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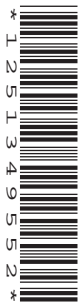
Friday 10 June 2016 – Morning

**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

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**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**

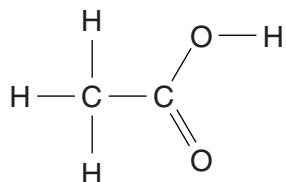
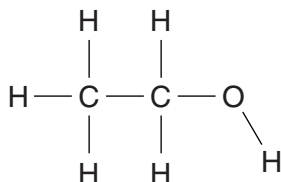
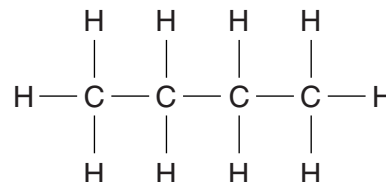
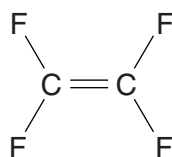
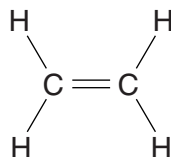
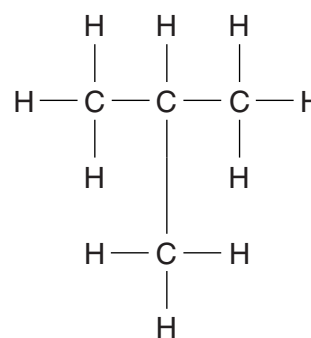
- The quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table can be found on the back page.
- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document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

2

Answer **all** the questions.**SECTION A – Module C1**

1 This question is about carbon compounds.

Look at the displayed formulas of some compounds.

**A****B****C****D****E****F****(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]**

## 3

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.

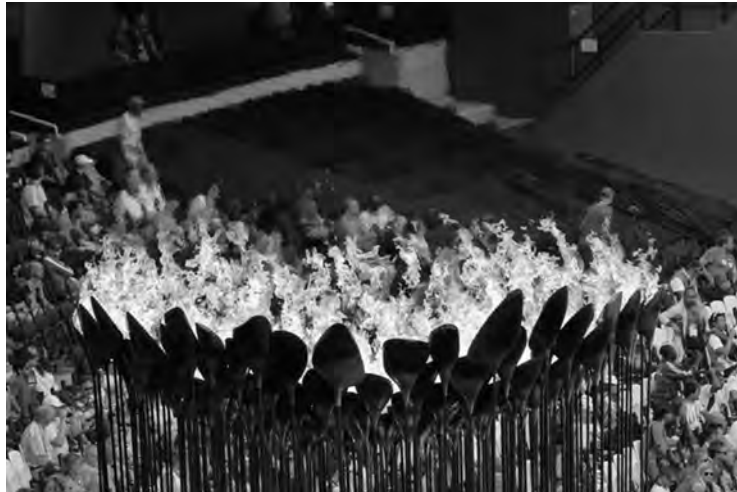
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 ..... [3]

[Total: 5]

Turn over



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.

.....

.....

.....

..... [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.

.....  
.....  
.....  
..... [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.

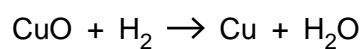
One material has been done for you.

Alloy	Metallic element
	copper

[2]

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

Look at the equation.



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

Copper oxide is reduced.

Explain how you can tell from the equation.

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



9

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

Alloy	Density in g/cm <sup>3</sup>	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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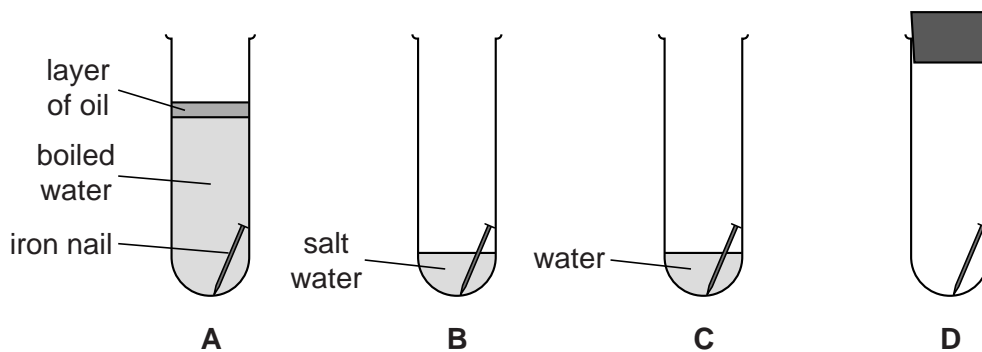
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..... [2]

[Total: 5]

7 Robert investigates the rusting of iron.

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



<b>Substances in contact with iron</b>	boiled water with no dissolved air	air and salt water	air and water	air with no water
<b>Results</b>	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.

.....  
 .....  
 ..... [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]

11

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**Question 8 begins on page 12**

**PLEASE DO NOT WRITE ON THIS PAGE**

12

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.

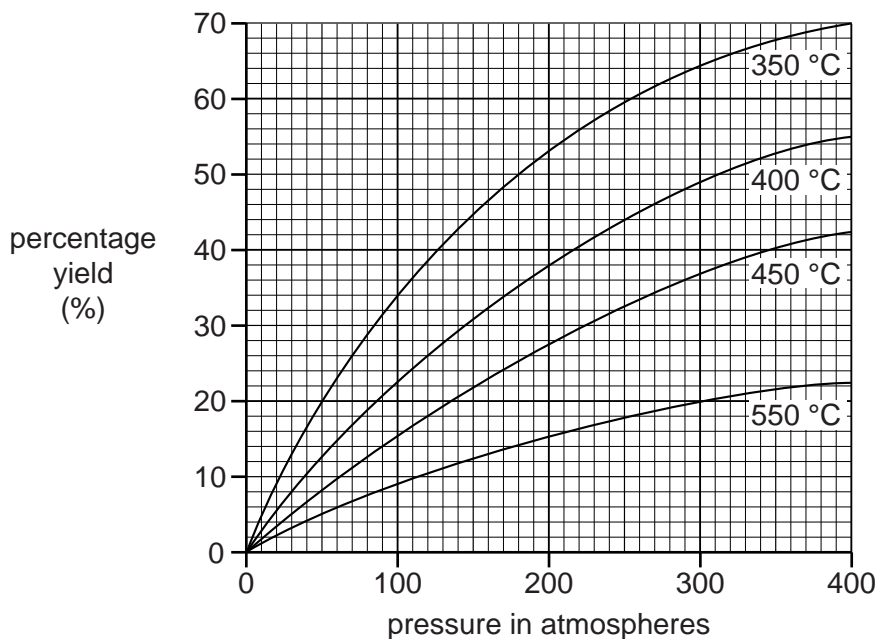
Not all of the nitrogen and hydrogen reacts.

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]

Turn over

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]

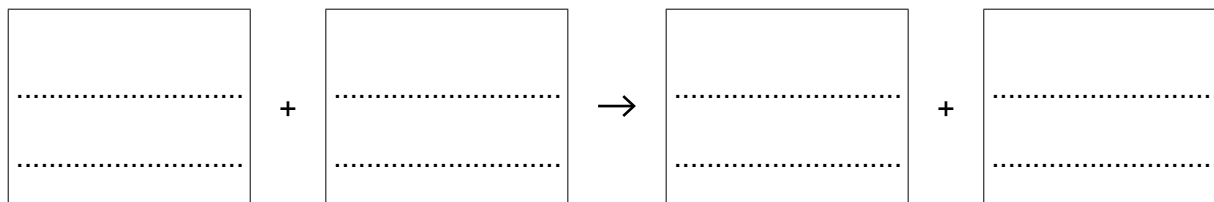
15

(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.

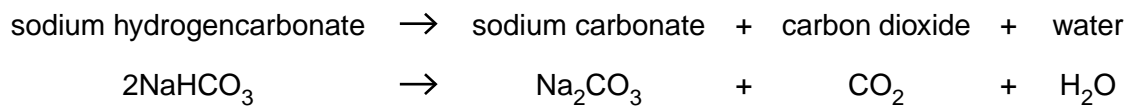
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..... [2]

[Total: 7]

Question 10 begins on page 16

## SECTION C – Module C3

10 Sodium hydrogencarbonate decomposes when it is heated.



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

Substance	Relative formula mass
$\text{NaHCO}_3$	84
$\text{Na}_2\text{CO}_3$	106
$\text{CO}_2$	44
$\text{H}_2\text{O}$	18

(a) Show that the relative formula mass of  $\text{Na}_2\text{CO}_3$  is 106.

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

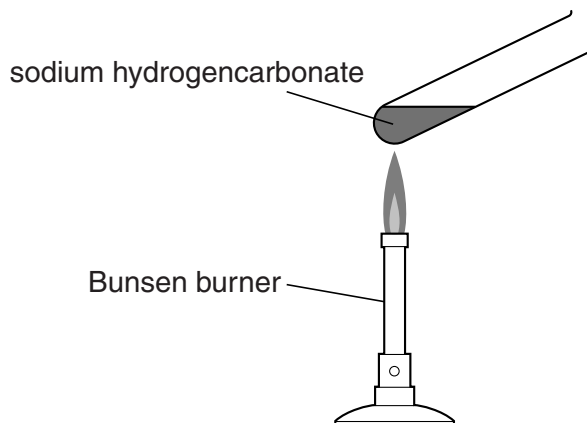
..... [1]



17

(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.

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

[Total: 5]

## 18

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

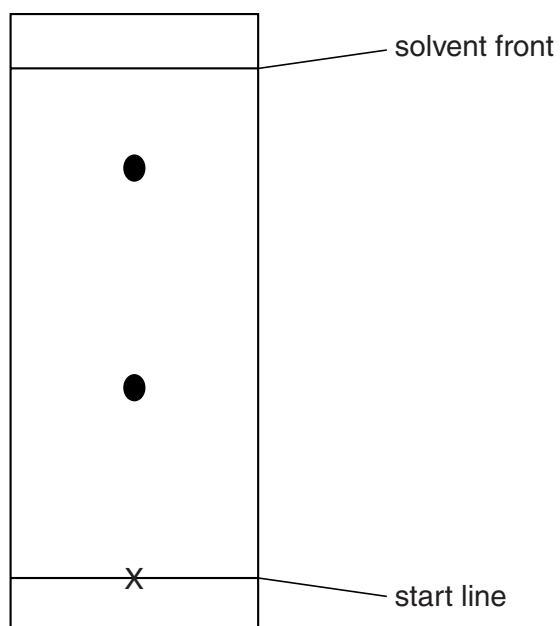
- melting point
- thin layer chromatography.

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.*

..... [6]

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

Explain why.

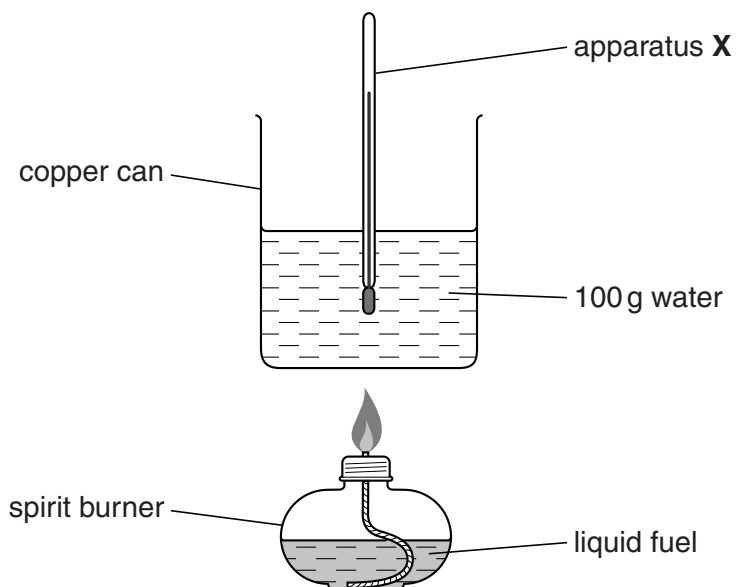
..... [2]

**[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.

.....  
 ..... [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.

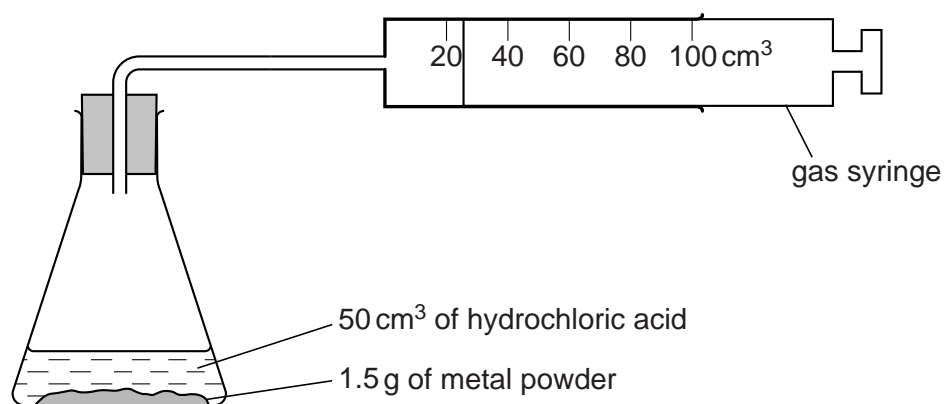
(a) Write the **word** equation for this reaction.

..... [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.

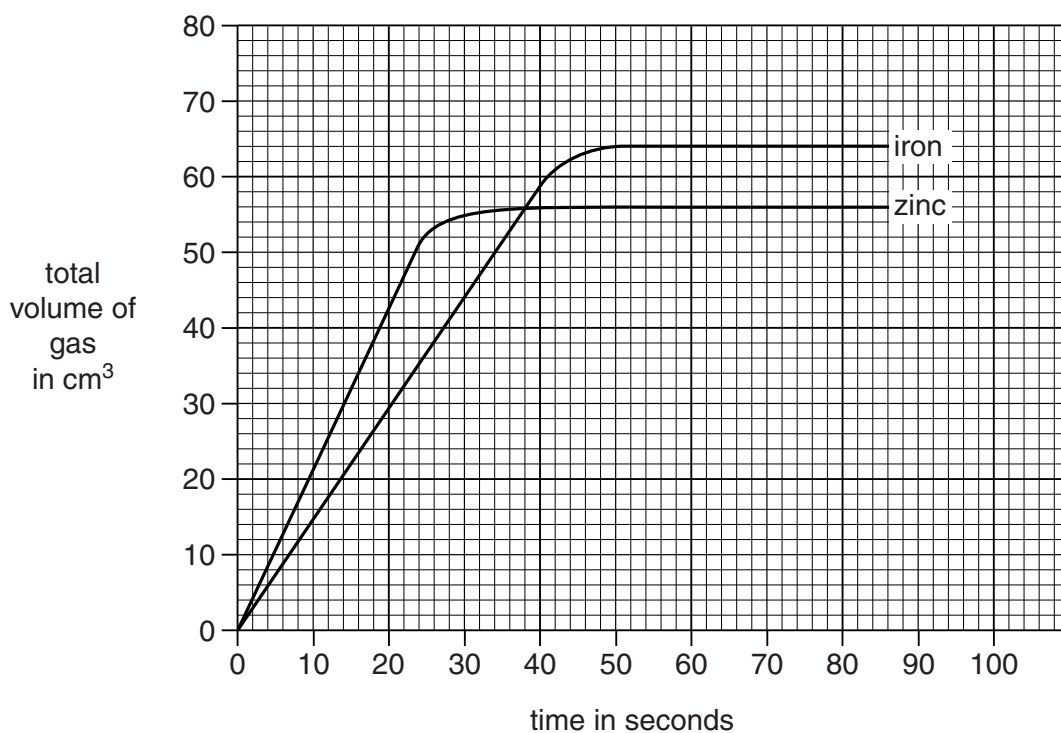
Look at the apparatus they use.



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

23

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.

.....

..... [1]

24

- (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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.....

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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.

A large area of lined paper for writing answers. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and cover most of the page area.



A large area of the page is reserved for writing, featuring a vertical margin line on the left and horizontal dotted lines for text alignment.



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# The Periodic Table of the Elements

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

\* 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.