



General Certificate of Secondary Education  
2013

## Double Award Science: Chemistry

Unit C2

Higher Tier

[GSD52]



MONDAY 10 JUNE 2013, AFTERNOON

### 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 90.

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 Questions **2** and **5(a)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.



Centre Number

71

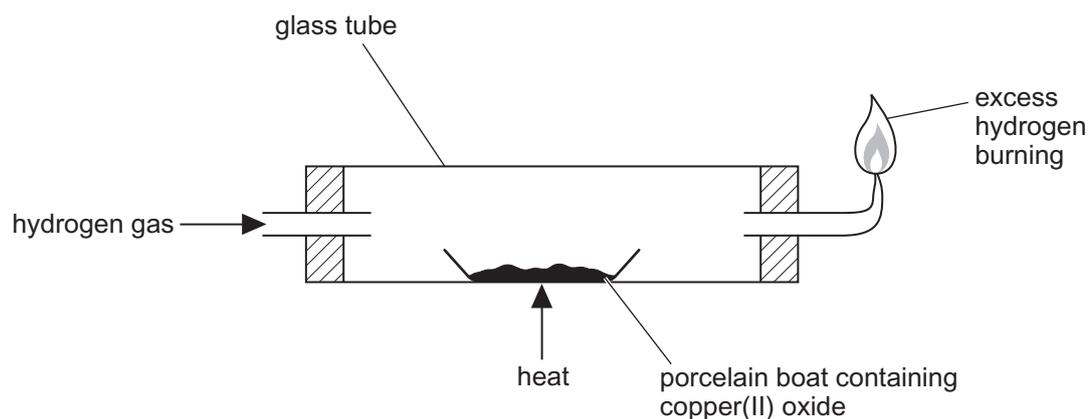
Candidate Number

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	

Total Marks

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- 1 The reaction between hydrogen gas and copper(II) oxide can be carried out using the apparatus shown below.



- (i) What colour change takes place during this reaction?

from \_\_\_\_\_ to \_\_\_\_\_ [2]

- (ii) Complete the word equation for the reaction.

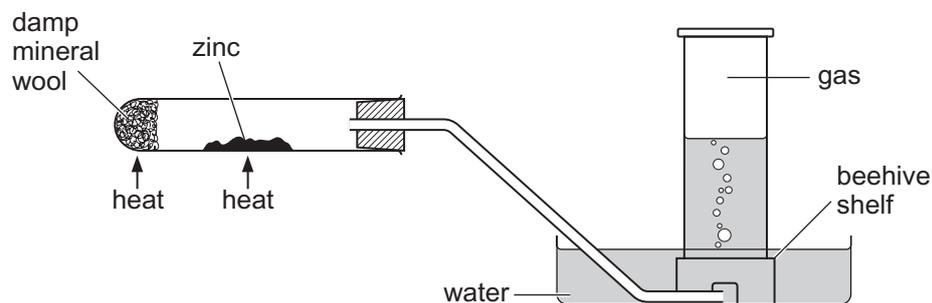


Examiner Only	
Marks	Remark



- 3 (a) Zinc does not react with cold water, but does react with steam.

The diagram below shows the apparatus used to react zinc with steam and to collect the gas produced.



- (i) What gas is produced when zinc reacts with steam?

\_\_\_\_\_ [1]

- (ii) Why is the damp mineral wool heated?

\_\_\_\_\_ [1]

- (iii) What colour is the solid product formed from zinc in this reaction?

\_\_\_\_\_ [1]

- (iv) Name a metal, other than zinc, which will react with steam but not with cold water.

\_\_\_\_\_ [1]

- (b) Magnesium is a Group 2 metal.

- (i) Give two observations made when magnesium is burned in air.

1. \_\_\_\_\_

2. \_\_\_\_\_ [2]

- (ii) Complete and balance the symbol equation for the reaction of magnesium with air.



[2]

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Marks Remark

4 This question is about carbon dioxide and the gases in the Earth's atmosphere.

- (a) The atmosphere contains about 0.04% carbon dioxide gas. Complete the table below by adding the two most abundant gases in the atmosphere and their approximate proportions.

Gas	Approximate proportion in the atmosphere
carbon dioxide	about 0.04%

[4]

- (b) The table below shows how the level of carbon dioxide in the Earth's atmosphere has changed over the last 150 years. The table also shows the change in average global temperature in the same time span.

Year	1750	1800	1850	1900	1950	2000
concentration of CO <sub>2</sub> in atmosphere/% by volume	0.027	0.028	0.029	0.030	0.032	0.037
average global temperature/°C	13.3	13.4	13.5	13.6	13.8	14.4

- (i) Use the information in the table to describe the pattern of change in carbon dioxide levels in the atmosphere between 1750 and 2000.

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[2]

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Marks Remark

(ii) What is the relationship between the level of carbon dioxide in the atmosphere and average global temperature?

\_\_\_\_\_  
\_\_\_\_\_ [1]

(iii) Give one reason for the changing amounts of carbon dioxide in the atmosphere.

\_\_\_\_\_  
\_\_\_\_\_ [1]

(iv) Give one way in which our planet is affected by global warming.

\_\_\_\_\_  
\_\_\_\_\_ [1]

(c) Carbon dioxide is used to make fizzy drinks and can be tested for in the laboratory using limewater solution.

(i) Give one physical property which makes carbon dioxide suitable for use in fizzy drinks.

\_\_\_\_\_ [1]

(ii) What is the name of the substance formed when carbon dioxide dissolves in water?

\_\_\_\_\_ [1]

(iii) What would be observed when carbon dioxide gas is bubbled through limewater solution?

\_\_\_\_\_  
\_\_\_\_\_ [2]

(iv) What would be observed if you continued to bubble carbon dioxide gas through limewater solution?

\_\_\_\_\_  
\_\_\_\_\_ [1]

Examiner Only	
Marks	Remark



(iii) Name one industry which benefits from hard water.

\_\_\_\_\_ [1]

(iv) Why could it be less expensive to live in town B, where the water is soft, rather than town A?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

(c) The water in town C is temporary hard water

(i) Name a compound that causes temporary hard water.

\_\_\_\_\_ [1]

(ii) Explain, **in terms of ions present**, how temporary hard water can be softened by boiling.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [4]

Examiner Only

Marks Remark

6 The Haber Process is used in the manufacture of ammonia and it involves a reversible reaction.

(a) What do you understand by the term **reversible reaction**?

\_\_\_\_\_  
\_\_\_\_\_ [2]

(b) Write a balanced symbol equation to show the important reversible reaction in the Haber Process.

\_\_\_\_\_ [4]

(c) Name the catalyst used in the Haber Process.

\_\_\_\_\_ [1]

Examiner Only	
Marks	Remark

7 When zinc metal reacts with hydrochloric acid the mixture fizzes as hydrogen gas is given off. The reaction can be speeded up by increasing the concentration of the hydrochloric acid or by heating the reaction mixture.

(a) Use the collision theory to explain how increasing the concentration of the hydrochloric acid increases the rate of the reaction.

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[2]

(b) Use the collision theory to explain how increasing the temperature of the reaction mixture increases the rate of reaction.

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[3]

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Marks Remark

8 This question is about relative atomic mass, relative formula masses and using mole calculations.

(a) What do you understand by the relative atomic mass of an atom?

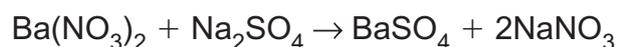
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 [3]

(b) Barium sulfate can be produced by reacting barium nitrate with excess sodium sulfate.



(i) Calculate the relative formula mass of barium sulfate.  
(Ba = 137; S = 32; O = 16)

Answer \_\_\_\_\_ [1]

(ii) Calculate the relative formula mass of barium nitrate.  
(Ba = 137; N = 14; O = 16)

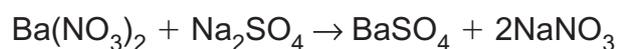
Answer \_\_\_\_\_ [1]

Examiner Only	
Marks	Remark

- (iii) Calculate the number of moles of barium nitrate in 13.05 g of the compound.

Answer \_\_\_\_\_ mole [1]

- (iv) Use your answer to (b)(i) and (b)(iii) and the equation:



to calculate the maximum mass of barium sulfate that can be obtained from 13.05 g of barium nitrate.

Answer \_\_\_\_\_ g [1]

- (c) A solution of dilute sodium hydroxide is described as 2.0 mol/dm<sup>3</sup>.

- (i) What does 2.0 mol/dm<sup>3</sup> mean?

\_\_\_\_\_  
 \_\_\_\_\_ [2]

- (ii) How much water must be added to 100 cm<sup>3</sup> of 2.0 mol/dm<sup>3</sup> sodium hydroxide to make a 1.0 mol/dm<sup>3</sup> solution?

\_\_\_\_\_ [1]

Examiner Only	
Marks	Remark

9 (a) Natural gas is an important fossil fuel that is found in refinery gases. It is described as a non-renewable fuel.

(i) What is a **fossil fuel**?

\_\_\_\_\_  
\_\_\_\_\_ [1]

(ii) What element is present in all fossil fuels?

\_\_\_\_\_ [1]

(iii) Natural gas is described as **non-renewable**. What does this mean?

\_\_\_\_\_  
\_\_\_\_\_ [1]

(b) Ethanol is a renewable fuel. It is produced from food crops. Distillation is needed in the manufacture of ethanol. Burning ethanol produces less carbon dioxide than burning natural gas but ethanol is more expensive to produce than natural gas.

(i) Suggest one reason why ethanol is used as a fuel.

\_\_\_\_\_  
\_\_\_\_\_ [1]

(ii) Suggest one reason why there could be concerns about replacing natural gas with ethanol as a fuel.

\_\_\_\_\_  
\_\_\_\_\_ [1]

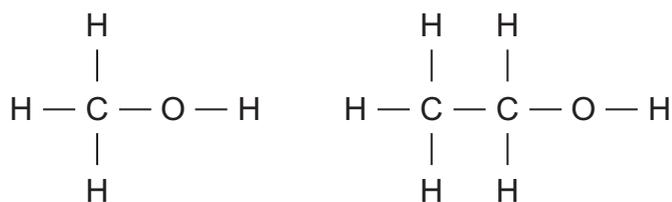
(iii) Why is hydrogen considered to be a “cleaner” fuel than either ethanol or natural gas?

\_\_\_\_\_  
\_\_\_\_\_ [1]

Examiner Only

Marks Remark

- (c) The structural formula for the first two members of the alcohol homologous series are given below:



- (i) Give the general formula of the alcohol homologous series.  
 \_\_\_\_\_ [1]
- (ii) What is the functional group of the alcohol homologous series?  
 \_\_\_\_\_ [1]
- (iii) Write out the molecular formula of ethanol.  
 \_\_\_\_\_ [1]
- (d) Ethanol can be prepared from the reaction of ethene with steam.  
 Write a balanced symbol equation for this reaction.  
 \_\_\_\_\_ [2]

Examiner Only	
Marks	Remark

- (e) (i) Methanol and ethanol can be used as fuels.  
Write a balanced symbol equation for the combustion of methanol in a plentiful supply of air.

\_\_\_\_\_ [3]

- (ii) When alcohols are burned in a limited supply of air another product is formed. Name this product.

\_\_\_\_\_ [1]

- (f) The alkane hexane and the alkene hexene are both colourless liquids. Describe a chemical test you could carry out on each of these liquids to determine which one is the alkene.

Test \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

Expected result with hexene: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

Expected result with hexane: \_\_\_\_\_

\_\_\_\_\_ [1]

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**THIS IS THE END OF THE QUESTION PAPER**

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Marks	Remark







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