

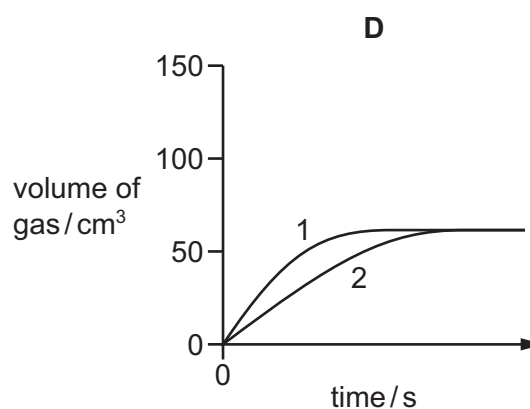
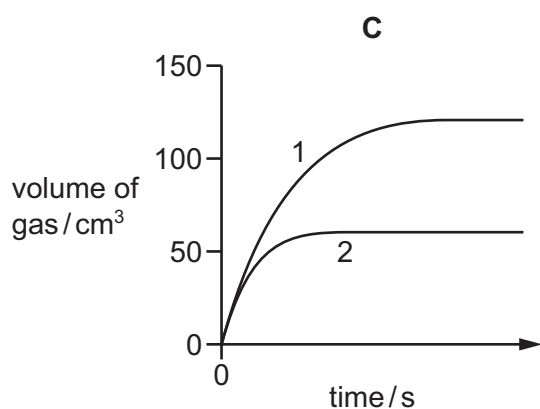
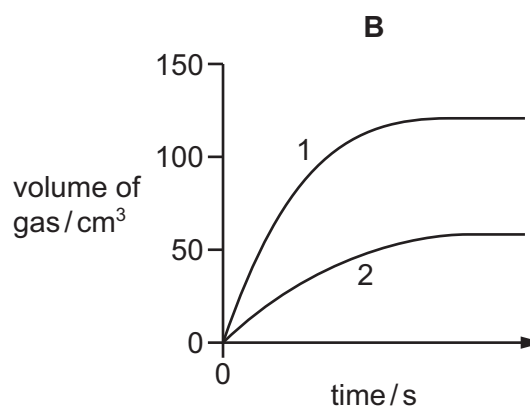
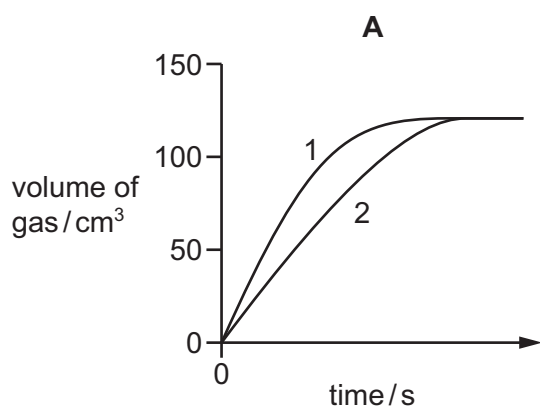
- 1 Excess calcium carbonate is added to 50 cm<sup>3</sup> of dilute hydrochloric acid of different concentrations in two separate experiments.

The volume of gas produced in experiment 1 and in experiment 2 is measured every 30 seconds.

The results are shown.

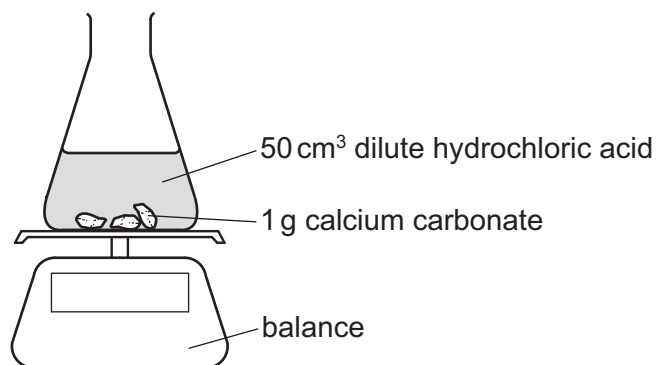
experiment	concentration of hydrochloric acid in mol/dm <sup>3</sup>	volume of gas after 30 seconds in cm <sup>3</sup>	volume of gas after 60 seconds in cm <sup>3</sup>	final volume of gas in cm <sup>3</sup>
1	0.20	55	99	120
2	0.10	26	50	59

Which diagram represents the data collected?



2 An experiment is set up as shown.

The mass of the conical flask and its contents is measured at 30-second intervals.



Which statement about the reaction and changes to the reaction conditions is correct?

- A Adding 10 cm<sup>3</sup> of water to the 50 cm<sup>3</sup> of acid increases the rate of the reaction.
- B Increasing the size of the pieces of calcium carbonate increases the rate of the reaction.
- C Increasing the temperature increases the rate of the reaction.
- D The mass of the conical flask and its contents increases as carbon dioxide is formed.

3 Magnesium powder reacts with an excess of dilute hydrochloric acid to produce hydrogen gas.

Which statements about this reaction are correct?

- 1 The smaller the particles of magnesium powder, the more slowly the hydrogen is produced.
- 2 The higher the temperature, the faster the magnesium powder disappears.
- 3 The lower the concentration of dilute hydrochloric acid, the faster the rate of reaction.
- 4 The faster the magnesium powder disappears, the faster the rate of reaction.

- A** 1 and 2      **B** 2 and 3      **C** 2 and 4      **D** 3 and 4

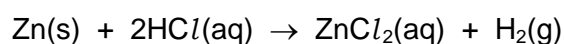
4 Lumps of calcium carbonate react with dilute hydrochloric acid as shown.



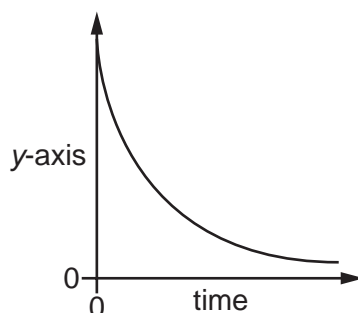
Which change in conditions decreases the rate of the reaction?

- A increasing the concentration of the acid
- B increasing the volume of the acid
- C increasing the size of the lumps of calcium carbonate
- D increasing the temperature

5 An experiment is carried out to find the rate of reaction between hydrochloric acid and zinc.



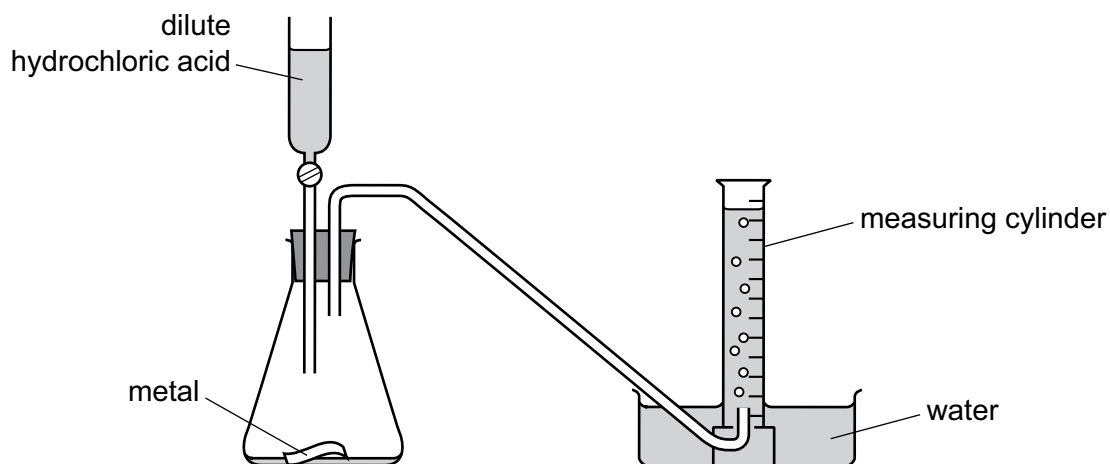
The results of the experiment are shown.



What is the label on the y-axis?

- A amount of  $\text{ZnCl}_2$  produced
- B concentration of  $\text{HCl}$
- C mass of  $\text{Zn}$  reacted
- D volume of  $\text{H}_2$  produced

6 The diagram shows an experiment to measure the rate of a chemical reaction.



Which change decreases the rate of reaction?

- A adding water to the flask
- B heating the flask during the reaction
- C using more concentrated acid
- D using powdered metal

7 Magnesium is added to dilute hydrochloric acid.

25 cm<sup>3</sup> of gas is given off in the first 30 s of the reaction.

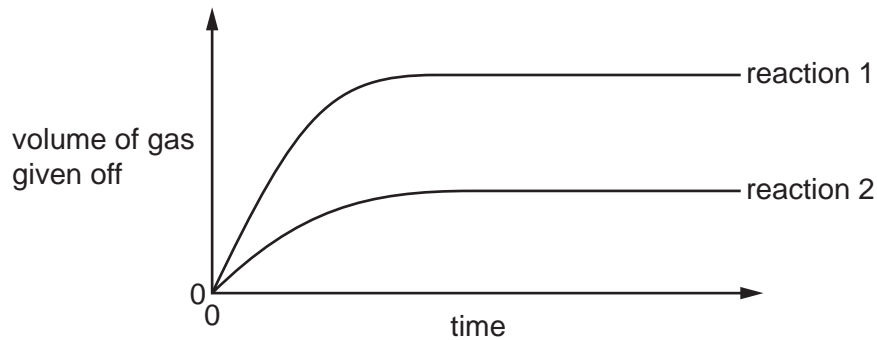
The experiment is repeated at a lower temperature. All other reaction conditions are the same.

Which volume of gas is produced in the first 30 s of this reaction?

- A 15 cm<sup>3</sup>      B 25 cm<sup>3</sup>      C 30 cm<sup>3</sup>      D 50 cm<sup>3</sup>

- 8 Excess magnesium ribbon is reacted with a fixed volume of hydrochloric acid and the volume of gas given off over time is measured.

The results of two different experiments are shown.



Which statement explains the differences between the results of the two experiments?

- A Reaction 1 uses a catalyst.
- B The acid used is twice as concentrated in reaction 1.
- C The magnesium ribbon is in smaller pieces in reaction 2.
- D The temperature is higher in reaction 2.

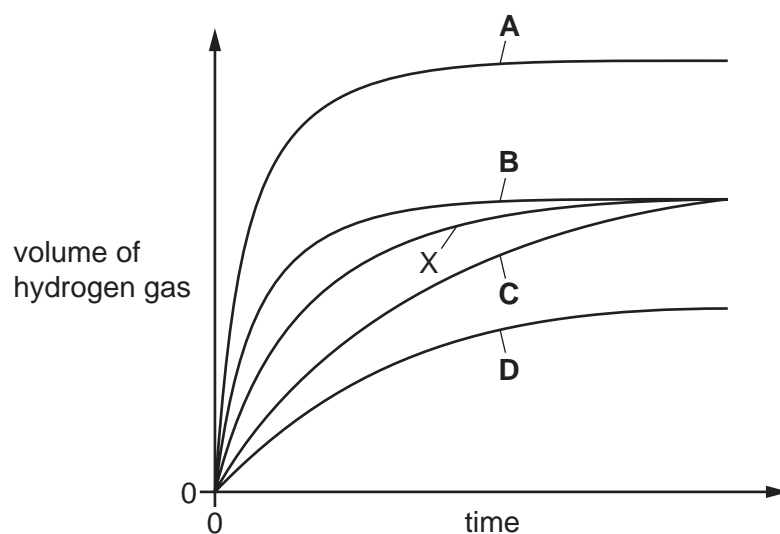
- 9 A student adds excess zinc to dilute hydrochloric acid at 25 °C.

The hydrogen gas produced is collected and measured at room temperature and pressure.

The results are plotted and labelled as curve X on the graph.

The experiment is repeated at 50 °C with all other conditions remaining the same.

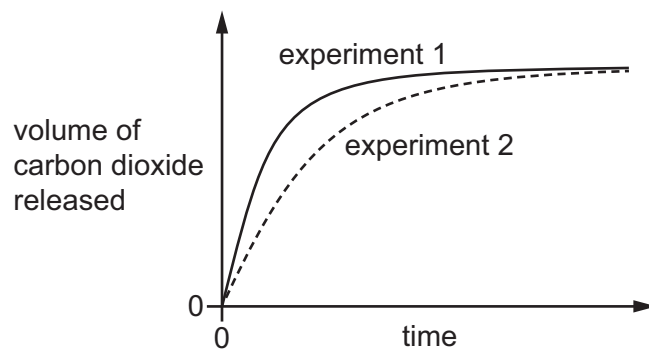
Which graph shows the results at 50 °C?



10 In experiment 1, small lumps of limestone are added to dilute ethanoic acid at 40 °C.

The volume of carbon dioxide released is measured at regular time intervals.

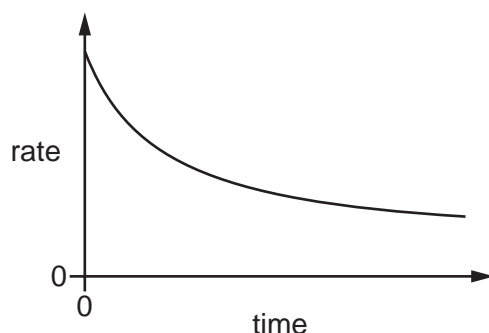
A graph of the results is shown.



Which changes give the results shown in experiment 2?

	limestone	temperature / °C
<b>A</b>	large lumps	40
<b>B</b>	powder	40
<b>C</b>	powder	60
<b>D</b>	small lumps	60

- 11 The reaction between two aqueous compounds, X and Y, is slow and exothermic. The graph shows how the rate of this reaction changes with time.



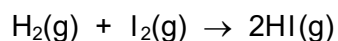
A student suggests that the rate of reaction decreases with time because:

- 1 the activation energy decreases
- 2 the speed of the molecules of X and Y decreases
- 3 the concentration of both X and Y decreases with time.

Which suggestions are correct?

- A** 1 and 2      **B** 1 and 3      **C** 2 only      **D** 3 only

- 12 Hydrogen reacts with iodine to form hydrogen iodide.



Which statements explain why the reaction is faster when the pressure is increased, at constant temperature?

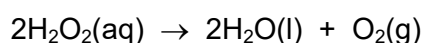
- 1 At higher pressure, the molecules are moving faster.
- 2 At higher pressure, more of the molecules have the required activation energy.
- 3 At higher pressure, the molecules are closer together.
- 4 At higher pressure, the molecules collide more frequently.

- A** 1 and 2      **B** 1 and 3      **C** 2 and 4      **D** 3 and 4

- 13 Which row describes the effect on the activation energy and the frequency of particle collisions when the temperature of a chemical reaction is increased?

	activation energy	frequency of collisions
<b>A</b>	increases	increases
<b>B</b>	no change	increases
<b>C</b>	increases	no change
<b>D</b>	no change	no change

- 14 Hydrogen peroxide,  $\text{H}_2\text{O}_2$ , decomposes to form water and oxygen.



Manganese(IV) oxide catalyses the decomposition reaction.

The reaction is investigated in four experiments.

experiment	volume and concentration of hydrogen peroxide	conditions
1	12.5 cm <sup>3</sup> of 1.0 mol/dm <sup>3</sup>	25 °C with manganese(IV) oxide powder added
2	12.5 cm <sup>3</sup> of 2.0 mol/dm <sup>3</sup>	40 °C with manganese(IV) oxide powder added
3	25 cm <sup>3</sup> of 1.0 mol/dm <sup>3</sup>	40 °C without manganese(IV) oxide powder
4	25 cm <sup>3</sup> of 1.0 mol/dm <sup>3</sup>	40 °C with manganese(IV) oxide powder added

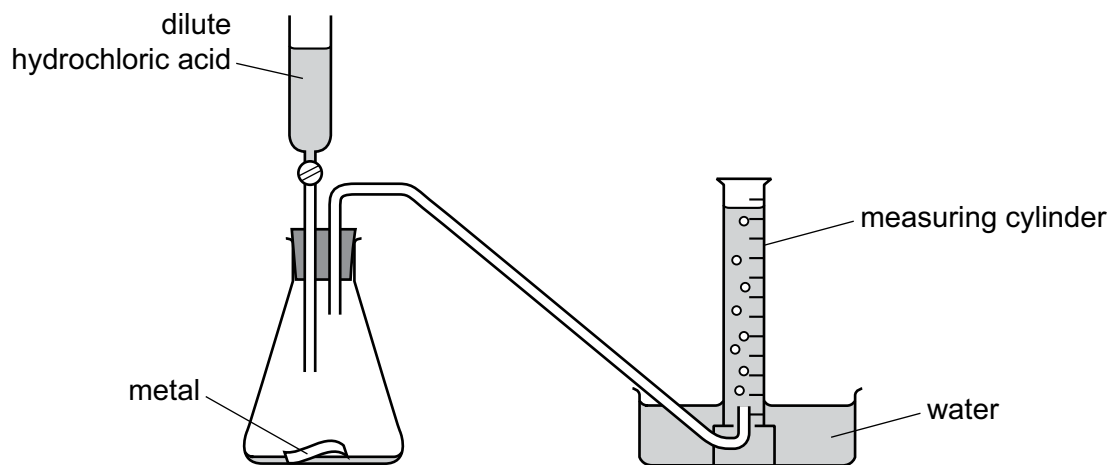
All reactions go to completion and all measurements of gas volumes are at room temperature and pressure.

Which statement is correct?

- A** Experiment 1 produces less gas than experiment 4, but at the same rate.
- B** Experiment 2 produces more gas than experiment 1, but at the same rate.
- C** Experiment 2 and experiment 4 each produce the same volume of gas, but at different rates.
- D** Experiment 3 and experiment 4 each produce the same volume of gas and at the same rate.



15 The diagram shows an experiment to measure the rate of a chemical reaction.



Which change decreases the rate of reaction?

- A adding water to the flask
- B heating the flask during the reaction
- C using more concentrated acid
- D using powdered metal

16 Which row describes the effect of increasing concentration and increasing temperature on the collisions between reacting particles?

	increasing concentration	increasing temperature
A	more collisions per second only	more collisions per second only
B	more collisions per second only	more collisions per second and more collisions with sufficient energy to react
C	more collisions per second and more collisions with sufficient energy to react	more collisions per second only
D	more collisions per second and more collisions with sufficient energy to react	more collisions per second and more collisions with sufficient energy to react

17 How does increasing the concentration affect the reacting particles in a chemical reaction?

	increases the collision rate	increases the proportion of particles with the activation energy
<b>A</b>	✓	x
<b>B</b>	✓	✓
<b>C</b>	x	x
<b>D</b>	x	✓