

3.2 Rates of Reaction

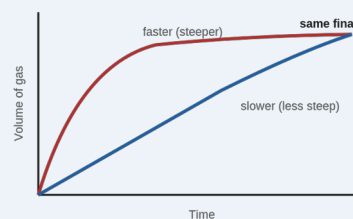
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1. KEY VOCABULARY

TERM	MEANING
Rate of reaction	How fast reactants are used up or products formed.
Collision theory	Particles must collide, with enough energy, to react.
Activation energy	Minimum energy a collision needs to cause a reaction.
Catalyst	Speeds up a reaction without being used up.
Surface area	The amount of solid surface exposed to react.

2. FOLLOWING A REACTION

Following a reaction — volume of gas vs time



FASTER RATE if:

- higher temperature
- higher concentration
- higher pressure (gases)
- larger surface area
- a catalyst added

Collision theory:

more frequent and more energetic collisions → faster reaction.

3. COLLISION THEORY

For a reaction to happen, particles must:

1. collide with each other, and
2. collide with at least the activation energy.

Anything that makes collisions more frequent or more energetic increases the rate.

4. FACTORS AFFECTING RATE

FACTOR (increase)	WHY RATE INCREASES
Temperature	Particles move faster — more frequent, more energetic collisions
Concentration	More particles per volume — more frequent collisions
Pressure (gases)	Particles closer — more frequent collisions
Surface area	More area exposed — more frequent collisions
Catalyst	Provides a route with lower activation energy

5. MEASURING RATE

Gas given off: measure volume with a gas syringe, or mass lost on a balance.

Precipitate forms: time how long until a mark is no longer visible.

A steeper line on a graph means a faster rate; a flat line means the reaction has finished.

6. THE WHY

Why a catalyst speeds up a reaction: it provides an alternative pathway with a lower activation energy, so more collisions are successful.

Why temperature has a big effect: it makes collisions both more frequent AND more energetic.

7. COMMON EXAM MISTAKES

- ✗ "A catalyst is used up in the reaction."
- ✓ A catalyst is not used up — it can be reused.
- ✗ "A catalyst increases the activation energy."
- ✓ It **LOWERS** the activation energy.
- ✗ "Higher concentration gives more energetic collisions."
- ✓ It gives more **FREQUENT** collisions, not more energetic ones.

8. SELF-CHECK · cover & quiz

Can you...

1. State the two conditions for a successful collision?
2. List five factors that affect rate?
3. Explain each factor using collision theory?
4. Describe two ways to measure the rate of a reaction?
5. Explain how a catalyst works?
6. Interpret the shape of a rate graph?