Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2013

Science: Chemistry

Unit C2

Foundation Tier

[GCH21]

GCH21

THURSDAY 20 JUNE, AFTERNOON

TIME

1 hour 30 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 box, around each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen**.
Answer **all** 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 question **3(c)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

Examiner Only	
Marks	Remark

1 Fireworks contain the three ingredients shown in the box below.

colouring agent
fuel
oxidiser

(a) Magnesium is often used in fireworks as the colouring agent.

(i) What is the colour of the flame observed when magnesium burns?

_____ [1]

(ii) Write a balanced symbol equation for magnesium burning in air.

_____ [3]

(iii) What is the percentage of oxygen in air?

_____ [1]

(b) Carbon in the form of charcoal is often used as the fuel in fireworks.

(i) What is observed when a sample of carbon burns?

_____

_____

_____ [2]

(ii) Name the product formed when carbon burns in a limited supply of oxygen.

_____ [1]

Examiner Only	
Marks	Remark

(c) Oxidisers provide the oxygen needed to allow fireworks to burn effectively. A common oxidiser is potassium nitrate.

Write the formula for potassium nitrate.

_____ [1]

(d) Sparklers are hand held fireworks which contain a fuel, an oxidiser and iron powder. Often the iron powder is mixed with linseed oil to prevent it rusting.

(i) What conditions are required for iron to rust?

_____

_____ [2]

(ii) Explain why rusting is an oxidation reaction.

_____

_____ [2]

(iii) State one observation you would make which would indicate that rusting is a chemical reaction.

_____

_____ [1]

(e) In industry, iron is manufactured in the Blast Furnace. Two of the reactions which occur in the Blast Furnace are shown in the table below. Choose a word or phrase from the box which is most suitable to describe each type of reaction.

thermal decomposition	**redox**	**displacement**
neutralisation	**combustion**	

Reaction in the Blast Furnace	Type of Reaction
$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$	
$CaCO_3 \rightarrow CaO + CO_2$	

[2]

Examiner Only	
Marks	Remark
Total Question 1	

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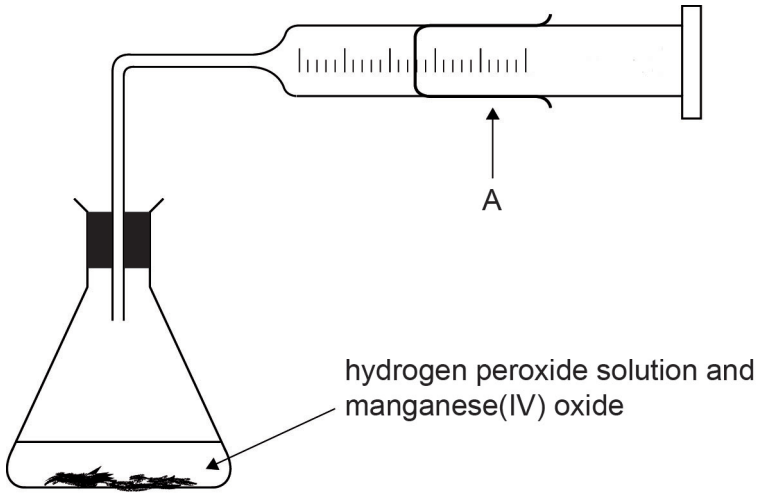
(Questions continue overleaf)

Examiner Only	
Marks	Remark

2 **(a)** The rate of decomposition of hydrogen peroxide using a catalyst can be measured using the apparatus shown below.



(i) Name the pieces of apparatus labelled A and B.

A _____

B _____ [2]

(ii) Name the catalyst used in the decomposition of hydrogen peroxide.

_____ [1]

(iii) What is meant by the term catalyst?

_____

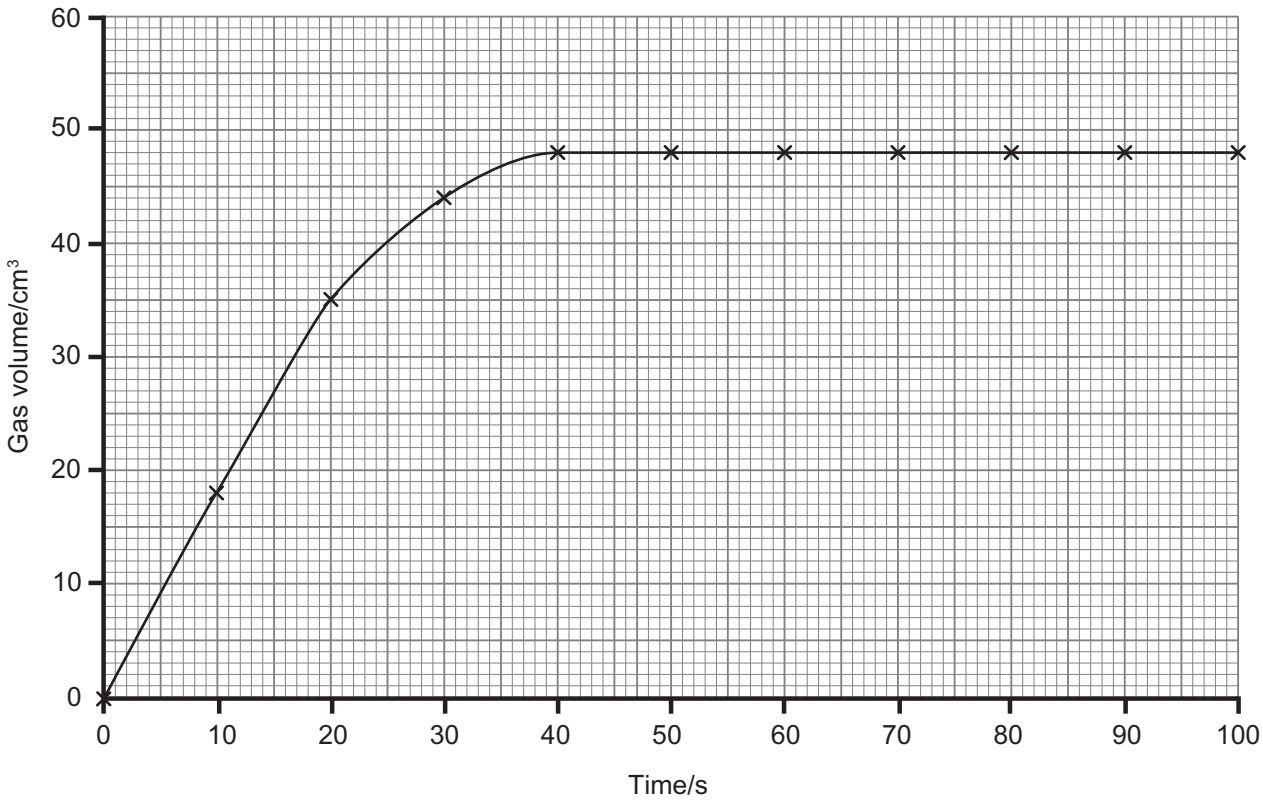
_____

_____ [3]

(iv) Write a balanced symbol equation for the decomposition of hydrogen peroxide.

_____ [3]

(b) The graph below shows a set of data obtained.



(i) Apart from the apparatus shown in the diagram in part **(a)**, name one other piece of equipment which would be required to collect the results used to draw the graph.

_____ [1]

(ii) What volume of gas was collected at 25 seconds?

_____ [1]

(iii) What was the total volume of gas collected?

_____ [1]

(iv) At what time did the reaction finish?

_____ [1]

Examiner Only	
Marks	Remark
Total Question 2	

[Turn over

Examiner Only	
Marks	Remark

3 Perfume is a mixture of essential oils dissolved in a solvent. One of the essential oils used in making perfume is called myrcene.

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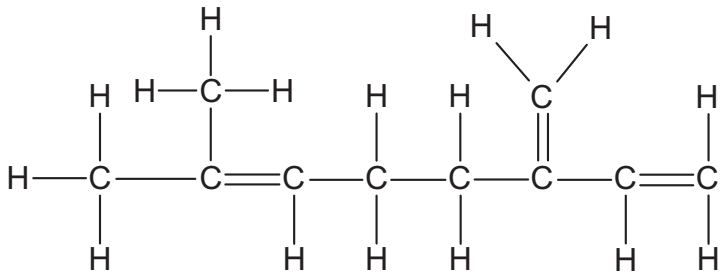
(a) The structural formula of a molecule of myrcene is shown below.



(i) Explain why a molecule of myrcene can be classified as a hydrocarbon.

_____

_____ [1]

(ii) Identify the functional group present in myrcene.

_____ [1]

(iii) Like all hydrocarbons, myrcene ($C_{10}H_{16}$) undergoes combustion. Complete the balanced symbol equation for the **complete** combustion of myrcene.

$C_{10}H_{16} + \quad O_2 \longrightarrow$ [2]

(iv) Calculate the relative molecular mass (RMM) of myrcene ($C_{10}H_{16}$).

_____ [1]

(v) Calculate the percentage of carbon present in myrcene ($C_{10}H_{16}$).

_____% [2]

(b) Ethene can be used to manufacture the solvent used in perfumes. Complete the table below to give information about ethene.

Name	Molecular formula	Structural formula	State at room temperature and pressure
Ethene			

[3]

Examiner Only	
Marks	Remark

(c) Ethene can also be used to make polymers. Polymers may be disposed of by landfill and incineration.

Explain what you understand by the term polymer and state the advantages and disadvantages associated with each method of disposal.

In this question, you will be assessed on using your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark
Total Question 3	

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

4 Bauxite is an ore of aluminium, named after the village La Baux in France where it was first discovered.

(a) Aluminium is obtained from purified bauxite by electrolysis.

(i) What is meant by the term electrolysis?

_____

_____ [2]

(ii) Bauxite contains aluminium oxide. Write the formula for aluminium oxide.

_____ [1]

(iii) During the electrolysis of purified bauxite the ions present are attracted to the electrodes. Complete the table below.

Name of ion	Formula of ion (including charge)	Name of electrode to which ion is attracted
aluminium		
	O^{2-}	

[4]

(iv) Explain why the carbon anodes need to be replaced periodically during this electrolysis.

_____

_____

_____

_____ [2]

(b) Aluminium cans are the world's most recycled packaging container. Over 50% of aluminium cans are recycled worldwide.

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State **two** reasons why it is important to recycle aluminium.

1. _____

_____

2. _____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 4	

[Turn over

Examiner Only	
Marks	Remark

5 Metals may be placed in a reactivity series by observing their reactions with air, water, steam and dilute acid.

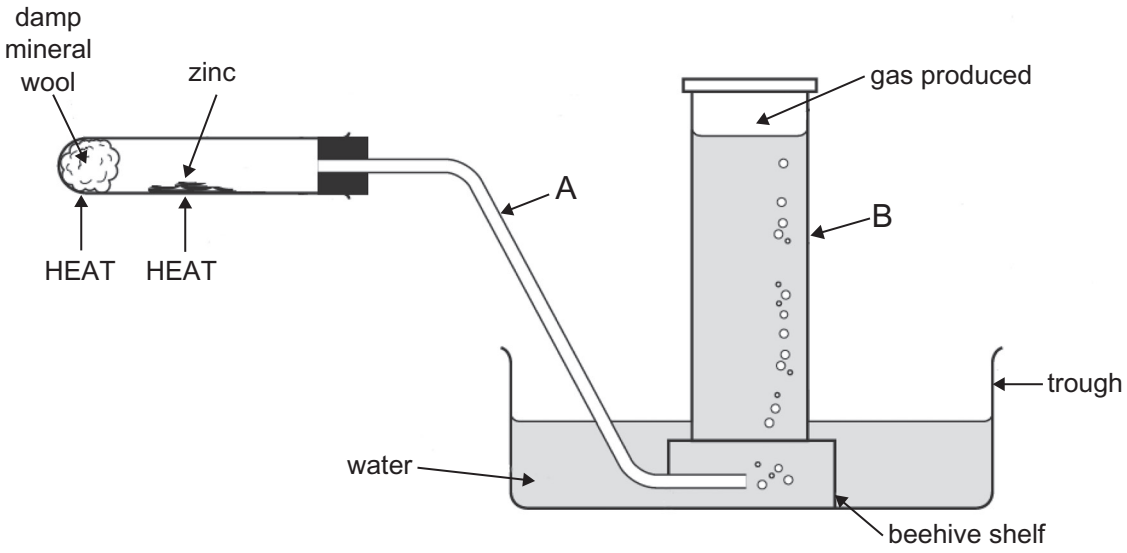
(a) Describe what would be observed when a piece of calcium metal is heated in air.

_____

_____

_____ [2]

(b) The apparatus below may be used to react zinc metal with steam.



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(i) What labels should be placed at A and B on the diagram?

A _____

B _____ [2]

(ii) Explain why the damp mineral wool is heated.

_____ [1]

(iii) Name the gas produced in this experiment.

_____ [1]

(iv) Name a metal which does not react when heated with steam.

_____ [1]

(c) X is an unknown metal. The table below gives details of some reactions of the three metals X, sodium and zinc.

Metal	Reaction when heated in oxygen	Reaction with cold water	Reaction with dilute hydrochloric acid
X	Black coating forms on metal without burning	No reaction	No reaction
Sodium	Burns very vigorously with a yellow flame		Dangerous reaction not carried out in school laboratory
Zinc	Burns forming a yellow solid which changes to white on cooling	No reaction	Reacts steadily

(i) Suggest the name of metal X.

_____ [1]

(ii) Describe what you would observe when sodium reacts with cold water.

_____

_____

_____

_____

_____ [3]

(iii) Write a balanced symbol equation for the reaction of sodium with water.

_____ [3]

Examiner Only	
Marks	Remark
Total Question 5	

Examiner Only	
Marks	Remark

6 **(a)** Fill in the blanks in the following sentences about water.

Water is a colourless liquid at room temperature and pressure and has a melting point of 0 °C and a boiling point of _____ °C.

One test for water is to use cobalt(II) chloride paper which changes colour from _____ to _____ if water is present. [3]

(b) An investigation was carried out to compare the hardness of water samples from three towns A, B and C.

25 cm^3 of each water sample were placed into three separate conical flasks and labelled A, B and C. A sample of deionised water was also tested.

Soap solution was added 1 cm^3 at a time to each conical flask with shaking until a lasting lather formed. The total volume of soap solution added to each flask was recorded.

The experiment was repeated with fresh samples of A, B and C which had been boiled and allowed to cool, before adding the soap solution.

The results are shown in the table below.

Water sample	**Volume of soap solution required to form a lather**	
	before boiling (cm^3)	**after boiling (cm^3)**
Deionised water	2	2
A	6	6
B	8	2
C	11	7

(i) Name a piece of apparatus which could be used to measure the 25 cm^3 samples of water.

_____ [1]

(ii) Which of the three water samples (A, B or C) is the hardest water?

_____ [1]

(iii) Which of the three water samples (A, B or C) contains **only** temporary hardness?

_____ [1]

(iv) Which of the three water samples (A, B or C) contains both temporary and permanent hardness?

_____ [1]

(c) State two disadvantages of hard water.

1. _____

_____

2. _____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 6	

Examiner Only	
Marks	Remark

7 **(a)** Nitrogen can be used to manufacture ammonia gas.

(i) Complete the table below giving some physical properties of nitrogen.

	Nitrogen
State at room temperature and pressure	
Colour	
Odour	

[3]

(ii) State one other use of nitrogen.

_____ [1]

(b) Describe how you would carry out a chemical test for the presence of ammonia gas, stating the observations you would make for a positive test.

_____

_____

_____

_____

_____ [4]

(c) Nitrogenous fertilisers contain ammonium compounds such as ammonium nitrate which is produced when ammonia reacts with nitric acid.

(i) Write a balanced symbol equation for the reaction of ammonia with nitric acid.

_____ [2]

(ii) State one disadvantage of using nitrogenous fertilisers.

_____ [1]

Examiner Only	
Marks	Remark
Total Question 7	

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For Examiner's use only	
Question Number	**Marks**
1	
2	
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QWC	
Total Marks	

Examiner Number