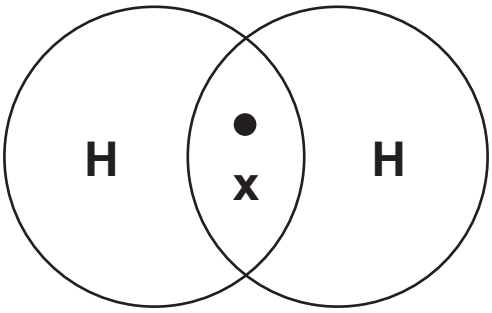


Magnesium Oxygen

[2]

(ii) Draw arrows on the diagrams above to show how electrons are transferred when these atoms combine to form magnesium oxide. [2]

(b) Below is a diagram of a hydrogen molecule.



In terms of electrons, describe the bonding in a molecule of hydrogen.

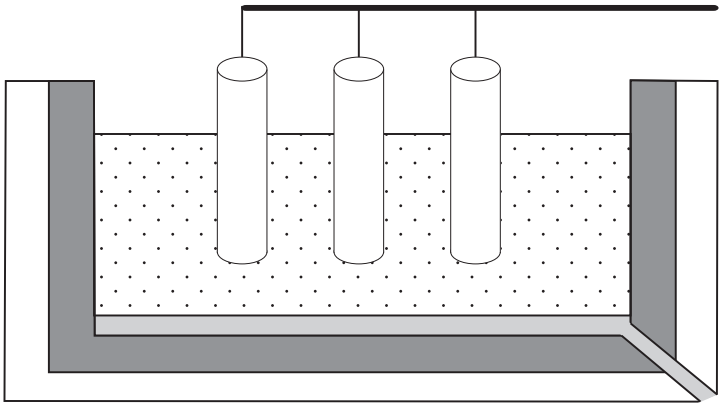
_____

_____

_____ [2]

10 Aluminium can be extracted from aluminium oxide using electrolysis.

Examiner Only	
Marks	Remark



(a) Label the anode and cathode.
Do this on the diagram above. [2]

(b) What is meant by 'electrolysis'?

_____

_____ [2]

(c) Aluminium is produced at the cathode. Complete the ionic equation for this reaction.

_____ + _____ → Al

[2]

(d) Write down the name of the gas produced at the anode.

_____ [1]

Examiner Only	
Marks	Remark

11 The **Greeks** were the first people to have the idea of elements. Early work on the Periodic Table began in the 19th Century by an English chemist called **John Newlands**. It was further improved by a Russian chemist called **Dmitri Mendeleev**.

Write about the development of the modern Periodic Table. Start with the early ideas of the Greeks.

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

[6]

THIS IS THE END OF THE QUESTION PAPER

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