

AQA A-Level Chemistry

Kinetics

Questions only

The newest questions, about an hour. All 25 are in the exam generator.

Questions

17

Total marks

39

Time allowed

51 min

Name

Class or teacher

Date

Instructions

- Answer all questions in the spaces provided.
- Use black ink. Show your working for every calculation.
- You may use a scientific calculator and the AQA Data Sheet.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2023 AS P2 Q19	1	
2	2023 A-level P2 Q1	7	
3	2025 AS P2 Q19	1	
4	2025 AS P2 Q2	8	
5	2025 AS P2 Q20	1	
6	2025 A-level P3 Q9	1	
7	2022 AS P2 Q14	1	
8	2023 A-level P3 Q12	1	
9	2023 A-level P3 Q25	1	

Q	Source	Marks	Score
10	2023 A-level P3 Q11	1	
11	2024 AS P2 Q10	1	
12	2023 AS P2 Q8	6	
13	2024 A-level P3 Q16	1	
14	2024 A-level P3 Q15	1	
15	2024 A-level P3 Q14	1	
16	2021 AS P2 Q1	5	
17	2022 A-level P3 Q9	1	

Total _____ / 39 Percentage _____ %

Questions from AQA past papers, 2021–2025, reproduced for revision. Practise these topics online, with instant marking:

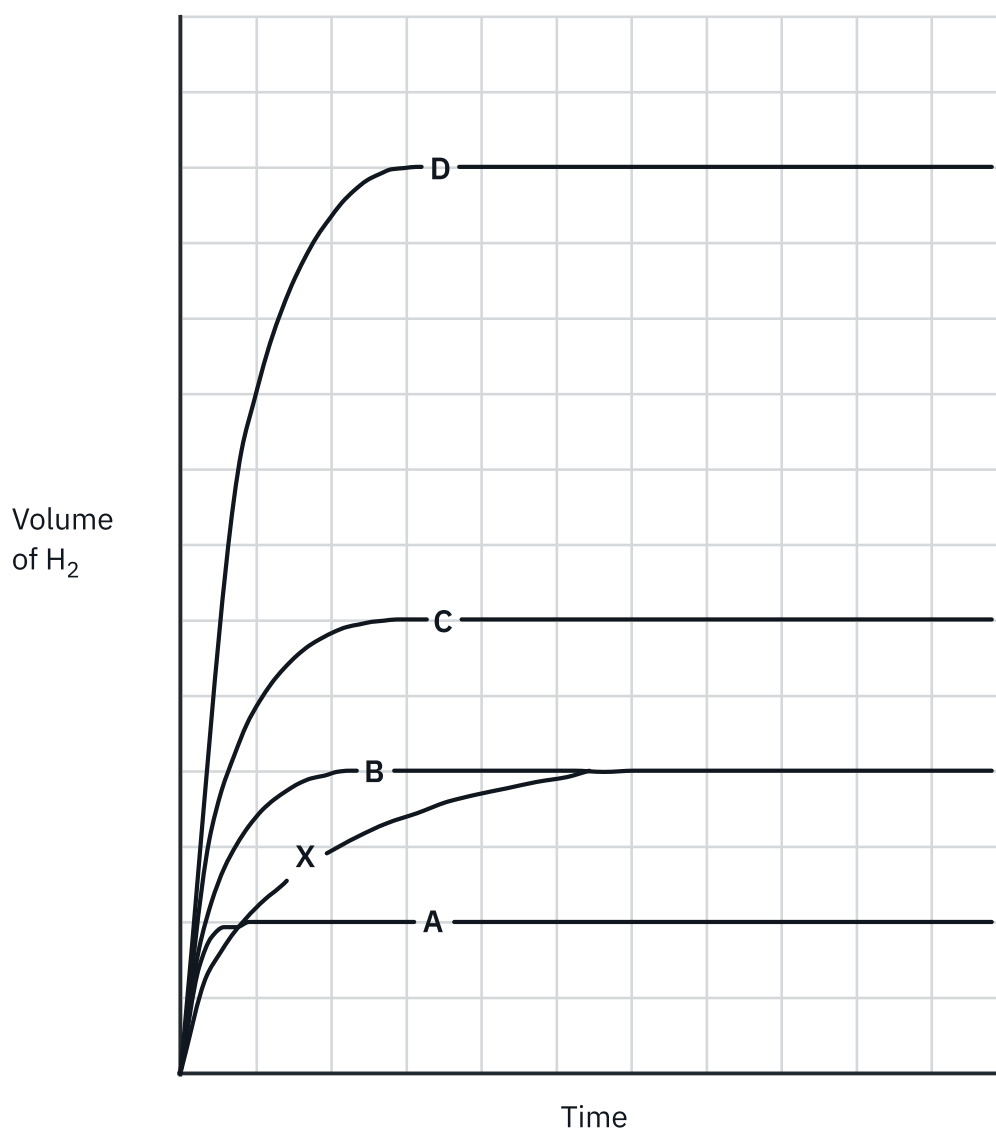
whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions?topics=kinetics&len=0

Questions

Kinetics · 17 questions · 39 marks · time allowed 51 min

Q1 · June 2023 · AS Paper 2 · Q19 · [1 mark]

Magnesium reacts with an acid to form hydrogen gas. Line X on the graph shows how the volume of hydrogen gas varies with time when 50 cm^3 of 0.50 mol dm^{-3} acid reacts with an excess of magnesium.



The reaction is repeated under the same conditions but using 25 cm^3 of 1.50 mol dm^{-3} acid. The magnesium is in excess. Which line represents this second reaction?

Tick (✓) one box.

- ☐ **A** line A
- ☐ **B** line B
- ☐ **C** line C

☐ D line D

Q2 · June 2023 · Paper 2 · Q1 · [7 marks]

This question is about rates of reaction.

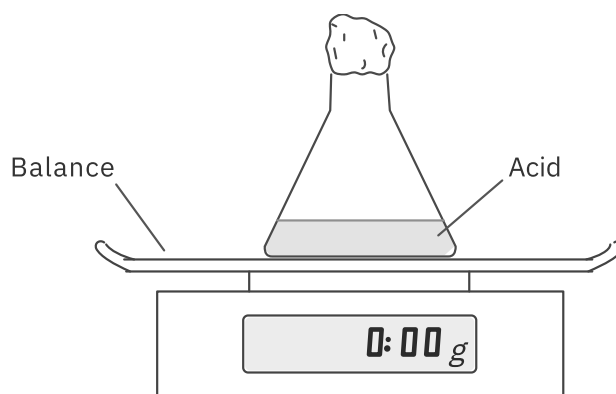
Figure 1 shows apparatus used to measure the rate of reaction when an acid reacts with an excess of solid sodium hydrogencarbonate, NaHCO_3

When different monoprotic organic acids are used, the rates at which gas escapes can be used to compare the strengths of the acids.

A timer is started when the NaHCO_3 is added to the acid and the mass of CO_2 gas lost is recorded at regular intervals.

(It is assumed that any change in mass is due to the loss of CO_2)

Figure 1

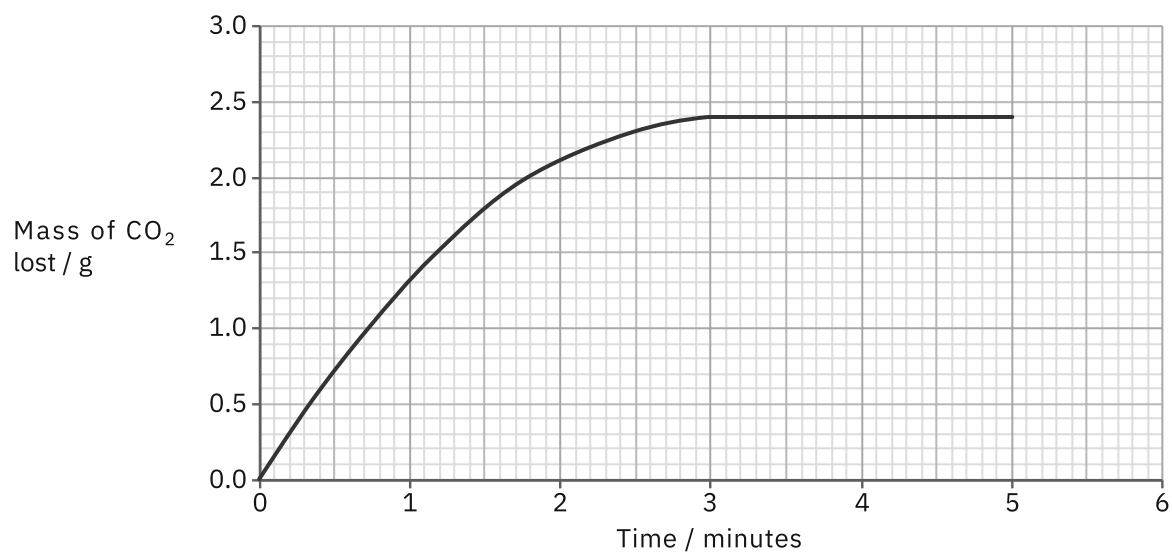


(a) Suggest a reason why using a conical flask instead of a beaker would give more accurate results in this experiment.

[1 mark]

Figure 2 shows the results of this experiment when 25.0 cm^3 of a 2.23 mol dm^{-3} solution of ethanoic acid reacts with an excess of NaHCO_3

Figure 2



(b) Use Figure 2 to calculate the rate of reaction at 2 minutes.

Deduce the units of your calculated rate.

Rate Units

[3 marks]

(c) Chloroethanoic acid is a stronger acid than ethanoic acid.

Sketch, on Figure 2, the curve you would expect when 25.0 cm^3 of a 2.23 mol dm^{-3} solution of chloroethanoic acid reacts with an excess of NaHCO_3

Suggest why chloroethanoic acid is a stronger acid than ethanoic acid.

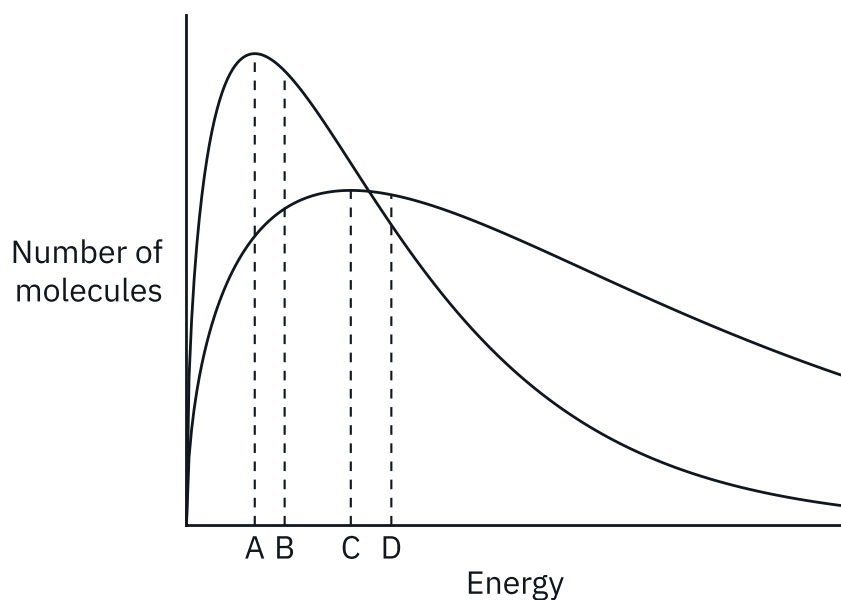
[3 marks]

Draw your answer on the figure above.

Q3 · June 2025 · AS Paper 2 · Q19 · [1 mark]

The Maxwell–Boltzmann distribution of molecular energies for a sample of gas at two different temperatures is shown.

Which letter represents the mean energy of the molecules at the lower temperature?



Tick (✓) one box.

- ☐ A A
- ☐ B B
- ☐ C C
- ☐ D D

Q4 · June 2025 · AS Paper 2 · Q2 · [8 marks]

Methanol can be made by the reaction of carbon monoxide with hydrogen.

This reaction is done with a catalyst at a high temperature.

02.1 Describe how a catalyst increases the rate of a reaction.

[2 marks]

02.2 Explain why the rate of a reaction increases as the temperature increases.

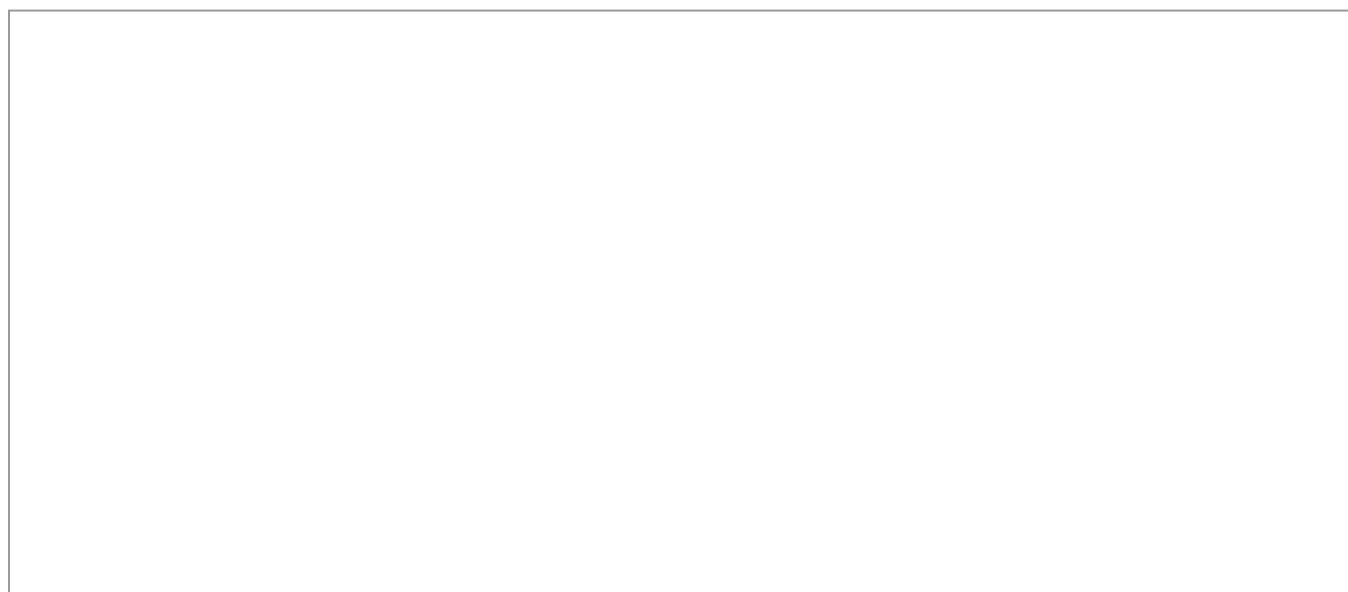
[3 marks]

02.3 Hydrogen bonds exist between molecules of liquid methanol.

Draw a diagram to show a hydrogen bond between two molecules of methanol.

Include all the lone pairs of electrons and the partial charges on the atoms involved in this hydrogen bond.

[3 marks]

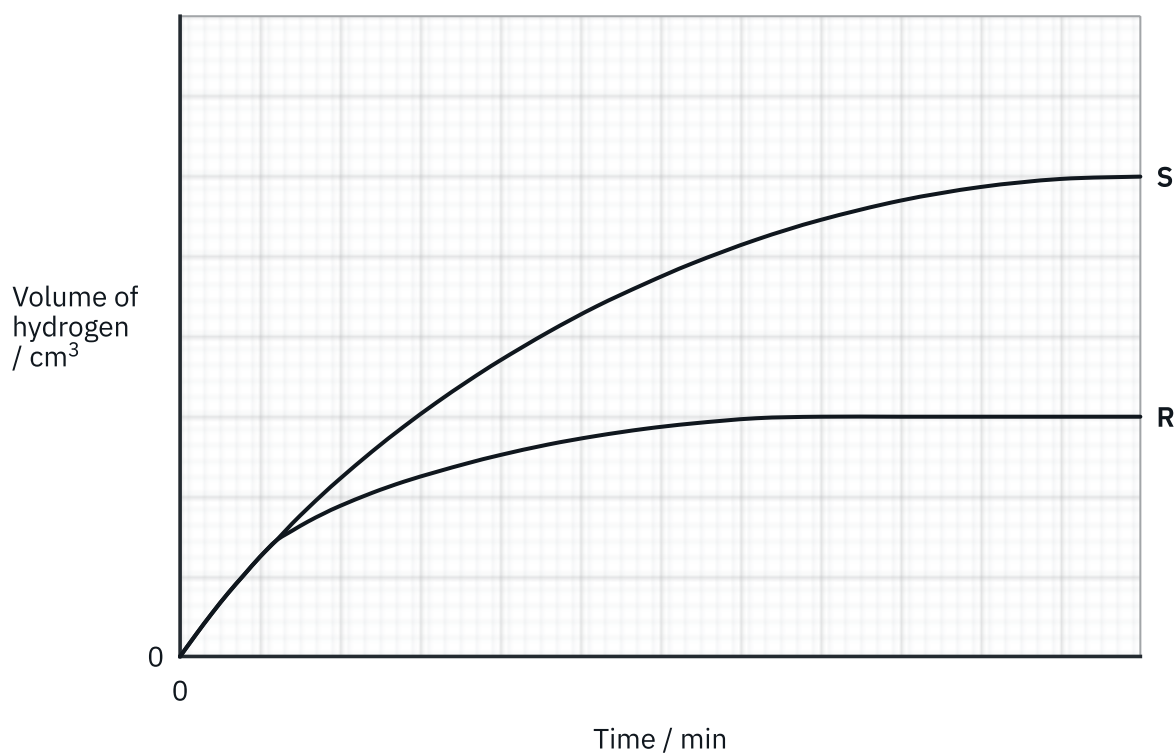


Q5 · June 2025 · AS Paper 2 · Q20 · [1 mark]

A student adds 0.48 g of magnesium ribbon to 100 cm³ of 1.0 mol dm⁻³ hydrochloric acid.

The student records the volume of hydrogen collected at regular time intervals.

Line R on the graph shows the results.



Which of these reactions gives results shown by line S?

Assume that the reactions occur at the same temperature.

Tick (✓) one box.

- ☐ **A** 0.48 g of magnesium reacting with 200 cm³ of 1.0 mol dm⁻³ hydrochloric acid
- ☐ **B** 0.48 g of magnesium reacting with 100 cm³ of 2.0 mol dm⁻³ hydrochloric acid
- ☐ **C** 0.96 g of magnesium reacting with 200 cm³ of 1.0 mol dm⁻³ hydrochloric acid
- ☐ **D** 0.96 g of magnesium reacting with 200 cm³ of 2.0 mol dm⁻³ hydrochloric acid

Q6 · June 2025 · Paper 3 · Q9 · [1 mark]

Which statement about the use of a catalyst in a reaction is correct?

Tick (✓) one box.

- ☐ **A** The activation energy of the reverse reaction increases.
 - ☐ **B** The equilibrium constant increases.
 - ☐ **C** The rate of the reverse reaction increases.
 - ☐ **D** The enthalpy change for the reaction decreases.
-

Q7 · June 2022 · AS Paper 2 · Q14 · [1 mark]

Which statement about molecules in a gas is correct?

Tick (✓) one box.

- ☐ **A** At a fixed temperature they all move at the same speed.
 - ☐ **B** At a fixed temperature their average kinetic energy is constant.
 - ☐ **C** As temperature increases, there are more molecules with the most probable energy.
 - ☐ **D** As temperature decreases, there are fewer molecules with the mean energy.
-

Q8 · June 2023 · Paper 3 · Q12 · [1 mark]

The rate of reaction is greater when a catalyst is used, without changing the temperature. Which statement explains why the rate of reaction is greater with a catalyst?

Tick (✓) one box.

- ☐ **A** The collision frequency increases because the catalysed reaction has a lower activation energy.
- ☐ **B** The collision frequency increases because there is an increase in the average energy of the particles.
- ☐ **C** The proportion of successful collisions increases because the catalysed reaction has a lower activation energy.
- ☐ **D** The proportion of successful collisions increases because there is an increase in the average energy of the particles.

Q9 • June 2023 • Paper 3 • Q25 • [1 mark]

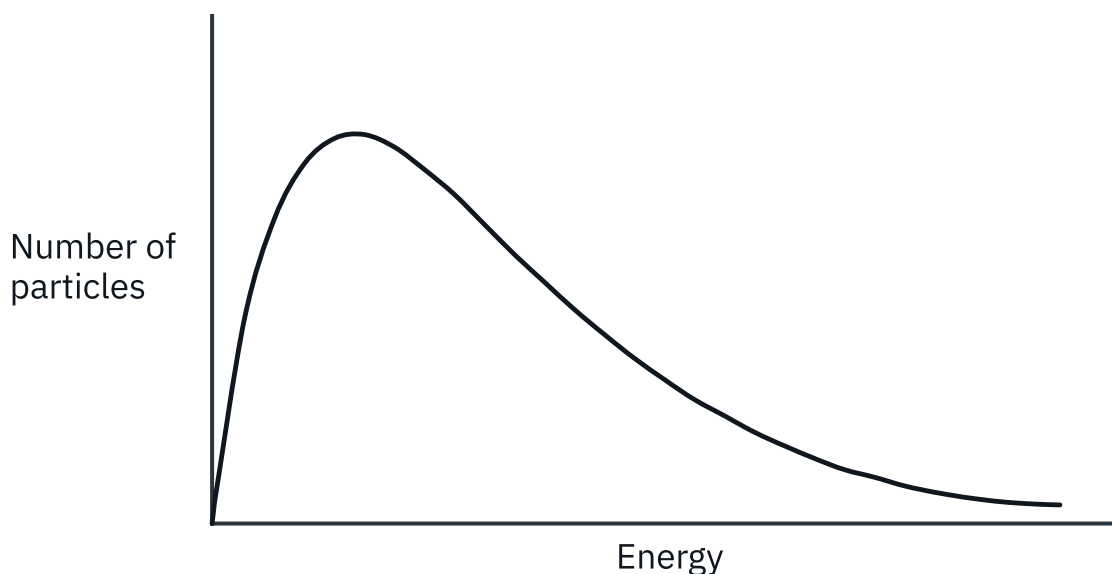
Which statement about catalysts used in reactions at equilibrium, at a constant temperature, is correct?

Tick (✓) one box.

- ☐ **A** They are always used in the solid state.
- ☐ **B** They increase the rate of the forward reaction but decrease the rate of the reverse reaction.
- ☐ **C** They have no effect on the value of the equilibrium constant.
- ☐ **D** They make the forward reaction more exothermic.

Q10 • June 2023 • Paper 3 • Q11 • [1 mark]

This is a Maxwell–Boltzmann distribution for a gaseous reactant.



What is represented by the total area under the curve?

Tick (✓) one box.

- ☐ **A** total energy of the particles
- ☐ **B** activation energy for the reaction
- ☐ **C** total number of reacting particles
- ☐ **D** total number of particles present

Q11 · June 2024 · AS Paper 2 · Q10 · [1 mark]

Which statement explains why the rate of a reaction increases when a catalyst is added to a reaction mixture at a constant temperature?

Tick (✓) one box.

- ☐ **A** The collision frequency increases because there is an increase in the activation energy.
- ☐ **B** The collision frequency increases because there is an increase in the mean energy of the particles.
- ☐ **C** The proportion of successful collisions increases because there is a decrease in the activation energy.
- ☐ **D** The proportion of successful collisions increases because there is an increase in the mean energy of the particles.

Q12 · June 2023 · AS Paper 2 · Q8 · [6 marks]

Draw the Maxwell–Boltzmann distribution curves for a fixed mass of a gas at two different temperatures.

This gas decomposes when heated.

By reference to these distribution curves, explain why the rate of decomposition of this gas increases at higher temperatures.

Q13 · June 2024 · Paper 3 · Q16 · [1 mark]

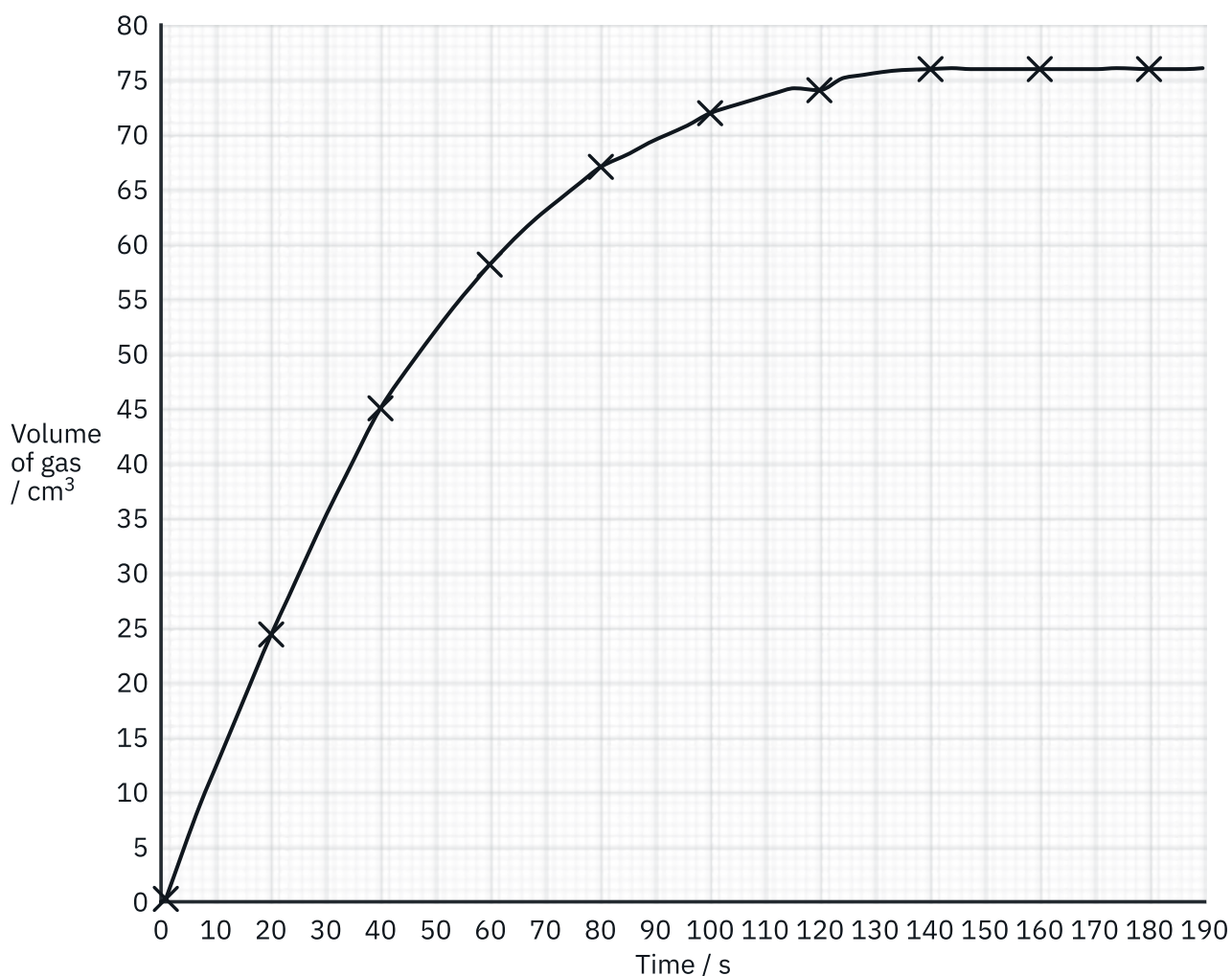
Which statement explains why the rate of a reaction increases when a catalyst is added at a constant temperature?

Tick (✓) one box.

- ☐ **A** The collision frequency increases because there is a decrease in activation energy.
- ☐ **B** The collision frequency increases because there is an increase in the average energy of the particles.
- ☐ **C** The proportion of successful collisions increases because there is a decrease in activation energy.
- ☐ **D** The proportion of successful collisions increases because there is an increase in the average energy of the particles.

Q14 · June 2024 · Paper 3 · Q15 · [1 mark]

A student investigated the reaction between magnesium and hydrochloric acid. $\text{Mg(s)} + 2 \text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$ The results are plotted on this graph.



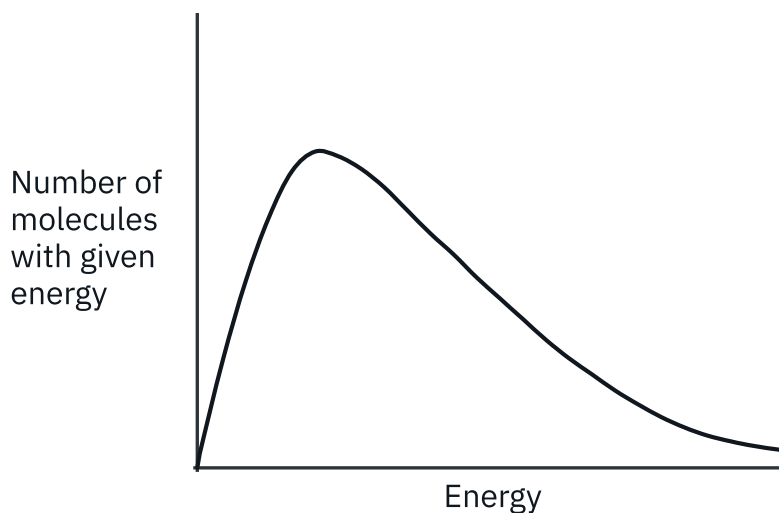
Which value is closest to the rate of reaction, in $\text{cm}^3 \text{s}^{-1}$, at 70 s?

Tick (✓) one box.

- ☐ **A** 0.4
- ☐ **B** 0.9
- ☐ **C** 1.1
- ☐ **D** 2.5

Q15 • June 2024 • Paper 3 • Q14 • [1 mark]

The Maxwell–Boltzmann distribution curve is shown for a gaseous reaction mixture.



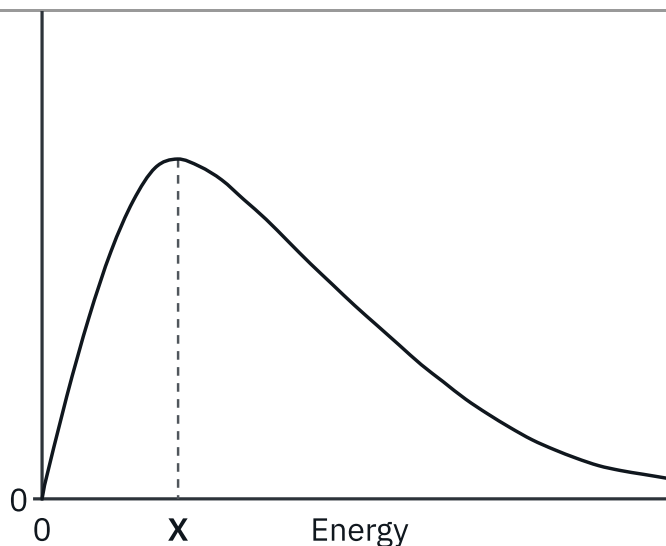
What is represented by the total area under the curve?

Tick (✓) one box.

- ☐ **A** The total energy of the molecules in the reaction mixture
- ☐ **B** The total energy of reacting molecules in the reaction mixture
- ☐ **C** The total number of molecules in the reaction mixture
- ☐ **D** The total number of reacting molecules in the reaction mixture

Q16 • November 2021 • AS Paper 2 • Q1 • [5 marks]

The figure below shows the Maxwell–Boltzmann distribution of molecular energies in a sample of gas.



(a) Label the y-axis on the figure above.

[1 mark]

Draw your answer on the figure above.

(b) State why the curve starts at the origin.

[1 mark]

(c) State what X indicates on the figure above.

X indicates

[1 mark]

(d) Half of the gas molecules in the sample are removed.

The remaining gas molecules are kept at the same temperature.

Draw the new distribution of molecular energies for the remaining gas on the figure above.

[2 marks]

Draw your answer on the figure above.

Q17 · June 2022 · Paper 3 · Q9 · [1 mark]

Consider the change that occurs in the shape of the curve for the distribution of molecular energies in a gas when the temperature of the gas is increased. Which is a correct statement about the gas molecules at a higher temperature?

Tick (✓) one box.

- ☐ **A** There are more molecules with any given energy.
- ☐ **B** There are more molecules with the mean energy.
- ☐ **C** There are more molecules with the most probable energy.
- ☐ **D** There is an increase in the most probable energy of the molecules.

Source: AQA A-Level Chemistry past papers. Reproduced for revision at whiteboardchemistry.com.

Mark scheme:

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