OCR
Oxford Cambridge and RSA

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Friday 10 June 2016 – Morning

GCSE GATEWAY SCIENCE
CHEMISTRY B

B741/01 Chemistry modules C1, C2, C3 (Foundation Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour 15 minutes

* B 7 4 1 0 1 *

* 1 2 5 1 3 4 9 5 5 2 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

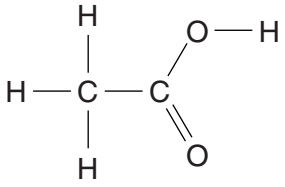
- The quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table can be found on the back page.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document consists of **28** pages. Any blank pages are indicated.

Answer **all** the questions.

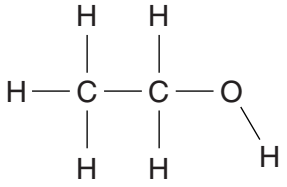
SECTION A – Module C1

1 This question is about carbon compounds.

Look at the displayed formulas of some compounds.



A



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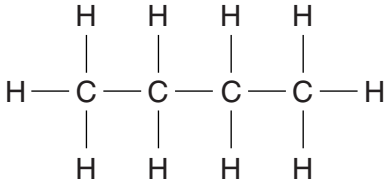
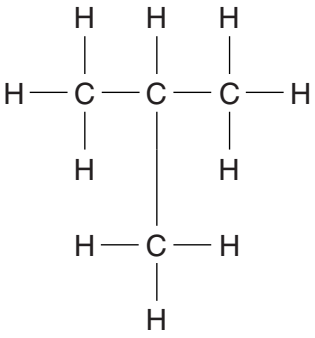
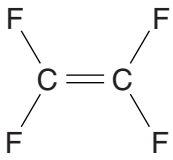


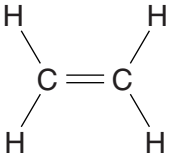
C



F



D



E

(a) Which compound has a molecule with **8 atoms**?

Choose from **A**, **B**, **C**, **D**, **E** or **F**.

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

(b) Which compound is an **alkene**?

Choose from **A**, **B**, **C**, **D**, **E** or **F**.

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

(c) Which **two** compounds have the same **molecular** formula?

Choose from **A**, **B**, **C**, **D**, **E** and **F**.

..... and ..... **[1]**

(d) Compound **D** is called tetrafluoroethene.

It is a monomer and can be made into a polymer.

What is the name of this polymer?

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

[Total: 4]

2 Esters can be used in nail varnish remover.

Look at the table of information about some esters.

Ester	Molecular formula of ester	Melting point in °C	Boiling point in °C	How well it dissolves in water (1 = poor 10 = good)
methyl ethanoate	$C_3H_6O_2$	–98	57	1
ethyl ethanoate	$C_4H_8O_2$	–84	77	8
propyl ethanoate	$C_5H_{10}O_2$	–95	102	2
butyl ethanoate	$C_6H_{12}O_2$	–77	127	1
pentyl ethanoate		–71	149	1

(a) Esters are **not** hydrocarbons.

Explain why using information from the molecular formulas.

.....

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

(b) Pentyl ethanoate has **seven** carbon atoms in its molecule.

Deduce the **molecular formula** for pentyl ethanoate.

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

(c) The solvent in a nail varnish remover needs to have these properties

- liquid at room temperature, 25 °C
- evaporates easily
- fairly soluble in water.

Which ester would be **most** suitable for use as a nail varnish remover?

Explain your answer.

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

[Total: 5]

3 Air contains oxygen, nitrogen and carbon dioxide.

The percentage by volume of these gases in air hardly changes.

This is because of the balance between the three processes, combustion, respiration and photosynthesis.

Write down the percentage by volume of oxygen and carbon dioxide in air.

Describe the effect of

- combustion
- respiration
- photosynthesis.

on these **two** percentages.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

[Total: 6]

4 The Olympic flame for the London Olympics burned a fuel. This fuel was a gas.

(a) The designer of the Olympic flame had to decide which fuel to use.

He could not decide whether to use bio gas or natural gas.

One factor he considered was the energy value of the two fuels.

Write about **three** other factors he had to consider.

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

(b) The designer decided to use natural gas.

The Olympic flame was yellow in colour and could be seen easily.

Natural gas normally burns with a blue flame.

Suggest **two** reasons why the Olympic flame was yellow and not blue.

.....

.....

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

[Total: 5]

5 This question is about different paints.

Look at the table. It shows the percentage by mass of each ingredient in four paints.

Ingredient	Percentage by mass in each paint			
	Paint A	**Paint B**	**Paint C**	**Paint D**
solvent	32	25	55	20
oil	0	25	0	25
pigment	24	10	5	30
bonding medium	30	30	28	23
other additives	14	10	12	2

(a) Look at the column for paint **D**.

Parminder wants to present the data about the ingredients in paint **D**.

Which will be the **best** way for her to present this data?

Choose from

bar chart

line graph

pie chart

scatter graph

answer ..... **[1]**

(b) Parminder wants to show the percentage of solvent in each of the four paints.

Which will be the **best** way for her to present this data?

Choose from

bar chart

line graph

pie chart

scatter graph

answer ..... **[1]**

(c) Which paint is likely to be the easiest to spread?

.....

Explain your answer.

.....

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

(d) Paint **B** contains a **thermochromic** pigment.

Paint **D** contains a **phosphorescent** pigment.

Write about the differences between a thermochromic pigment and a phosphorescent pigment.

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

[Total: 5]

Question 6 begins on page 8

SECTION B – Module C2

6 This question is about metals and alloys.

(a) Look at the list of materials.

amalgam

bronze

copper

mercury

solder

Some of the materials are **alloys**.

Some of the materials are **metallic elements**.

Finish the table. Put each material in the correct column.

One material has been done for you.

Alloy	Metallic element
	copper

[2]

(b) Copper can be made from copper oxide, CuO, using hydrogen gas.

Look at the equation.

$$CuO + H_2 \rightarrow Cu + H_2O$$

This reaction is an example of **reduction**.

Copper oxide is reduced.

Explain how you can tell from the equation.

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.....

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

(c) Look at the table. It shows the properties of some alloys.

Alloy	Density in g/cm^3	Relative strength	Relative cost
duralumin	2.8	high	high
brass	8.4	high	medium
steel	7.8	very high	low

Which alloy is most suitable for making aeroplane wings?

Use information from the table to give **two** reasons for your choice.

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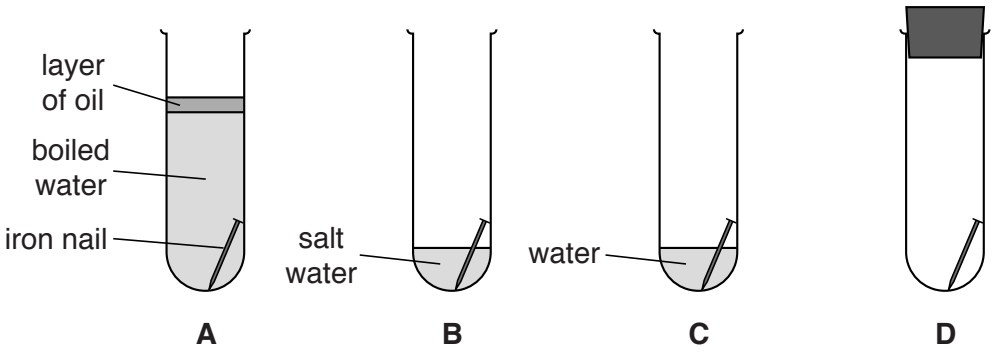
..... **[2]**

[Total: 5]

7 Robert investigates the rusting of iron.

Look at the diagram. It shows the apparatus he uses.



	A	B	C	D
Substances in contact with iron	boiled water with **no** dissolved air	air and salt water	air and water	air with **no** water
Results	**not** rusty after 10 days	rusty after 24 hours	rusty after 5 days	**not** rusty after 10 days

(a) (i) Robert thinks that **both** air and water are needed for iron to rust.

How do you know that he is right?

Use the diagram to help you.

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

(ii) Which substance in Robert's investigation **speeds up** rusting?

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

(b) Aluminium, Al, does not corrode in air.

This is because aluminium reacts with oxygen, O_2.

A protective layer of aluminium oxide, Al_2O_3, is made.

Write a **balanced symbol** equation for this reaction.

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

[Total: 5]

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Question 8 begins on page 12

PLEASE DO NOT WRITE ON THIS PAGE

8 This question is about making ammonia by the Haber process.

(a) Nitrogen and hydrogen react to make ammonia.

(i) The hydrogen gas used to make ammonia comes from natural gas.

Where does the **nitrogen gas** come from?

Choose from the list.

air

limestone

salt

water

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

(ii) Nitrogen and hydrogen react to make ammonia.

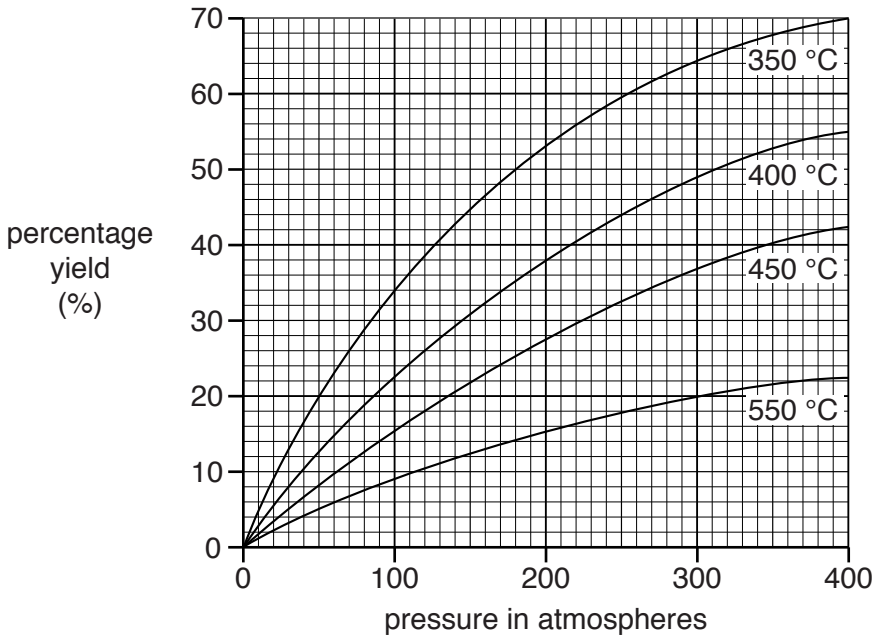
Not all of the nitrogen and hydrogen reacts.

What happens to the unreacted nitrogen and hydrogen?

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

(b) Look at the graph.

It shows the yield of ammonia under different conditions of temperature and pressure.



One cost of making ammonia is the **energy** needed.

Write about some of the **other** costs of making ammonia.

Use the graph to decide the conditions that give the **highest** yield of ammonia.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

[Total: 8]

9 In 2012 bad weather destroyed farmers' crops in Burma.

The charity called Oxfam helped farmers after the disaster.

Oxfam gave the farmers

- seeds to plant new crops
- fertilisers.

(a) Why do farmers use fertilisers?

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

(b) Potassium sulfate, K_2SO_4, is a fertiliser.

Potassium sulfate contains the **essential** element potassium, K.

Ammonium phosphate, $(NH_4)_3PO_4$, is another fertiliser.

Write down the names of the **two essential** elements in ammonium phosphate.

.....

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

(c) Fertilisers are made by reacting an acid with an alkali.

This is a neutralisation reaction.

(i) Potassium hydroxide reacts with nitric acid.

Write a **word equation** for this reaction.

.... + ... → .... + ...

[2]

(ii) One way to find out the pH of a solution of fertiliser is by using a pH meter.

Write about one **other** way to find the pH.

.....

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

[Total: 7]

Question 10 begins on page 16

SECTION C – Module C3

10 Sodium hydrogencarbonate decomposes when it is heated.

sodium hydrogencarbonate → sodium carbonate + carbon dioxide + water

$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

The table shows the relative formula masses, M_r, of the substances in the equation.

Substance	Relative formula mass
$NaHCO_3$	84
Na_2CO_3	106
CO_2	44
H_2O	18

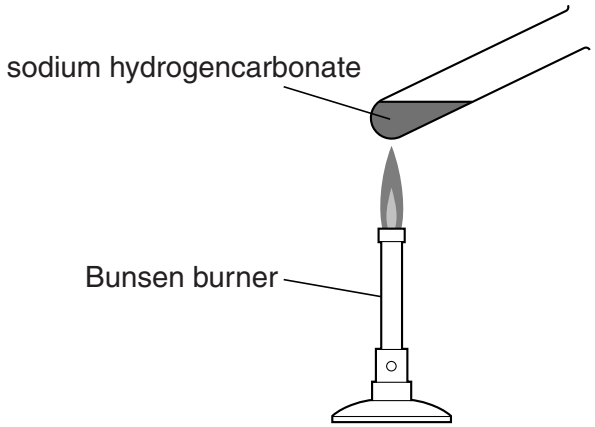
(a) Show that the relative formula mass of Na_2CO_3 is 106.

The relative atomic mass, A_r, of C = 12, O = 16 and of Na = 23.

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

(b) Zakia heats some sodium hydrogencarbonate.

Look at the apparatus she uses.



Zakia heats 0.84 g of solid sodium hydrogencarbonate.

When the reaction is complete the test tube contains 0.53 g of solid sodium carbonate.

(i) The mass of the solid in the test tube **decreases** when it is heated.

Explain why.

.....

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

(ii) Zakia does another experiment.

This time she heats 8.4 g of solid sodium hydrogencarbonate.

Predict the mass of solid sodium carbonate made when the reaction is complete.

.....

mass = ... g **[1]**

(iii) Zakia makes **less** solid sodium carbonate than she predicts.

Suggest **two** reasons why she makes less solid.

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

[Total: 5]

11 Phil is a research chemist.

He investigates a new pharmaceutical drug.

Phil extracts the drug from the leaves of a plant.

He purifies the drug and then checks to see if he has made a pure sample.

Phil uses two tests to check the purity of the drug

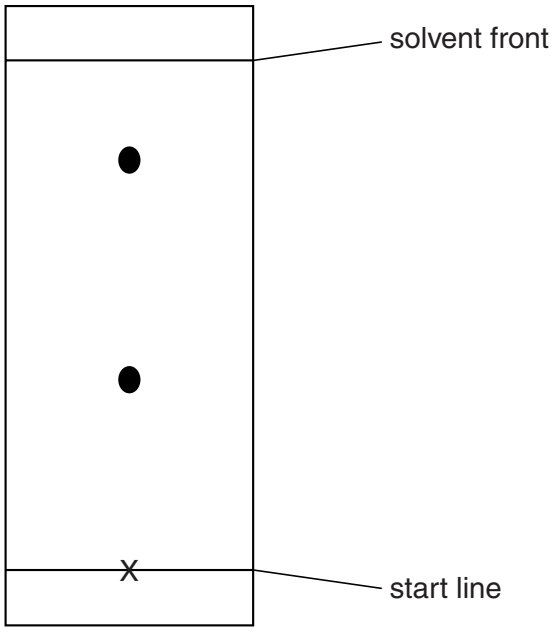
- melting point
- thin layer chromatography.

Look at the results of his tests.

Melting point

Substance	Melting point in °C
pure drug	175
sample of the drug obtained from plant	171 – 173

Thin layer chromatogram of sample of the drug obtained from the plant.



(a) Write about **how** a sample of the drug is obtained from the leaves of a plant.

What do the results of his tests show about the purity of the sample?

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

(b) Pharmaceutical drugs need to be thoroughly tested before they are allowed to be licensed to be sold.

Explain why.

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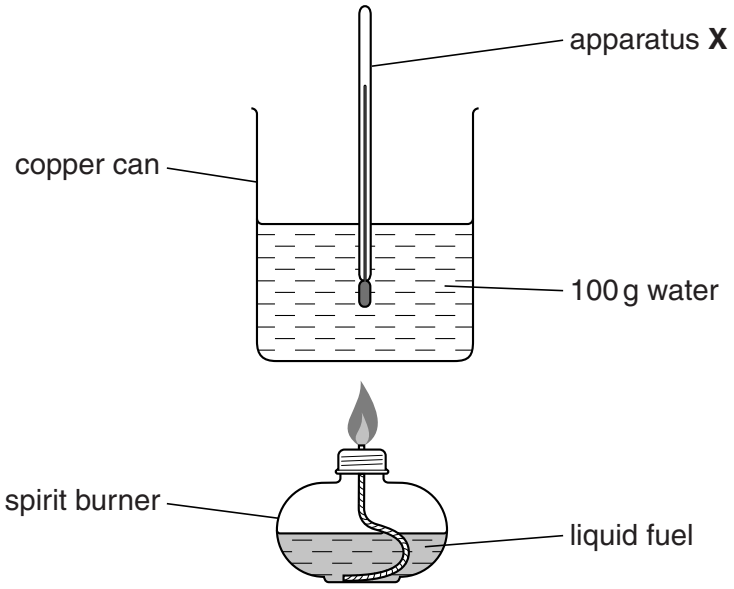
..... **[2]**

[Total: 8]

12 Zak compares different fuels.

He heats 100 g of water each time.

Look at the apparatus he uses.



(a) Look at the diagram.

What is the name of apparatus **X**?

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

(b) Zak uses four fuels.

Zak always burns the same mass of fuel.

Explain why.

.....

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

(c) Look at Zak's table of results.

Fuel	Temperature of water at start in °C	Temperature of water after heating in °C	Temperature change of water in °C
A	22	45	23
B	22	48	.....
C	21	48	.....
D	17	47	.....

Calculate the temperature change for each fuel. One has been done for you.

Use these results to decide which fuel releases the most heat energy.

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

(d) What is the name of the **type** of chemical reaction that gives out energy into the surroundings?

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

[Total: 5]

Question 13 begins on page 22

13 Zinc reacts with hydrochloric acid.

Hydrogen gas and zinc chloride are made.

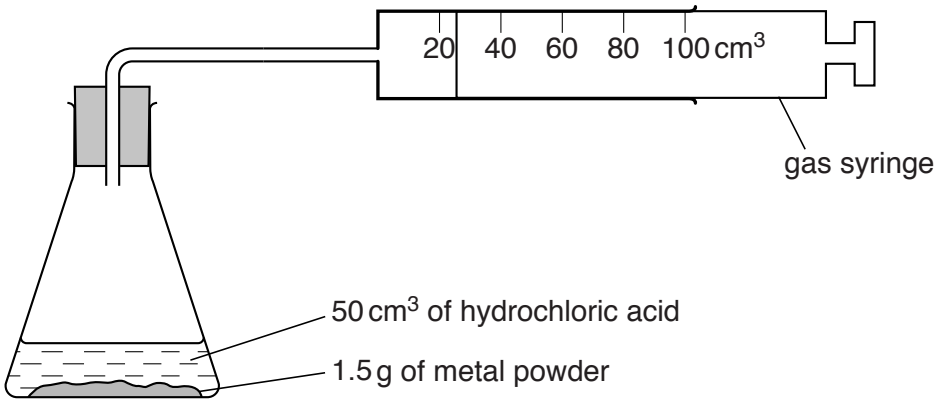
(a) Write the **word** equation for this reaction.

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

(b) Fatimah and Sam investigate the reaction between acid and metals.

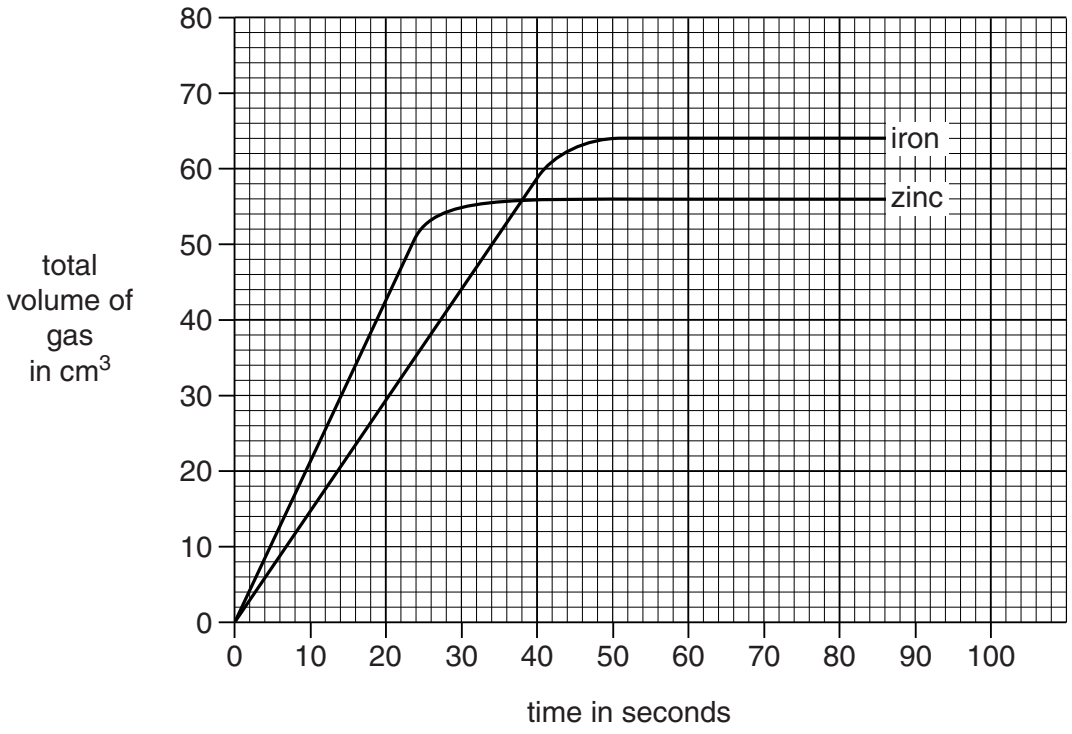
They react dilute hydrochloric acid with zinc powder and then with iron powder.

Look at the apparatus they use.



Every 10 seconds they measure the volume of gas in the gas syringe.

Look at the graph of the results.



(i) The graph for the reaction of **zinc** is different from the graph for **iron**.

Write about **two** differences in these graphs.

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

(ii) Iron powder reacts faster than a lump of iron of the same mass.

Explain why.

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

(iii) Fatimah and Sam want to make the reaction between iron powder and dilute hydrochloric acid **faster**.

They do not want to change the mass of the iron powder or the volume of acid.

Write about **three** ways they can make the reaction faster.

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

[Total: 7]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.