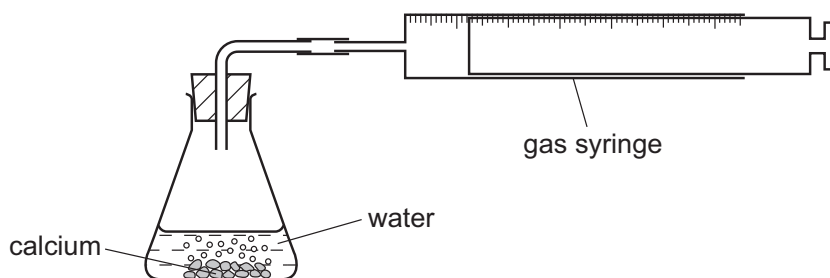


- 1** Which statement about catalysts in chemical reactions is **not** correct?
- A** Catalysts are not used up in the reaction.
  - B** Catalysts increase the energy of the reacting particles.
  - C** Catalysts increase the rate of the reaction.
  - D** Catalysts lower the activation energy.

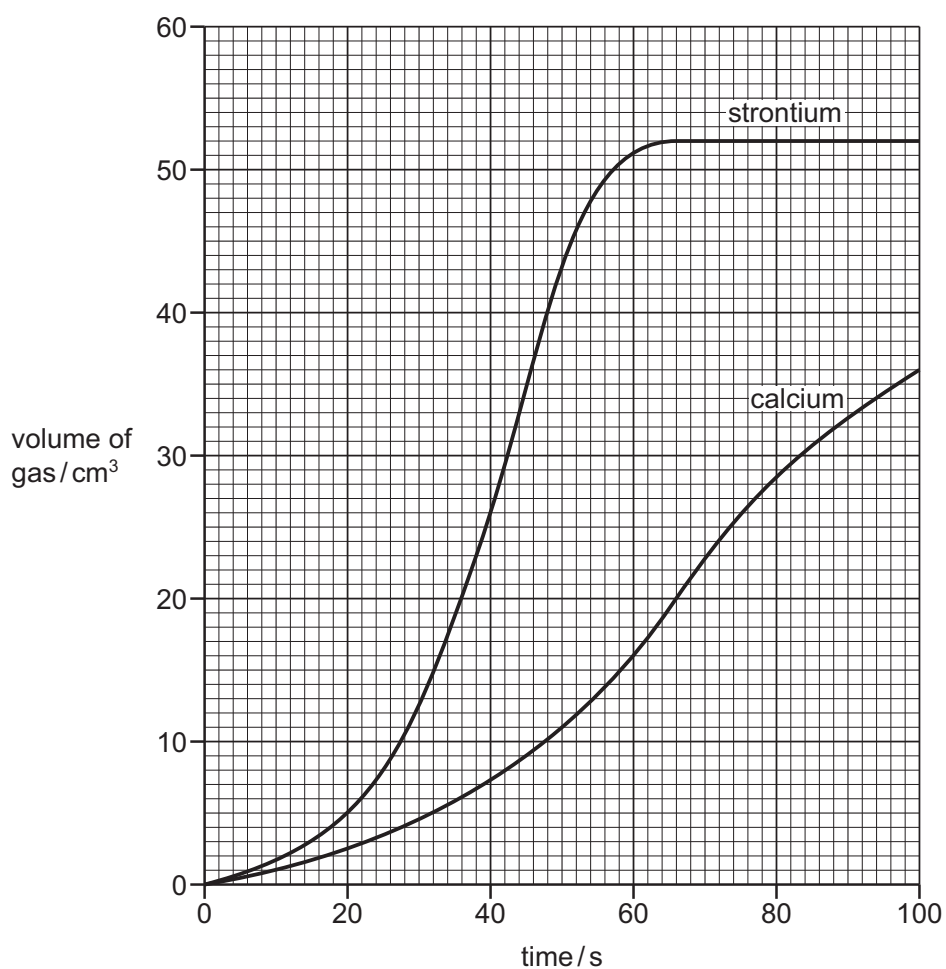
[1]

[Total: 1]

- 2 A teacher demonstrated the reactivity of calcium with water. He used the apparatus shown below.



The teacher measured the volume of gas given off at various times during the reaction. He then repeated the experiment using strontium but keeping all the conditions the same. The graph obtained from the results is shown below.



Explain how the graph shows that strontium is more reactive than calcium.

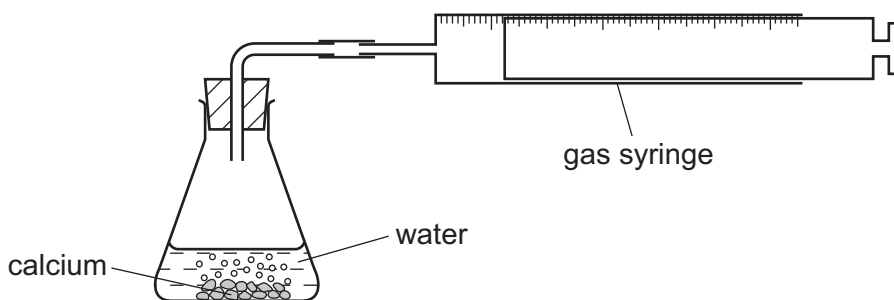
.....

.....

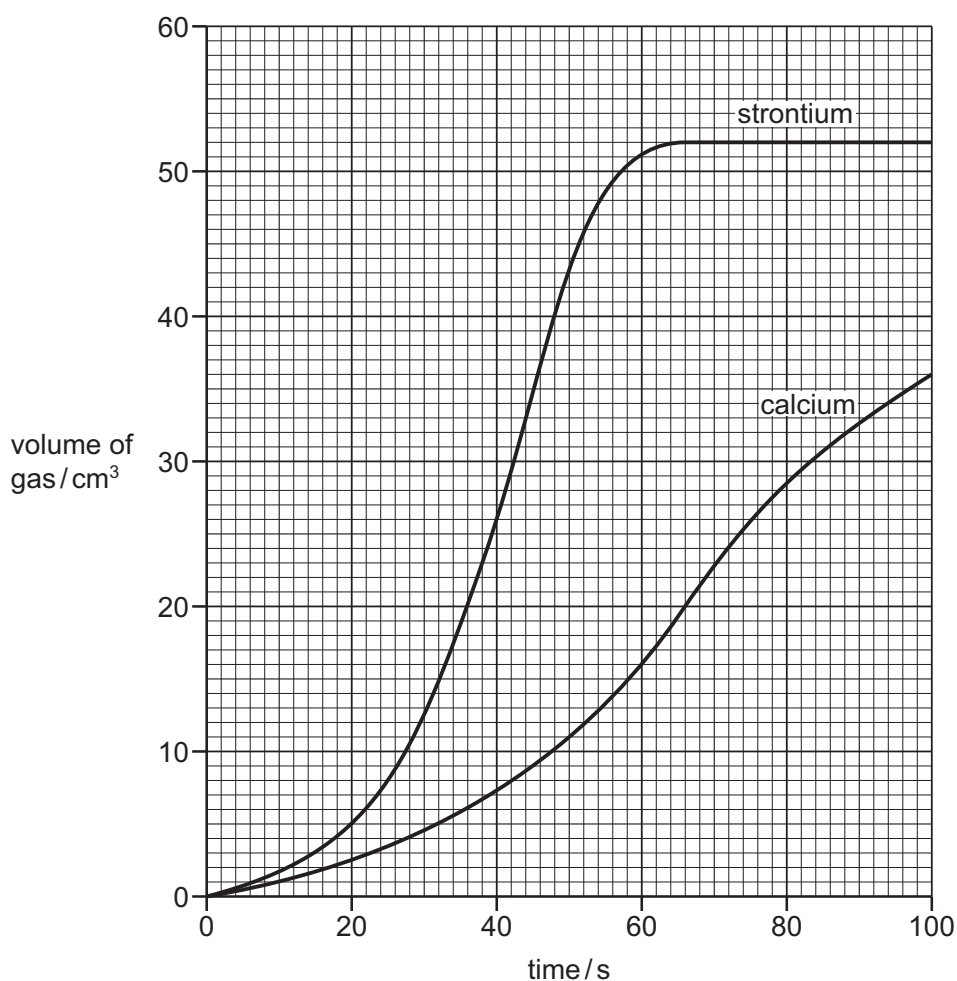
[1]

[Total: 1]

- 3 A teacher demonstrated the reactivity of calcium with water. He used the apparatus shown below.



The teacher measured the volume of gas given off at various times during the reaction. He then repeated the experiment using strontium but keeping all the conditions the same. The graph obtained from the results is shown below.



For the reaction between calcium and water, deduce the volume of gas produced in the first 50 seconds.

..... cm<sup>3</sup> [1]

[Total: 1]

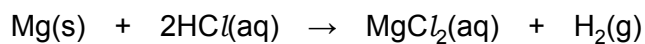
- 4 Glycolic acid is prepared by heating a mixture of methanal, carbon monoxide and water with a sulfuric acid catalyst.

What is the function of the catalyst?

..... [1]

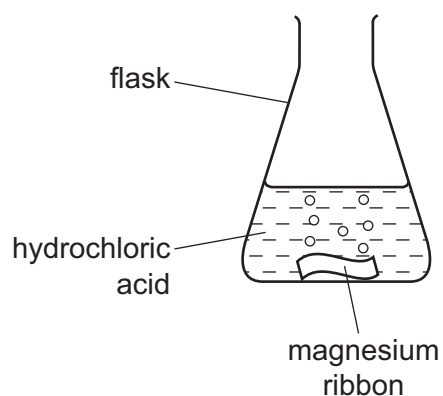
[Total: 1]

- 5 A student investigated the reaction of magnesium with dilute hydrochloric acid.



She measured the volume of gas given off at various times during the reaction.

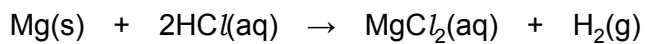
Complete the diagram of the apparatus she would use to measure the volume of the gas given off. Label the apparatus.



[3]

[Total: 3]

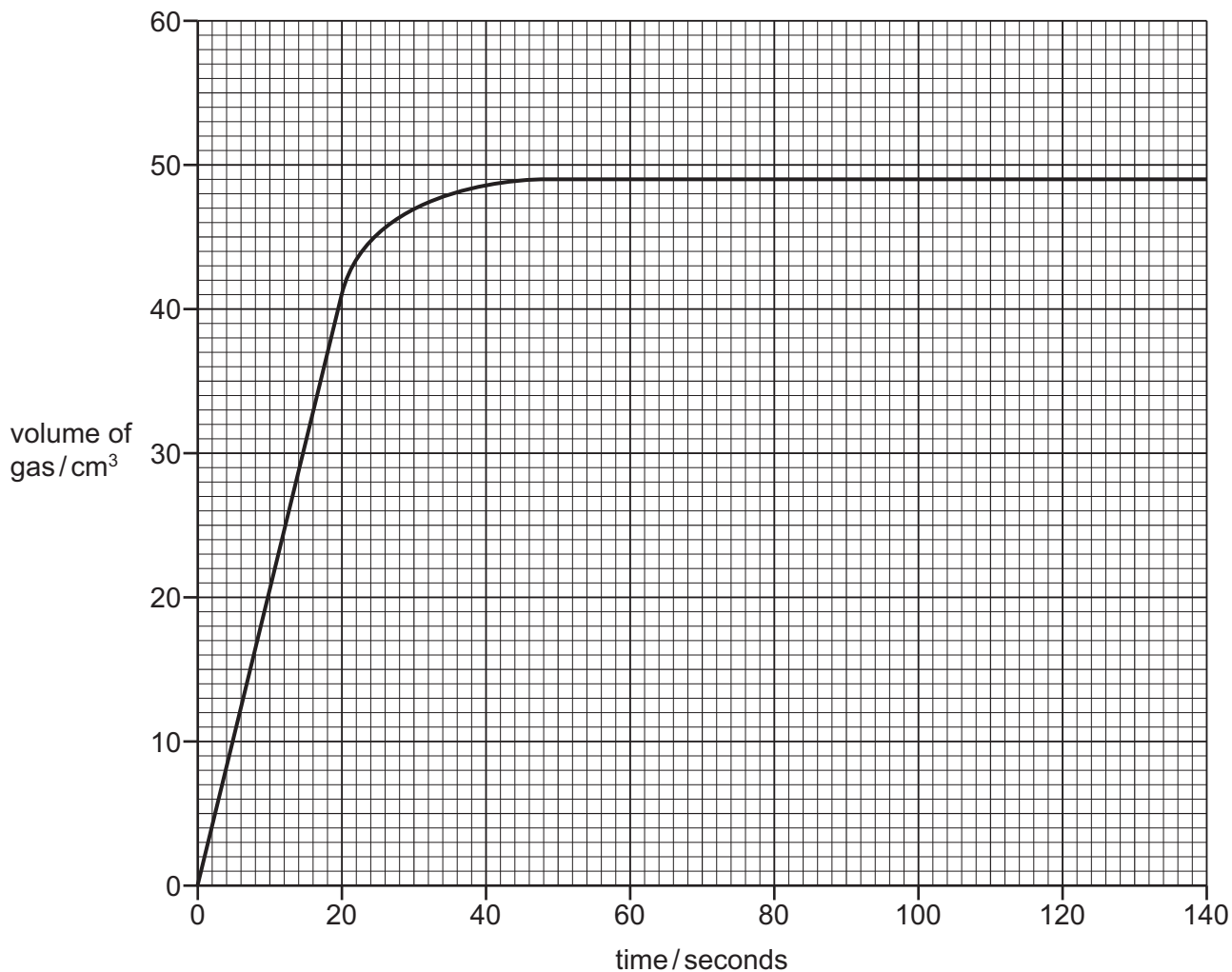
- 6 A student investigated the reaction of magnesium with dilute hydrochloric acid.



She measured the volume of gas given off at various times during the reaction.

The student carried out the reaction at 25 °C using magnesium ribbon.

Her results are shown below.

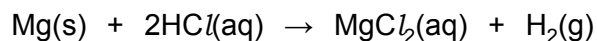


How long does it take for the reaction to stop?

..... seconds [1]

[Total: 1]

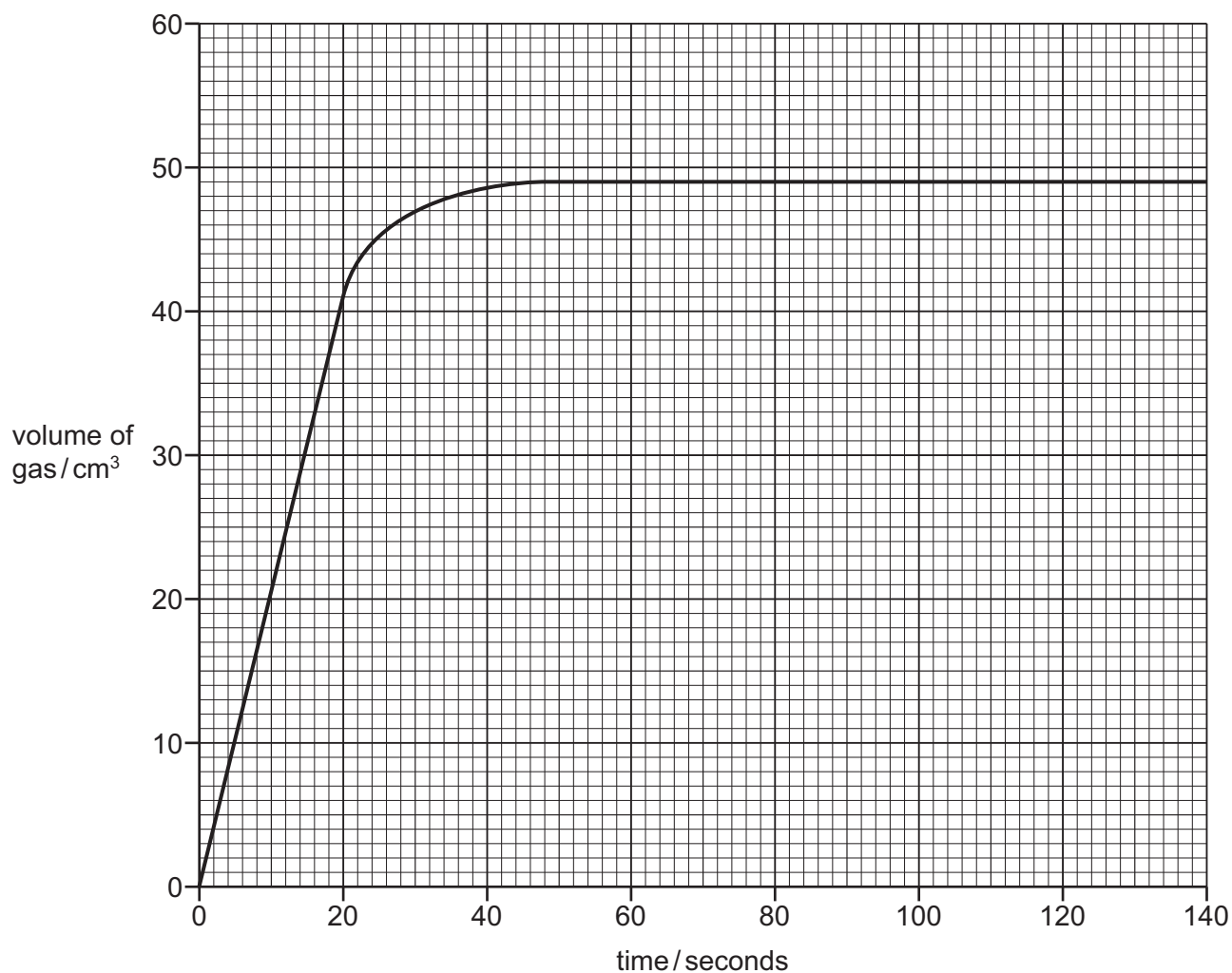
- 7 A student investigated the reaction of magnesium with dilute hydrochloric acid.



She measured the volume of gas given off at various times during the reaction.

The student carried out the reaction at 25 °C using magnesium ribbon.

Her results are shown below.



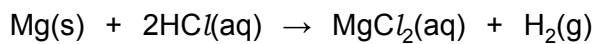
The student repeated the experiment using magnesium powder. All other conditions remain the same.

How does the rate of reaction with magnesium powder compare with the rate of reaction with magnesium ribbon?

..... [1]

[Total: 1]

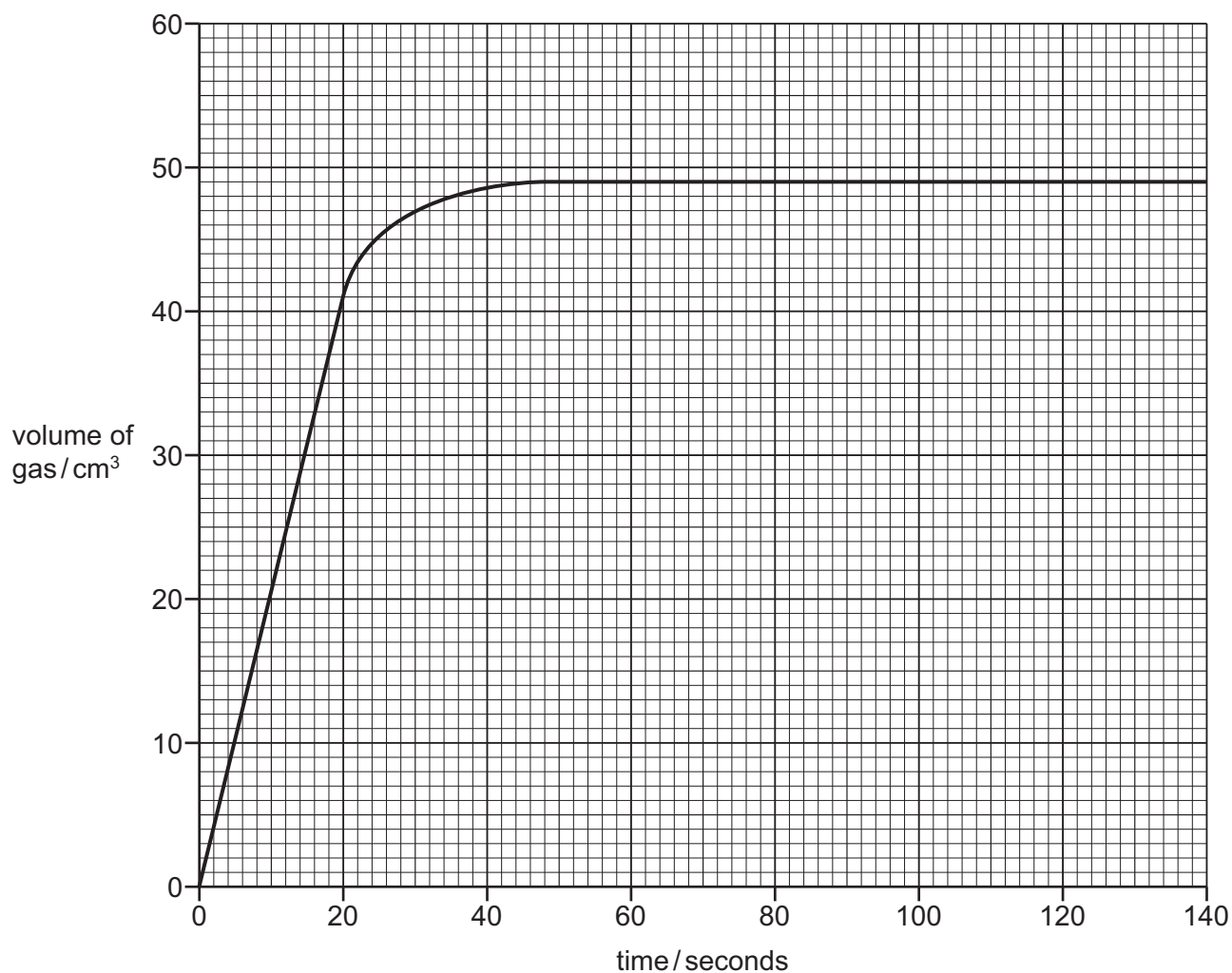
- 8 A student investigated the reaction of magnesium with dilute hydrochloric acid.



She measured the volume of gas given off at various times during the reaction.

The student carried out the reaction at 25 °C using magnesium ribbon.

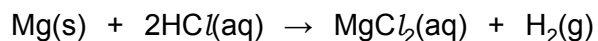
Her results are shown below.



On the grid above, draw a line to show how the volume of gas changes when the experiment is carried out at 15 °C and all other conditions remain the same. [2]

[Total: 2]

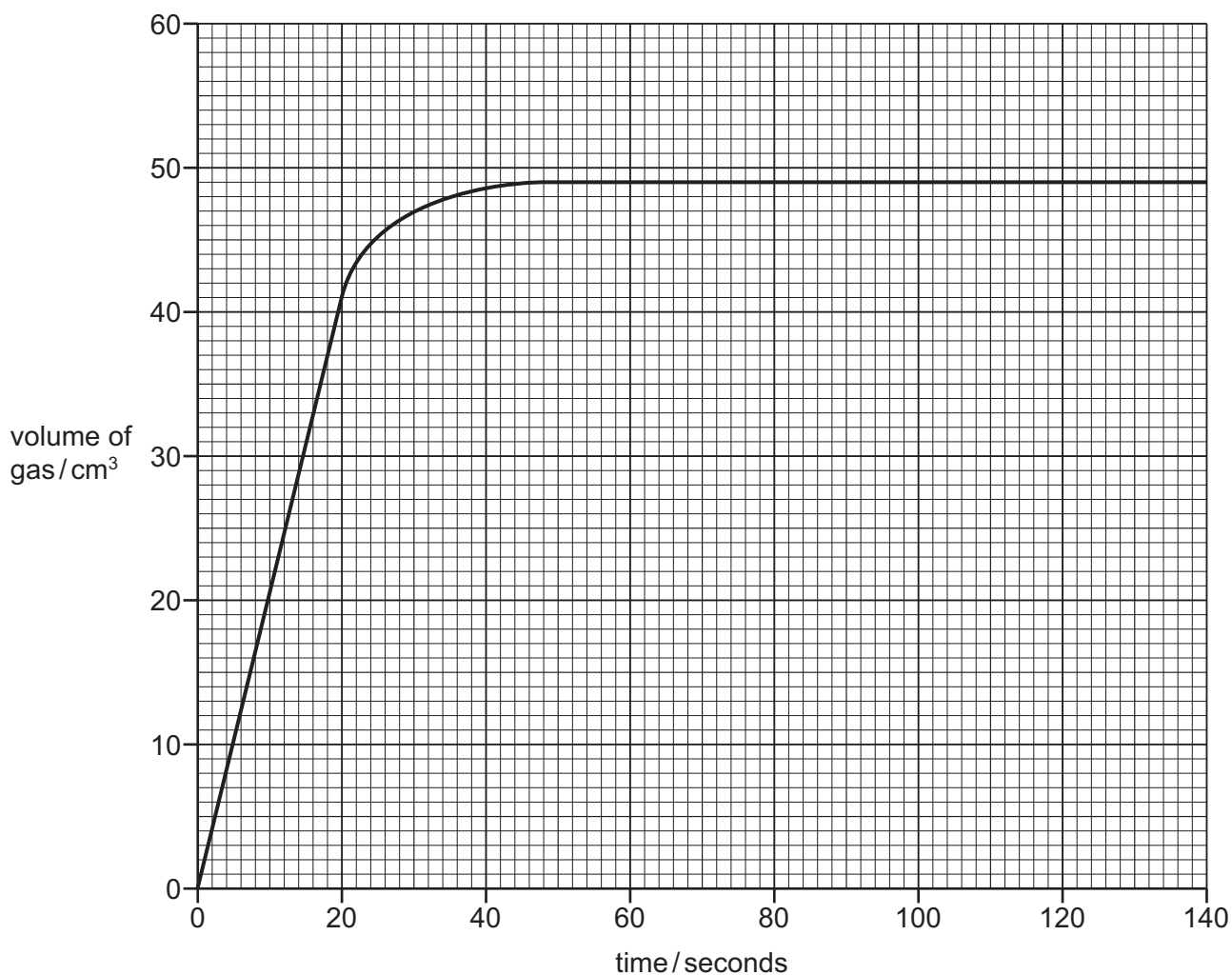
- 9 A student investigated the reaction of magnesium with dilute hydrochloric acid.



She measured the volume of gas given off at various times during the reaction.

The student carried out the reaction at 25 °C using magnesium ribbon.

Her results are shown below.



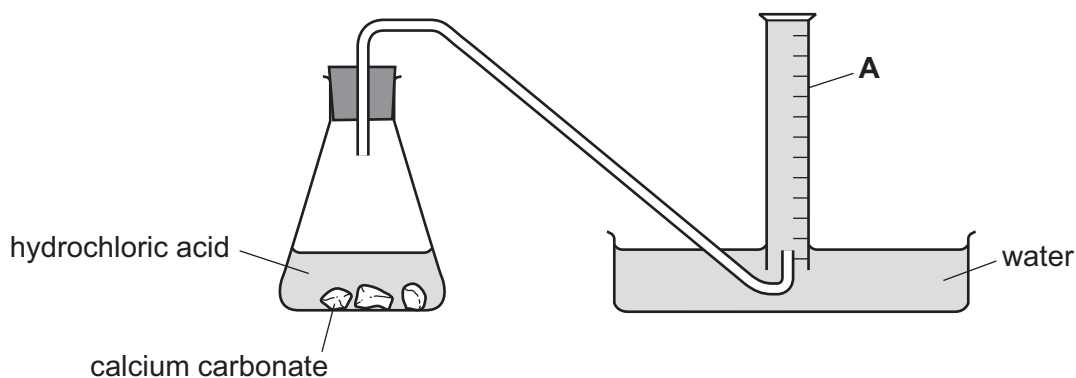
What is the volume of hydrogen made after 20 seconds?

..... cm<sup>3</sup> [1]

[Total: 1]

- 10 The apparatus shown is used to investigate the rate of reaction between calcium carbonate and hydrochloric acid at 30 °C.





(a) Name the piece of apparatus labelled **A** in the diagram.

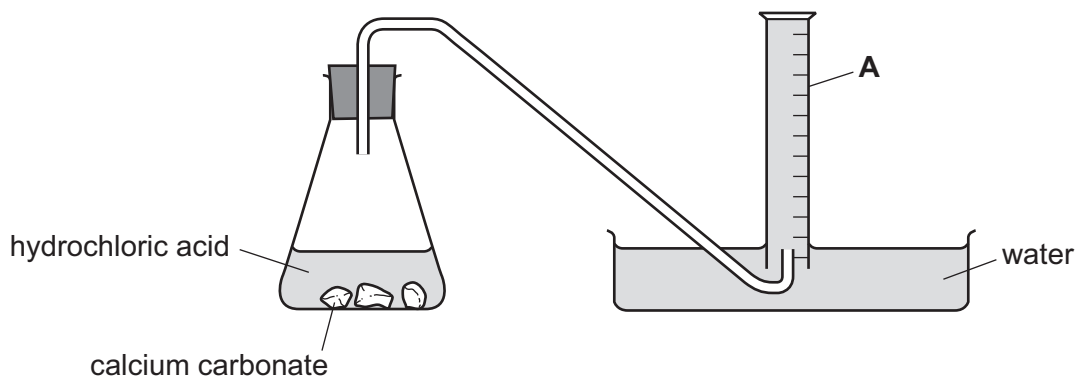
..... [1]

(b) Describe how this apparatus can be used to find the rate of reaction.

.....  
 .....  
 ..... [2]

[Total: 3]

**11** The apparatus shown is used to investigate the rate of reaction between calcium carbonate and hydrochloric acid at 30 °C.



The experiment is repeated at 20 °C. All other conditions are kept the same.

How does the decrease in temperature affect the rate of reaction?

..... [1]

[Total: 1]

**12** Natural gas contains hydrocarbons and hydrogen sulfide.

- (a) Give the name of the hydrocarbon which is present in the greatest concentration in natural gas.

..... [1]

- (b) Hydrogen sulfide is removed from natural gas by reaction with oxygen in the presence of a catalyst.

What is the purpose of a catalyst?

..... [1]

[Total: 2]

- 13 Dilute hydrobromic acid reacts with magnesium ribbon.

Suggest **three** ways of increasing the rate of this reaction.

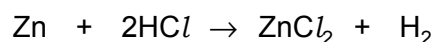
1 .....

2 .....

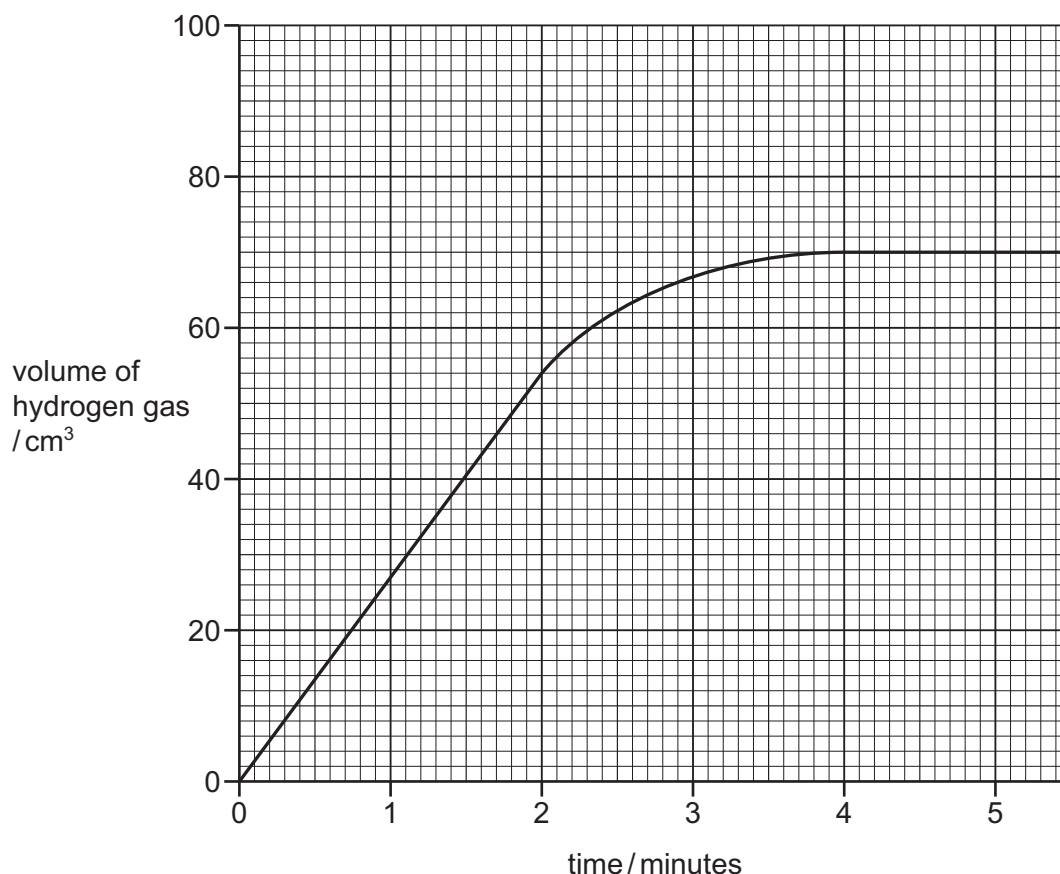
3 ..... [3]

[Total: 3]

- 14 A student investigated the reaction between zinc and dilute hydrochloric acid by measuring the volume of hydrogen gas produced at one minute intervals.



The graph shows the results using small pieces of zinc and dilute hydrochloric acid.



- (a) Deduce the volume of hydrogen gas produced in the first two minutes of the reaction.

..... cm<sup>3</sup> [1]

- (b) Draw a letter **S** on the graph to show where the reaction is slowing down but has **not** stopped completely. [1]

- (c) Draw a line **on the grid** to show how the volume of hydrogen gas changes with time when the reaction is repeated with a catalyst. All other conditions are kept the same. [1]

- (d) State the effect on the rate of this reaction of decreasing the temperature at which the reaction is done. All other conditions are kept the same.

..... [1]

- (e) State the effect on the rate of this reaction of using zinc powder instead of small pieces of zinc. All other conditions are kept the same.

..... [1]

[Total: 5]

- 15 What effects do these factors have on the rate of a chemical reaction?

(a) decreasing the concentration of a reactant

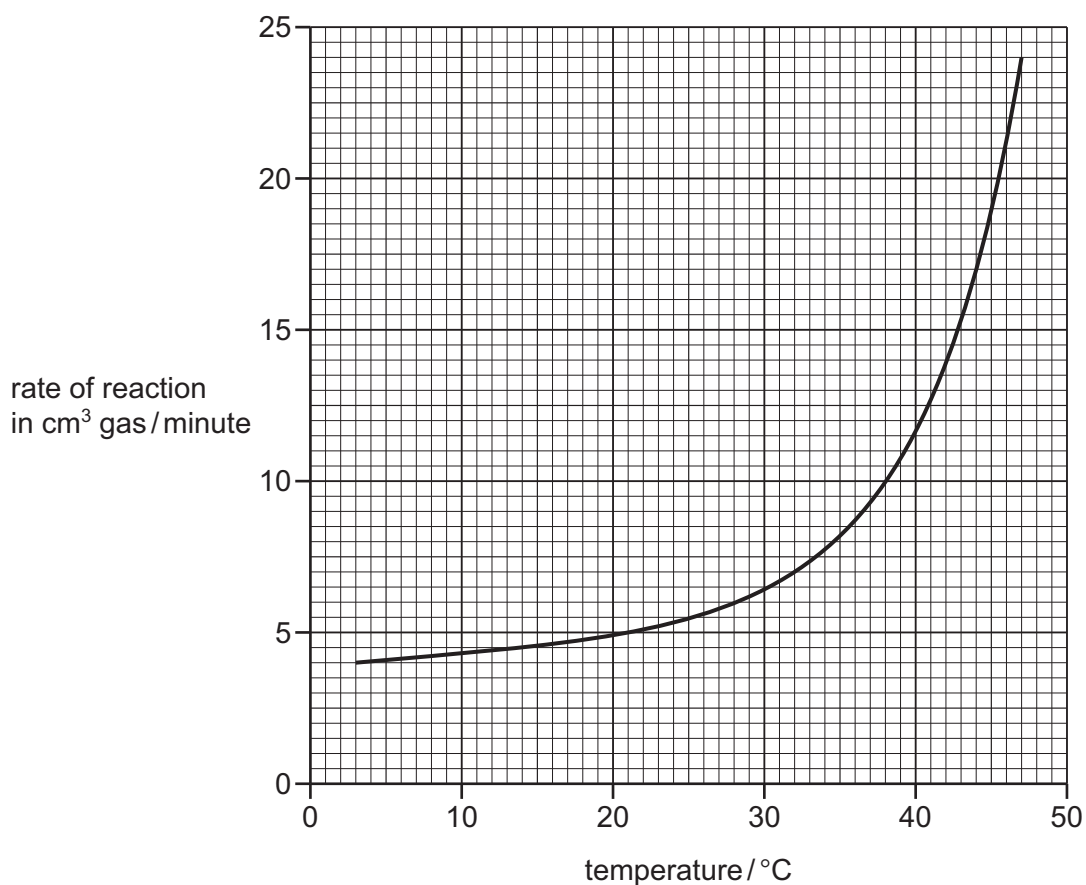
..... [1]

(b) adding a catalyst

..... [1]

[Total: 2]

16 The graph shows the effect of temperature on the rate of reaction of dilute hydrochloric acid with zinc powder.

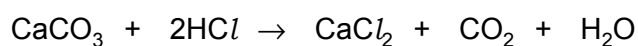


The experiments were repeated using small lumps of zinc instead of zinc powder. All other conditions were kept the same.

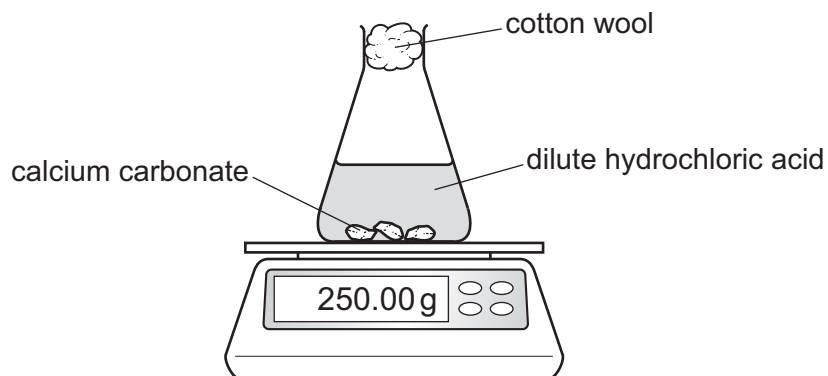
**On the grid**, draw a graph to show how the rate of reaction changes with temperature when small lumps of zinc are used instead of zinc powder. [2]

[Total: 2]

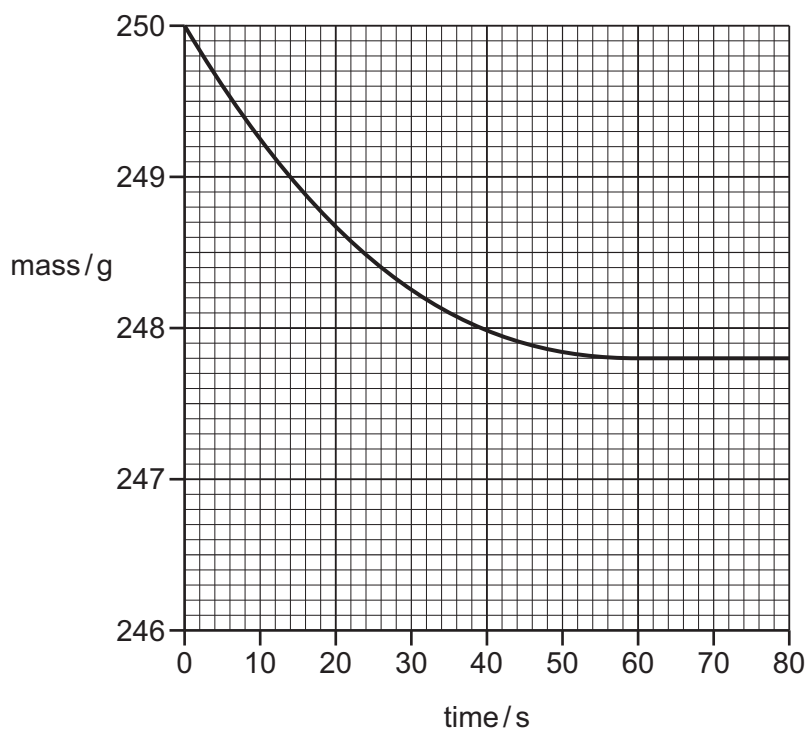
17 A student investigates the reaction of calcium carbonate with dilute hydrochloric acid.



The student measures the mass of the reaction mixture at 10 second intervals using the apparatus shown.



The graph shows the results when 5.0g of calcium carbonate is added to an **excess** of dilute hydrochloric acid.



(a) Suggest why the reaction mixture decreases in mass as the reaction proceeds.

..... [1]

(b) Calculate the loss of mass in grams when the reaction is complete.

loss in mass = ..... g [1]

- (c) The experiment is repeated using dilute hydrochloric acid of **twice** the concentration. All other conditions are kept the same.

**On the grid**, draw a graph to show how the mass changes with time using dilute hydrochloric acid of **twice** the concentration.

[2]

- (d) The original experiment is repeated at three different temperatures. All other conditions are kept the same. The three temperatures are 20 °C, 30 °C and 40 °C.

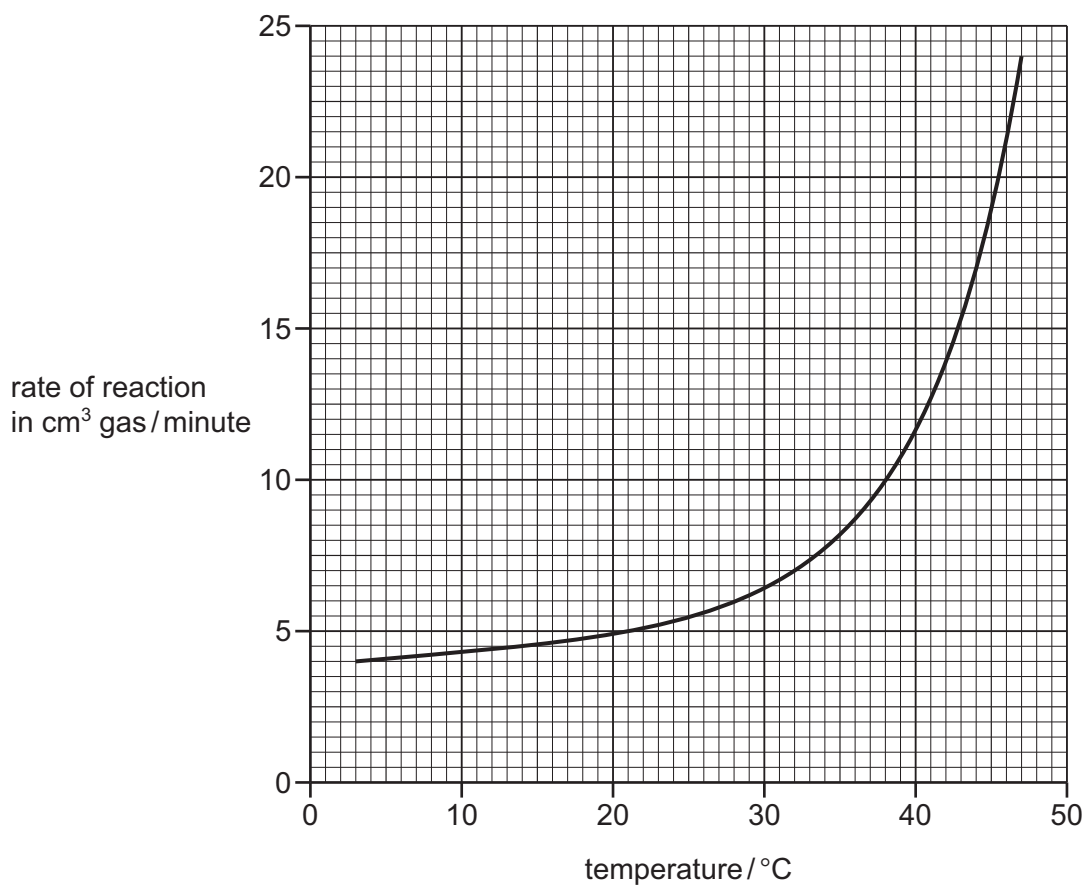
Complete the table by writing the temperatures in the first column.

temperature in °C	initial rate of reaction in g/s
	0.16
	0.64
	0.32

[1]

[Total: 5]

- 18 The graph shows the effect of temperature on the rate of reaction of dilute hydrochloric acid with zinc powder.



Determine the rate of reaction at 40 °C.

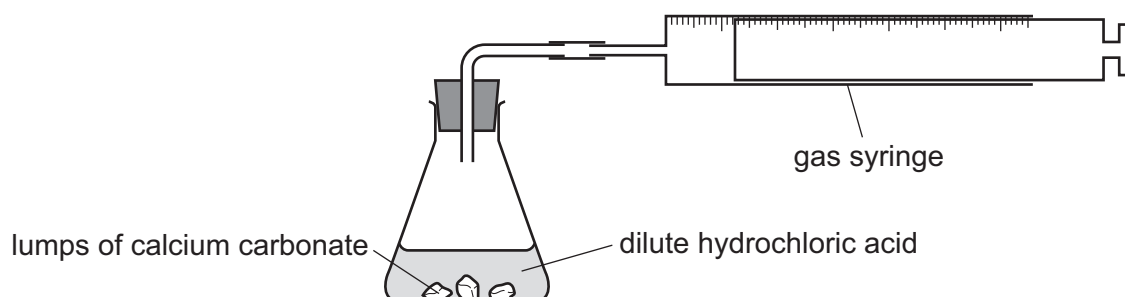
rate of reaction = .....cm<sup>3</sup> gas / minute [1]

[Total: 1]

- 19 A student investigates the rate of reaction between lumps of calcium carbonate and dilute hydrochloric acid using the apparatus shown.



The calcium carbonate was in excess.



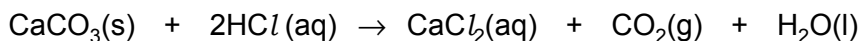
Which measurements should the student make during the reaction to determine the rate of reaction?

.....  
 .....

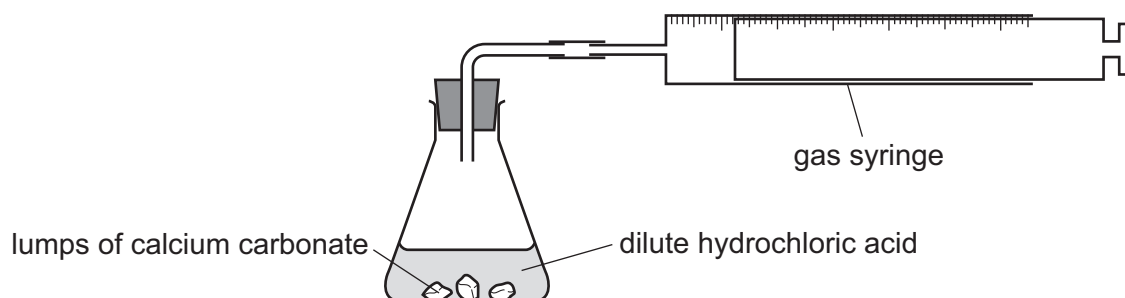
[2]

[Total: 2]

- 20 A student investigates the rate of reaction between lumps of calcium carbonate and dilute hydrochloric acid using the apparatus shown.



The calcium carbonate was in excess.



Apart from using a higher temperature, suggest **two** other methods of increasing the rate of this reaction.

1 .....

2 .....

[2]

[Total: 2]