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 28 FEBRUARY 2012
11.00 am–12.15 pm

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 eight** questions.

INFORMATION FOR CANDIDATES

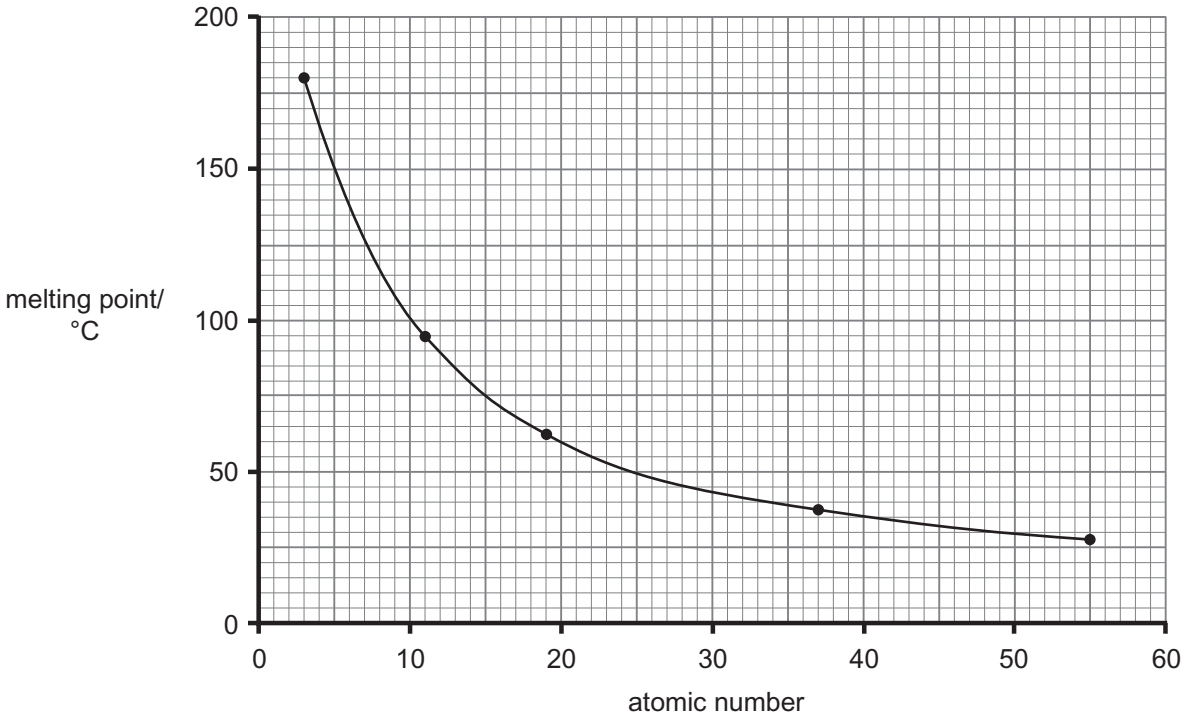
The total mark for this paper is 75.
Quality of written communication will be assessed in questions **2(d)** and **5(b)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet, which includes a Periodic Table of the elements, is provided for your use.

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

Examiner Only	
Marks	Remark

1 The graph below shows the relationship between the melting point and atomic number of five elements.

The five elements are all from the same group of the Periodic Table.



You may find your Data Leaflet helpful to answer the questions below.

(a) (i) What is the atomic number of the element with the highest melting point?

_____ [1]

(ii) Name this element. _____ [1]

(b) (i) What is the melting point of the element with atomic number 37?

_____ °C [1]

(ii) Name this element. _____ [1]

(c) To which group of the Periodic Table do these elements belong?

Group _____ [1]

(d) Describe fully the trend shown by the graph.

Examiner Only

Marks	Remark

_____

_____ [2]

(e) The table below lists some information about the elements called halogens. At the melting point an element changes from a solid to a liquid. At the boiling point an element changes from a liquid to a gas.

Element	Melting point/ °C	Boiling point/ °C	Mass number
Fluorine	−220	−188	19
Chlorine	−101	−35	36
Bromine	−7	59	80
Iodine	113	183	127

(i) Name the element in the table which has the lowest melting point.

_____ [1]

(ii) Name the halogen which is a **liquid** at room temperature (20 °C).

_____ [1]

(iii) Complete the following sentence to describe a trend shown by the results.

As the boiling point of the elements _____

the mass number _____. [1]

Examiner Only	
Marks	Remark

2 Mineral water contains many different ions which give it a characteristic taste. The table below gives the information shown on the label of a popular brand of mineral water.

Ions present	Concentration/arbitrary units
Magnesium	18
Potassium	3
Calcium	113
Sodium	17
Chloride	32
Hydrogencarbonate	430
Nitrate	11
Phosphate	1
Sulfate	2

(a) (i) Using the information in the table, calculate the total concentration of the ions causing this mineral water to be hard.
(Show your working out.)

_____ arbitrary units [2]

(ii) Name the ion in the table which would be thermally decomposed if the water was boiled.

_____ [1]

Examiner Only	
Marks	Remark

(b) Hard water can cause undesirable deposits of calcium carbonate, called 'fur', in kettles.

Complete the word equation to show how the 'fur' forms in kettles.

[ ] → calcium carbonate + [ ] + [ ]

[3]

(c) Explain what is meant by the term **hard water**.

[2]

(d) Describe an experiment you could carry out in the laboratory to compare the hardness of bottled water to the hardness of the tap water in your school.

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

[6]

(e) Give **one** advantage of drinking hard water.

[1]

Examiner Only	
Marks	Remark

3 **(a)** Aluminium sulfate has the chemical formula $Al_2(SO_4)_3$.

(i) How many different elements are present in this formula?

_____ [1]

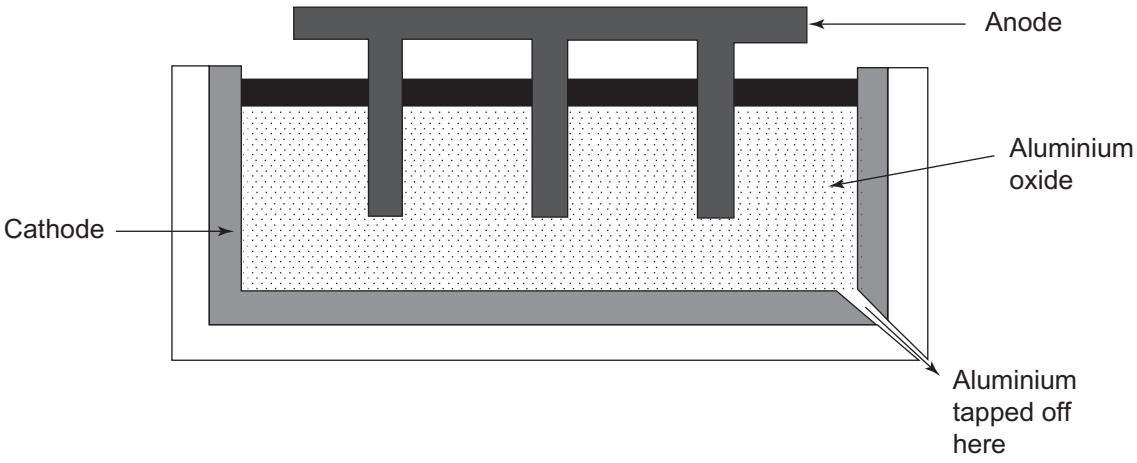
(ii) How many oxygen atoms are there in this formula?

_____ [1]

(iii) What is the total number of atoms in this formula?

_____ [1]

Aluminium metal is produced by passing electricity through a cell containing molten aluminium oxide.



(b) Describe how the aluminium is extracted from the aluminium oxide by completing the following sentences.

In this extraction process the cathode is _____ charged

and is made of _____ . The aluminium ions travel to the

_____ where they are discharged and form

_____ metal. Oxide ions travel to the _____

where they form _____ gas. [6]

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

4 The properties of four metals are shown in the table below.

Metal	Density/ g/cm^3	Relative strength	Melting point/ °C	Relative electrical conductivity	Cost per tonne/£
Iron	7.9	1.0	1535	1.0	130
Aluminium	2.7	0.3	660	3.7	950
Copper	8.9	0.6	1083	5.8	3100
Silver	10.5	0.4	962	6.1	250 000

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

(i) Explain fully why the properties of aluminium make it more suitable than copper for use in overhead electrical cables in the National Grid.

_____

_____

_____ [3]

(ii) Explain why iron is used to make bridges.

_____

_____ [2]

(b) The table below gives some information about materials A, B, C and D. These could be metals, metal compounds or non-metals.

Metal compounds can only conduct electricity in the liquid state.

Material	Electrical conductivity in solid state	Electrical conductivity in liquid state	Melting point/ °C
A	Poor	Poor	3550
B	Good	Good	327
C	Poor	Good	808
D	Good	Good	1540

Use this information to answer the following questions.

(i) Which material (A, B, C or D) is a metal with a low melting point?

_____ [1]

(ii) Which material (A, B, C or D) is a metal compound?

_____ [1]

(iii) Which material (A, B, C or D) is a non-metal?

_____ [1]

(c) Silver is used in sterilising sprays and wound dressings.

The silver has to be specially prepared to give it new properties for these specialised uses. Fully describe the silver particles that are used in sterilising sprays.

_____

_____ [2]

(d) Some newly developed materials are described as smart materials.

Explain fully what is meant by the term 'smart material'.

_____

_____ [2]

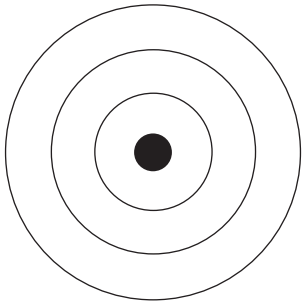
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 Sodium reacts with chlorine to form the compound sodium chloride.

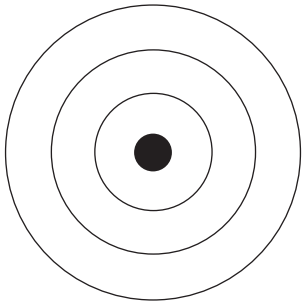
(a) Complete the diagrams below to show the arrangement of **all** of the electrons in a sodium atom and a chlorine atom.

(i) Sodium atom



[1]

(ii) Chlorine atom



[1]

(b) Explain fully in terms of the ions and atoms involved, how the electron arrangement changes when sodium chloride is formed from sodium and chlorine.

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

[6]

6 **(a)** Explain fully how Archbishop Ussher used the Bible to estimate the age of the Earth.

_____

_____

_____

_____ [2]

(b) What is the age of the Earth estimated by Ussher?

_____ [1]

(c) Some rocks contain fossils. These can help scientists in estimating the age of the Earth.

Explain fully what is meant by the term fossil.

_____

_____ [2]

(d) The modern scientific method for estimating the age of the Earth suggests that the Earth is very much older than Ussher's estimate.

Explain fully how the modern scientific method works.

_____

_____

_____

_____

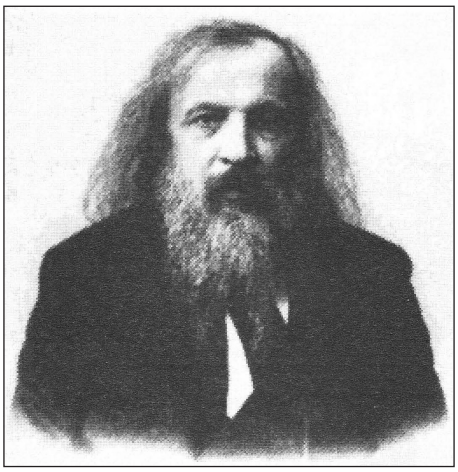
_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 The Periodic Table has been developed over a period of time.

Dimitri Mendeleev was one of the chemists who helped to do this.



The Greeks were the first to attempt to classify the elements. They had just four elements.

John Newlands noticed a repeating pattern and he tried to put the chemical elements into a table.

Mendeleev developed the idea of a table further and left some gaps in between the elements.

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

You may find your Data Leaflet helpful.

(a) Name the four elements known to the Greeks.

_____ [1]

(b) What was the repeating pattern noticed by John Newlands?

_____

_____ [1]

(c) **(i)** In what order did Mendeleev arrange the elements?

_____ [1]

(ii) Why did he leave gaps between some of the elements?

_____ [1]

(d) The modern Periodic Table is still very like the one produced by Mendeleev. However much more is now known about the structure of atoms.

How does the modern Periodic Table take account of what is now known about the structure of the atom?

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

8 The following chemical compounds are important hydrocarbons.

methane : ethane : propane : ethene : butane

(a) (i) Which one of these compounds is **not** an alkane?

_____ [1]

(ii) Propane has the molecular formula C_3H_8.

In the space below draw the **structural** formula of propane.

[1]

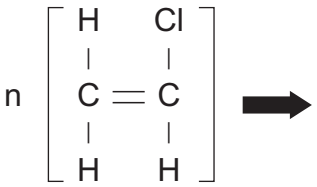
(iii) Give the molecular formula for:

1. butane _____

2. ethene _____ [2]

(b) Vinyl chloride can be polymerised to form the well known polymer PVC.

In the space below, complete the balanced symbol equation for the formation of PVC.



[3]

THIS IS THE END OF THE QUESTION PAPER