Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 2 (Chemistry)
Higher Tier

GSS22

[GSS22]

THURSDAY 12 NOVEMBER 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 nine** questions.

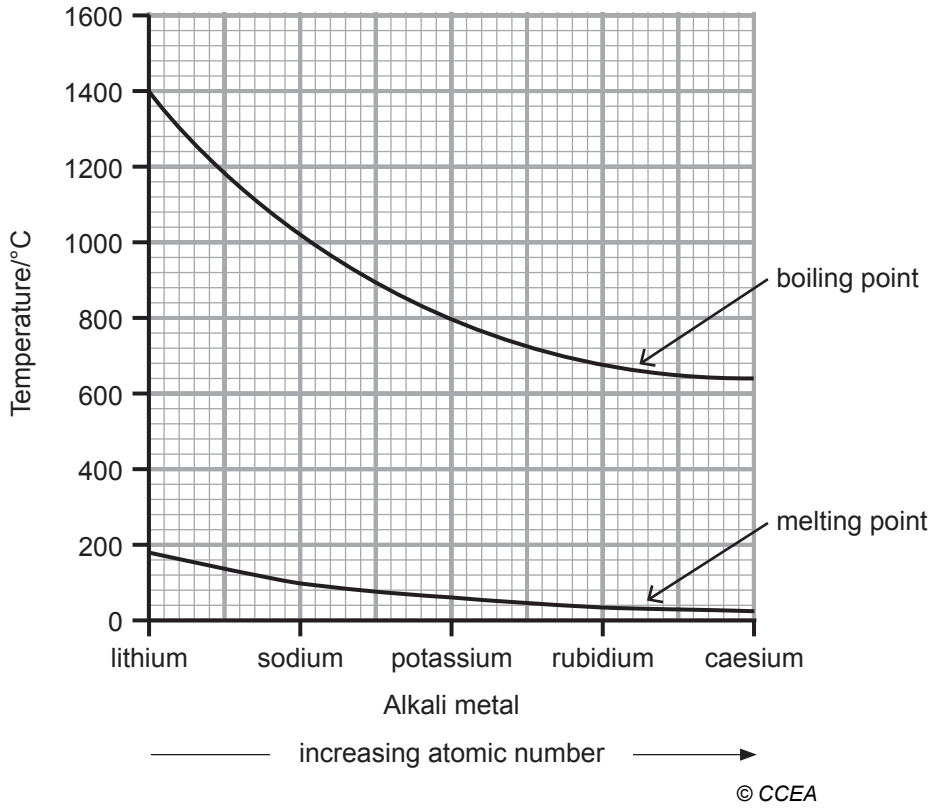
INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Quality of written communication will be assessed in Questions **2** and **9(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	
Total Marks	

Examiner Only	
Marks	Remark

1 Information about the melting and boiling points of some Group 1 (alkali) metals is shown below.



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

(a) Complete the following sentence to describe the trend in boiling points of the alkali metals.

As the atomic number of the alkali metals _____

_____ [1]

(b) Francium is below caesium in Group 1 of the Periodic Table. Predict the boiling point of francium.

_____ °C [1]

(c) Choose the metal with the biggest difference between its melting point and its boiling point. Calculate the temperature difference between its melting point and its boiling point.

(Show your working out.)

_____ °C [2]

Examiner Only	
Marks	Remark

(d) Name the gas formed when the alkali metals react with water.

_____ [1]

(e) Potassium reacts vigorously with water. Describe how you would expect lithium to react with water compared to potassium.

_____

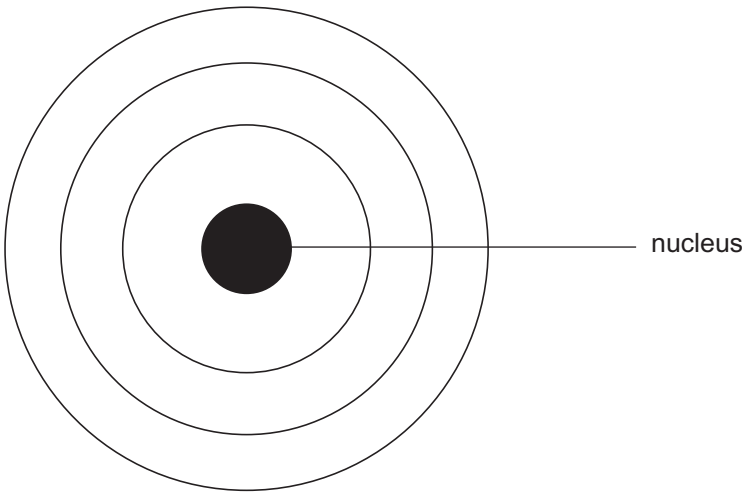
_____ [1]

(f) Apart from wearing safety goggles, state **two** safety precautions needed when adding potassium to water.

1. _____

2. _____ [2]

(g) **(i)** A sodium atom has 11 electrons. Complete the diagram below to show how the electrons are arranged in a sodium atom.



[1]

(ii) In terms of the arrangement of electrons, state why sodium and other alkali metals are placed in Group 1 of the Periodic Table.

_____

_____ [1]

2 Describe the process of a volcanic eruption.

Your answer should include:

- why volcanoes occur
- the effect on surrounding areas
- the type of rock produced after an eruption.

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

[6]

Examiner Only	
Marks	Remark

3 The table below gives information about some plastics.

Plastic	Properties	Colours available	Cost
PVC	hard, keeps its shape, weather resistant	wide range of colours	medium
nylon	hard, long lasting	white or cream	high
polythene	soft, flexible, good electrical insulator	wide range of colours but they fade easily	medium
plasticised PVC	soft, flexible, good electrical insulator	wide range of colours	medium
polystyrene	does not keep its shape, good heat insulator	white	low
acrylic	stiff, weather resistant, good electrical insulator	wide range of colours	high

Use the information in the table to answer the questions below.

Examiner Only	
Marks	Remark

(a) Which **two** plastics could be best used for covering electrical cables?

_____ and _____ [1]

(b) A manufacturer is going to produce cheap, green buckets to sell at large DIY stores.

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Which plastic should the manufacturer choose? Give **two** reasons for your choice.

_____

_____

_____ [3]

(c) Give **one** reason why polystyrene is **not** used to make garden chairs. Explain your answer.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

4 Given below is information about the reactions of some metals with their metal salt solutions.

	Tin sulfate	**Zinc sulfate**	**Copper sulfate**	**Magnesium sulfate**
Tin		no reaction	reaction	no reaction
Zinc	reaction		reaction	no reaction
Copper	no reaction	no reaction		no reaction
Magnesium	reaction	reaction	reaction	

(a) Use the information to put the metals in order of decreasing reactivity.

_____ most reactive

_____

_____

_____ least reactive [2]

(b) (i) Complete the word equation for the reaction between tin and copper sulfate.

copper sulfate	+	tin	→		+	

[2]

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

_____ [1]

(c) Using lines, match each metal reaction with **one** expected observation.

Metal reaction	Expected observation
zinc + copper sulfate	bubbles of gas
	blue solution fades
magnesium + acid	silver coloured solid forms
	solution turns milky

[2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

5 **(a)** The table below gives information about the structure of four elements **A**, **B**, **C** and **D**.

Element	Number of protons	Number of electrons	Number of neutrons
A	4	4	5
B	9	9	10
C	15	15	16
D	12	12	12

You may find your Data Leaflet helpful.

(i) Name the element labelled **C** above.

_____ [1]

(ii) Which element (**A**, **B**, **C** or **D**) has 7 electrons in its outer shell?

_____ [1]

(iii) Which **two** elements (**A**, **B**, **C** or **D**) are in the same Group of the Periodic Table?

_____ and _____ [1]

(iv) Calculate the mass number of element **A**.

_____ [1]

(v) Which element (**A**, **B**, **C** or **D**) is a halogen?

_____ [1]

(b) The Greeks were the first to recognise the idea of elements.
Name **two** elements the Greeks used.

_____ and _____ [2]

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(Questions continue overleaf)

6 Shown below are parts of labels from two mineral water bottles, **A** and **B**.

Examiner Only	
Marks	Remark

Ions present	Composition/ mg/dm^3
calcium	78.0
magnesium	24.0
potassium	1.0
sodium	5.0
chloride	4.5
hydrogencarbonate	329.0
nitrate	2.8
sulfate	8.0
pH = 7.2	

Water A

Ions present	Composition/ mg/dm^3
calcium	24.5
magnesium	8.5
potassium	0.4
sodium	5.7
chloride	9.0
hydrogencarbonate	260.0
nitrate	3.5
sulfate	9.0
pH = 7.8	

Water B

(a) How many different metal ions are present in mineral water **A**?

_____ [1]

(b) A student carried out an investigation using soap solution to see if the mineral waters were hard water.

(i) How would the student know from this investigation if the water was hard?

_____

_____ [1]

(ii) His teacher suggested that he also tested pure distilled water for hardness. Suggest why the student's teacher thought this was important.

_____

_____ [1]

Examiner Only

Marks	Remark

(iii) Which mineral water (**A** or **B**) would you expect to be the hardest? Explain your choice.

_____

_____ [1]

(iv) How could the student accurately check the pH of the water?

_____ [1]

(c) Apart from taste, give **one** advantage of drinking hard water.

_____ [1]

(d) One disadvantage of living in a hard water area is the build-up of 'fur' on the inside of kettles. What is the chemical name for kettle 'fur'?

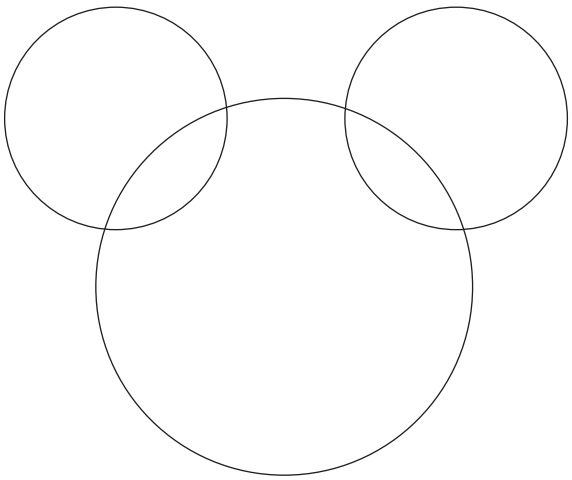
_____ [1]

(e) Give **two** methods of softening permanent hard water.

1. _____

2. _____ [2]

(f) Water has the formula H_2O. Complete the diagram for the bonding in water, showing only the outer electrons.
Label the oxygen and hydrogen atoms.



[3]

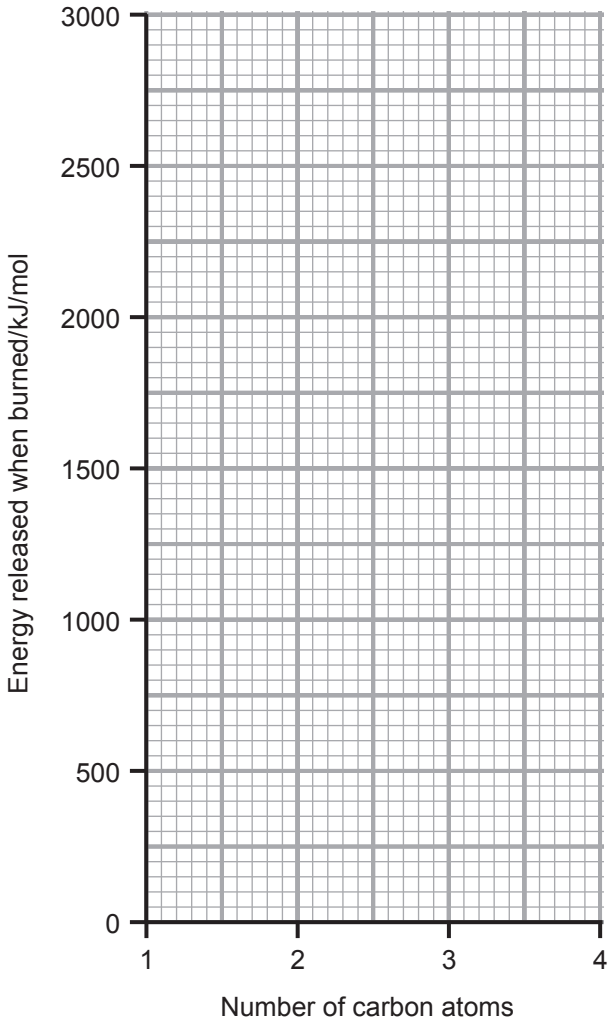
Examiner Only

Marks	Remark

7 **(a)** The table below shows information about the energy released when some alkanes burn.

Alkane	Number of carbon atoms	Energy released when burned/kJ/mol
methane	1	900
ethane	2	1550
propane	3	2200
butane	4	2850

(i) On the grid below draw a line graph to show this information.



[3]

(ii) Pentane is an alkane with five carbon atoms. Predict the energy released when pentane is burned.

_____ kJ/mol [1]

(b) In the space below draw the structural formula for ethane (C_2H_6).

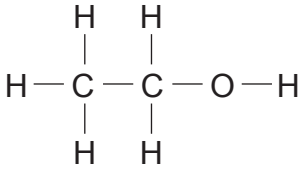
[1]

(c) Complete the balanced symbol equation for the burning of methane.

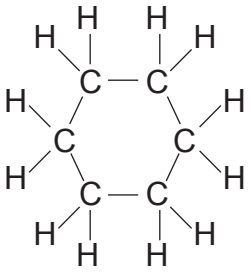
$$CH_4 \quad + \quad O_2 \quad \rightarrow$$

[3]

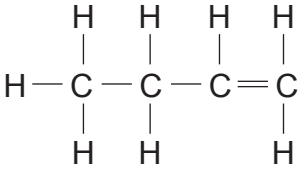
(d) Below are the structures of some organic compounds.



A



B



C

(i) Which compound (**A**, **B** or **C**) has the formula C_4H_8?

_____ [1]

(ii) Which compound (**A**, **B** or **C**) is **not** a hydrocarbon? Explain your answer fully.

_____

_____

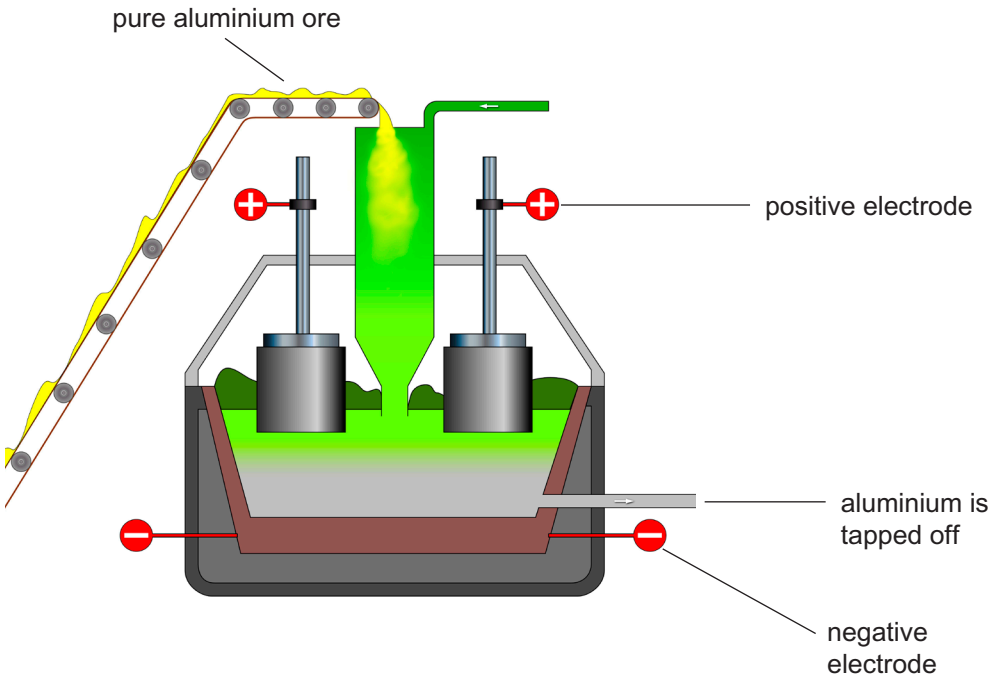
_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

8 Electrolysis can be used to extract aluminium from its ore on a large scale using the process shown below.



(a) What is meant by the term 'electrolysis'?

_____

_____ [2]

(b) What is the chemical name for pure aluminium ore?

_____ [1]

(c) **(i)** What name is given to the negative electrode?

_____ [1]

(ii) Explain in terms of ions and electrons how aluminium is formed at the negative electrode.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

9 **(a)** Explain the cause of indigestion and describe how sodium hydrogencarbonate can cure it.

Your answer should also include the names of the products formed in this process.

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 thermal decomposition of sodium hydrogencarbonate.

[3]

THIS IS THE END OF THE QUESTION PAPER

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