

C6 Rate and extent of chemical change

Chemistry Paper 2 | AQA Combined Science Trilogy | Key ideas to remember

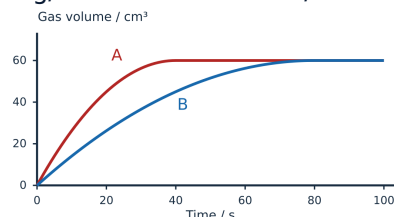
RATE

1 Measure and read a rate

Mean rate = amount used or formed ÷ time.

40 cm³ in 20 s → 40 ÷ 20 = **2 cm³/s.**

Mass rate: g/s. Volume rate: cm³/s.



Steeper = faster. Flat = no more product. Same plateau = same final amount.

HT: mol/s uses moles ÷ seconds. Rate at a moment = tangent gradient (rise ÷ run).

COLLISIONS

2 Explain changes in rate

Particles must **collide with enough energy**. Activation energy is the minimum required.

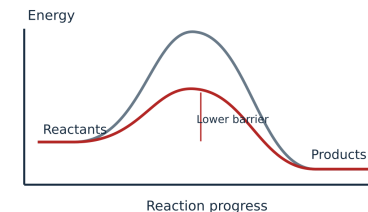
Change	Why rate increases
Higher temperature	Faster particles; more frequent and more energetic collisions.
Higher concentration	More particles per unit volume; more collisions.
Higher gas pressure	Closer gas particles → more frequent collisions.
Smaller solid pieces	Greater exposed surface area → more surface collisions.

Equal masses of chips and powder can give the same final gas volume with excess acid.

PRACTICALS

EQUILIBRIUM

3 Catalysts and surface area

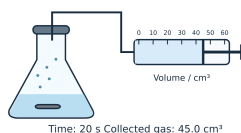


A catalyst gives an **alternative pathway with lower activation energy**. It is not used up overall. Overall energy change stays the same.

Enzymes are biological catalysts. Different reactions need different catalysts.

For cubes: area = 6 × side²; volume = side³. Smaller pieces have a larger area:volume ratio.

4 Practical 11: gas volume



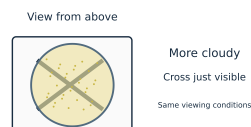
Change acid concentration. Use equal magnesium pieces and excess acid. Keep acid volume, temperature, metal mass and surface area the same.

Add metal, fit bung promptly, start timer. Record gas at regular intervals; repeat and compare mean rates.

Checks: no leaks; plunger moves freely.

Safety: eye protection; no flames near hydrogen. Follow the teacher's method.

5 Practical 11: disappearing cross



Change thiosulfate concentration by dilution; keep total volume, flask, acid conditions and temperature the same.

Add acid and start timer. Stop when sulfur cloudiness hides the cross. Keep cross, lighting and viewing method the same.

Repeat. Shorter time = faster; relative rate = **1/time (s⁻¹)**. Endpoint is subjective.

Safety: small quantities, eye protection, good ventilation; avoid sulfur dioxide fumes.

6 Reversible reactions & equilibrium

A ⇌ B: products can reform reactants. If forward is exothermic, reverse is endothermic: equal energy, opposite transfer.

Dynamic equilibrium: closed system; forward and reverse rates equal. Both reactions continue. Amounts stay constant, **not necessarily equal**.

HIGHER TIER ONLY

Equilibrium shifts to counteract a change:

- Add reactant / remove product → products.
- Heat → endothermic direction; cool → exothermic.
- Higher pressure → fewer gas molecules; lower → more. Equal gas counts: no shift.
- Catalyst: same equilibrium, reached sooner.