

Measuring Rates

Q1. (2018)

- 9 (a) The rate of reaction between magnesium ribbon and dilute hydrochloric acid at room temperature is investigated.

The apparatus used is shown in Figure 11.

The volume of hydrogen gas given off was measured at regular intervals during the reaction.

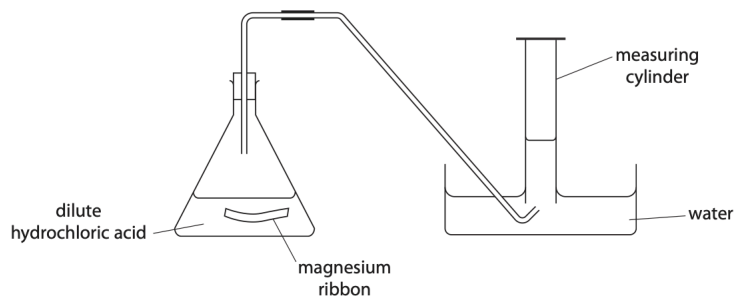


Figure 11

The graph in Figure 12 shows the results of this experiment.

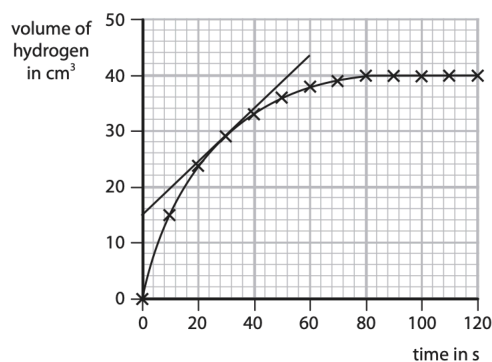


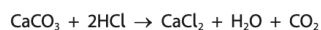
Figure 12

- (i) State a change that can be made to the apparatus in Figure 11 to measure the volumes of gas more accurately.

(1)

Q2. (2019)

- 8 Calcium carbonate reacts with dilute hydrochloric acid to produce calcium chloride, water and carbon dioxide.



- (a) A student wanted to measure the amount of gas produced in two minutes.

The student suggested that this could be done by counting the number of bubbles formed.

However, the bubbles are produced too quickly to count them.

Figure 4 shows a conical flask in which the calcium carbonate and dilute hydrochloric acid are reacting.

Complete Figure 4 to show the apparatus that could be used to measure accurately the volume of gas given off in two minutes.

(2)

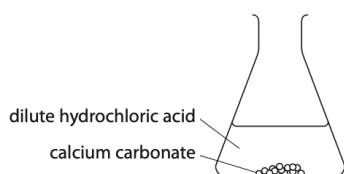


Figure 4

Q3. (2020) – 3b

- 3 Calcium carbonate reacts with dilute hydrochloric acid to produce carbon dioxide gas.

The rate of reaction between calcium carbonate and dilute hydrochloric acid at room temperature was investigated.

- (b) The calcium carbonate powder produced 90 cm^3 of carbon dioxide in five minutes.

Calculate the average rate of reaction in $\text{cm}^3\text{ s}^{-1}$.

(3)

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.....

average rate of reaction = $\text{cm}^3\text{ s}^{-1}$

Q4. (2020)

- 6 (a) Sodium thiosulfate solution, $\text{Na}_2\text{S}_2\text{O}_3$, reacts with dilute hydrochloric acid.



A)

- (i) When dilute hydrochloric acid is mixed with sodium thiosulfate solution, the mixture turns cloudy.

Explain why the mixture turns cloudy.

(2)

B)

- (ii) In an investigation, different concentrations of hydrochloric acid are reacted with sodium thiosulfate solution.
The mixture goes cloudy at different rates.

Describe how the rate at which the mixture goes cloudy can be measured.

(3)

C)

(iii) You are provided with some dilute hydrochloric acid which has a concentration of 50 g dm^{-3} .

For this experiment, dilute hydrochloric acid with a concentration of 20 g dm^{-3} is required.

How much water must be added to 100 cm^3 of 50 g dm^{-3} hydrochloric acid to make dilute hydrochloric acid with a concentration of 20 g dm^{-3} ?

(1)

- ☒ A 200 cm^3
☒ B 150 cm^3
☒ C 100 cm^3
☒ D 50 cm^3

Q5. (2021) – 6b

(b) Some pieces of calcium carbonate were added to dilute hydrochloric acid in a conical flask and the volume of carbon dioxide produced was measured.

Complete the diagram in Figure 7 to show the apparatus to collect the gas produced and measure its volume.

(2)

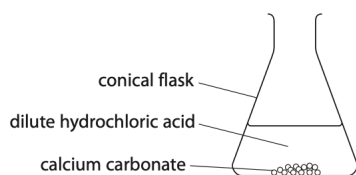


Figure 7

Q6. (2022)

- 2 A student used the apparatus in Figure 3 to investigate the rate of the reaction between a metal and dilute hydrochloric acid.

Pieces of the metal were placed in dilute hydrochloric acid in the flask, and the total volume of gas produced was measured every minute.

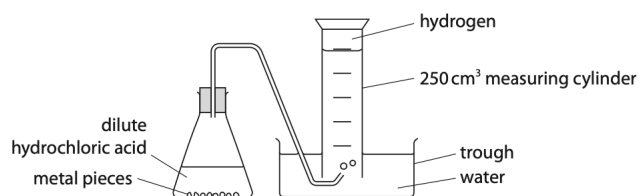


Figure 3

- (a) Figure 4 shows a graph of the student's results.

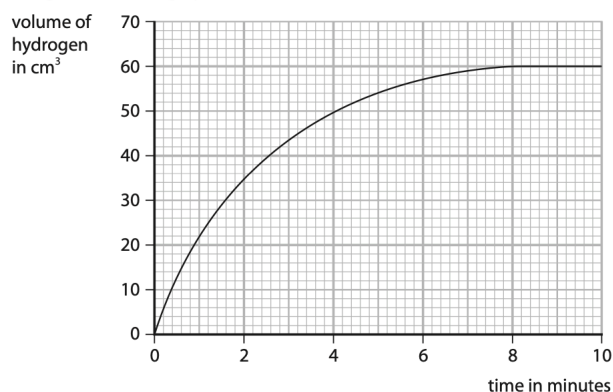


Figure 4

A)

- (i) Name a piece of apparatus that would be better to measure the volume of gas produced, instead of the 250 cm³ measuring cylinder.

Give a reason for your answer.

(2)

name of apparatus

reason

B)

- (ii) Calculate the mean rate of production of hydrogen over the first 90 seconds, in cm³ per second.

(3)

rate = cm³ per second

C)

- (iii) The student measured the volume of gas for 10 minutes.

State why the measurements could have been stopped at 9 minutes.

(1)

Q7. (2023)

- 2 A student used the apparatus shown in Figure 3 to investigate the reaction between marble chips and dilute hydrochloric acid.

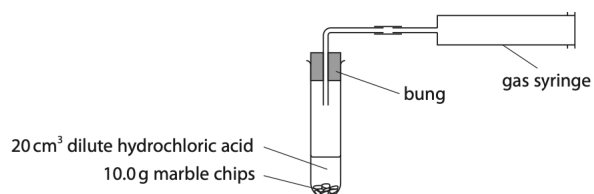


Figure 3

The student recorded the volume of gas every minute as shown in Figure 4.

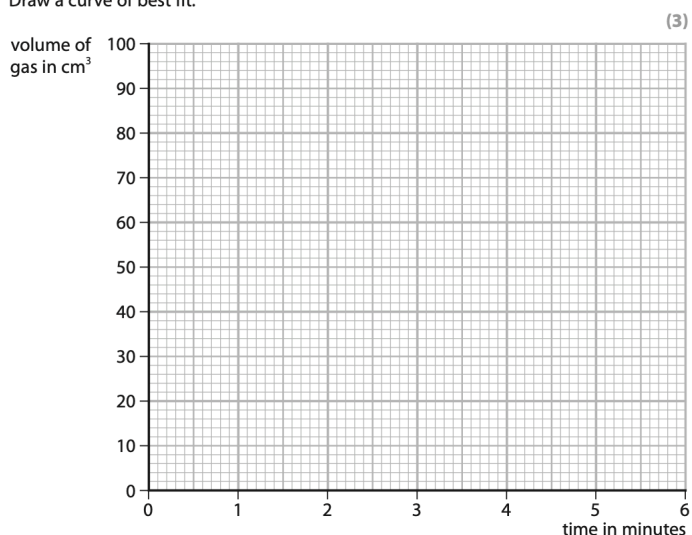
time in minutes	0	1	2	3	4	5	6
volume of gas in cm ³	0	52	78	91	97	100	100

Figure 4

A)

- (a) On the grid, plot the results shown in Figure 4.

Draw a curve of best fit.



B)

- (b) Rate of reaction can be calculated using

$$\text{rate of reaction} = \frac{\text{volume of gas produced in 1 minute}}{1 \text{ minute}}$$

Figure 5 shows the rates of reaction calculated from the results of this experiment.

The rate of reaction for the time interval 2 to 3 minutes is missing.

time interval	0 to 1 minute	1 to 2 minutes	2 to 3 minutes	3 to 4 minutes	4 to 5 minutes
rate of reaction in cm ³ min ⁻¹	52	26		6	3

Figure 5

- (i) Calculate the rate of reaction for the time interval 2 to 3 minutes.

(1)

rate of reaction = cm³ min⁻¹

Q8. (2023) – 6b

- 6 Chlorine gas can be prepared by reacting concentrated hydrochloric acid with solid potassium manganate(VII).

Figure 10 shows the apparatus used.

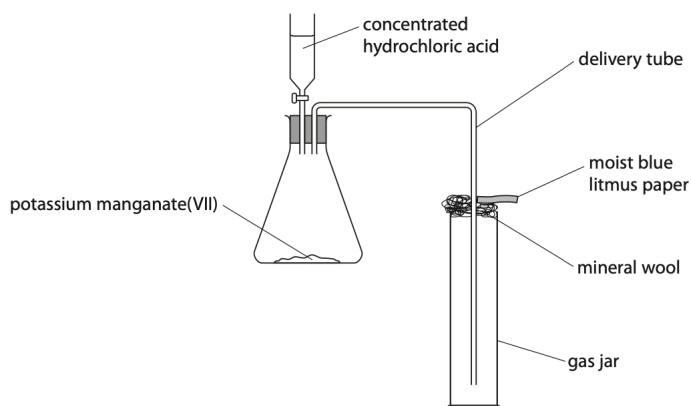


Figure 10

- (b) State the purpose of the delivery tube.

(1)

Q9. (2024)

- 2 A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

A)

- (a) Figure 3 shows part of the apparatus used in the experiment.

Complete Figure 3 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas.

(2)

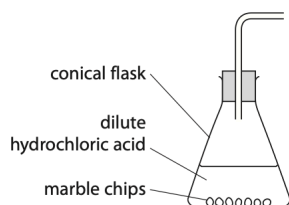


Figure 3

B)

(b) Figure 4 shows a graph of the results of the experiment.

A tangent has been drawn on the curve at a time of 3.5 minutes.

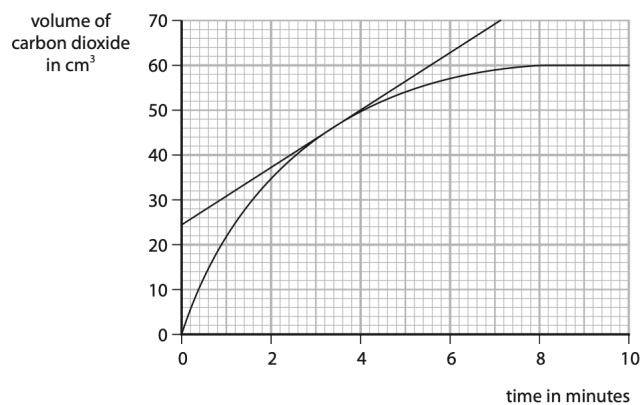


Figure 4

(i) State the total volume of carbon dioxide produced in the first 3.5 minutes.

(1)

volume = cm³