

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE**

**B741/01**

**GATEWAY SCIENCE  
CHEMISTRY B**

**Chemistry modules C1, C2, C3  
(Foundation Tier)**

**FRIDAY 10 JUNE 2016: Morning**

**DURATION: 1 hour 15 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.  
A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**

**A copy of the Periodic Table**

**OTHER MATERIALS REQUIRED:**

**Pencil**

**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**



## **INSTRUCTIONS TO CANDIDATES**

**Write your name, centre number and candidate number in the boxes on the first page. 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.**

## **INFORMATION FOR CANDIDATES**

**The quality of written communication is assessed in questions marked with a pencil ().**

**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.**

**Any blank pages are indicated.**

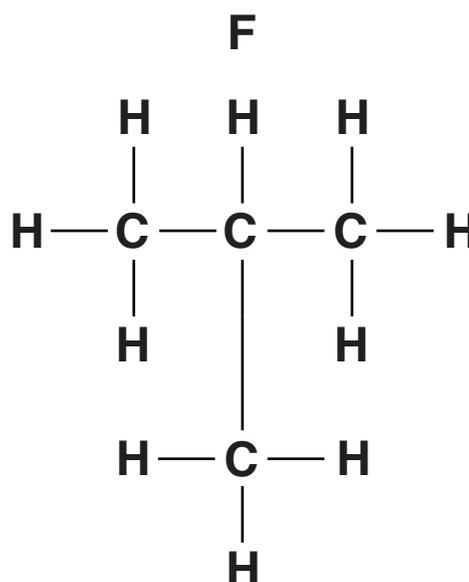
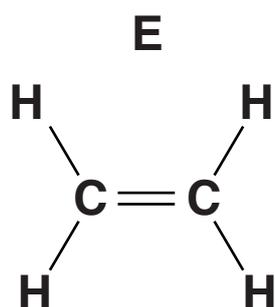
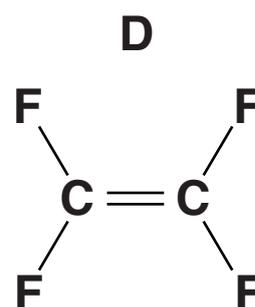
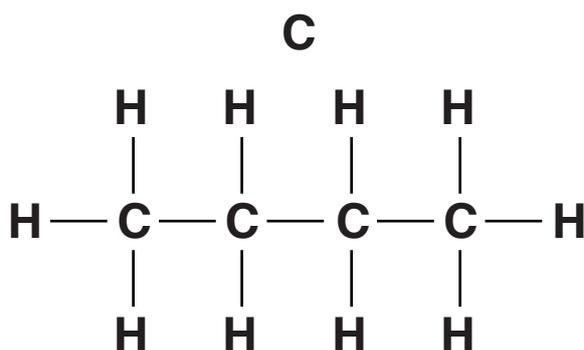
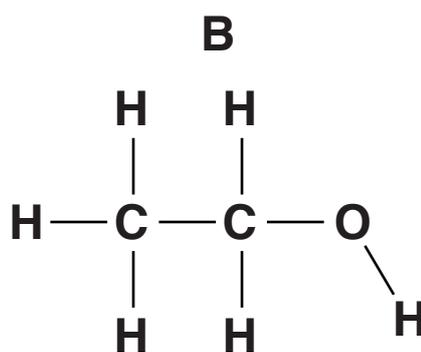
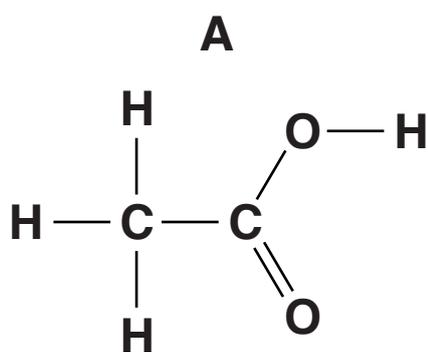
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Answer ALL the questions.

## SECTION A – Module C1

1 This question is about carbon compounds.

Look at the displayed formulas of some compounds.



**(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.

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[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.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [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.**



**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.**

<b>INGREDIENT</b>	<b>PERCENTAGE BY MASS IN EACH PAINT</b>			
	<b>Paint A</b>	<b>Paint B</b>	<b>Paint C</b>	<b>Paint D</b>
<b>solvent</b>	<b>32</b>	<b>25</b>	<b>55</b>	<b>20</b>
<b>oil</b>	<b>0</b>	<b>25</b>	<b>0</b>	<b>25</b>
<b>pigment</b>	<b>24</b>	<b>10</b>	<b>5</b>	<b>30</b>
<b>bonding medium</b>	<b>30</b>	<b>30</b>	<b>28</b>	<b>23</b>
<b>other additives</b>	<b>14</b>	<b>10</b>	<b>12</b>	<b>2</b>

**(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]**

## 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.

<b>ALLOY</b>	<b>METALLIC ELEMENT</b>
	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.**

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**[1]**

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

<b>ALLOY</b>	<b>DENSITY IN g/cm<sup>3</sup></b>	<b>RELATIVE STRENGTH</b>	<b>RELATIVE COST</b>
<b>duralumin</b>	<b>2.8</b>	<b>high</b>	<b>high</b>
<b>brass</b>	<b>8.4</b>	<b>high</b>	<b>medium</b>
<b>steel</b>	<b>7.8</b>	<b>very high</b>	<b>low</b>

**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 opposite. It shows the apparatus he uses.**

- (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?**

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**[1]**

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

**This is because aluminium reacts with oxygen, O<sub>2</sub>.**

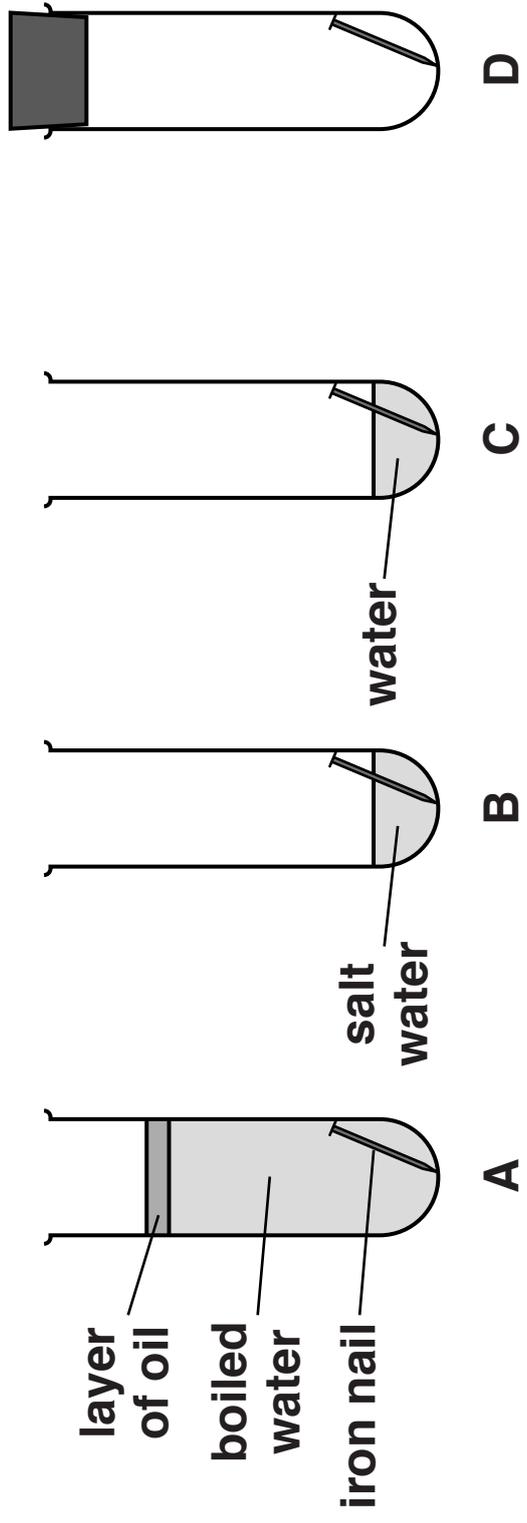
**A protective layer of aluminium oxide, Al<sub>2</sub>O<sub>3</sub>, is made.**

**Write a BALANCED SYMBOL equation for this reaction.**

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**[2]**

**[TOTAL: 5]**



**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

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**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.**

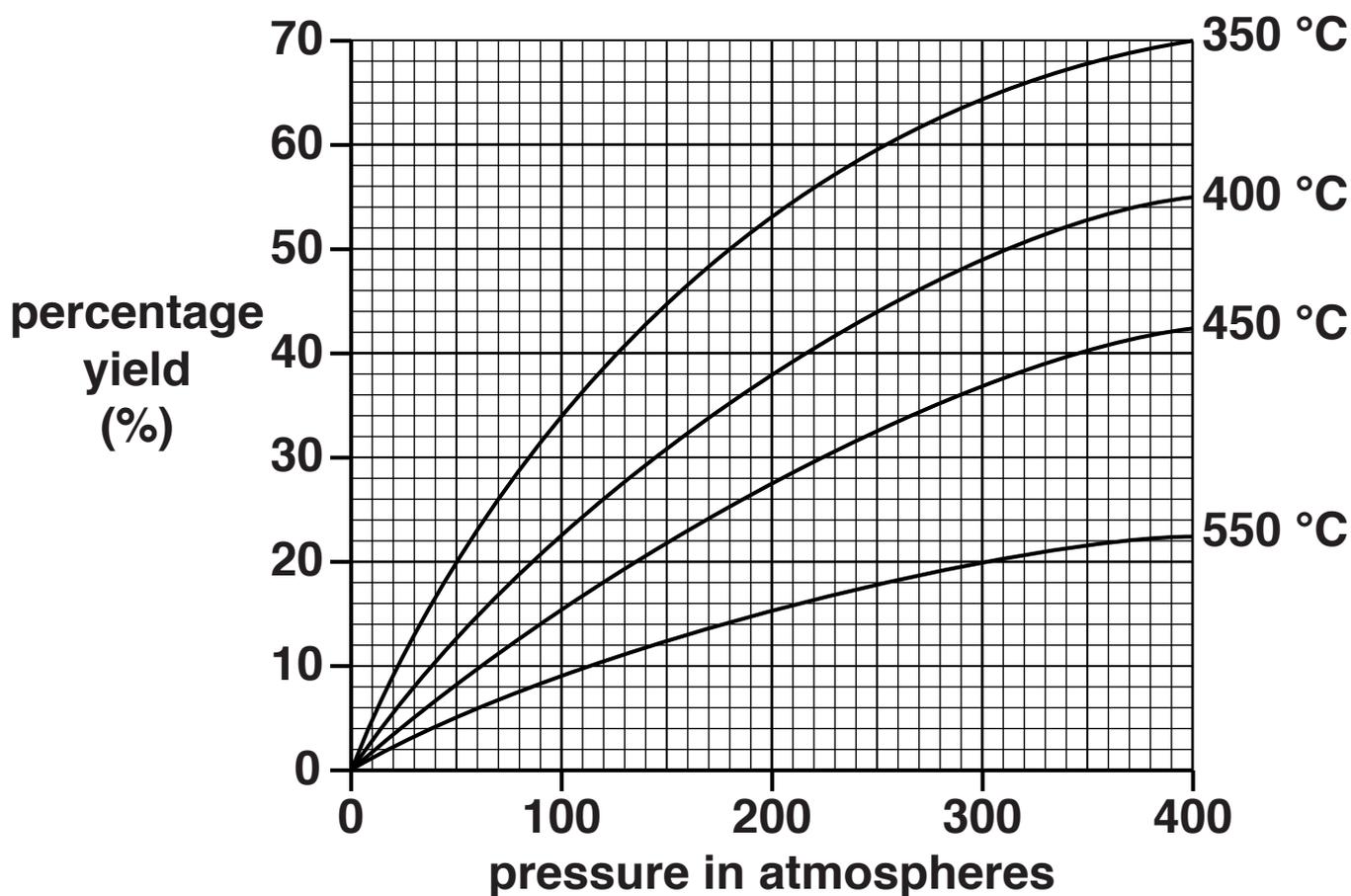
**Not all of the nitrogen and hydrogen reacts.**

**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.**



**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.**

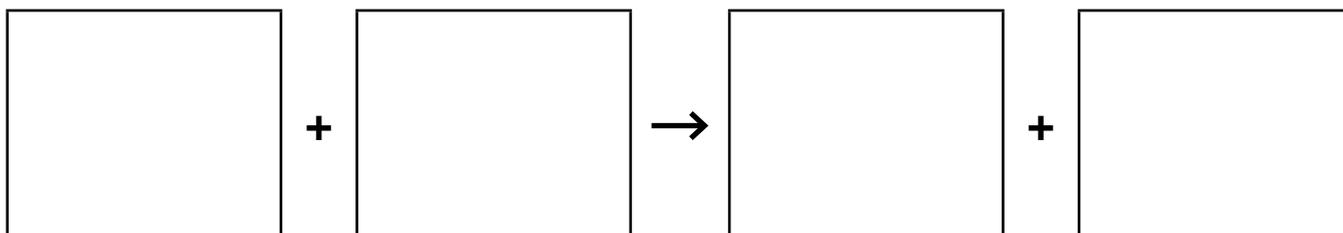
\_\_\_\_\_  
\_\_\_\_\_ [2]

**(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]**

## SECTION C – Module C3

10 Sodium hydrogencarbonate decomposes when it is heated.

sodium hydrogencarbonate  $\rightarrow$  sodium carbonate + carbon dioxide + water



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.

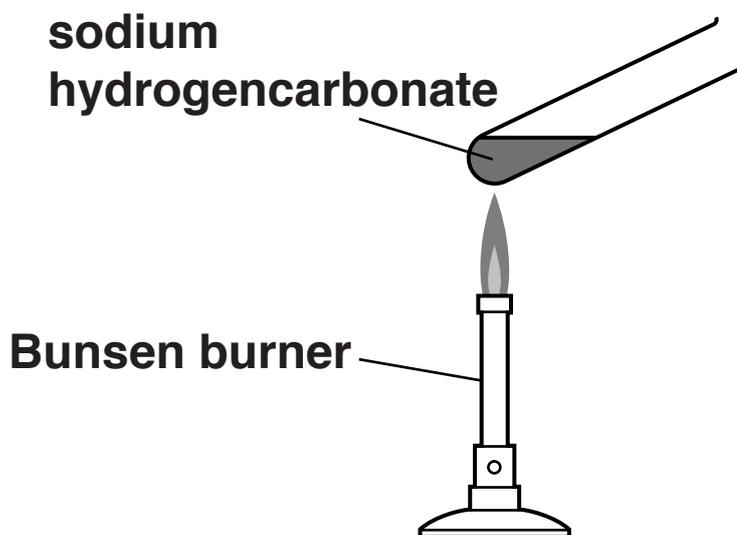
The relative atomic mass,  $A_r$ , of C = 12, O = 16 and of Na = 23.

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[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.**

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[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]**

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**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**

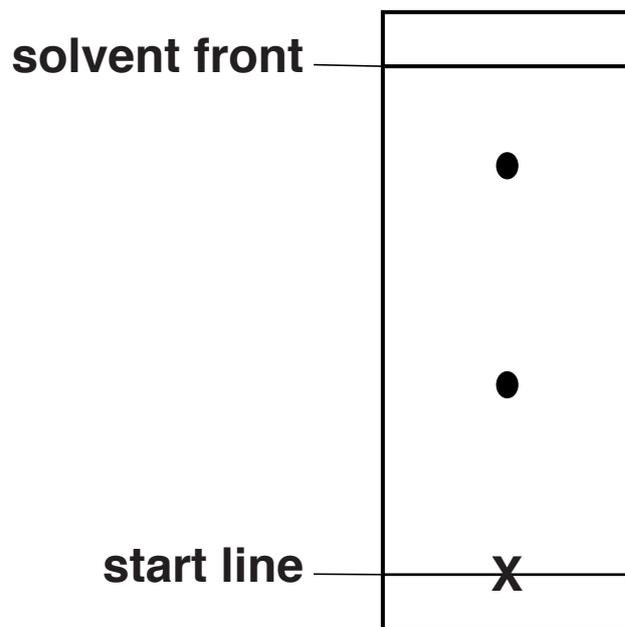
**thin layer chromatography.**

**Look at the results of his tests.**

### **MELTING POINT**

<b>SUBSTANCE</b>	<b>MELTING POINT in °C</b>
<b>pure drug</b>	<b>175</b>
<b>sample of the drug obtained from plant</b>	<b>171 – 173</b>

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





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

**Explain why.**

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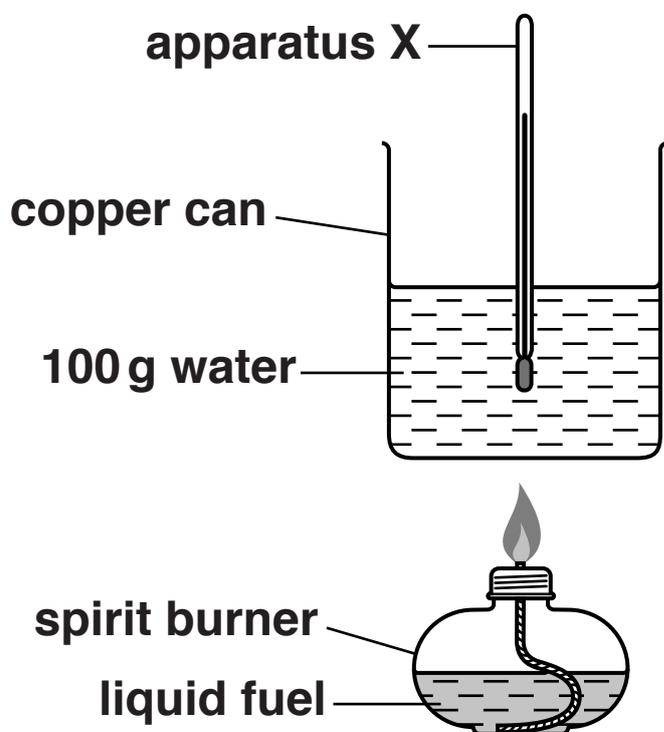
**[2]**

**[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.**

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

**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]**

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### 13 Zinc reacts with hydrochloric acid.

Hydrogen gas and zinc chloride are made.

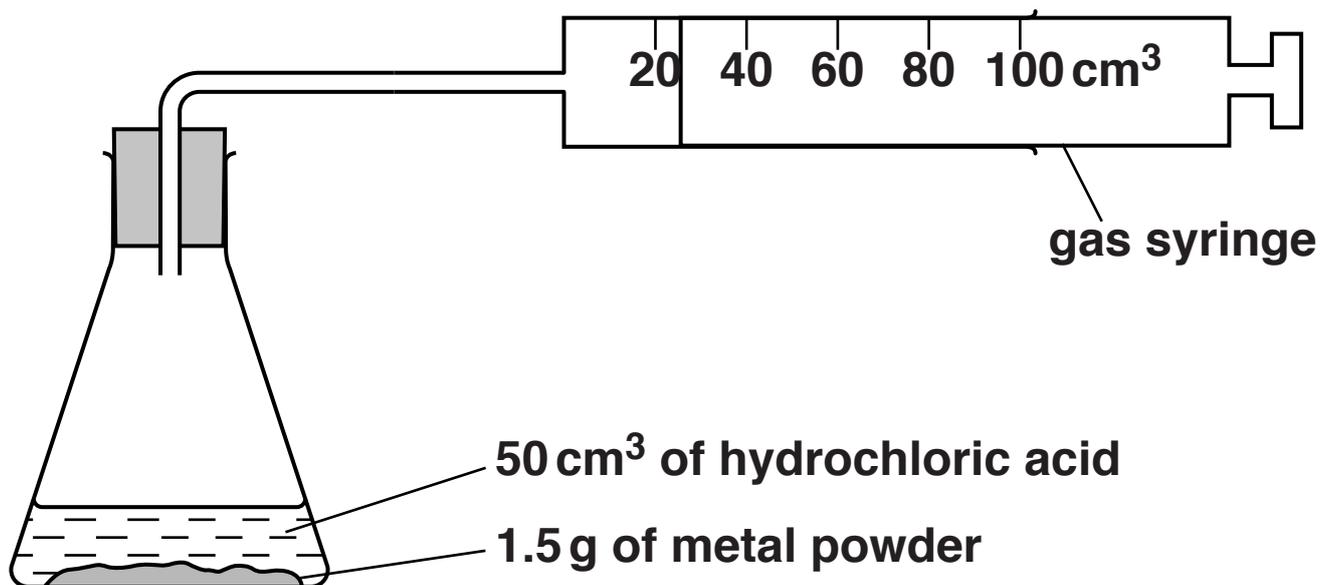
(a) Write the WORD equation for this reaction.

\_\_\_\_\_ [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 opposite.**

- (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]**

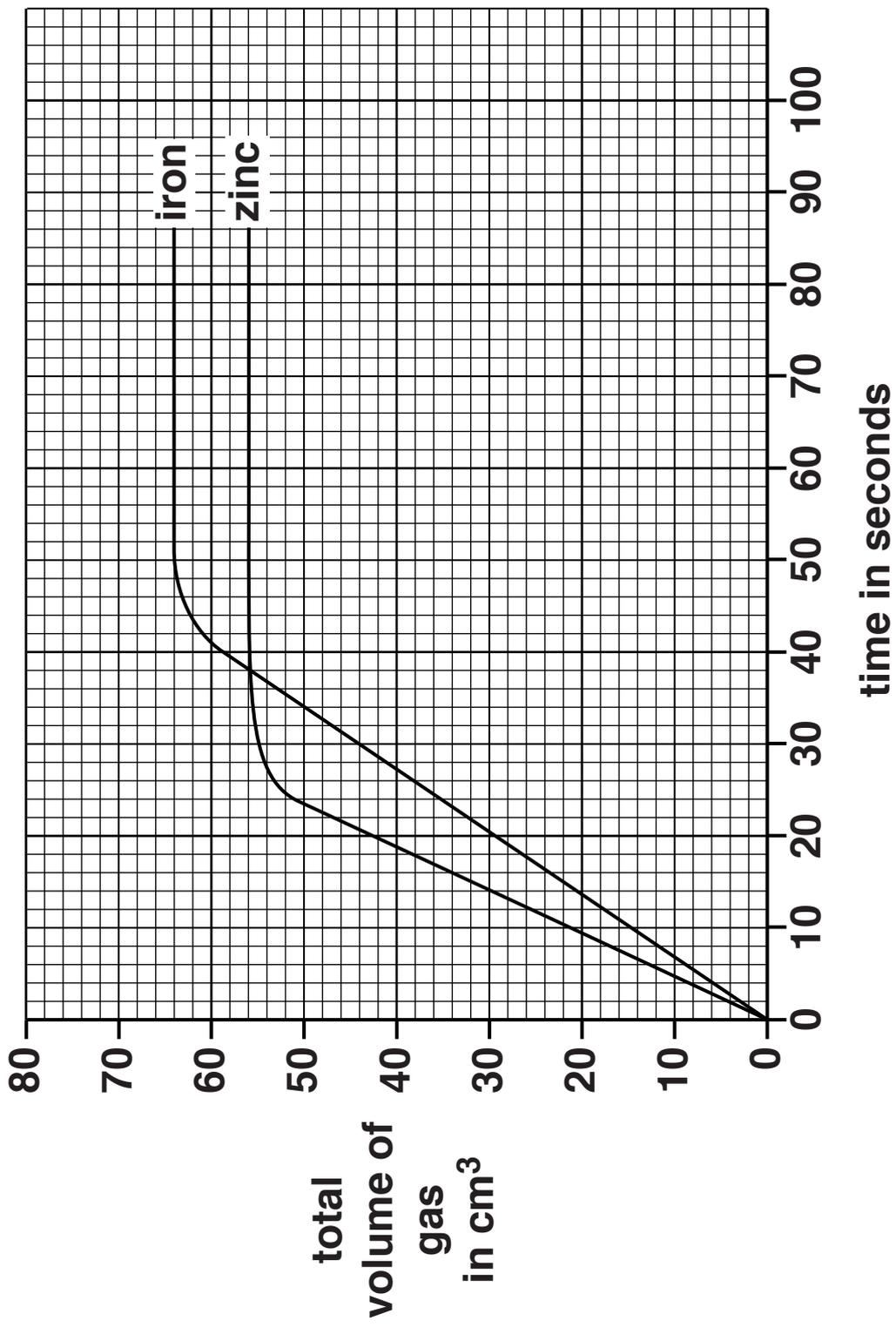
- (ii) Iron powder reacts faster than a lump of iron of the same mass.**

**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**









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