



Rewarding Learning

General Certificate of Secondary Education

Centre Number

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Candidate Number

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GCSE Chemistry

Unit 2

Foundation Tier



[GCM21]

GCM21

Assessment

TIME

1 hour 15 minutes.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

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 black ink only. **Do not write with a gel pen.**

Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.

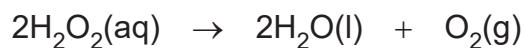
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **2(c)**.

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



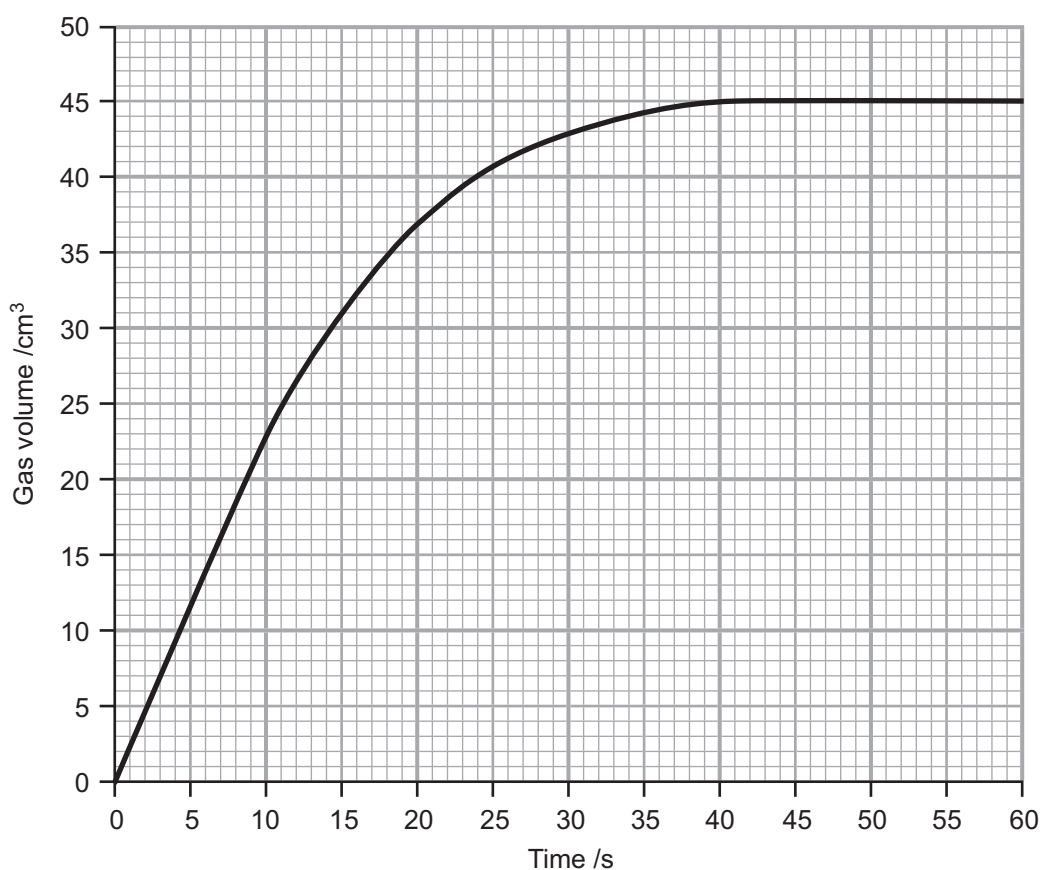
- 1 Hydrogen peroxide decomposes in the presence of a catalyst to form oxygen and water. The equation for the decomposition is:



- (a) Explain how a catalyst increases the rate of reaction.

[2]

- (b) 25.0 cm³ of 0.15 mol/dm³ hydrogen peroxide solution were placed in a conical flask with 1.0 g of a suitable catalyst and the gas volume measured over a period of 60 seconds. The reaction was carried out at 25°C and the results obtained are plotted in the graph below.



(i) At what time did the reaction finish?

_____ [1]

(ii) What was the total volume of gas produced in this reaction?

_____ [1]

(iii) Circle the time interval below during which the rate of reaction was fastest.

0 to 10 s 10 to 20 s 20 to 30 s 30 to 40 s 40 to 50 s

[1]

(iv) On the graph, sketch the line you would expect to obtain if the experiment was repeated using 25.0 cm³ of **0.15 mol/dm³** hydrogen peroxide solution with 1.0 g of the same catalyst at 10°C.

[1]

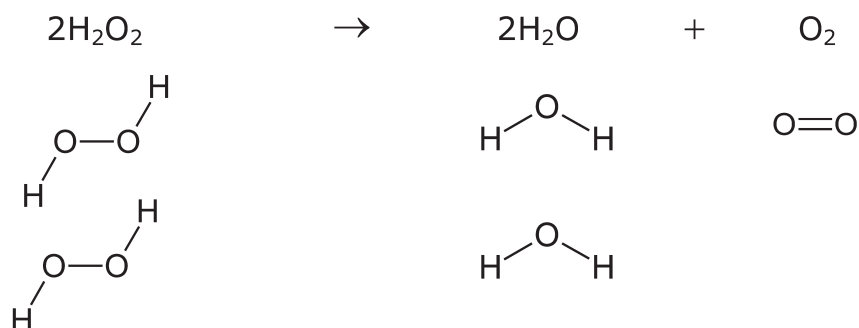
[Turn over



(c) The table below gives the bond energy in kJ for some covalent bonds.

Bond	Bond energy /kJ
O—O	146
O=O	496
O—H	463

The covalent bonds which are present in the reactants and products are shown below the equation for the decomposition of hydrogen peroxide.



(i) Calculate the energy required to break all the bonds in the reactants.

energy = _____ kJ [1]



(ii) Calculate the total energy released when all the bonds are formed in the products.

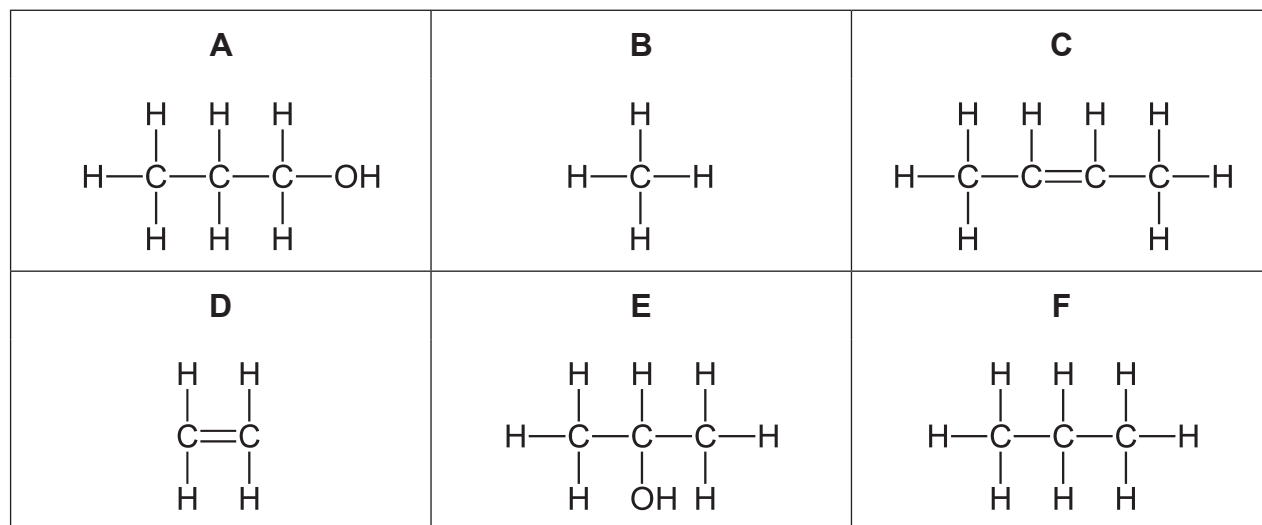
energy = _____ kJ [1]

(iii) Calculate the overall energy change for the reaction.

energy change = _____ kJ [2]



2 The structural formulae of six organic compounds are shown below. They are labelled **A**, **B**, **C**, **D**, **E** and **F**.



(a) (i) Write the molecular formula of **B** and name the homologous series to which it belongs.

_____ [2]

(ii) Which organic compounds (**A**, **B**, **C**, **D**, **E** and **F**) are hydrocarbons?

_____ [1]

(iii) Which two organic compounds (**A**, **B**, **C**, **D**, **E** and **F**) have the same molecular formula?

_____ [1]

(iv) Name compound **F**.

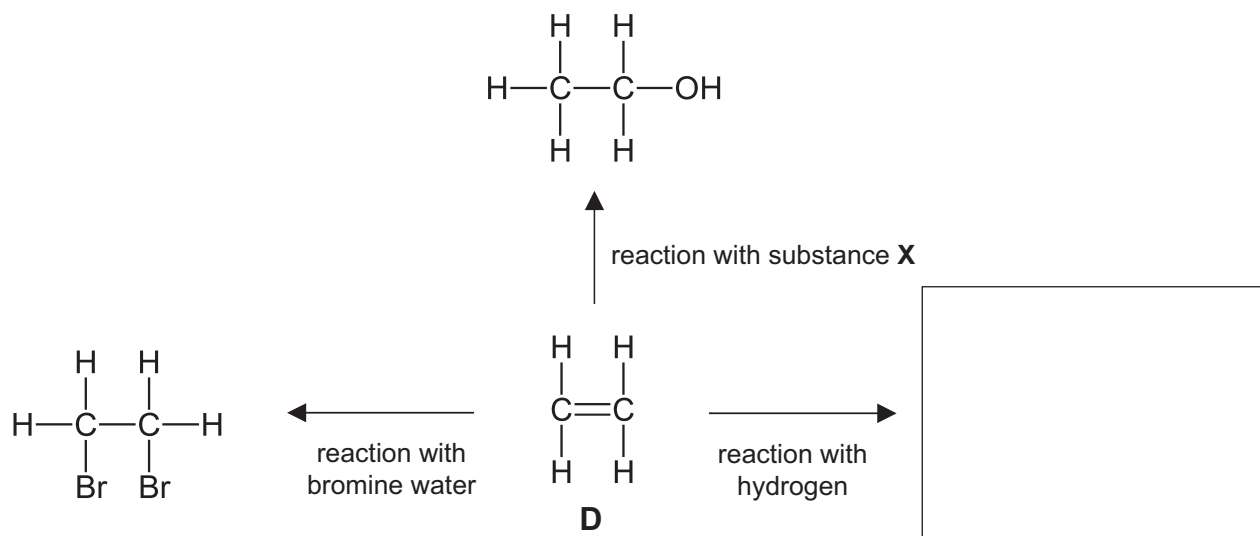
_____ [1]

(v) Write a balanced symbol equation for the complete combustion of **D**.

_____ [3]



(b) Some reactions of organic compound **D** are shown below.



(i) Name substance **X**.

_____ [1]

(ii) What is observed when **D** reacts with bromine water?

_____ [2]

(iii) In the box in the diagram, draw the structural formula for the product formed from the reaction of **D** with hydrogen. [1]

[Turn over



(c) Many organic chemicals are obtained from crude oil. Name and describe the process by which crude oil is separated into fractions.

Your answer should include:

- the name of the process
- an explanation of how the process separates crude oil into fractions
- the names of two of the fractions obtained and one use for each fraction.

In your answer you will be assessed on the quality of your written communication including the use of specialist scientific terms.

Name of the process and an explanation of how the process separates crude oil into fractions

Names of two of the fractions and one use for each fraction

[6]





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20GCM2109

3 When sulfur burns in air, sulfur dioxide is formed. Sulfur dioxide contributes to the formation of acid rain.

(a) (i) Write a balanced symbol equation for sulfur burning in air. Include state symbols.

_____ [3]

(ii) Describe the appearance of sulfur.

_____ [2]

(iii) What is the colour of the flame observed when sulfur burns in air?

_____ [1]

(b) State two negative environmental effects of acid rain.

1. _____

2. _____

_____ [2]



(c) Some oxides of metallic and non-metallic elements are given in the table below.

water	carbon dioxide	sulfur dioxide
magnesium oxide	carbon monoxide	copper(II) oxide

(i) Name one oxide from the table which is black.

_____ [1]

(ii) Write a balanced symbol equation for the reaction of copper with oxygen to form copper(II) oxide.

_____ [3]

(iii) Name one basic oxide from the table.

_____ [1]

(iv) Name one colourless gaseous oxide from the table which is toxic.

_____ [1]

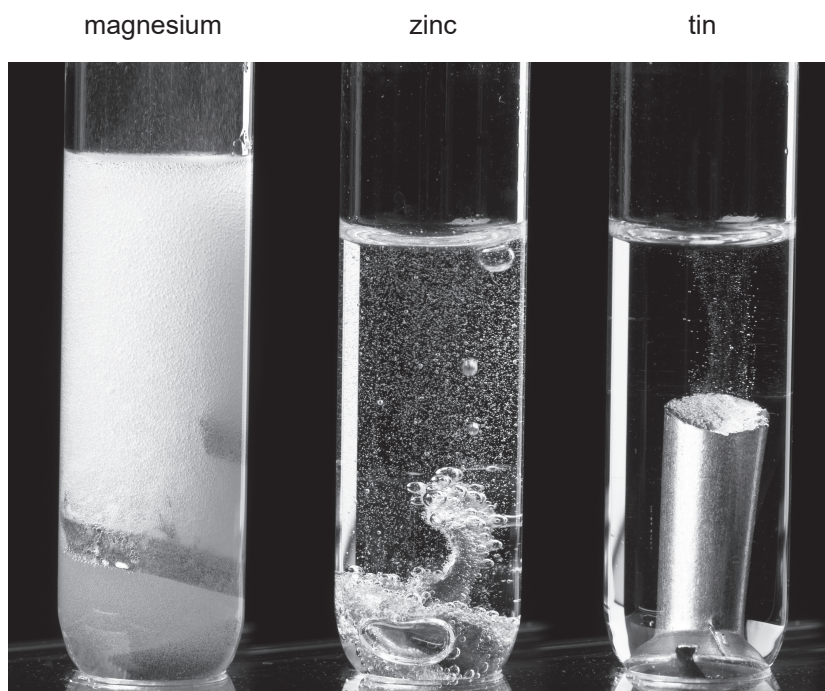
(v) Name one gaseous oxide from the table which reacts with water to form carbonic acid.

_____ [1]

[Turn over



- 4 (a) The image below shows three metals (magnesium, zinc and tin) reacting with hydrochloric acid. Bubbles of hydrogen gas are observed in all reactions.



- (i) Suggest why the reaction between tin and hydrochloric acid would not be used to prepare a gas jar of hydrogen in the laboratory.

_____ [1]

- (ii) Write a balanced symbol equation for the reaction between zinc and hydrochloric acid.

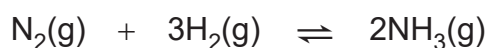
_____ [3]



(iii) Explain which metal (magnesium, zinc or tin) is most reactive.

[1]

(b) Ammonia is produced from the reaction of nitrogen with hydrogen according to the balanced symbol equation below.



(i) What is meant by \rightleftharpoons ?

[1]

(ii) Explain why nitrogen is unreactive.

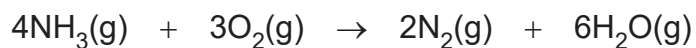
[2]

(iii) Name the salt formed when ammonia reacts with sulfuric acid.

[1]



- (c) Ammonia reacts with oxygen forming nitrogen and water according to the balanced symbol equation below.



Calculate the percentage atom economy in this reaction if nitrogen is the desired product. Use the expression below:

$$\text{Percentage atom economy} = \frac{\text{mass of desired product}}{\text{total mass of products}} \times 100$$

percentage atom economy = _____ % [3]





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20GCM2115

5 Dilute sulfuric acid conducts electricity.

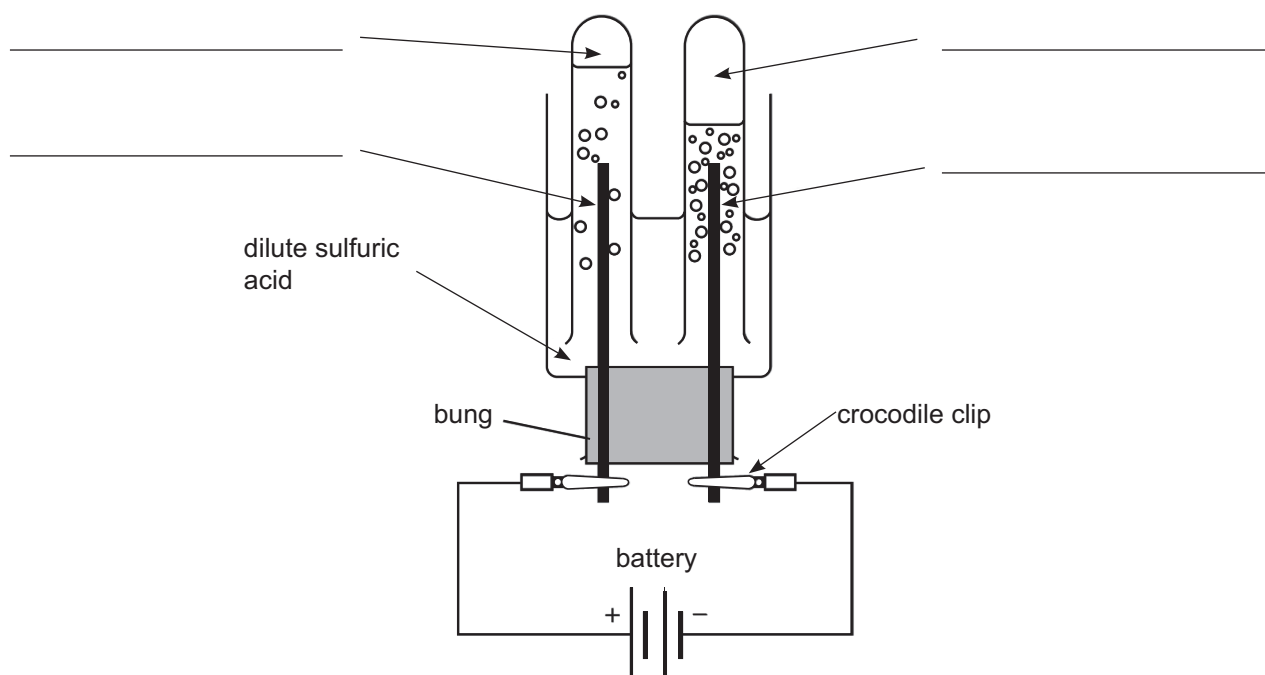
(a) (i) What is the chemical formula of sulfuric acid?

_____ [1]

(ii) Explain why dilute sulfuric acid conducts electricity.

_____ [2]

(b) The apparatus below is used to carry out the electrolysis of dilute sulfuric acid. The electrodes used during this electrolysis are made from platinum.



(i) Using the words in the box below, complete the missing labels on the diagram.

anode	electrolyte	oxygen
carbon dioxide	cathode	hydrogen

[4]



(ii) What is meant by the term electrolysis?

[2]

(iii) State two reasons why the electrodes are made from platinum.

1. _____
2. _____

[2]

(iv) What could be added to the apparatus to show that dilute sulfuric acid conducts electricity?

[1]



6 Metals such as copper, iron and aluminium are extracted from ores which contain compounds of the metals.

(a) (i) Complete the table below.

Metal	Name of ore	Major metal compound present in the ore
copper	chalcopyrites	copper(II) sulfide
iron		
aluminium		

[4]

(ii) Write the formula of copper(II) sulfide.

[1]



(b) The table below shows some of the results of a series of reactions between metals and metal nitrate solutions. Only two results have been completed.

Metal	magnesium nitrate solution	copper(II) nitrate solution	iron(II) nitrate solution	zinc nitrate solution
magnesium		✓		
copper				
iron				
zinc	×			

(i) Using your knowledge of the reactivity series, complete the table by placing a tick (✓) where you predict a reaction would occur and × where you think no reaction would occur. [4]

(ii) Name the products of the reaction of magnesium with copper(II) nitrate solution.

_____ [2]

(iii) Explain, in terms of reactivity, why zinc does not react with magnesium nitrate solution.

_____ [2]

THIS IS THE END OF THE QUESTION PAPER



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Question Number	Marks
1	
2	
3	
4	
5	
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Total Marks	
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Examiner Number

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