



ADVANCED SUBSIDIARY GCE
CHEMISTRY
 Foundation Chemistry

2811/01

Candidates answer on the question paper

OCR Supplied Materials:

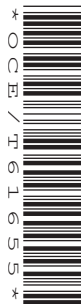
- *Data Sheet for Chemistry* (inserted)

Other Materials Required:

- Scientific calculator

Wednesday 3 June 2009
Morning

Duration: 1 hour



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use a scientific calculator.
- A copy of the *Data Sheet for Chemistry* is provided as an insert with this question paper.
- You are advised to show all the steps in any calculations.
- This document consists of **12** pages. Any blank pages are indicated.

FOR EXAMINER'S USE

Qu.	Max.	Mark
1	13	
2	14	
3	17	
4	16	
TOTAL	60	

Answer **all** the questions.

- 1 The element sulphur, S, has been known since ancient times and was originally named 'brimstone'.

(a) Sulphur exists as a mixture of four isotopes, ^{32}S , ^{33}S , ^{34}S and ^{36}S .

(i) What is meant by the term *isotopes*?

.....
 [1]

(ii) Complete the table below to show the composition of the ^{33}S and ^{34}S isotopes.

isotope	protons	neutrons	electrons
^{33}S			
^{34}S			

[2]

(b) A sample of sulphur was collected from a volcano. The relative atomic mass of the sulphur was determined.

(i) Define the term *relative atomic mass*.

.....

 [3]

(ii) The sample of sulphur had the following percentage composition by mass:

^{32}S , 94.93%; ^{33}S , 0.76%; ^{34}S , 4.29%; ^{36}S , 0.02%.

Calculate the relative atomic mass of the sample of sulphur.

Give your answer to **four** significant figures.

answer = [2]

(iii) What instrument is used to determine the isotopic abundances in sulphur?

..... [1]

(c) Sulphur also occurs naturally in sulphates. Gypsum is a common sulphate ore, containing mainly calcium sulphate as $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.

(i) What is meant by the ' $2\text{H}_2\text{O}$ ' in the formula $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$?

.....

..... [1]

(ii) What is the molar mass of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$?

answer = g mol^{-1} [1]

(iii) What is the oxidation number of sulphur in $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$?

..... [1]

(iv) State the formula and charge of the negative ion in $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.

..... [1]

[Total: 13]

2 Magnesium and aluminium are both metals in Period 3 of the Periodic Table.

(a) Magnesium forms compounds that have ionic bonding.

What is meant by the term *ionic bonding*?

.....
..... [1]

(b) Magnesium forms an ionic chloride, MgCl_2 .

(i) Draw a '*dot-and-cross*' diagram to show the bonding in MgCl_2 .

Show outer electron shells only.

[2]

(ii) Complete the electron configuration, in terms of sub-shells, for a chloride ion.

$1s^2$ [1]

(c) At room temperature, magnesium and aluminium both exist as solid lattices.

(i) In terms of the particles involved, explain how these solid lattices are held together.

.....
.....
.....
..... [2]

(ii) Aluminium has a higher melting point than magnesium.

Suggest why.

.....
.....
..... [1]

- (d) Cobalt and nickel are both metals in the d-block of the Periodic Table. Cobalt is placed before nickel despite having a greater relative atomic mass.

(i) State why Co is placed before Ni in the Periodic Table.

.....
 [1]

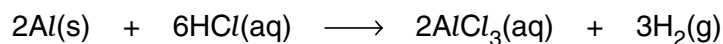
(ii) Suggest why Co has a greater relative atomic mass than Ni.

.....
 [1]

- (e) Aluminium reacts with acids, releasing hydrogen gas.

A student reacted 2.025 g of aluminium metal with an excess of 1.80 mol dm^{-3} hydrochloric acid, HCl.

The equation for this reaction is shown below.



(i) Calculate how many moles of Al reacted.

answer = mol [1]

(ii) Calculate the volume, in dm^3 , of $\text{H}_2\text{(g)}$ that formed from 2.025 g Al at room temperature and pressure, r.t.p.

1.00 mol of $\text{H}_2\text{(g)}$ has a volume of 24.0 dm^3 at r.t.p.

volume = dm^3 [2]

(iii) Calculate the volume, in cm^3 , of 1.80 mol dm^{-3} HCl that reacts exactly with 2.025 g of Al.

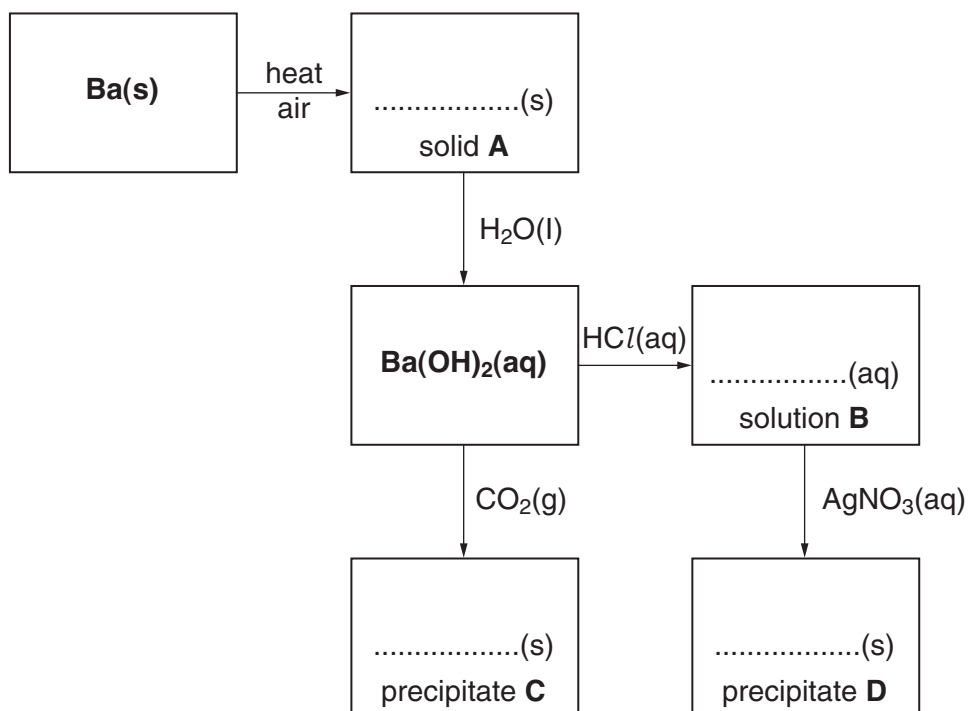
volume = cm^3 [2]

[Total: 14]
 Turn over

3 This question looks at reactions of Group 2 elements and their compounds.

(a) The flowchart below shows some reactions involving barium.

Write the **formulae** of substances **A–D** in the boxes.



[4]

(b) Barium forms a compound with carbon and oxygen with the following percentage composition by mass:

Ba, 60.89%; C, 10.67%; O, 28.44%.

Calculate the empirical formula of the compound.

[2]

- (c) The reactivity of the Group 2 elements increases down the group. Ionisation energy is one factor responsible for this trend.

(i) Write an equation, with state symbols, to represent the **first** ionisation energy of barium.

..... [2]

(ii) State and explain the trend in first ionisation energies in Group 2.

.....
.....
.....
.....
.....
..... [4]

- (d) The Group 2 elements become more reactive down the group.
The Group 7 elements become **less** reactive down the group.

(i) Explain this difference between Group 2 and Group 7.

.....
.....
.....
.....
.....
..... [3]

(ii) A student bubbled chlorine gas through a colourless aqueous solution of potassium iodide. The solution turned brown in colour.

Explain what has happened. Use an equation in your answer.

.....
.....
.....
.....
..... [2]

[Total: 17]

Turn over

4 In this question, one mark is available for the quality of spelling, punctuation and grammar.

Explain the following.

- Sodium atoms are larger than magnesium atoms. [3]
- Iodine has a low boiling point but diamond has a high boiling point. [5]
- Carbon dioxide, methane and water have molecules with different bond angles. [7]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

[15]

[Total: 16]

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