



Rewarding Learning

General Certificate of Secondary Education  
2016

Centre Number

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Candidate Number

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# Double Award Science: Chemistry

Unit C2

Higher Tier



[GSD52]

\*GSD52\*

**WEDNESDAY 15 JUNE 2016, 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.

**You must answer the questions in the spaces provided.**

**Do not write outside the boxed area on each page or on blank pages.**

Complete in blue or black ink only. **Do not write with a gel pen.**

Answer **all eight** 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 **3** and **6(c)**.

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

10294



\*20GSD5201\*

1 This question is about the rate of reaction of zinc metal with acid.

- (a) In the reaction of zinc granules with hydrochloric acid, a little copper sulfate is sometimes added as a catalyst.

Why is the copper sulfate described as a catalyst and not a reactant?

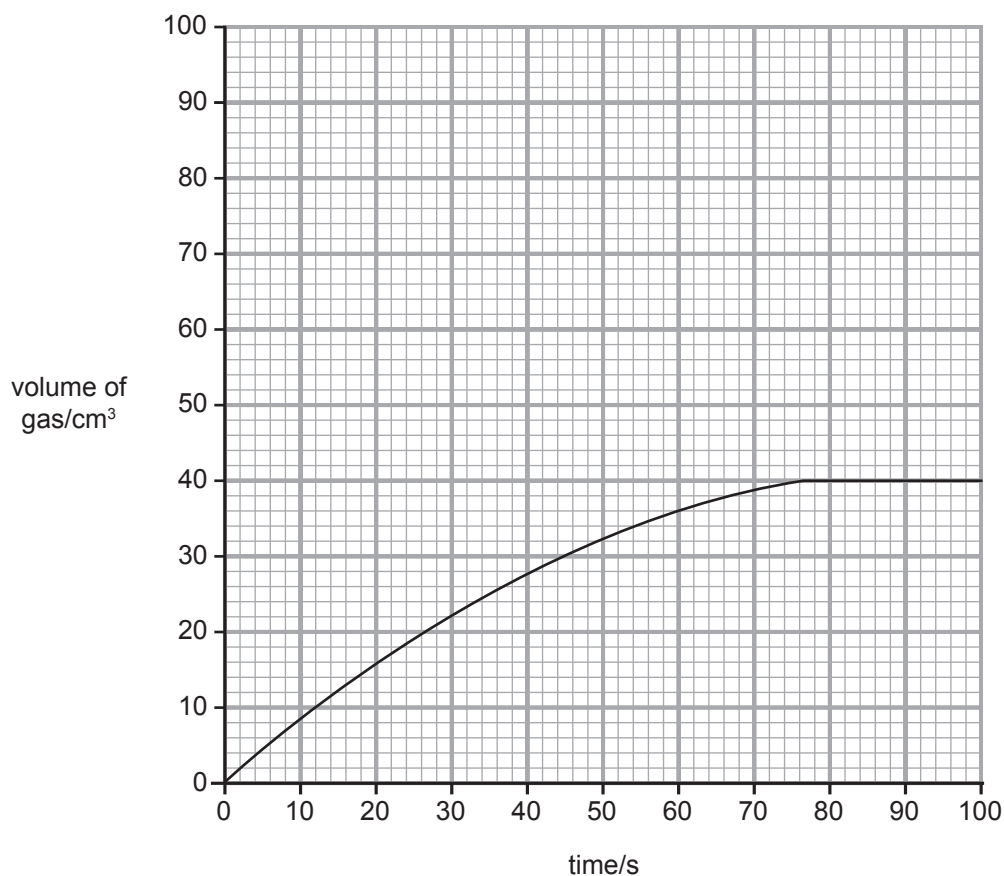
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[2]

- (b) A group of students investigated how dilute hydrochloric acid reacted with zinc granules. The volume of hydrogen gas given off was measured every 20 seconds and a graph drawn as shown below. Excess zinc was used to make sure that all the acid reacted.



(i) How much gas is given off after 40 seconds?

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

(ii) After how many seconds did the reaction stop?

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

(iii) What happens to the reaction rate as the time increases?

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

(c) **On the graph** draw the curve you would expect to get if the acid concentration was doubled, and the zinc granules were still in excess. You should assume that the volume of acid used was the same as in the earlier investigation. [2]

[Turn over



2 This question is about the combustion of carbon and the properties of the products formed.

(a) (i) What compound is formed on the **complete** combustion of carbon?

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

(ii) Write a balanced symbol equation for the **incomplete** combustion of carbon.

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

(iii) Explain why the compound formed in the incomplete combustion of carbon is so dangerous.

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

(b) (i) Complete the symbol equation below to show what happens when carbon dioxide reacts with water.

$\text{CO}_2 + \text{H}_2\text{O} \rightarrow$  [1]

(ii) Name the product formed in this reaction.

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



(c) When carbon dioxide is bubbled through limewater ( $\text{Ca}(\text{OH})_2$ ) solution a white precipitate is formed. If more carbon dioxide is bubbled through, the precipitate will disappear.

(i) What is the chemical name of the precipitate?

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

(ii) Why does the precipitate disappear when excess carbon dioxide is added?

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

[Turn over







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**(Questions continue overleaf)**



4 This question is about relative formula masses and using and understanding the term mole.

(a) Calculate the relative formula mass of each of the following substances.

(relative atomic masses: H = 1, C = 12, O = 16, N = 14, Na = 23, Mg = 24)

(i) ammonia  $\text{NH}_3$

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

(ii) sodium carbonate  $\text{Na}_2\text{CO}_3$

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

(iii) magnesium hydroxide  $\text{Mg}(\text{OH})_2$

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

(b) What do you understand by the term “a mole of a substance”?

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





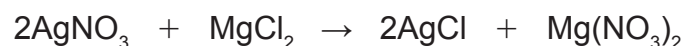
(c) (i) The relative formula mass of sulfur dioxide is 64. What is the mass of 0.6 moles of sulfur dioxide?

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

(ii) How many moles are in 320 grams of sulfur dioxide?

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

(d) Solid silver chloride can be formed by mixing silver nitrate solution with magnesium chloride solution.



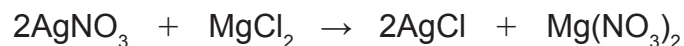
Relative formula masses:

silver nitrate = 170, magnesium chloride = 95, silver chloride = 143.5

(i) How many moles of magnesium chloride would be needed to react with 8.5 g of silver nitrate?

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

(ii) Use the equation:



to calculate the mass of silver nitrate needed to produce 14.35 g of silver chloride.

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

[Turn over



5 (a) Adding water to anhydrous copper sulfate can be used as a test for water.

(i) Describe the colour change when water is added drop by drop to anhydrous copper sulfate.

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

(ii) Is this an exothermic or endothermic reaction?

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

(b) When copper carbonate is heated it undergoes thermal decomposition.

(i) Write a balanced symbol equation for this reaction.

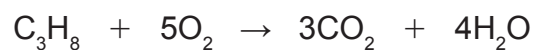
\_\_\_\_\_ [2]

(ii) Describe the colour change when copper carbonate is heated.

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



(c) Propane can be used as a fuel. It burns to form carbon dioxide and water.



Describe in terms of bond breaking and bond making why **this** reaction is exothermic.

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[5]



6 This question is about hard and soft water.

(a) Give three disadvantages of hard water.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_ [3]

(b) Temporary hardness in water occurs in limestone regions. Explain what happens chemically to produce temporary hardness in water.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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





7 (a) Explain how fractional distillation separates the compounds found in crude oil.

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[3]

(b) Complete the table below by giving the molecular and structural formulae of the named compounds.

Name	Molecular Formula	Structural Formula
Ethanol		
Ethene		

[4]



(c) Ethene and ethane are both gaseous hydrocarbons.

(i) To which homologous series does ethene belong?

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

(ii) Describe a test to distinguish between the two gases ethane and ethene.

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

(d) Polychloroethene is a useful plastic made from chloroethene molecules.

(i) Write a balanced symbol equation for the reaction of chloroethene molecules to form polychloroethene.

[4]

(ii) Give one use of polychloroethene and explain what property or properties make it suitable for this use.

Use: \_\_\_\_\_

Property: \_\_\_\_\_ [2]

[Turn over



8 (a) In the manufacture of iron, haematite (impure iron(III) oxide), limestone (calcium carbonate), coke (carbon) and hot air are used.

(i) What happens to the limestone in the Blast Furnace?

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[3]

(ii) Describe the main way in which the reducing agent, carbon monoxide, is produced in the Blast Furnace.

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[2]

(b) Write a balanced symbol equation for the reduction of iron(III) oxide in the Blast Furnace.

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[3]





- (c) In the manufacture of aluminium the reaction at the cathode can be represented as:

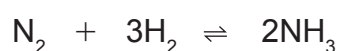


Is this type of reaction an oxidation, a reduction, redox or none of these?  
Explain your answer.

\_\_\_\_\_

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

- (d) The Haber process involves the following reaction:



- (i) Which substance undergoes reduction in the reaction above?

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

- (ii) What is the meaning of the symbol  $\rightleftharpoons$  that is used in the reaction above?

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

\_\_\_\_\_

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\_\_\_\_\_



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

Examiner Number

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## SYMBOLS OF SELECTED IONS

### Positive ions

Name	Symbol
Ammonium	$\text{NH}_4^+$
Chromium(III)	$\text{Cr}^{3+}$
Copper(II)	$\text{Cu}^{2+}$
Iron(II)	$\text{Fe}^{2+}$
Iron(III)	$\text{Fe}^{3+}$
Lead(II)	$\text{Pb}^{2+}$
Silver	$\text{Ag}^+$
Zinc	$\text{Zn}^{2+}$

### Negative ions

Name	Symbol
Carbonate	$\text{CO}_3^{2-}$
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	$\text{CH}_3\text{COO}^-$
Hydrogen carbonate	$\text{HCO}_3^-$
Hydroxide	$\text{OH}^-$
Methanoate	$\text{HCOO}^-$
Nitrate	$\text{NO}_3^-$
Sulfate	$\text{SO}_4^{2-}$
Sulfite	$\text{SO}_3^{2-}$

## DATA LEAFLET

For the use of candidates taking  
Science: Chemistry,  
Science: Double Award  
or Science: Single Award

Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations.

### SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble

Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

Contents	Page
Periodic Table of the Elements	2–3
Symbols of Selected Ions	4
Solubility of Common Salts	4

# gcse . Science

chemistry  
double award  
single award

