

6.2 Rate of reaction

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS concentration 浓度 • rate of reaction 反应速率 • activation energy 活化能
• collision theory 碰撞理论 • particles 粒子

Objective

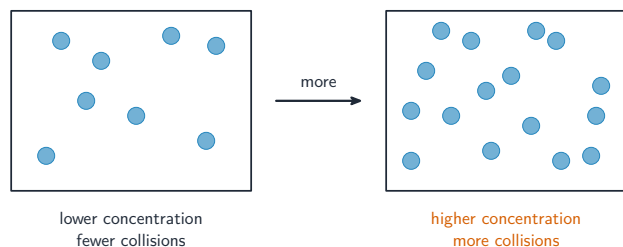
Build the skills to answer exam questions on the **rate of reaction** 反应速率 — **collision theory** 碰撞理论, the factors that change the rate, **catalysts** 催化剂, and measuring rate.

You must be able to:

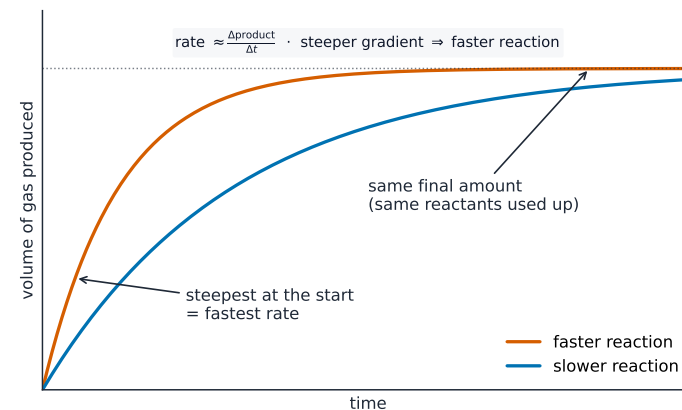
- use collision theory to explain the effect of concentration, surface area, temperature, pressure
- explain how a catalyst speeds up a reaction
- interpret a rate graph (steepest at the start, levels off)

1 Worked examples

■ Collision theory & rate graphs



More particles in the same volume collide more often → faster rate



Rate is fastest at the start (steepest), then levels off when the reaction finishes

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

2 Practice

2.1 State two factors that increase the rate of a reaction. [2]

2.2 State how a catalyst speeds up a reaction. [1]

3 Exam-style questions

3.1 Increasing the temperature speeds up a reaction mainly because the particles: [1]

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

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

(a) Explain, using collision theory, why powdered marble reacts faster than large chips.^[2]

(b) Describe one method to measure the rate of this reaction. ^[2]

3.3 On a graph of gas volume against time, explain why the line becomes less steep and then flat. ^[2]

Solutions

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

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

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

3.2 (a) a powder has a larger surface area; so there are more frequent collisions between acid particles and the marble, giving a faster rate.

(b) collect the gas in a gas syringe and record its volume at regular times; or stand the flask on a balance and record the falling mass.

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