



Centre Number

71

Candidate Number

General Certificate of Secondary Education
2013–2014

Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]

ML

THURSDAY 14 NOVEMBER 2013, MORNING

TIME

1 hour, 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 six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question 5.
A Data Leaflet which includes a Periodic Table of the Elements is provided.

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

Total Marks	
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1 The balanced symbol equation below includes state symbols.



Look at the equation carefully. Then answer the questions.

(a) Write down the name of the product which is dissolved in water.

_____ [1]

(b) Write down the name of the solid reactant.

_____ [1]

(c) What two observations can be made when the reactants are added together?

1. _____ [1]

2. _____ [1]

(d) Fill in the table below so that it gives information about the elements present in a substance which has the formula K_2CO_3 .

Name of element	Number of atoms of the element in the formula

[3]

Examiner Only

Marks Remark

2 By the 1860s chemists had discovered about 60 elements and were attempting to organise them by looking for patterns. Today, over 100 elements are known and they are arranged in a particular way in the modern Periodic Table.

(a) What does the word element mean?

_____ [1]

(b) One pattern that was developed was called “The Law of Octaves”.

(i) Write down the name of the chemist who developed “The Law of Octaves”.

_____ [1]

(ii) Fill in the missing words in the sentence to explain what is meant by “The Law of Octaves”.

When elements are arranged in order of their _____
every eighth element has _____ [2]

(c) In what order are the elements arranged in the modern Periodic Table?

_____ [1]

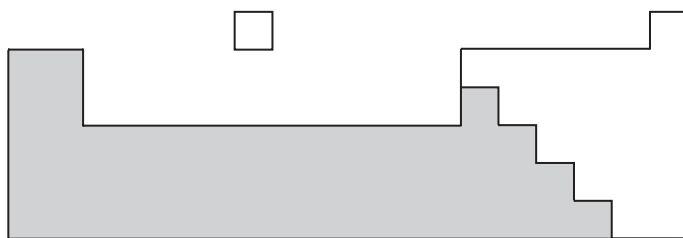
(d) What names are given to the rows and columns of elements in the modern Periodic Table?

(i) rows _____ [1]

(ii) columns _____ [1]

Examiner Only	
Marks	Remark

- (e) The diagram below shows an outline of part of the modern Periodic Table with a shaded area.



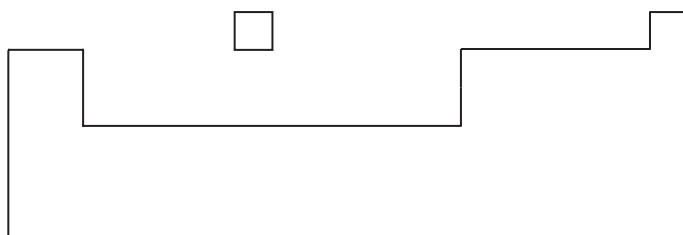
The elements in the shaded area in the diagram have similar physical properties. Write down two physical properties of the elements in this area.

1. _____ [1]

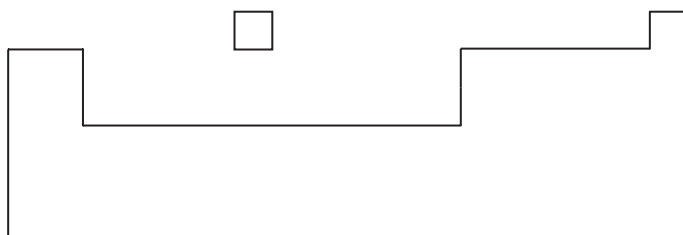
2. _____ [1]

- (f) On the outlines of the Periodic Tables below:

- (i) Shade in the area where the halogens can be found.



- (ii) Shade in the area where the alkaline earth metals can be found.



[2]

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Marks Remark

3 Carbon-12 ($^{12}_6\text{C}$) atoms have 6 electrons, 6 protons and 6 neutrons.

(a) Fill in the table to show the relative charge and mass of the different particles found in an atom.

Particle	Relative charge	Relative mass
electron		
proton		
neutron		

[3]

(b) Carbon-14 ($^{14}_6\text{C}$) and carbon-12 ($^{12}_6\text{C}$) are isotopes of carbon.

Compare, in terms of the particles in the atoms, an atom of carbon-14 ($^{14}_6\text{C}$) with an atom of carbon-12 ($^{12}_6\text{C}$).

[3]

(c) Methane and carbon dioxide are molecules which contain carbon.

(i) What does the word **molecule** mean?

[2]

(ii) Draw a dot and cross diagram of a molecule of methane (CH_4). Show the outer electrons only.

[2]

Examiner Only

Marks Remark

(iii) Draw a dot and cross diagram of a molecule of carbon dioxide (CO₂). Show the outer electrons only.

[3]

(iv) Label a lone pair of electrons on your diagram of the molecule of carbon dioxide. [1]

(v) Write down two typical physical properties of molecules such as methane and carbon dioxide.

1. _____ [1]

2. _____ [1]

(d) When carbon dioxide dissolves in water it forms carbonic acid, H₂CO₃ with a pH range of 4–5.

(i) What is the formula of the ion which is present in all acids?

_____ [1]

(ii) Why is carbonic acid described as a weak acid?

_____ [1]

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Marks

Remark

4 Aluminium is produced on an industrial scale by the electrolysis of aluminium oxide.

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Marks Remark

(a) A mixture of aluminium oxide and substance X is melted at the start of the process. The mixture has a lower melting point than the pure aluminium oxide.

(i) Balance the symbol equation below which describes the production of aluminium from aluminium oxide.



(ii) What does the word electrolysis mean?

_____ [2]

Substance X lowers the melting point of aluminium oxide.

(iii) What is the name of substance X?

_____ [1]

(iv) Write down one other reason why substance X is added to the aluminium oxide.

_____ [1]

(b) As the process continues aluminium ions move to the cathode.

(i) Draw a diagram showing the electronic structure of the aluminium **ion** and give the charge.

[2]

(ii) Why do the aluminium ions move to the cathode?

_____ [2]

(iii) Explain, **in words**, what happens to the aluminium ions at the cathode.

_____ [3]

(c) The **structure** of aluminium metal can be described as a regular arrangement of aluminium ions surrounded by a sea of delocalised electrons.

(i) Describe the **metallic bonding** in a sample of aluminium metal.

_____ [1]

(ii) Explain, in terms of its **structure**, why aluminium can be drawn into thin wires i.e. is ductile.

_____ [3]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

6 Displacement reactions of the halogens can be used to work out a reactivity series for the elements in Group 7.

(a) Explain what is meant by a displacement reaction.

_____ [1]

(b) A pupil investigated the trend in reactivity within Group 7 (bromine, chlorine and iodine).

Firstly, a small amount of chlorine solution was added to potassium bromide solution in a test tube and the mixture was shaken.

The solution in the test tube turned an orange-brown colour showing that a reaction had taken place.

The investigation was continued by mixing different halogen solutions with different halide solutions, e.g. iodine solution with potassium chloride.

The results are shown in the table below:

	potassium bromide solution	potassium chloride solution	potassium iodide solution
bromine solution		no reaction	reaction
chlorine solution	reaction		reaction
iodine solution	no reaction	no reaction	

(i) Why does the solution turn orange-brown when chlorine solution is mixed with potassium bromide solution?

_____ [1]

(ii) Which of the three halogens, bromine, chlorine or iodine, is the most reactive? Use the results in the table to help you answer this question.

_____ [1]

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Marks

Remark

(iii) Based on the trend in reactivity found in the investigation, predict the reactivity of fluorine. Then put the **four** halogens, bromine, chlorine, iodine and fluorine in order of reactivity, with the most reactive first.

[2]

(c) Explain, in terms of their electronic configuration, why the halogens have similar chemical properties.

[2]

(d) Iodine is a flaky dark grey solid which does not conduct electricity and which sublimes easily when warmed.
Look at the four types of structure given below. Then put a tick (✓) beside the structure which is most likely to represent solid iodine.

For **each** of the other three structure types write down one reason why it is not correct for solid iodine.

ionic lattice _____
_____ [1]

molecular covalent _____
_____ [1]

giant covalent _____
_____ [1]

metallic _____
_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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