

OCR

Oxford Cambridge and RSA

Accredited

**GCSE (9–1) Combined Science
(Chemistry) A (Gateway Science)
J250/10 Paper 10 (Higher Tier)
Sample Question Paper**

H**Date – Morning/Afternoon**

Time allowed: 1 hour 10 minutes

You must have:

- the Data Sheet

You may use:

- a scientific or graphical calculator
- a ruler



First name

Last name

Centre
numberCandidate
number**INSTRUCTIONS**

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [].
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages. Any blank pages are indicated.

SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

- 1** Fractional distillation is used to separate crude oil into a range of other substances. The process uses a fractionating column.

Which of these statements about fractional distillation is / are correct?

- 1** propane, C_3H_8 , is found in the fraction obtained from the top of the column
2 crude oil is heated before it enters the bottom of the column

- A** 1 only
B 2 only
C both 1 and 2
D neither 1 nor 2

Your answer

[1]

- 2** These processes are used to make water safe to drink.

- chlorination
- filtration
- sedimentation

In what order are these processes done?

- A** chlorination then filtration then sedimentation
B filtration then sedimentation then chlorination
C sedimentation then chlorination then filtration
D filtration then chlorination then sedimentation

Your answer

[1]

- 3 Rubidium is found in Group 1 of the Periodic Table. Bromine is found in Group 7. They react together to form an ionic compound.

Which row shows the electron change that occurs for rubidium and the correct formula of a rubidium ion?

	Electron change	Formula of ion
A	Electron gained	Rb ⁺
B	Electron gained	Rb ⁻
C	Electron lost	Rb ⁺
D	Electron lost	Rb ⁻

Your answer

[1]

- 4 Aluminium is extracted from its ore by electrolysis.

Which of these statements explains why aluminium can **only** be extracted by electrolysis?

- A Aluminium is higher than iron in the reactivity series.
 B Aluminium is lower than carbon in the reactivity series.
 C Aluminium is higher than carbon in the reactivity series.
 D Aluminium is lower than sodium in the reactivity series.

Your answer

[1]

- 5 Crude oil is separated into fractions which have different boiling points.

Look at the table.

Which letter represents the correct relationship between the boiling point, the number of carbon atoms and the size of intermolecular forces?

	Boiling point	Number of carbon atoms in the molecule	Size of intermolecular forces
A	high	more than 50	small
B	low	more than 50	large
C	high	less than 20	large
D	low	less than 20	small

Your answer

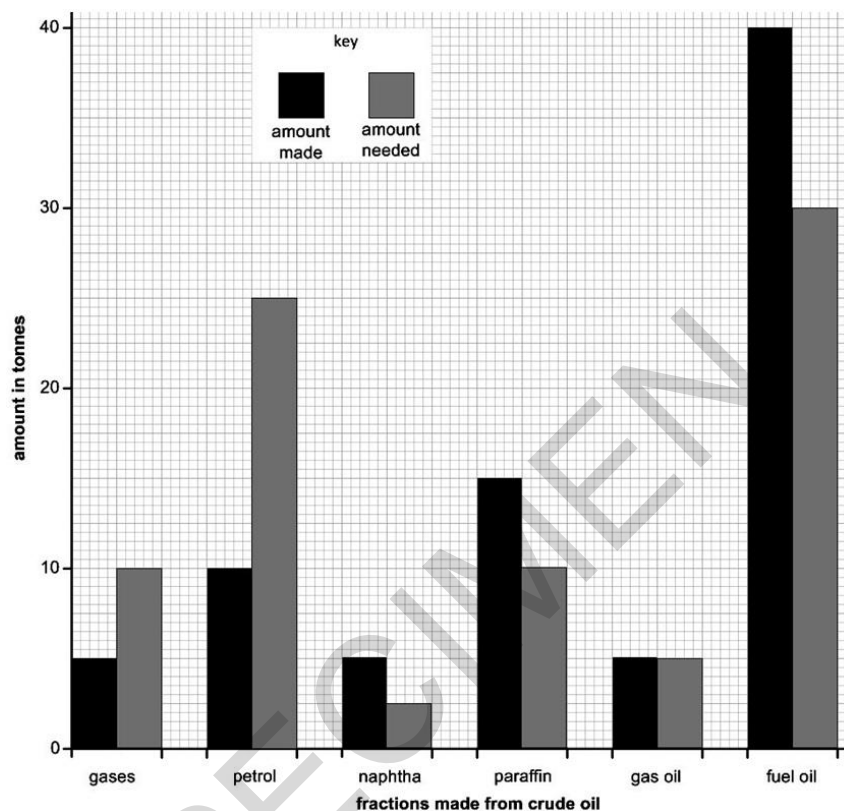
[1]

6 Fractional distillation separates the substances in crude oil into useful fractions in a refinery.

Look at the bar chart.

It shows the amount of some of the fractions made from 100 tonnes of crude oil.

It also shows the amount of each fraction needed for everyday uses.



Cracking converts large molecules into smaller more useful molecules to make supply meet demand.

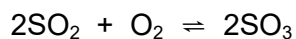
What percentage of petrol is produced by cracking?

- A 25%
- B 40%
- C 50%
- D 60%

Your answer

[1]

- 7 During the manufacture of sulfuric acid, sulfur dioxide, SO_2 , and oxygen, O_2 , react together in a reversible reaction to make sulfur trioxide, SO_3 .



The forward reaction is exothermic.

Which of these sets of conditions give the highest percentage yield of sulfur trioxide at equilibrium?

- A 450°C and 250 atm pressure
- B 250°C and 250 atm pressure
- C 450°C and 1 atm pressure
- D 250°C and 1 atm pressure

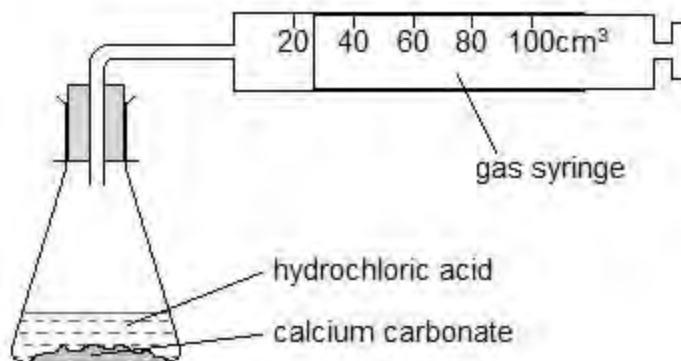
Your answer

[1]

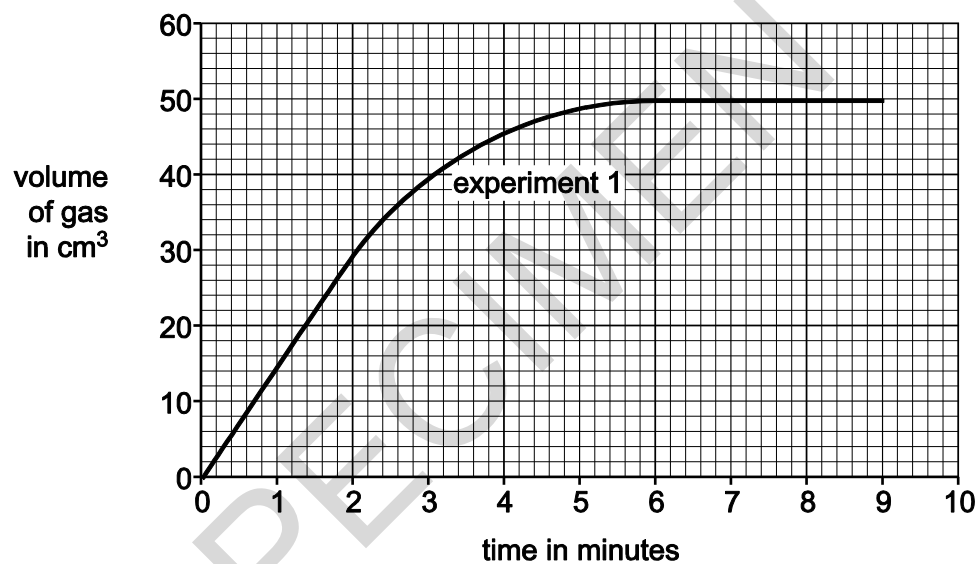
SPECIMEN

8 Alfie investigates the reaction between calcium carbonate and hydrochloric acid.

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



Look at the graph. It shows his results for the experiment.



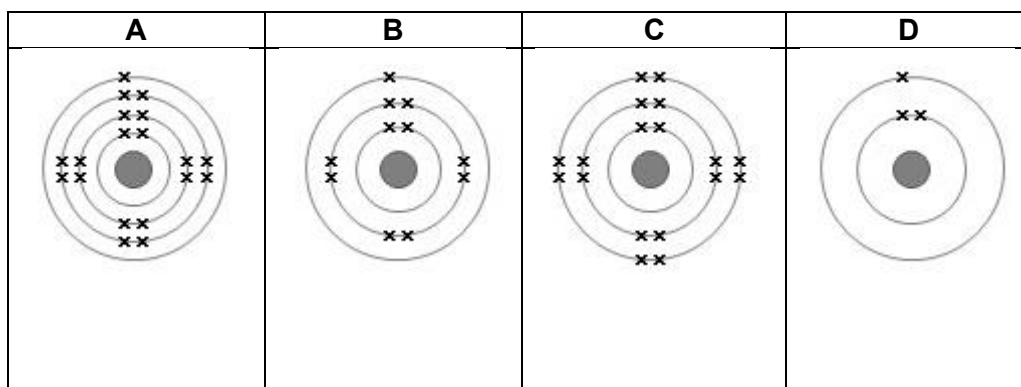
What is the rate of reaction between 0 and 2 minutes in $\text{cm}^3/\text{minute}$?

- A 7.5 $\text{cm}^3/\text{minute}$
- B 15 $\text{cm}^3/\text{minute}$
- C 30 $\text{cm}^3/\text{minute}$
- D 60 $\text{cm}^3/\text{minute}$

Your answer

[1]

9 Look at the diagrams of the electron structures of four elements.



Which element is the most reactive?

Your answer

[1]

10 Which statement is correct for a Group 1 element?

- A It dissolves in water to form a bleach.
- B It is a non-metal.
- C It is an inert gas.
- D It reacts with water to form hydrogen.

Your answer

[1]

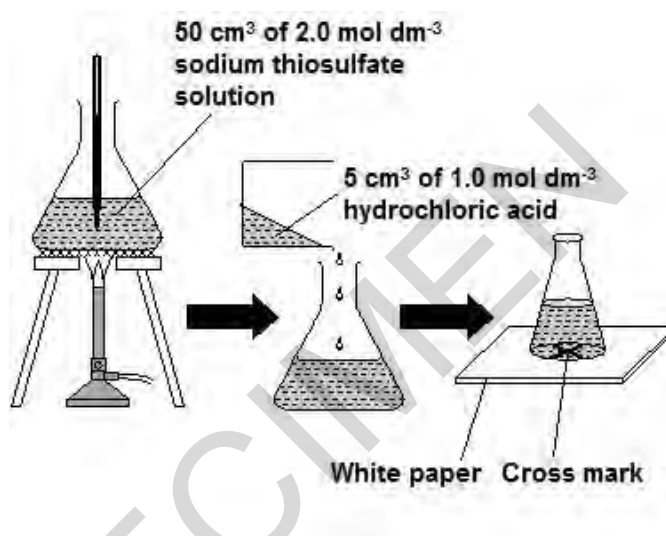
SECTION B

Answer **all** the questions.

11 This question is about rates of reaction.

Mark investigates the reaction between sodium thiosulfate and hydrochloric acid at different temperatures.

(a) Look at how Mark does the experiment.



1. He measures 50 cm^3 of sodium thiosulfate into the conical flask and heats it to the required temperature. He records the temperature.
2. He takes the flask off the tripod and gauze and places it on the bench.
3. He adds 5 cm^3 of hydrochloric acid and then places the flask on the cross.
4. He times how long it takes for the cross to disappear.

How should Mark improve his method?

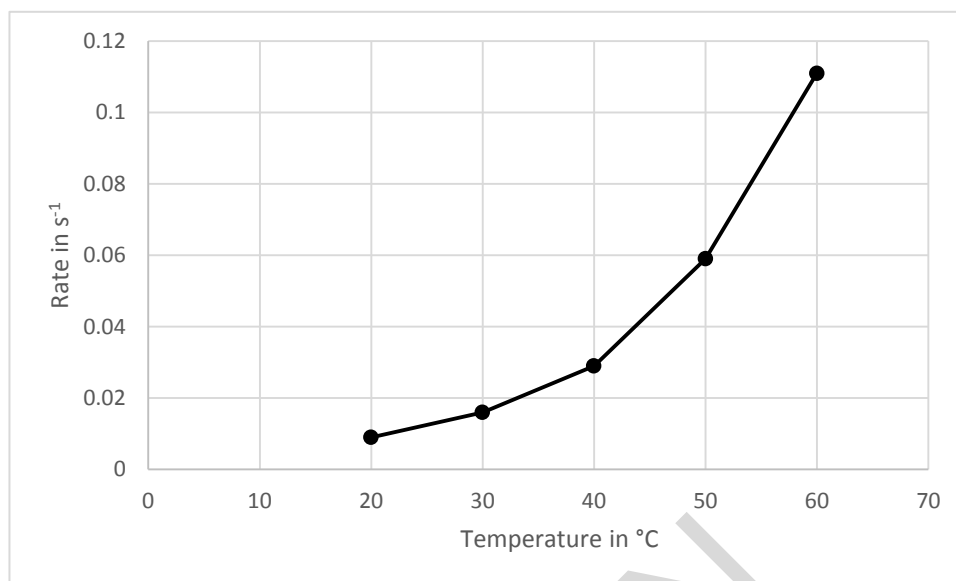
Explain your answer.

.....

.....

..... [2]

- (b) Look at the graph. It shows Mark's results at different temperatures.



When is the reaction fastest?

Use the graph to explain your answer.

.....

.....

..... [2]

- (c) Explain why the rate of reaction of sodium thiosulfate and hydrochloric acid is different at different temperatures.

.....

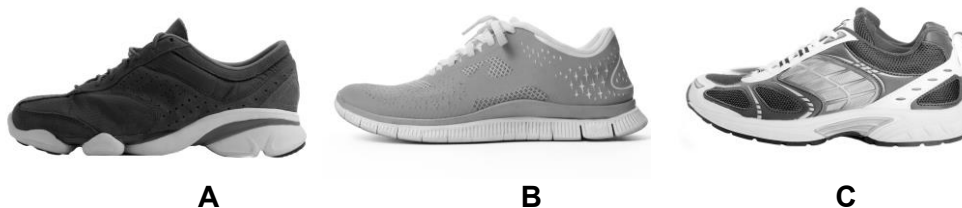
.....

.....

..... [2]

13 This question is about life-cycle assessment.

(a) A sports company is developing three new training shoes.



They do a **life-cycle assessment** of each training shoe.

Look at the table.

It gives some information from the life-cycle assessment of the training shoes.

	Training shoe A	Training shoe B	Training shoe C
Total energy use in MJ	178.77	204.23	156.07
CO₂ emissions in kg	13.8	12.0	10.9
Fresh water use in litres	4424	3733	3868
Solid waste produced in kg	1.04	0.67	0.95
Relative use of solvents	0.101	0.082	0.079

The company decides to manufacture and sell training shoe **C**.

Explain why they make this choice. Use information from the table to help you.

.....

.....

.....

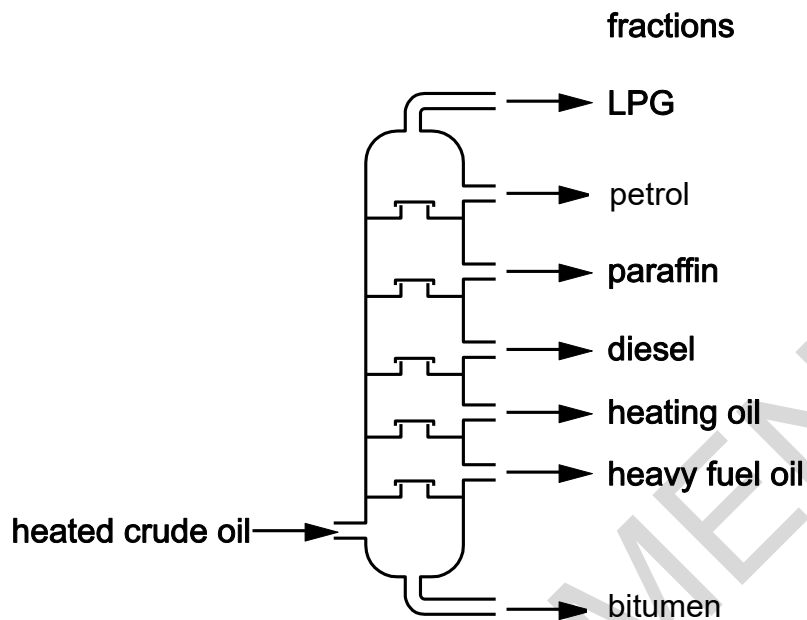
.....

[2]

(b) The materials used to make trainers are made from crude oil.

Crude oil is separated into many fractions by fractional distillation.

The diagram below shows a fractionating column.



Explain **how** crude oil is separated using a fractionating column.

.....

.....

.....

.....

.....

.....

.....

[4]

15 Helen is making magnesium chloride.

(a) Look at the method Helen uses.

1. Measure 50 cm³ of dilute hydrochloric acid into a beaker.
2. Add magnesium powder until there is no more effervescence.
3. Heat the mixture until saturated.

Helen's method does not make a pure dry sample of magnesium chloride.

How should Helen improve her method to get a **pure dry** sample of magnesium chloride?

.....

.....

.....

.....

.....

.....

[1]

(b) Magnesium reacts rapidly with hydrochloric acid.

Barium reacts **more** rapidly with hydrochloric acid.

Explain why. Use ideas about loss of electrons.

.....

.....

.....

.....

[2]

- (c) Magnesium chloride, MgCl_2 , can also be made by reacting hydrochloric acid, HCl , with magnesium carbonate, MgCO_3 .

Look at the equation for the reaction.



Helen uses 2.8g of magnesium carbonate.

Calculate how much magnesium chloride she should make.

Give your answer to **two significant figures**.

Relative formula mass of magnesium carbonate = 84.3

Relative formula mass of magnesium chloride = 95.3

.....

.....

.....

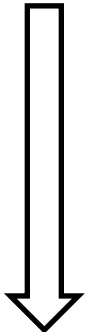
answer.....g

[2]

SPECIMEN

16 Look at the reactivity series of some metals.

The element carbon is also included in the reactivity series.

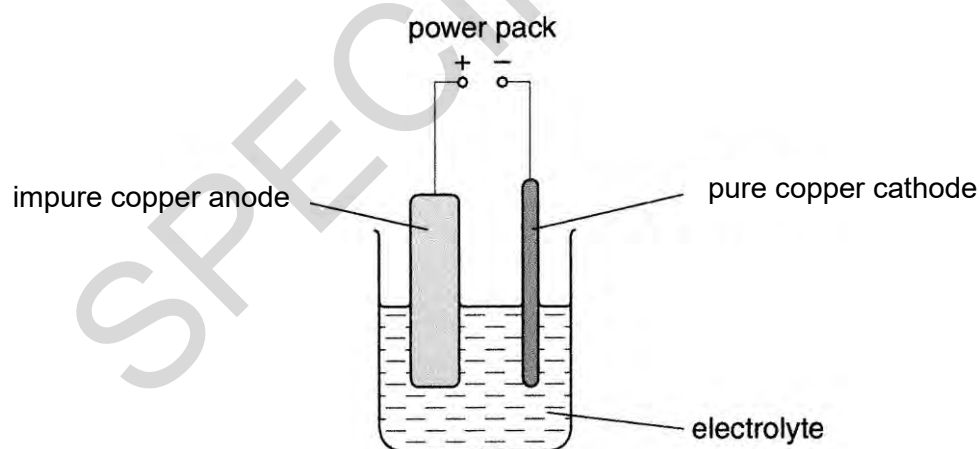
sodium	MOST REACTIVE
calcium	
carbon	
tin	
copper	
silver	
gold	

(a) Why is carbon used to extract **copper** from copper oxide?

.....

..... [1]

(b) The copper obtained from copper oxide is purified by **electrolysis**.



At the cathode, copper ions, Cu^{2+} , gain electrons.

Copper atoms are formed.

Write a **balanced half equation** for the reaction.

Use e^- to represent an electron.

..... [2]

(c) There are other methods of extracting copper.

Look at the information about three other methods of extracting copper.

Method	Key features
Thermal decomposition of copper sulfide, CuS	<ul style="list-style-type: none">• $\text{CuS} \rightarrow \text{Cu} + \text{SO}_2$• endothermic reaction• fast reaction
Bioleaching	<ul style="list-style-type: none">• bacteria use energy of Cu-S bond• uses only 30-50% of energy of thermal decomposition• slow
Phytomining	<ul style="list-style-type: none">• plants absorb copper compounds when they grow• plants are burned and copper is extracted from the ash

Evaluate bioleaching and phytomining as methods of extracting copper.

Which method would you use? Explain your answer.

.....

.....

.....

.....

.....

.....

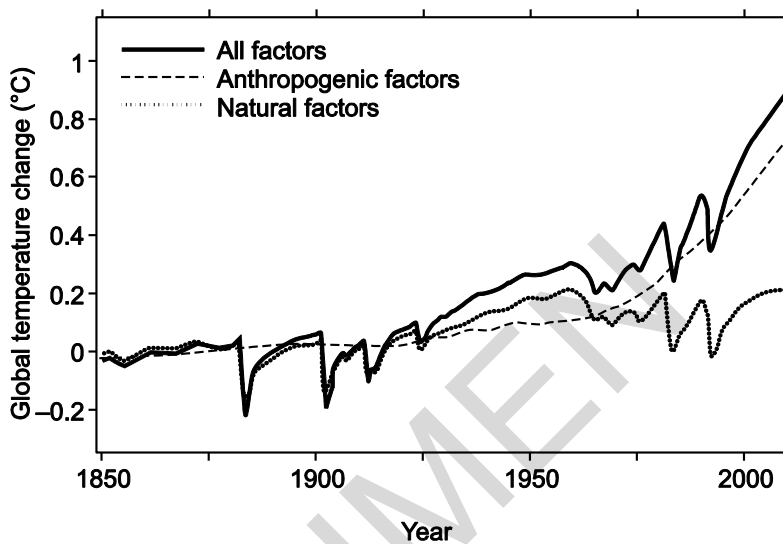
[3]

17 Gases such as methane and carbon dioxide absorb infrared radiation that is radiated by the Earth's surface. As a result, the Earth's surface is warmed. This is called the greenhouse effect.

(a) Look at the graph.

It shows how global temperatures have changed as a result of

- all factors
- anthropogenic factors
- natural factors



Evaluate the evidence that anthropogenic factors are contributing significantly to global temperature change.

.....

.....

.....

.....

.....

.....

[2]

(b) Global temperature change is one potential effect of increased carbon dioxide levels.

Describe **three** ways in which this effect may be reduced.

.....

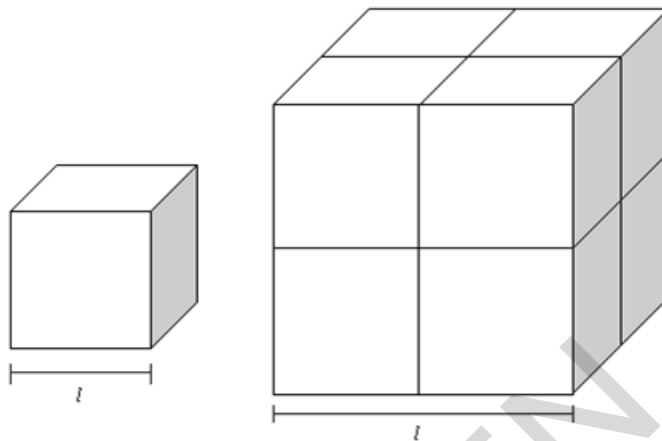
.....

.....

.....

[3]

- 18** William investigates the reaction between calcium carbonate and hydrochloric acid. He thinks the reaction will be faster if he uses smaller pieces of calcium carbonate. He uses different sized cubes of calcium carbonate.



William finds out that the larger the surface area to volume ratio, the faster the reaction.

The surface area to volume ratio for a cube with $l = 1\text{cm}$ is 6.0.

- (a)** Calculate the surface area to volume ratio for a cube with $l = 5\text{cm}$.

surface area to volume ratio

[3]

- (b)** Explain why cubes of calcium carbonate with a larger surface area to volume ratio react faster.

.....

 **[1]**

- (c) William reacts hydrochloric acid with excess calcium carbonate to produce carbon dioxide gas.

He measures the rate at which the carbon dioxide gas is produced.

He finds that when he uses cubes of calcium carbonate with $l = 5\text{cm}$ the gas is produced at a rate of 1.6 cm^3 per second.

William assumes the surface area to volume ratio is proportional to the rate.

Predict the rate of reaction for cubes of calcium carbonate with $l = 1\text{ cm}$.

Use your answer to part (a) to help you answer.

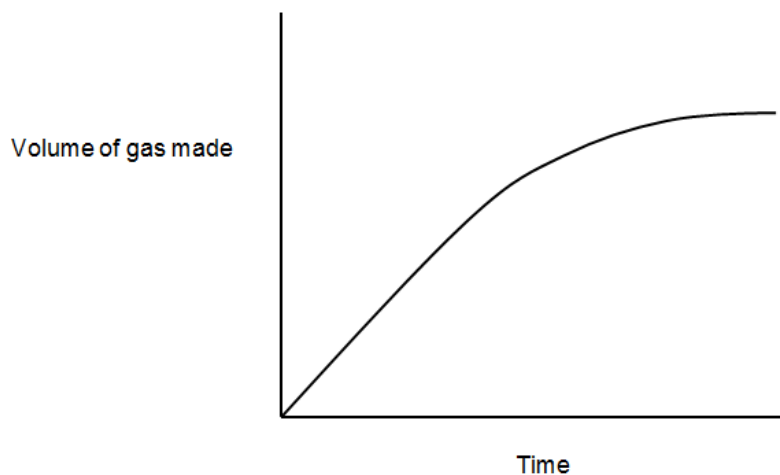
rate of reaction cm^3 per s [2]

- (d) Other factors affect the rate of a reaction.

The graph below shows the rate of a reaction in which a gas product is made at $60\text{ }^\circ\text{C}$, without a catalyst.

Add two curves to this graph:

- (i) One for the same reaction which is carried out at $30\text{ }^\circ\text{C}$, without a catalyst. Label the line, **A**. [1]
- (ii) One for the same reaction which is carried out at $60\text{ }^\circ\text{C}$, with a catalyst. Label the line, **B**. [1]



END OF QUESTION PAPER