OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

B741/02

GATEWAY SCIENCE CHEMISTRY B

Chemistry modules C1, C2, C3 (Higher Tier)

FRIDAY 10 JUNE 2016: Morning
DURATION: 1 hour 15 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidate forename		Candidate surname	

Centre number					Candidate number				

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.
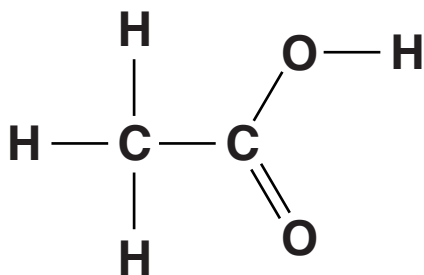
Any blank pages are indicated.

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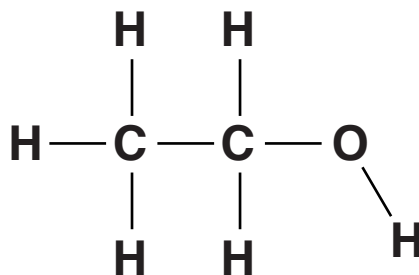**Answer ALL the questions.**

SECTION A – Module C1

1   This question is about carbon compounds.
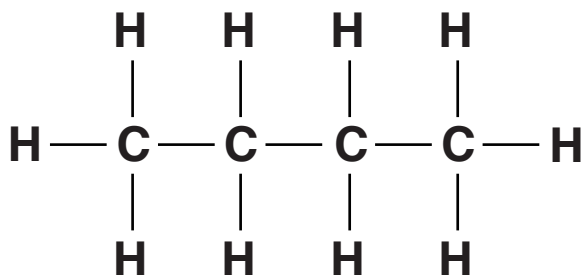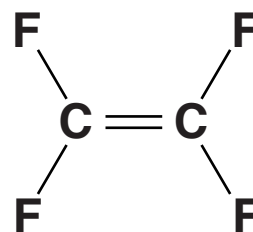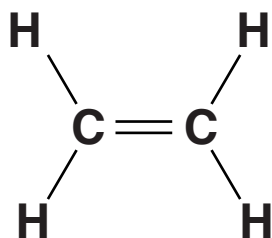
Look at the displayed formulas of some compounds.
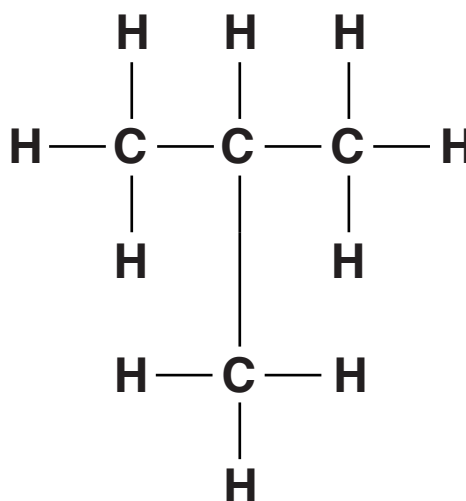
(a) **Which compound is an ALKENE?**

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

_____   [1]

(b) **Which TWO compounds have the same MOLECULAR FORMULA?**

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

_____ and _____   [1]

(c) **A molecule of dodecane, $C_{10}H_{22}$, can be cracked to give compound E and one other hydrocarbon, X.**

Deduce the MOLECULAR formula for X.

_____[1]

(d) **Compound D is a monomer and makes an addition polymer.**

Draw the DISPLAYED formula for 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	$C_7H_{14}O_2$	−71		

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

Explain why using information from the molecular formulas.

_____

_____ **[1]**

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

liquid at room temperature, 25 °C

evaporates easily

fairly soluble in water.

  (i) Predict the boiling point for pentyl ethanoate.

     _____ °C   **[1]**

  (ii) Use the information in the table to predict if pentyl ethanoate is suitable as a solvent in nail varnish remover.

Explain your answer.

_____

_____

_____

_____ **[2]**

[TOTAL: 4]

3   Air contains a mixture of gases.

The table shows the percentage by volume of different gases in air.

GAS	PERCENTAGE (%)
carbon dioxide	0.04
nitrogen	78
oxygen	21

The percentage by volume of these gases in air hardly changes because of the carbon cycle.

Explain why the percentage by volume of the gases in the table hardly changes.

Predict the effect that an increase in the world's population may have on these 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 natural gas.

Natural gas is mostly methane, CH_4.

The Olympic flame was yellow because there was some incomplete combustion.

Construct a BALANCED SYMBOL equation to show the incomplete combustion of methane to make carbon.

_____ **[2]**

[TOTAL: 2]

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) Paint D is an oil paint.

Explain how an oil paint dries.

_____

_____

_____

_____ [2]

(d) Paint is a mixture called a COLLOID.

Explain why the ingredients of a paint will not separate.

_____

_____

_____

_____ [2]

[TOTAL: 6]

6   A Gore-Tex® jacket is both waterproof and breathable.

Gore-Tex® is made from a layer of nylon that is laminated with a PTFE polymer membrane.

(a) Use ideas about the structure of Gore-Tex® to explain why it is both waterproof and breathable.

_____

_____

_____

_____

_____ [2]

(b) Suggest ONE advantage of a Gore-Tex® jacket over one made from only nylon.

_____

_____

_____

_____ [1]

[TOTAL: 3]

SECTION B – Module C2

7   This question is about metals and alloys.

(a) Look at the table. It shows some alloys and the metals they contain.

Complete the table.

ALLOY	METAL(S) IN THE ALLOY
amalgam	
	copper and zinc
solder	and

[2]

(b) The alloy duralumin contains aluminium.

Aluminium reacts with oxygen, O_2.

Aluminium oxide, Al_2O_3, is made.

Write a BALANCED SYMBOL equation for this reaction.

_____ [2]

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

Alloy	Density in g/cm^3	Relative strength	Relative cost
A	2.8	high	high
B	8.4	high	medium
C	7.8	high	low
D	2.6	low	low

(i) Evaluate the advantages and disadvantages of these alloys for making aeroplane wings.

Put your answers in the table below.

Alloy	Advantages	Disadvantages
A		
B		
C		
D		

[3]

(ii) Which alloy would you choose?

_____ [1]

[TOTAL: 8]

8 The structure of the Earth is explained using the theory of plate tectonics.

The continental drift theory was put forward by a scientist called Wegener in 1914.

It has developed into the theory of plate tectonics.

Explain why the theory of plate tectonics is widely accepted by scientists.
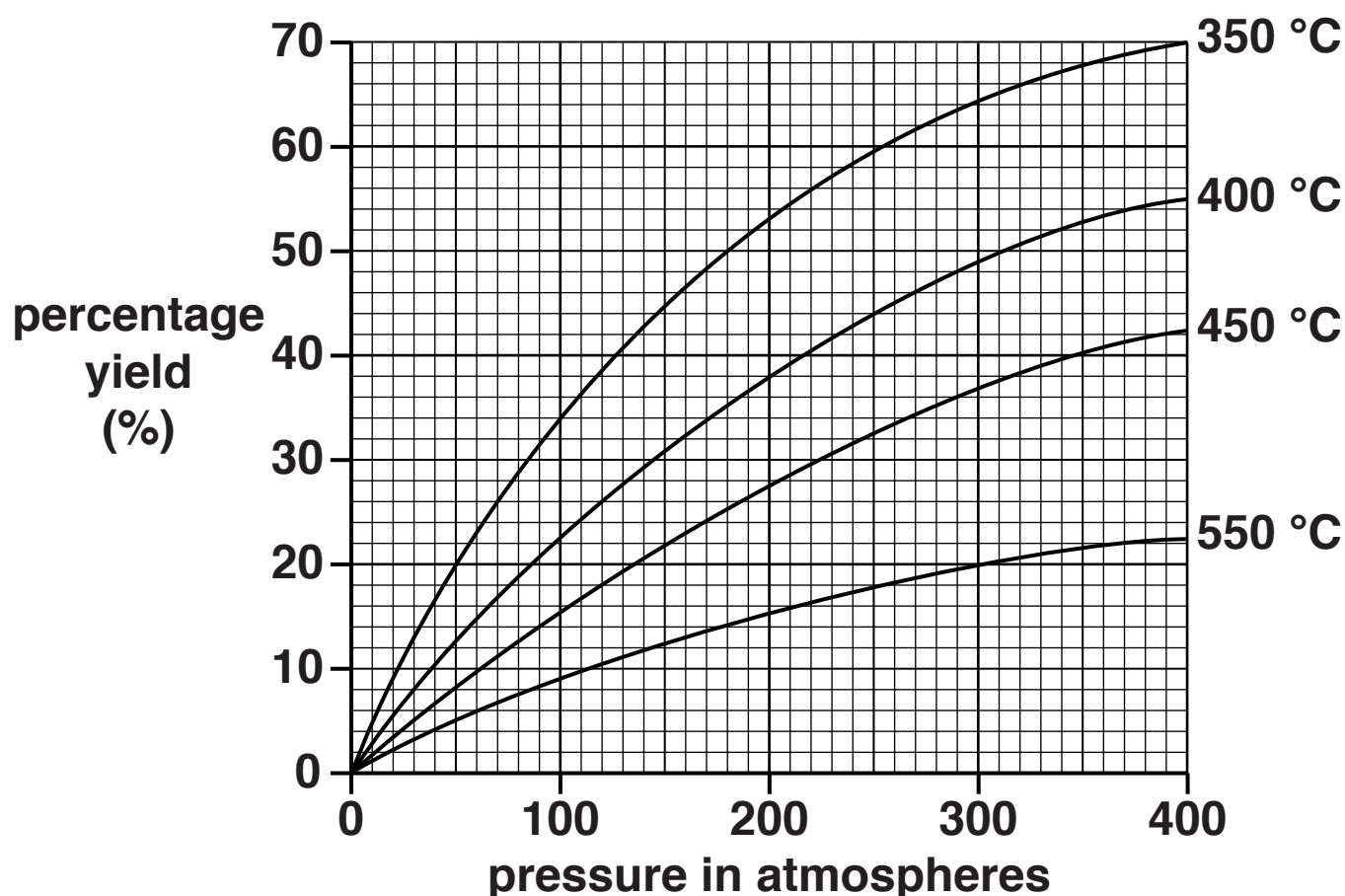
_____

_____

_____

_____ [2]

[TOTAL: 2]

9 This question is about the conditions used in the Haber process to make ammonia.

Look at the graph.

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

In the manufacture of ammonia, the conditions used are:

a pressure of 200 atmospheres

a temperature of 450 °C.

Use the graph to decide the conditions of temperature and pressure that give the HIGHEST yield of ammonia.

Explain why the conditions that give the highest yield are NOT used in the Haber process.

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

_____

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_____

_____ **[6]**

[TOTAL: 6]

10 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) The fertilisers must be dissolved in water.

Explain why.

_____

_____ [1]

(b) If too much fertiliser is used, it can run off into streams and lakes.

This can cause EUTROPHICATION.
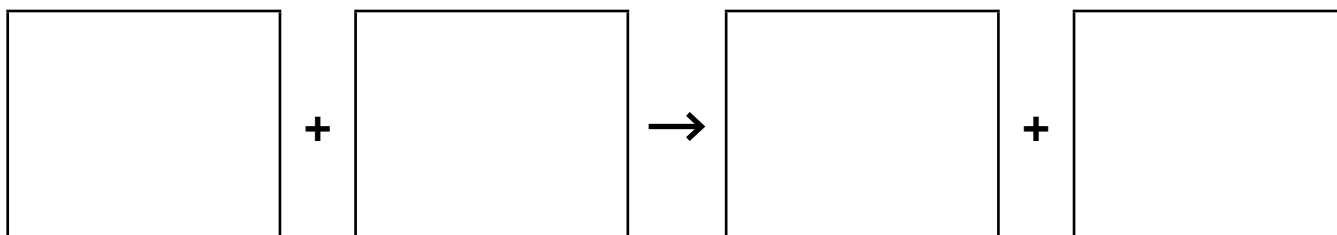
Explain what happens during eutrophication.

_____

_____

_____

_____

_____ [3]

20

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

This is a neutralisation reaction.

Potassium hydroxide reacts with nitric acid.

Write a WORD equation for this reaction.

	+		→		+	

[2]

[TOTAL: 6]

11 This question is about the corrosion of metals.

Look at the table. It shows how four metals corrode in different conditions.

METAL	DOES THE METAL CORRODE IN		
	DAMP AIR?	DAMP ACIDIC AIR?	DRY AIR?
A	no	quickly	no
B	slowly	quickly	no
C	very slowly	very slowly	no
D	very quickly	very quickly	quickly

(a) Metal A is aluminium.

Explain how you can tell from the information in the table.

_____

_____ [1]

(b) (i) Iron rusts in damp air.

Rust is hydrated iron(III) oxide.

Write the WORD equation for the rusting of iron.

_____ [1]

(ii) The rusting of iron is an OXIDATION reaction.
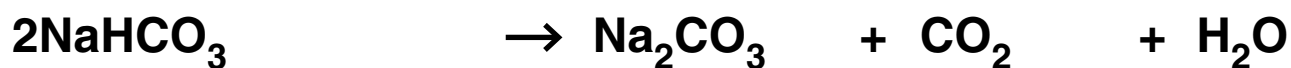
   Explain why.

   _____ [1]

   [TOTAL: 3]

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SECTION C – Module C3

12 Sodium hydrogencarbonate decomposes when it is heated.

| sodium hydrogencarbonate | $\rightarrow$ | 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) Use the relative formula masses in the table to show that mass is conserved during this reaction.

_____ [2]

(b) Zakia heats some sodium hydrogencarbonate.

Look at the apparatus she uses.

sodium
hydrogencarbonate

Bunsen burner
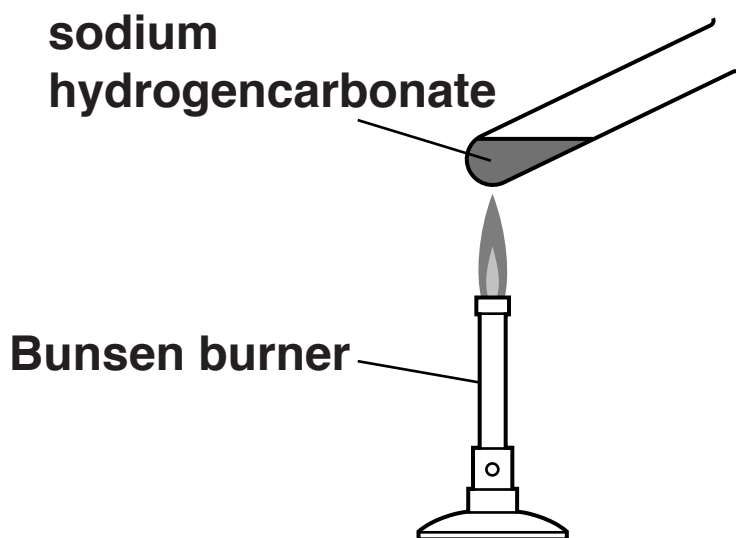
Zakia heats 1.000 g of solid sodium hydrogencarbonate.

After heating for ten minutes the test tube contains 0.631 g of solid sodium carbonate.

Zakia does the experiment again.

This time she uses 2.500 g of solid sodium hydrogencarbonate.

(i) Show that the predicted mass of solid sodium carbonate that she should make is 1.578 g.

_____

_____

_____ [1]

(ii) Zakia actually makes 1.124 g of solid sodium carbonate.

Calculate the percentage yield.

Give your answer to THREE SIGNIFICANT FIGURES.

percentage yield = _____ %   [2]

[TOTAL: 5]

13 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.
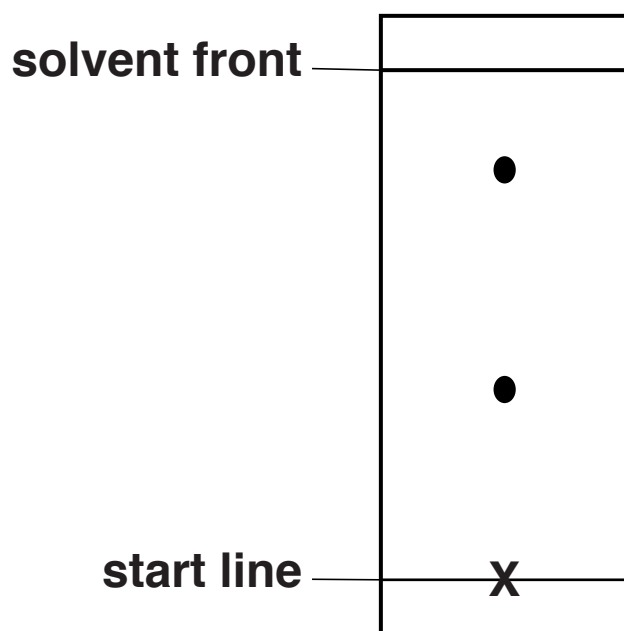
Phil uses two tests to check the purity of the drug

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.

solvent front —

start line —   X

(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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_____

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_____

_____

_____

_____

_____

_____

_____ **[6]**

**(b) It is difficult to test and develop new
pharmaceutical drugs that are safe to use.**

Explain why.

_____

_____

_____

_____

_____ **[2]**

[TOTAL: 8]

14 **Zak heats 100 g of water using a liquid fuel.**

Look at the apparatus he uses.

thermometer

copper can

100 g water

spirit burner
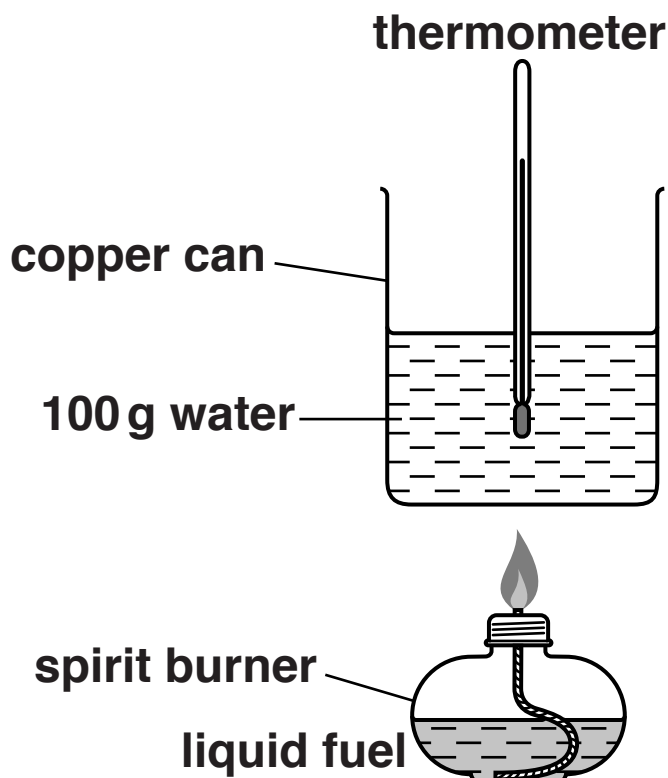
liquid fuel

Zak burns 2.0 g of the liquid fuel.

The energy output of the fuel is 16 000 J / g.

(a) **Calculate the energy released when 2.0 g of the liquid fuel is burned.**

energy released = _____ J   [1]

(b) The energy released by the liquid fuel is related to the rise in temperature of the water, ΔT.

This relationship is shown by the equation

energy released = mass $\times$ 4.2 $\times$ ΔT

Calculate the rise in temperature of the water in Zak's experiment.

rise in temperature = _____ $°C$ [3]

(c) The burning of a liquid fuel is an example of an EXOTHERMIC reaction.

Explain, using ideas about bond breaking and bond making, why this reaction is exothermic.

_____

_____

_____

_____

_____

_____ [3]

[TOTAL: 7]

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15 **Zinc, Zn, reacts with hydrochloric acid, HCl.**

Hydrogen gas, H$_2$, and zinc chloride, ZnCl_2, are made.

(a) Construct the BALANCED SYMBOL 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 with iron powder.

Look at the apparatus they use.

gas syringe

50 cm^3 of hydrochloric acid

1.5 g of metal powder
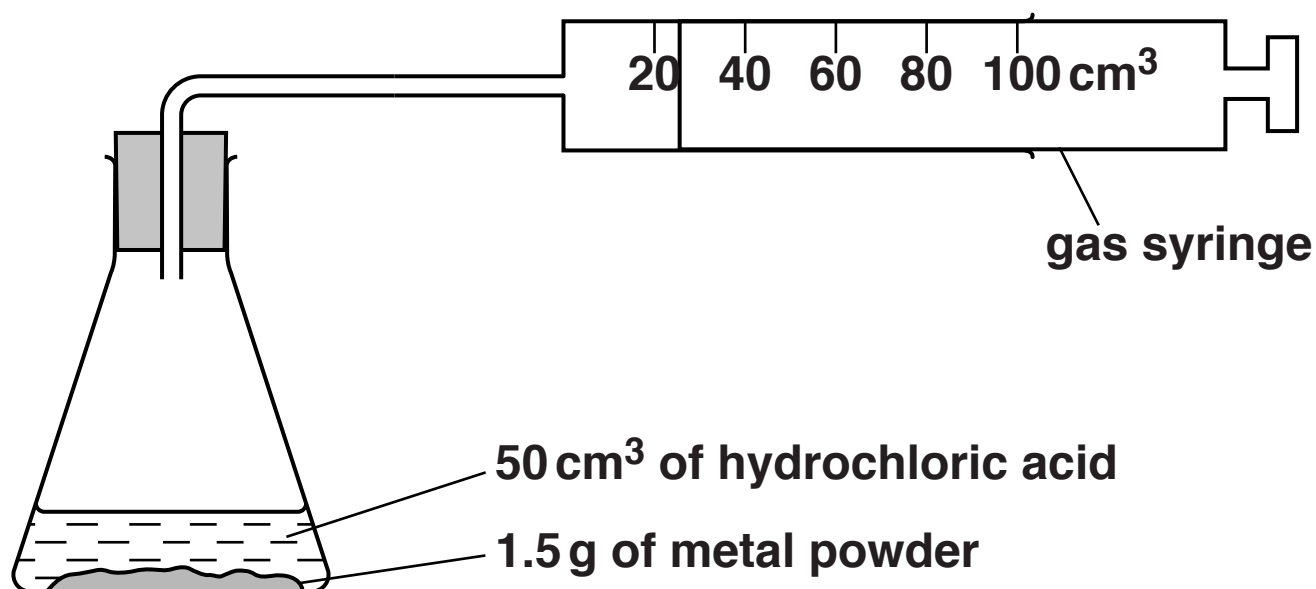
Every 10 seconds they measure the volume of gas in the gas syringe.

Fatimah and Sam do three different experiments.

50 cm^3 hydrochloric acid and 0.15 g of zinc

50 cm^3 hydrochloric acid and 0.15 g of iron

50 cm^3 hydrochloric acid and 0.075 g of iron mixed with 0.075 g of zinc.

Look at the graph opposite of the results for the first two experiments.

(i) **Calculate the rate of reaction of IRON during the FIRST 30 SECONDS.**

_____

_____

rate of reaction = _____ cm^3/s   [1]

(ii) **Predict the total volume of hydrogen formed when the MIXTURE of zinc and iron powder is used.**

_____ cm^3 [1]

(c) **Increasing the concentration of a reactant in solution will increase the rate of reaction.**

Use the reacting particle model to explain why.

_____

_____

_____

_____ [2]

[TOTAL: 5]

total volume of hydrogen in cm³

time in seconds

iron

zinc
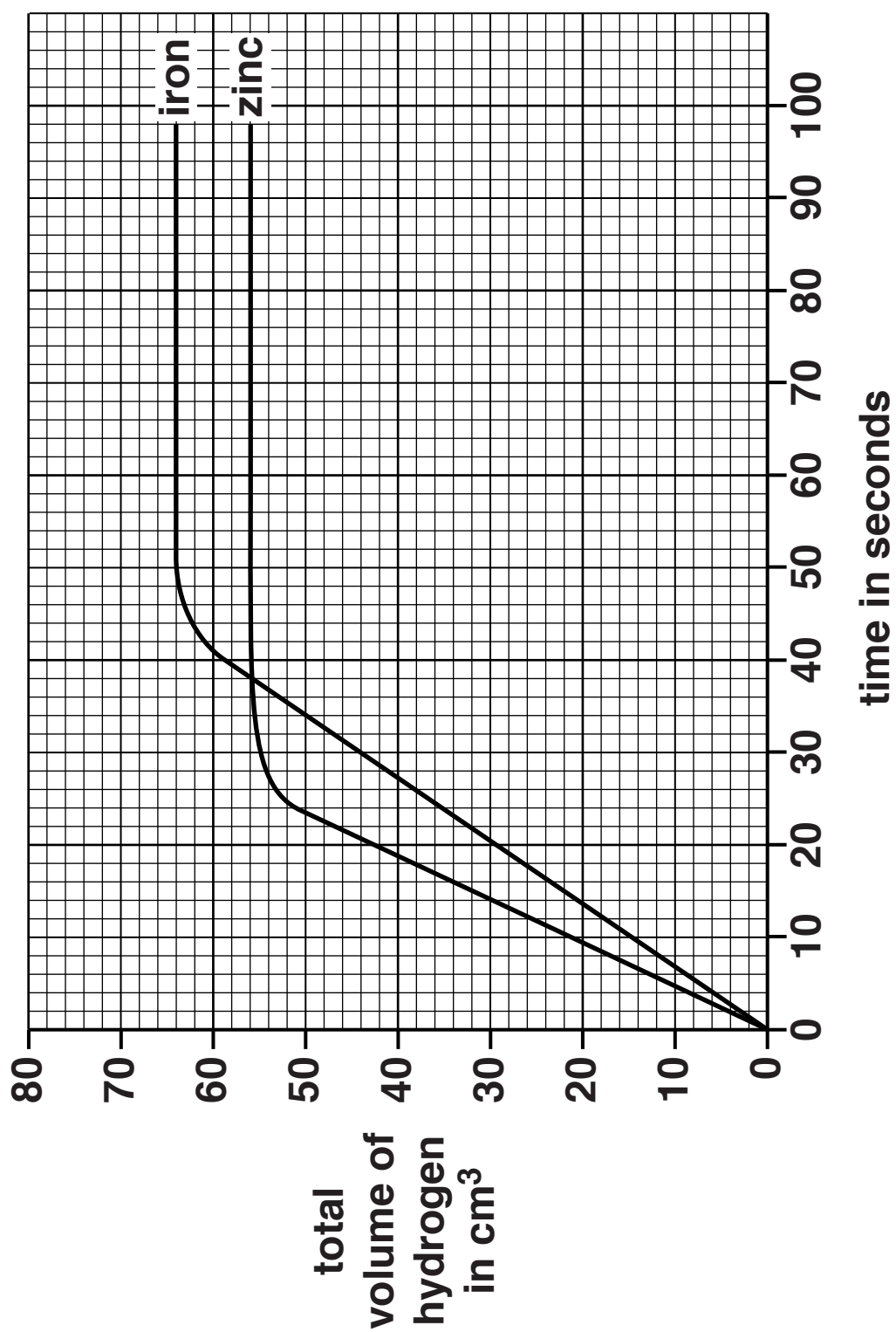
END OF QUESTION PAPER

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.

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