

(Factors affecting rate of reaction (temperature, concentration, pressure, surface area, catalysts))

Q1. (2018)

Which **two** variables should the student keep the same to make the investigation a fair test?

[2 marks]

Tick **two** boxes.

Concentration of hydrochloric acid

☐

Mass of magnesium powder

☐

Temperature of hydrochloric acid

☐

Time for reaction to end

☐

Volume of gas collected

☐

Q2.a)(2019)

A student investigated how the mass of three iron nails, **A**, **B** and **C**, increased after rusting.

Table 4 shows the student's results.

Table 4

Nail	Mass of nail before rusting in g	Mass of nail after rusting in g	Increase in mass of nail in g
A	1.22	1.30	0.08
B	1.25	1.36	X
C	1.24	1.33	0.09

Calculate **X** in **Table 4**.

[1 mark]

X = _____ g

Q2.b)(2019)

Calculate the mean increase in mass of the three iron nails, **A**, **B** and **C**.

Use **Table 4** and your answer to Question **06.2**

[1 mark]

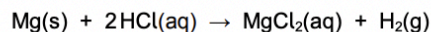
Mean increase in mass = _____ g

Q3.a)(2019)

This question is about rate of reaction.

A student investigated the rate of the reaction between magnesium and dilute hydrochloric acid.

The equation for the reaction is:



Which state symbol in the equation for the reaction does **not** represent one of the three states of matter?

[1 mark]

Q3.b)(2019)

The student determined the rate of production of hydrogen gas.

What **two** pieces of measuring apparatus could the student use to find the rate of production of hydrogen gas?

[2 marks]

1 _____

2 _____

Q3.c)(2019)

Table 6 shows the results of the investigation.

Table 6

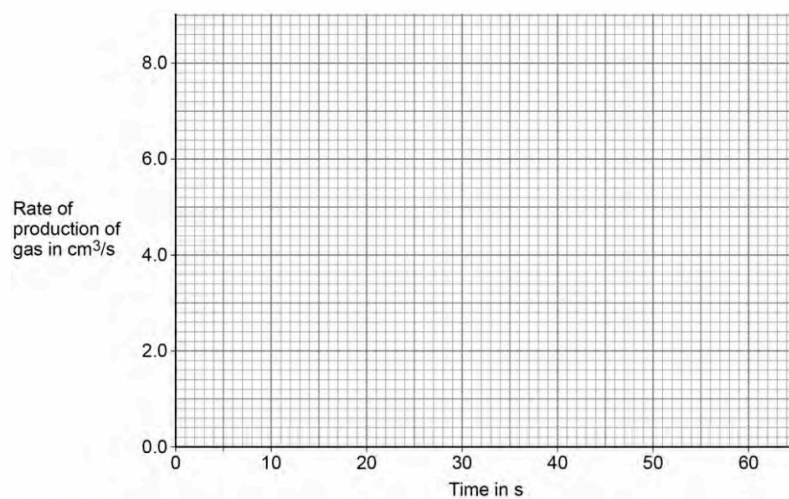
Time in s	Rate of production of gas in cm^3/s
10	6.9
20	3.9
30	2.0
40	0.9
50	0.3
60	0.0

Plot the data from **Table 6** on **Figure 8**.

You should draw a line of best fit.

[3 marks]

Figure 8



Q3.d)(2019)

Give **three** conclusions that can be drawn about the rate of reaction between magnesium and dilute hydrochloric acid in this investigation.

Use data from **Figure 8** and **Table 6**.

[3 marks]

1 _____

2 _____

3 _____

Q3.e)(2019)

The student repeated the investigation using dilute hydrochloric acid at a higher temperature.

All the other variables were kept the same.

Which **two** statements are correct?

[2 marks]

Tick (✓) **two** boxes.

More bubbles were produced in the first 10 seconds.

☐

The activation energy for the reaction was higher.

☐

The magnesium was used up more quickly.

☐

The reaction finished at the same time.

☐

The total volume of gas collected was greater.

☐

Q4.a)(2020)

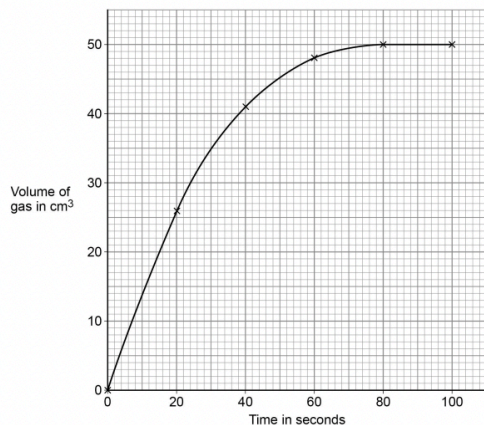
Table 2 shows the student's results for large calcium carbonate lumps.

Table 2

Time in seconds	Volume of gas in cm ³
0	0
20	16
40	30
60	40
80	46
100	48

Figure 4 shows the student's results for small calcium carbonate lumps.

Figure 4



Complete Figure 4.

You should:

- plot the data for large calcium carbonate lumps from Table 2 on Figure 4
- draw a line of best fit for large calcium carbonate lumps.

[3 marks]

Q4.b)(2020)

Determine the mean rate of reaction using **small** calcium carbonate lumps between 0 seconds and 60 seconds.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{volume of gas produced}}{\text{time taken}}$$

Use Figure 4.

[3 marks]

Mean rate of reaction = _____ cm³/s

Q4.c)(2020)

Describe what happens to the volume of gas collected using **small** calcium carbonate lumps:

- between 0 and 20 seconds
- between 80 and 100 seconds.

Use **Figure 4**.

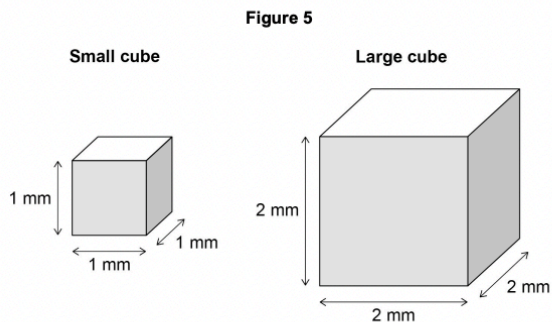
[2 marks]

Between 0 and 20 seconds _____

Between 80 and 100 seconds _____

Q5.a)(2020)

Figure 5 shows the dimensions of two cubes of calcium carbonate.



□ A cube of calcium carbonate has six faces.

Calculate the total surface area of the **large** cube of calcium carbonate.

Use **Figure 5**.

[3 marks]

Total surface area = _____ mm²

Q5.b)(2020)

The large cube of calcium carbonate was divided into eight smaller cubes.

The eight smaller cubes have a greater total surface area than the one large cube.

Compare the rate of reaction when using the eight smaller cubes with the rate of reaction when using the large cube.

Complete the sentence.

Choose the answer from the box.

[1 mark]

faster	slower	the same
---------------	---------------	-----------------

The rate of reaction of the eight smaller cubes is _____.

Q6.(2021)

The rate of reaction between gases is affected by changing the pressure.

Complete the sentences.

[3 marks]

When the pressure of the reacting gases is increased,

the rate of reaction _____.

This is because at higher pressures the distance

between the particles _____.

This means that the frequency of collisions _____.

Q7.(2021)

Give **one** other way of changing the rate of reaction between gases.

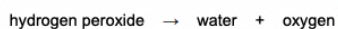
You should **not** refer to pressure in your answer.

[1 mark]

Q8.a)(2023)

Oxygen is produced when manganese dioxide is added to hydrogen peroxide solution.

The equation for the reaction is:

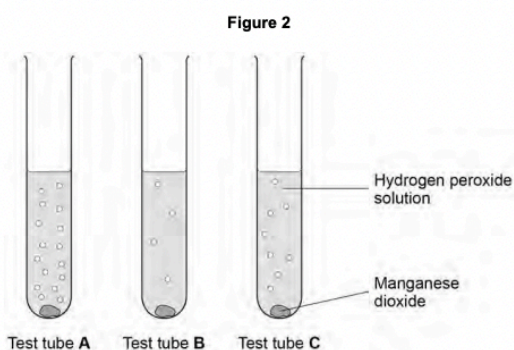


A student investigated the effect of changing the temperature on the decomposition of hydrogen peroxide.

This is the method used.

1. Add 5 cm³ of hydrogen peroxide solution to three test tubes labelled **A**, **B** and **C**.
2. Place each test tube in a water bath at a different temperature.
3. Add 0.2 g of manganese dioxide to each test tube.

Figure 2 shows the results.



Which test tube contained hydrogen peroxide solution at the highest temperature?

[1 mark]

Tick (✓) **one** box.

Test tube **A**

☐

Test tube **B**

☐

Test tube **C**

☐

Q8.b)(2023)

The student tested the gas produced.

What is used to prove that the gas is oxygen?

[1 mark]

Tick (✓) **one** box.

A glowing splint

☐

Bromine water

☐

Damp litmus paper

☐

Q8.c)(2023)

Manganese dioxide does not appear in the chemical equation for this reaction.

Which is a correct statement about manganese dioxide in this reaction?

[1 mark]

Tick (✓) **one** box.

Manganese dioxide increases the activation energy in this reaction.

☐

Manganese dioxide is a catalyst in this reaction.

☐

Manganese dioxide is used up during this reaction.

☐

Manganese dioxide reduces the rate of this reaction.

☐