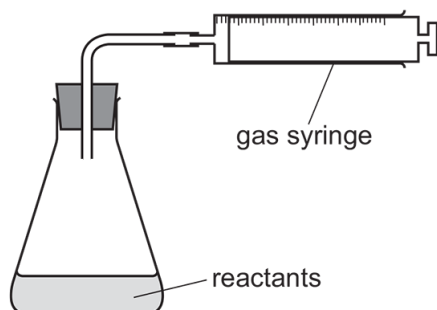


7.2 Rate (speed) of reaction

01. 0620_m21_qp_22 Q: 16

The apparatus shown is used to measure the rate of a reaction.



Which equation represents a reaction where the rate can be measured using this apparatus?

- A** $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$
- B** $\text{HCl(aq)} + \text{NaOH(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$
- C** $\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{Cu(s)} + \text{FeSO}_4\text{(aq)}$
- D** $2\text{Na(s)} + \text{Br}_2\text{(l)} \rightarrow 2\text{NaBr(s)}$

02. 0620_s21_qp_21 Q: 15

Four statements about the effect of increasing temperature on a reaction are shown.

- 1 The activation energy becomes lower.
- 2 The particles move faster.
- 3 There are more collisions between reacting particles per second.
- 4 There are more collisions which have energy greater than the activation energy.

Which statements are correct?

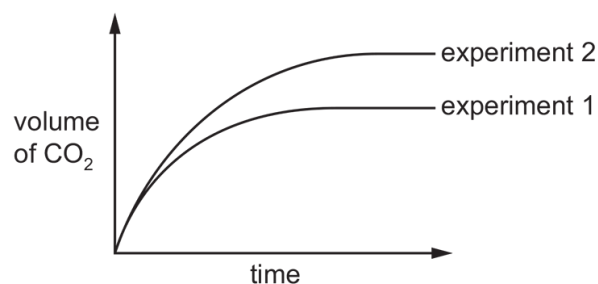
- A** 1, 2 and 3 **B** 1, 3 and 4 **C** 2, 3 and 4 **D** 2 and 3 only

03. 0620_s21_qp_22 Q: 13

An excess of calcium carbonate reacts with dilute hydrochloric acid. The volume of carbon dioxide produced is measured at regular time intervals. The results are shown as experiment 1.

The experiment is repeated with only **one** change to the reaction conditions.

The results are shown as experiment 2.



Which change is made in experiment 2?

- A The concentration of the acid is increased.
- B The volume of acid is increased.
- C The mass of calcium carbonate is increased.
- D The calcium carbonate is powdered.

04. 0620_s21_qp_22 Q: 15

Four statements about the effect of increasing temperature on a reaction are shown.

- 1 The activation energy becomes lower.
- 2 The particles move faster.
- 3 There are more collisions between reacting particles per second.
- 4 There are more collisions which have energy greater than the activation energy.

Which statements are correct?

- A 1, 2 and 3 B 1, 3 and 4 C 2, 3 and 4 D 2 and 3 only
-

7.2. RATE (SPEED) OF REACTION

05. 0620_s21_qp_23 Q: 15

Four statements about the effect of increasing temperature on a reaction are shown.

- 1 The activation energy becomes lower.
- 2 The particles move faster.
- 3 There are more collisions between reacting particles per second.
- 4 There are more collisions which have energy greater than the activation energy.

Which statements are correct?

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

06. 0620_w21_qp_21 Q: 13

Which statements about the effect of increasing the temperature on the rate of a reaction are correct?

- 1 It increases the rate of a reaction.
- 2 It increases the activation energy.
- 3 It increases the frequency of collisions.

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

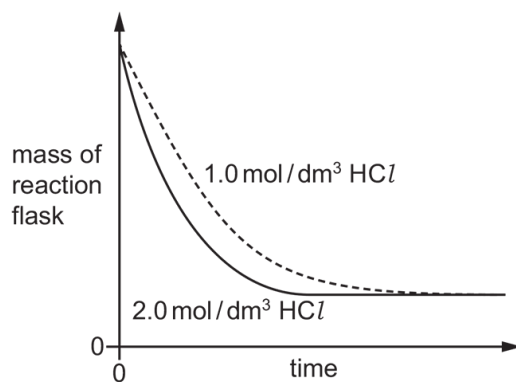
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07. 0620_w21_qp_23 Q: 17

Excess dilute hydrochloric acid is added to equal masses of powdered calcium carbonate in two separate experiments.

Two different concentrations of hydrochloric acid are used. The temperature in both experiments is the same.

The results show the change in mass of the reaction flask measured over time.



Why is the rate of reaction for the 1.0 mol/dm^3 hydrochloric acid slower?

	collision energy	collision rate
A	lower	higher
B	lower	lower
C	same as for 2.0 mol/dm^3	higher
D	same as for 2.0 mol/dm^3	lower

7.2. RATE (SPEED) OF REACTION

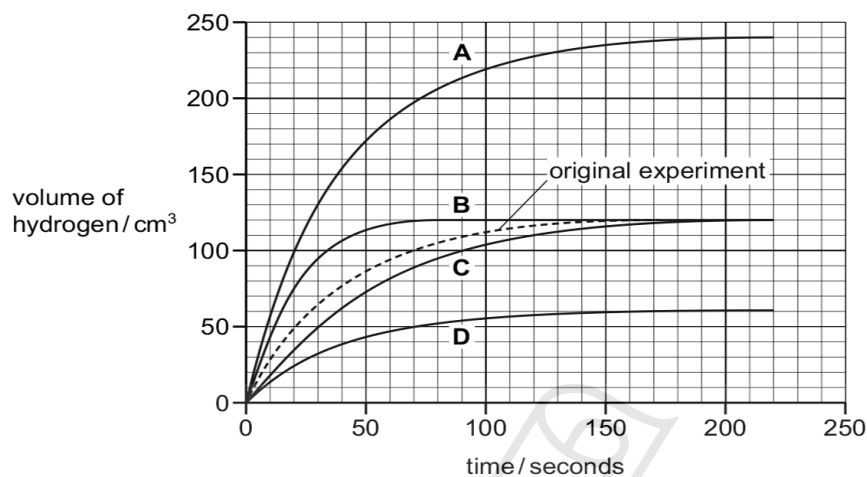
08. 0620_m20_qp_22 Q: 15

A student adds excess magnesium ribbon to 10 cm³ of 0.5 mol/dm³ sulfuric acid.

The hydrogen gas is collected and its volume measured every 10 seconds.

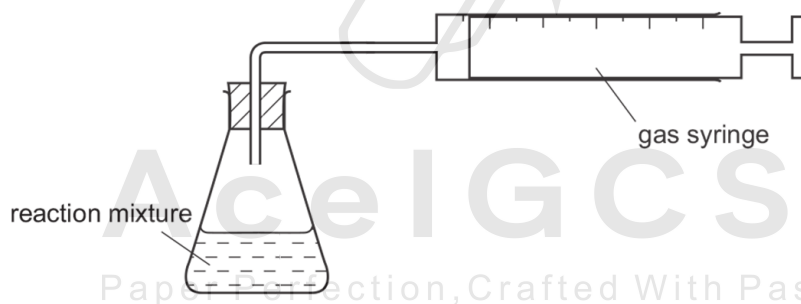
The experiment is repeated using the same mass of magnesium ribbon with 5 cm³ of 0.5 mol/dm³ sulfuric acid added to 5 cm³ of water.

Which graph shows the results of the second experiment?

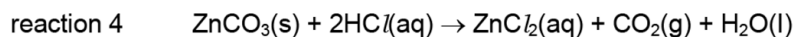
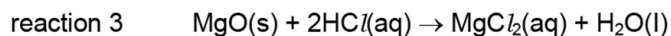
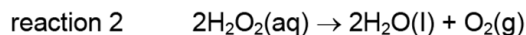


09. 0620_p20_qp_20 Q: 18

The apparatus shown can be used to measure the rate of some chemical reactions.



For which two reactions would this apparatus be suitable?



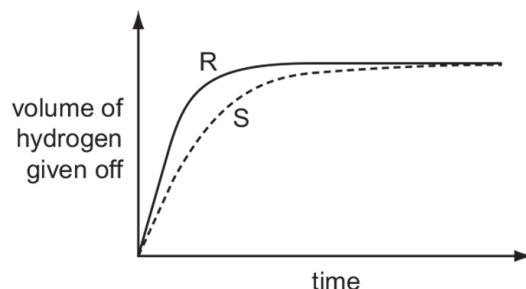
A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

10. 0620_p20_qp_20 Q: 19

A student investigates the rate of reaction between magnesium and excess sulfuric acid.

The volume of hydrogen given off in the reaction is measured over time.

The graph shows the results of two experiments, R and S.



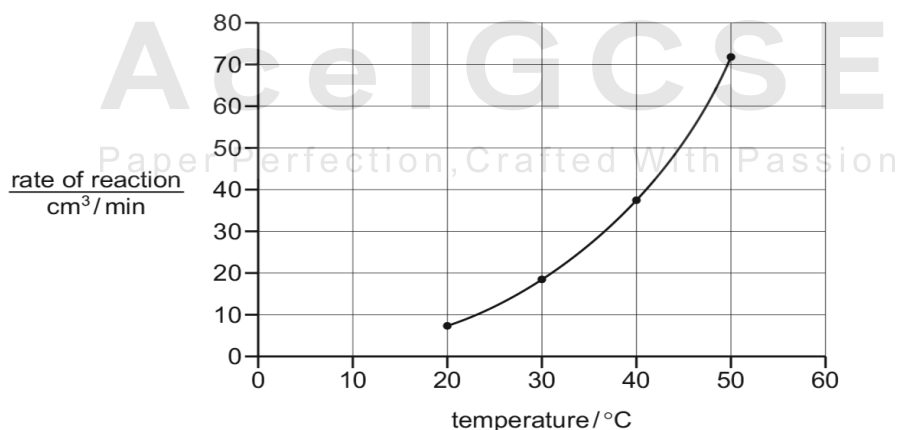
Which change in conditions would cause the difference between R and S?

- A A catalyst is added in S.
- B The acid is more concentrated in R than in S.
- C The magnesium is less finely powdered in R than in S.
- D The temperature in R is lower than in S.

11. 0620_s20_qp_21 Q: 15

The rate of reaction between calcium carbonate chips and hydrochloric acid is studied by collecting the volume of gas released in one minute at different temperatures.

A graph of rate of reaction against temperature is shown.



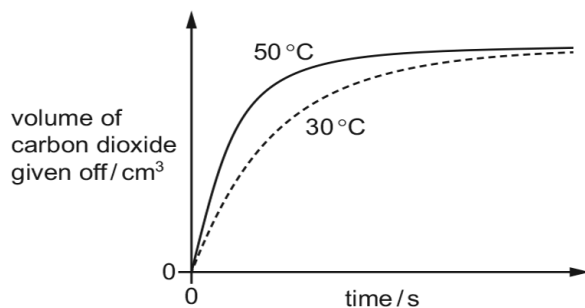
Which statement fully explains why increasing the temperature has this effect on the rate?

- A The kinetic energy of the particles increases so the collisions are harder.
- B The number of collisions between particles increases.
- C The activation energy needed for the particles to react is reduced.
- D There are more frequent collisions between particles with enough energy to react.

7.2. RATE (SPEED) OF REACTION

12. 0620_s20_qp_22 Q: 15

The results of adding excess marble chips (calcium carbonate) to hydrochloric acid at 50 °C and at 30 °C are shown. Only the temperature is changed.



Which row describes the reacting particles at 30 °C compared to those at 50 °C?

	collision rate	collision energy
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

13. 0620_s20_qp_23 Q: 15

A chemical reaction occurs when the reacting particles collide.

Which reaction conditions would produce the greatest rate of particle collisions?

	concentration of acid	reaction temperature
A	decrease	decrease
B	no change	increase
C	increase	increase
D	increase	no change

14. 0620_w20_qp_21 Q: 18

A sign displayed in a flour mill is shown.



Which statement explains why there is a danger of explosion in a flour mill?

- A Flour burns very quickly because it is a fine powder.
 - B Flour is a catalyst for combustion.
 - C Flour mills get hot and speed up the rate of combustion.
 - D The combustion of flour is exothermic.
-

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7.2. RATE (SPEED) OF REACTION

15. 0620_w20_qp_21 Q: 19

A student investigates the effect of concentration on the rate of reaction between calcium carbonate and hydrochloric acid. He follows the method shown.

- Place 1 g of calcium carbonate in a conical flask.
- Add excess hydrochloric acid.
- Let the reaction continue until no more gas is made.
- Repeat the experiment with different concentrations of hydrochloric acid.

Which essential step has been left out of the method if he is to work out the rate of the reaction?

- A** heating the reaction mixture
- B** placing a bung in the flask
- C** timing the reaction
- D** using a catalyst



16. 0620_w20_qp_22 Q: 17

Nitrogen, N_2 , and hydrogen, H_2 , can be converted into ammonia, NH_3 , using a catalyst.

What is the purpose of the catalyst?

- A** to increase the amount of ammonia produced
 - B** to increase the rate of reaction
 - C** to reduce the amount of reactants needed
 - D** to reduce the rate of reaction
-

17. 0620_w20_qp_23 Q: 18

Which reaction is an example of a photochemical reaction?

- A glucose forming carbon dioxide and water
- B magnesium reacting with oxygen
- C potassium reacting with water
- D silver chloride forming silver metal



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7.2. RATE (SPEED) OF REACTION

18. 0620_w20_qp_23 Q: 19

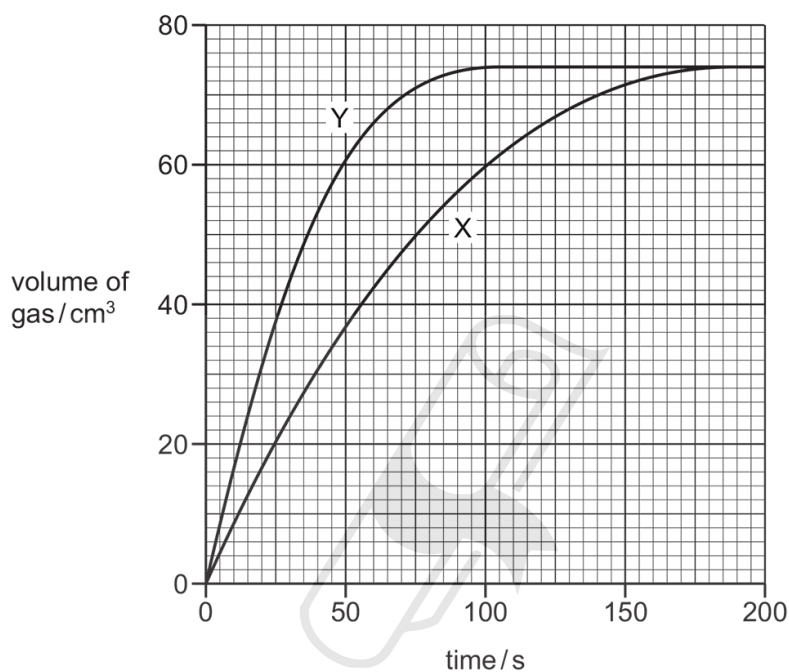
An excess of calcium carbonate is added to dilute hydrochloric acid, X.

The carbon dioxide gas given off is collected and its volume recorded at regular time intervals.

Line X on the graph shows the results obtained.

The experiment is repeated using dilute hydrochloric acid, Y.

Line Y on the graph shows the results obtained.



Which statement about the two hydrochloric acid samples, X and Y, is correct?

- A They had the same volume but Y had higher concentration.
- B They had the same concentration but Y had a larger volume.
- C X had a higher concentration but Y had a larger volume.
- D Y had a higher concentration but X had a larger volume.

19. 0620_m19_qp_22 Q: 15

A student adds dilute hydrochloric acid at two different temperatures to two different lumps of limestone. The lumps of limestone have the same mass.

The carbon dioxide gas produced is collected in a gas syringe.

The volume of carbon dioxide collected in 1 minute at each temperature is shown.

temperature / °C	volume of carbon dioxide produced in 1 minute / cm ³
25	10
50	40

Which row describes and explains the results obtained at 50 °C compared with 25 °C?

	reaction rate	energy of collisions
A	higher	lower
B	higher	higher
C	lower	lower
D	lower	higher

20. 0620_s19_qp_21 Q: 13

Which change in reaction conditions increases both the collision rate and the proportion of molecules with sufficient energy to react?

- A** addition of a catalyst
- B** increasing the concentration of a reactant
- C** increasing the surface area of a reactant
- D** increasing the temperature of the reaction

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7.2. RATE (SPEED) OF REACTION

21. 0620_w19_qp_21 Q: 16

The rate of reaction between magnesium and dilute hydrochloric acid is increased by increasing the concentration of the acid.

How does this affect the reacting particles?

	collision rate of particles	proportion of particles with sufficient energy to react
A	increases	increases
B	increases	stays the same
C	stays the same	increases
D	stays the same	stays the same

22. 0620_w19_qp_22 Q: 16

A sample of dilute nitric acid is added to lumps of limestone in a conical flask. The conical flask is placed on a balance and the loss in mass is measured.

A second sample of nitric acid of a different concentration is separately tested. All other conditions are kept the same.

The loss in mass in 1 minute at each concentration of nitric acid is shown.

concentration in mol/dm ³	loss in mass in 1 minute/g
0.5	0.15
1.0	0.25

Which row describes and explains the results obtained using 1.0 mol/dm³ nitric acid compared with 0.5 mol/dm³ nitric acid?

	description	explanation
A	decrease in reaction rate	decrease in particle collision energy
B	decrease in reaction rate	increase in particle collision rate
C	increase in reaction rate	increase in particle collision rate
D	increase in reaction rate	increase in particle collision rate and collision energy

23. 0620_w19_qp_23 Q: 16

Magnesium reacts with dilute hydrochloric acid.

Which statement about the particles in the reaction is correct?

- A** Increasing the concentration of dilute hydrochloric acid increases the collision rate but has no effect on the activation energy.
- B** Increasing the concentration of dilute hydrochloric acid increases the collision rate and the activation energy.
- C** Increasing the temperature of the reaction increases the activation energy.
- D** Increasing the temperature of the reaction causes all collisions to lead to a reaction.

24. 0620_m18_qp_22 Q: 15

In which reaction is the rate of reaction **not** affected by light?

- A** the conversion of carbon dioxide and water to glucose and oxygen in green plants
- B** the reaction of bromine with ethene
- C** the reaction of chlorine with methane
- D** the reduction of silver ions to silver

25. 0620_m18_qp_22 Q: 16

Calcium carbonate reacts with dilute hydrochloric acid to form bubbles of carbon dioxide.

At a higher temperature, the same reaction is faster.

Which row explains this observation?

	collision rate	number of molecules with sufficient energy to react
A	increases	more
B	increases	the same
C	stays the same	more
D	stays the same	the same

7.2. RATE (SPEED) OF REACTION

26. 0620_s18_qp_21 Q: 14

Which row describes the effects of increasing both concentration and 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 and more collisions with sufficient energy to react	more collisions per second only
C	more collisions per second only	more collisions per second and more collisions with sufficient energy to react
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

27. 0620_w18_qp_21 Q: 14

The effects of a change in conditions on a chemical reaction are listed.

- 1 The total number of collisions per minute increased.
- 2 The number of effective collisions per minute increased.
- 3 The average energy of the particles increased.

Which change in conditions caused all of these effects?

- A** addition of a catalyst
- B** increasing the concentration of a solution of a reactant
- C** increasing the surface area of a solid reactant
- D** increasing the temperature

28. 0620_w18_qp_22 Q: 14

The rate of reaction between magnesium ribbon and 2 mol/dm^3 hydrochloric acid at 25°C to produce hydrogen gas is measured.

In another experiment, either the concentration of the hydrochloric acid or the temperature is changed. All other conditions are kept the same.

Which conditions increase the rate of reaction?

- A** 1 mol/dm^3 hydrochloric acid at 25°C
- B** 2 mol/dm^3 hydrochloric acid at 10°C
- C** 2 mol/dm^3 hydrochloric acid at 20°C
- D** 3 mol/dm^3 hydrochloric acid at 25°C

29. 0620_w18_qp_23 Q: 14

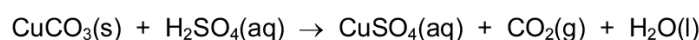
Dilute hydrochloric acid reacts with 1 g of limestone.

Which conditions produce the fastest rate of reaction?

- A 2 mol/dm³ hydrochloric acid and a single lump of limestone
 - B 4 mol/dm³ hydrochloric acid and a single lump of limestone
 - C 4 mol/dm³ hydrochloric acid and small pieces of limestone
 - D 4 mol/dm³ hydrochloric acid and powdered limestone
-

30. 0620_m17_qp_22 Q: 14

Copper(II) carbonate reacts with dilute sulfuric acid.



The rate of the reaction can be changed by varying the conditions.

Which changes always increase the rate of this chemical reaction?

- 1 increasing the concentration of sulfuric acid
- 2 increasing the size of the pieces of copper(II) carbonate
- 3 increasing the temperature
- 4 increasing the volume of sulfuric acid

- A 1, 3 and 4 B 1 and 3 only C 2 and 3 D 3 and 4 only
-

31. 0620_m17_qp_22 Q: 15

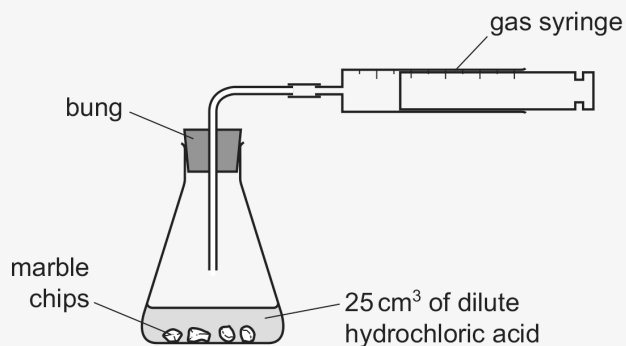
Which reaction is **not** affected by the presence of light?

- A a candle burning
 - B methane reacting with chlorine
 - C photosynthesis
 - D silver bromide decomposing to form silver
-

7.2. RATE (SPEED) OF REACTION

32. 0620_s17_qp_21 Q: 15

15 A student was investigating the reaction between marble chips and dilute hydrochloric acid.



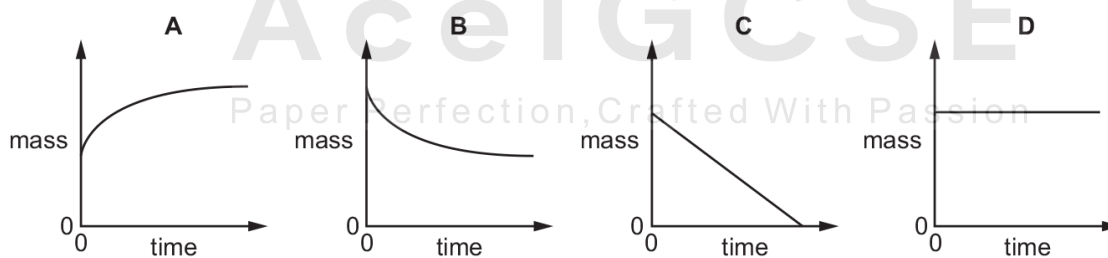
Which changes slow down the rate of reaction?

	temperature of acid	concentration of acid	surface area of marble chips
A	decrease	decrease	decrease
B	decrease	decrease	increase
C	increase	decrease	decrease
D	increase	increase	increase

33. 0620_w17_qp_21 Q: 13

The mass of a beaker and its contents is plotted against time.

Which graph represents what happens when sodium carbonate reacts with an excess of dilute hydrochloric acid in an open beaker?



34. 0620_w17_qp_21 Q: 15

Ethanoic acid reacts slowly with calcium carbonate.

Which statements explain why an increase in temperature increases the rate of the reaction?

- 1 The activation energy of the reaction is decreased.
- 2 There is an increase in collision rate.
- 3 The particles have more energy.
- 4 There will be fewer successful collisions.

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

35. 0620_w17_qp_22 Q: 15

Four statements about the effect of increasing temperature on a reaction are shown.

- 1 The activation energy becomes lower.
- 2 The particles move faster.
- 3 There are more collisions between reacting particles.
- 4 There are more collisions which have energy greater than the activation energy.

Which statements are correct?

A 1, 2 and 3 **B** 1, 3 and 4 **C** 2, 3 and 4 **D** 2 and 3 only

36. 0620_w17_qp_23 Q: 14

Silver chloride reacts when it is exposed to light.

Which row shows what happens to the silver in this process?

	half-equation	type of reaction
A	$\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$	oxidation
B	$\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$	reduction
C	$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$	oxidation
D	$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$	reduction

7.2. RATE (SPEED) OF REACTION

37. 0620_w17_qp_23 Q: 15

Which statement about the effect of concentration and temperature on the rate of a reaction is **not** correct?

- A If the concentration of a reactant is increased, the rate of reaction increases because more particles have sufficient energy to react.
- B If the concentration of a reactant is increased, the rate of reaction increases because there are more collisions between particles per second.
- C If the temperature is increased, the rate of reaction increases because there are more collisions between particles per second.
- D If the temperature is increased, the rate of reaction increases because more particles have sufficient energy to react.

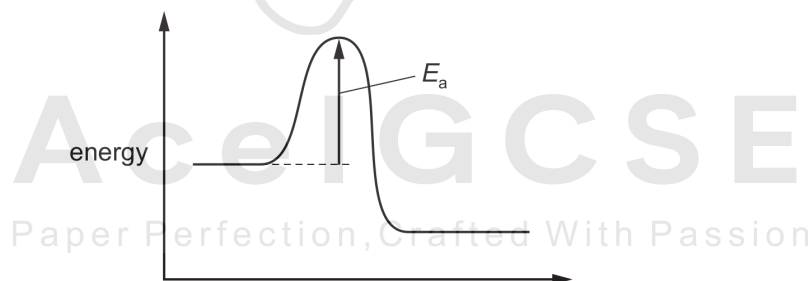
38. 0620_m16_qp_22 Q: 15

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.

39. 0620_m16_qp_22 Q: 17

The diagram shows an energy level diagram for a reaction.



The diagram shows that the reaction is1..... .

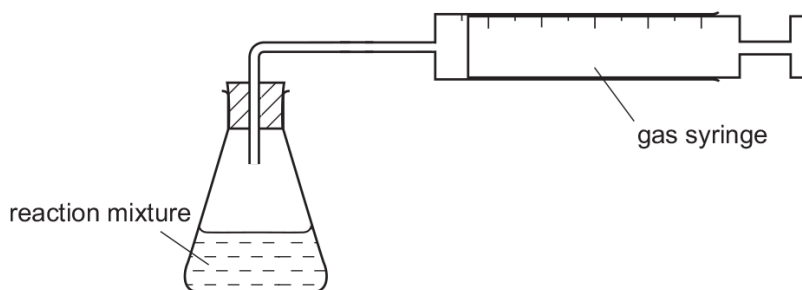
Increasing the temperature increases the rate of reaction. A reason for this is that the2..... .

Which words correctly complete gaps 1 and 2?

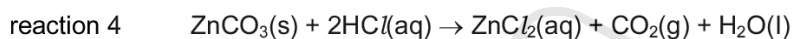
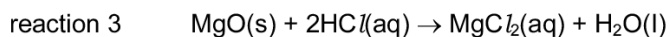
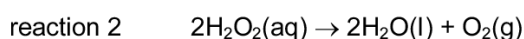
	1	2
A	endothermic	activation energy decreases
B	endothermic	collision rate increases
C	exothermic	activation energy decreases
D	exothermic	collision rate increases

40. 0620_p16_qp_20 Q: 18

The apparatus shown can be used to measure the rate of some chemical reactions.



For which two reactions would this apparatus be suitable?



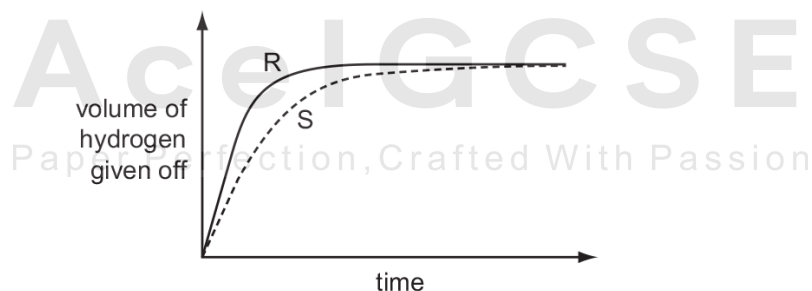
- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

41. 0620_p16_qp_20 Q: 19

A student investigates the rate of reaction between magnesium and excess sulfuric acid.

The volume of hydrogen given off in the reaction is measured over time.

The graph shows the results of two experiments, R and S.



Which change in conditions would cause the difference between R and S?

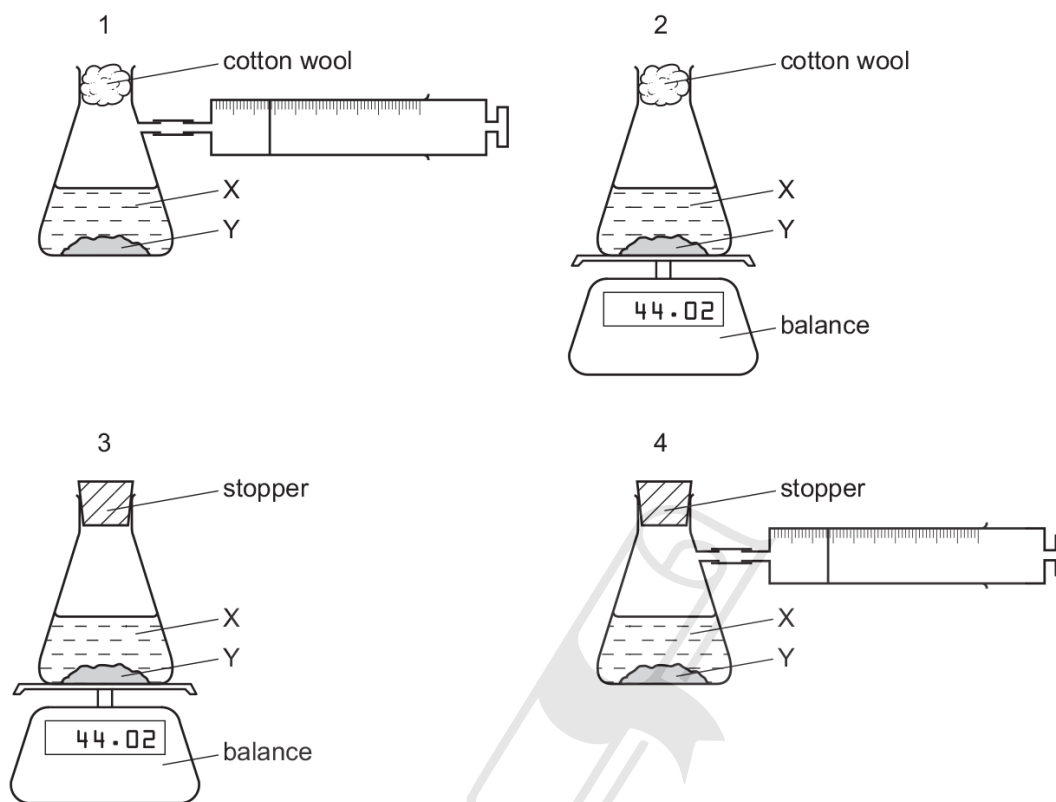
- A** A catalyst is added in S.
B The acid is more concentrated in R than in S.
C The magnesium is less finely powdered in R than in S.
D The temperature in R is lower than in S.

7.2. RATE (SPEED) OF REACTION

42. 0620_s16_qp_21 Q: 14

A liquid X reacts with solid Y to form a gas.

Which two diagrams show suitable methods for investigating the rate (speed) of the reaction?



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

43. 0620_s16_qp_21 Q: 15

Which statements explain why increasing temperature increases the rate of a chemical reaction?

- 1 Heat makes the molecules move faster and collide more often.
- 2 Heat makes the molecules collide with more energy so they are more likely to react.
- 3 Increasing temperature lowers the activation energy for the reaction.

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

44. 0620_s16_qp_22 Q: 15

Which row describes how the energy of collision between particles changes when concentration and temperature are increased?

	concentration	temperature
A	increases	increases
B	increases	no change
C	no change	increases
D	no change	no change

45. 0620_s16_qp_23 Q: 15

Which row explains why increasing temperature increases the rate of reaction?

	particles collide more often	particles collide with more energy
A	✓	✓
B	✓	x
C	x	✓
D	x	x

7.2. RATE (SPEED) OF REACTION

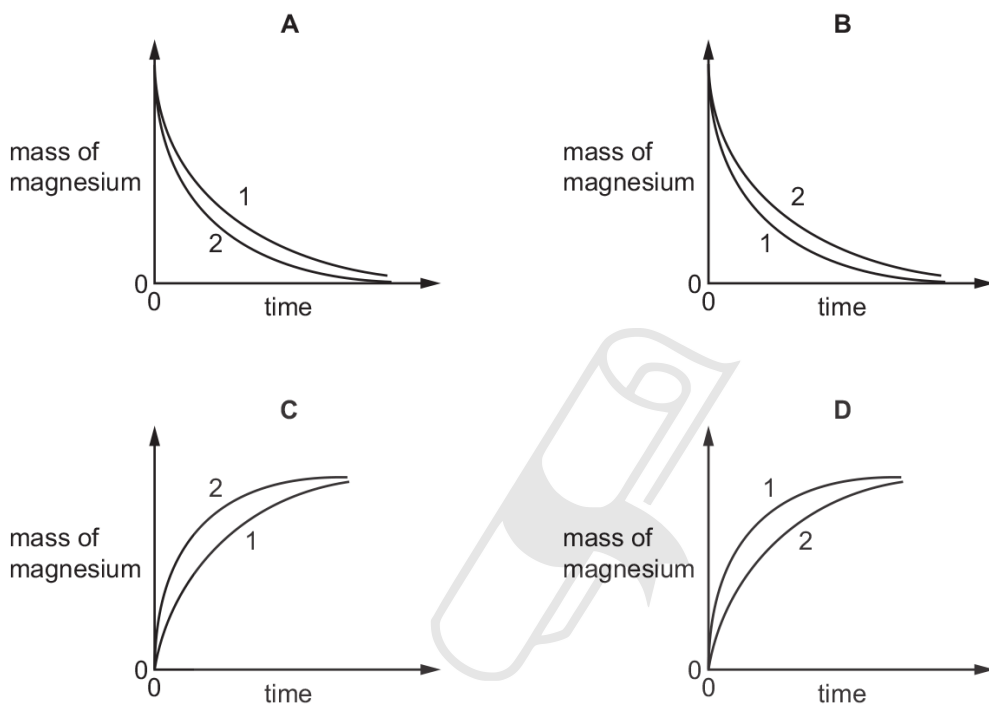
46. 0620_w16_qp_21 Q: 14

The rate of reaction between magnesium and excess dilute hydrochloric acid was followed by measuring the mass of magnesium present at regular time intervals.

Two experiments were performed.

Both experiments used 0.1g of magnesium ribbon. The acid in experiment 1 was less concentrated than in experiment 2.

Which graph shows the results of the experiments?



47. 0620_w16_qp_21 Q: 15

Which statement explains why coal dust forms an explosive mixture with air?

- A Coal dust catalyses the explosion.
- B Coal dust has a large surface area.
- C Crushing coal increases the concentration of the coal.
- D Crushing coal increases the temperature of the coal.

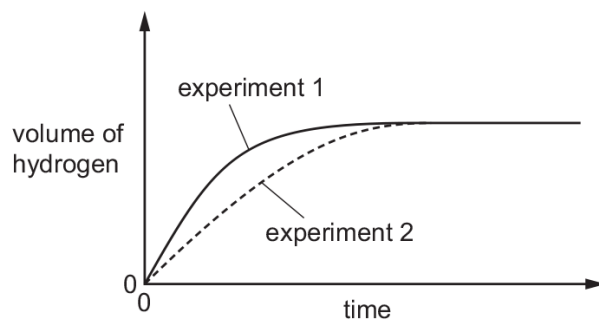
48. 0620_w16_qp_22 Q: 14

Zinc granules are reacted with excess dilute hydrochloric acid.

The volume of hydrogen given off is measured at different times.

The results are shown on the graph, labelled experiment 1.

The results for a second experiment are also shown on the graph, labelled experiment 2.



Which change to the conditions was made in experiment 2?

- A The concentration of the hydrochloric acid was decreased.
 - B The size of the zinc granules was decreased.
 - C The surface area of the zinc granules was increased.
 - D The temperature was increased.
-

49. 0620_w16_qp_22 Q: 15

In an experiment nitric acid is added to excess marble chips and the volume of carbon dioxide formed is measured.

The experiment is repeated using smaller marble chips. All other conditions remain the same.

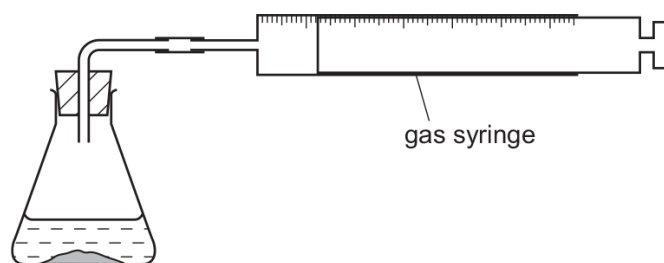
Which statement about the second experiment is correct?

- A The collisions are more frequent and higher energy.
 - B The collisions are more frequent and the same energy.
 - C The collisions are the same frequency and the same energy.
 - D The collisions are the same frequency and higher energy.
-

7.2. RATE (SPEED) OF REACTION

50. 0620_w16_qp_23 Q: 14

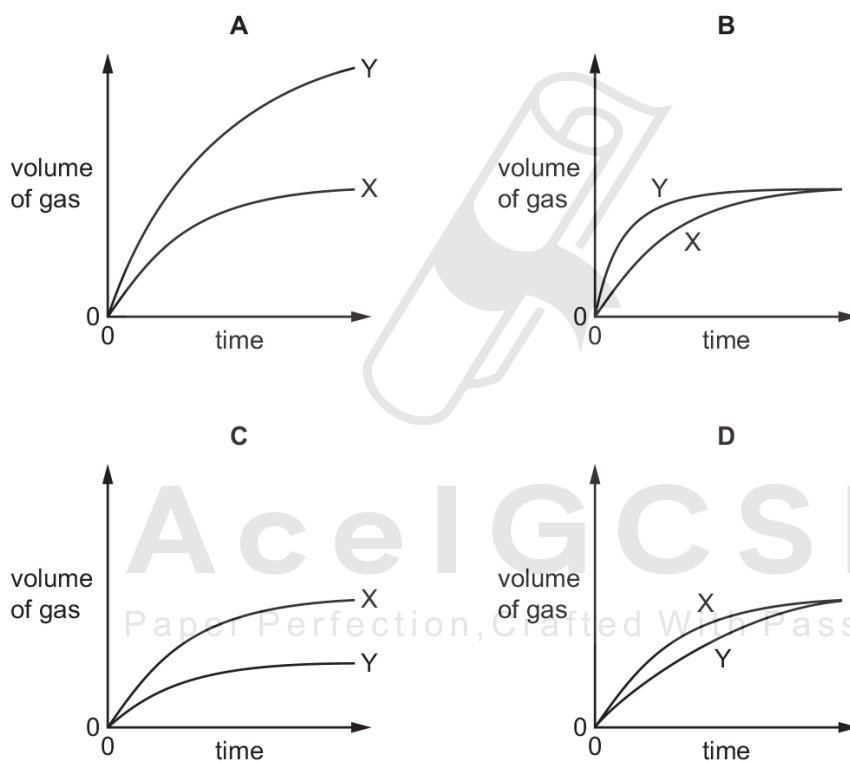
An experiment X is carried out between a solid and a solution using the apparatus shown.



The volume of gas given off is measured at different times and the results plotted on a graph.

In a second experiment Y, the surface area of the solid is increased but all other factors remain the same.

Which graph shows the results of experiments X and Y?



51. 0620_w16_qp_23 Q: 15

Which change in conditions increases the energy of the particles in a reaction?

- A addition of a catalyst
- B increase in concentration
- C increase in surface area
- D increase in temperature

SN	Paper	Q. No.	Answer
01	0620_m21_qp_22	16	A
02	0620_s21_qp_21	15	C
03	0620_s21_qp_22	13	B
04	0620_s21_qp_22	15	C
05	0620_s21_qp_23	15	C
06	0620_w21_qp_21	13	C
07	0620_w21_qp_23	17	D
08	0620_m20_qp_22	15	D
09	0620_p20_qp_20	18	C
10	0620_p20_qp_20	19	B
11	0620_s20_qp_21	15	D
12	0620_s20_qp_22	15	D
13	0620_s20_qp_23	15	C
14	0620_w20_qp_21	18	A
15	0620_w20_qp_21	19	C
16	0620_w20_qp_22	17	B
17	0620_w20_qp_23	18	D
18	0620_w20_qp_23	19	D
19	0620_m19_qp_22	15	B
20	0620_s19_qp_21	13	D
21	0620_w19_qp_21	16	B
22	0620_w19_qp_22	16	C
23	0620_w19_qp_23	16	A
24	0620_m18_qp_22	15	B
25	0620_m18_qp_22	16	A
26	0620_s18_qp_21	14	C
27	0620_w18_qp_21	14	D
28	0620_w18_qp_22	14	D
29	0620_w18_qp_23	14	D
30	0620_m17_qp_22	14	B
31	0620_m17_qp_22	15	A
32	0620_s17_qp_21	15	A
33	0620_w17_qp_21	13	B
34	0620_w17_qp_21	15	C
35	0620_w17_qp_22	15	C
36	0620_w17_qp_23	14	D
37	0620_w17_qp_23	15	A
38	0620_m16_qp_22	15	B
39	0620_m16_qp_22	17	D
40	0620_p16_qp_20	18	C
41	0620_p16_qp_20	19	B
42	0620_s16_qp_21	14	D
43	0620_s16_qp_21	15	A
44	0620_s16_qp_22	15	C
45	0620_s16_qp_23	15	A
46	0620_w16_qp_21	14	A
47	0620_w16_qp_21	15	B
48	0620_w16_qp_22	14	A
49	0620_w16_qp_22	15	B

SN	Paper	Q. No.	Answer
50	0620_w16_qp_23	14	B
51	0620_w16_qp_23	15	D