

Enzymes

IGCSE Biology ■ Topic 5

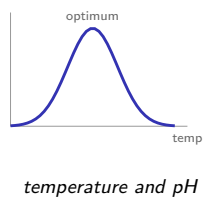
IGCSE Biology



Enzymes

What we will cover

- 1 What enzymes are
- 2 How an enzyme works
- 3 Why enzymes are specific
- 4 The effect of temperature
- 5 The effect of pH



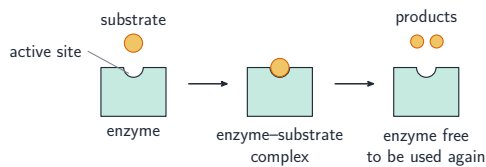
1 Enzyme action

What enzymes are



- The shape of the active site is **complementary** 互补 to the shape of the substrate – they fit together like a key in a lock.
- The substrate slots into the active site. **(Supplement)** This makes an **enzyme-substrate complex** 酶底物复合物.
- The reaction takes place, and the substrate is changed into one or more **products** 产物.
- The products leave the active site, which is then free to be

How an enzyme works



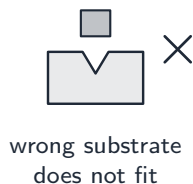
The **substrate** 底物 fits the **active site** 活性位点 like a key in a lock.

- shapes are **complementary** 互补
- it forms an **enzyme-substrate complex** 酶底物复合物
- **products** 产物 leave; the enzyme is reused

Why enzymes are specific



right substrate fits



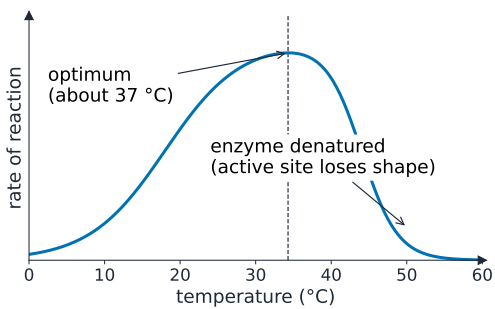
wrong substrate does not fit

Each enzyme is **specific** 专一 – it works on only **one** substrate. Only the right-shaped substrate fits the active site; the wrong key will not fit.

2 Conditions

Enzymes
↳ Conditions

The effect of temperature

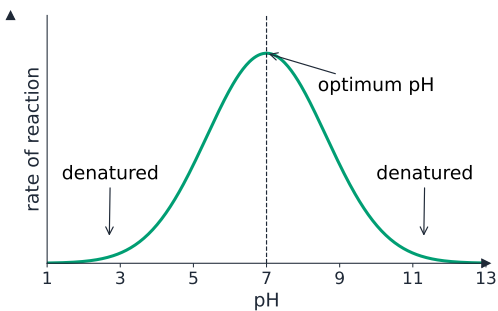


Activity peaks at the **optimum temperature** 最适温度 (~37°C).

Too hot → the active site loses shape: the enzyme is **denatured** 变性 (permanent – not “killed”).

Enzymes
↳ Conditions

The effect of pH



Each enzyme has one **optimum pH** 最适 pH. Too far from it changes the active site's shape, so the substrate no longer fits – denatured again.

3

Recap

Enzymes
└ Recap

Worked example – enzymes and temperature

Explain the shape of a graph of enzyme activity against temperature.

- Below the optimum: heating gives molecules more **kinetic energy** 动能.
- More successful collisions with the **active site** ⇒ rate rises.
- At the **optimum** ($\approx 37^{\circ}\text{C}$ in humans) the rate is highest.
- Above it, the bonds holding the enzyme's shape break: it is **denatured** 变性.
- The active site no longer fits the substrate ⇒ **rate falls to zero**.

Never say the enzyme is “killed” – it is not alive.
Say **denatured**: the **active site changes shape** so the substrate no longer fits.

Enzymes
└ Recap

Topic 5 – key takeaways

1 Enzymes

protein catalysts; not used up

2 Lock & key

substrate fits the complementary active site

3 Specific

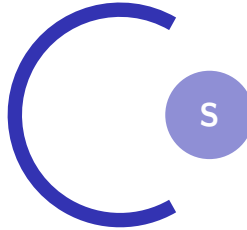
one enzyme, one substrate shape

4 Denaturing

too hot or wrong pH wrecks the shape

Check yourself

- 1 What type of molecule is an enzyme?
- 2 What is the pocket the substrate fits called?
- 3 What is the optimum temperature for a human enzyme?
- 4 What happens to an enzyme above its optimum?



Answers 1. a protein 2. the active site 3. about 37°C 4. it is denatured (loses its shape)