

Exercise walk-through

Rate of reaction ■ 6.2

eXercise

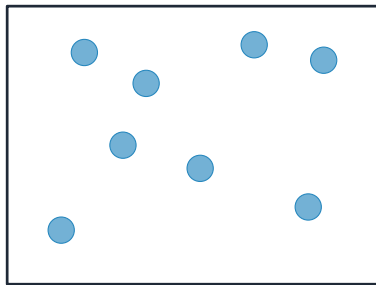
You must be able to

- use collision theory to explain the effect of concentration, surface area, temperature, pressure
- explain how a catalyst speeds up a reaction
- interpret a rate graph (steepest at the start, levels off)

Method — Collision theory & rate graphs

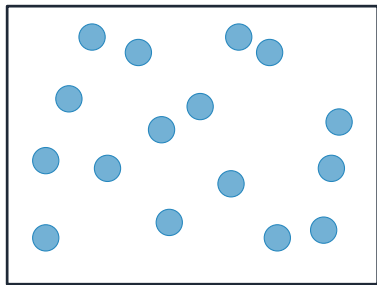
- **catalyst:** lowers the activation energy $\rightarrow$ more successful collisions; not used up.

Method — Collision theory & rate graphs



lower concentration
fewer collisions

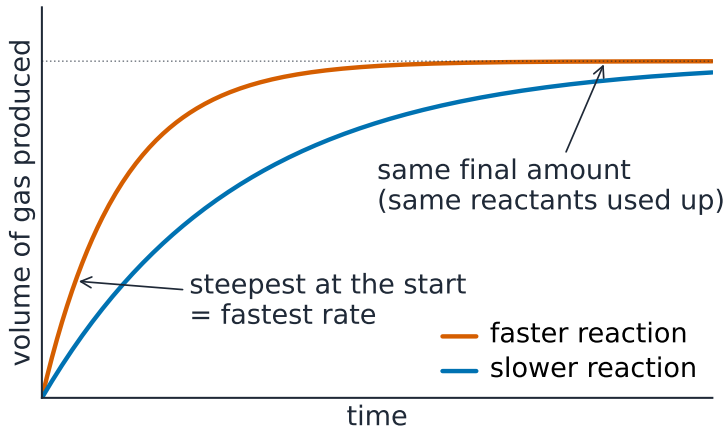
more
→



higher concentration
more collisions

Higher concentration = more particles, more collisions

Method — Collision theory & rate graphs



A rate graph: steep then levelling off

Practice 2.1 ■ 2 marks

State two factors that increase the rate of a reaction.

Solution 2.1

Method: Collision theory & rate graphs

Worked steps

any two of: higher concentration; larger surface area; higher temperature; higher pressure (gases); a catalyst **B1** **B1**.

Practice 2.2 ■ 1 mark

State how a catalyst speeds up a reaction.

Solution 2.2

Method: Collision theory & rate graphs

Worked steps

it lowers the activation energy, so more collisions are successful **B1**.

Exam-style 3.1 ■ 1 mark

Increasing the temperature speeds up a reaction mainly because the particles:

- A** become larger
- B** move faster and collide more often with enough energy
- C** become catalysts
- D** stop colliding

Solution 3.1

Method: Collision theory & rate graphs

- A become larger
- B move faster and collide more often with enough energy 
- C become catalysts
- D stop colliding

Worked steps

B. Hotter particles move faster, colliding more often and with more energy.

Exam-style 3.2 ■ 2 marks

Marble chips react with hydrochloric acid, giving off carbon dioxide.

- (a) Explain, using collision theory, why powdered marble reacts faster than large chips.
- (b) Describe one method to measure the rate of this reaction.

Solution 3.2

Method: Collision theory & rate graphs

Worked steps

- (a) a powder has a larger surface area **M1**; so there are more frequent collisions between acid particles and the marble, giving a faster rate **A1**.
- (b) collect the gas in a gas syringe and record its volume at regular times **M1**; or stand the flask on a balance and record the falling mass **A1**.

Exam-style 3.3 ■ 2 marks

On a graph of gas volume against time, explain why the line becomes less steep and then flat.

Solution 3.3

Method: Collision theory & rate graphs

Worked steps

as reactants are used up, there are fewer collisions per second, so the rate (steepness) decreases (M1); when a reactant runs out the reaction stops, so the line is flat (A1).