

3 Enzymes – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	Write it 3 times (English)		
biological catalysts	_____	_____	_____
enzyme	_____	_____	_____
globular protein	_____	_____	_____
catalyses	_____	_____	_____
intracellular	_____	_____	_____
catalase	_____	_____	_____
extracellular	_____	_____	_____
secreted	_____	_____	_____
amylase	_____	_____	_____
active site	_____	_____	_____
substrate	_____	_____	_____
enzyme-substrate complex	_____	_____	_____
products	_____	_____	_____
specific	_____	_____	_____
complementary	_____	_____	_____

English	Write it 3 times (English)		
lock-and-key	_____	_____	_____
induced fit	_____	_____	_____
activation energy	_____	_____	_____
temperature	_____	_____	_____

Recall

You met enzymes at IGCSE:

- Enzymes are **biological catalysts** – they speed up reactions in living things.
- They are not used up, so one enzyme works again and again.
- You saw that heat and the wrong **pH** can stop an enzyme working.

This sheet sharpens those ideas ready for AS. Nothing here is harder than IGCSE.

New ideas

Read these first, then do the Practice.

■ 1 What an enzyme is

An **enzyme** is a **globular protein** (a rounded, soluble protein) that **catalyses** (speeds up) a reaction. Enzymes work in two places:

- intracellular** – inside the cell that made it (e.g. **catalase**).
- extracellular** – **secreted** to work outside the cell (e.g. **amylase** in the gut).

■ 2 The active site and the substrate

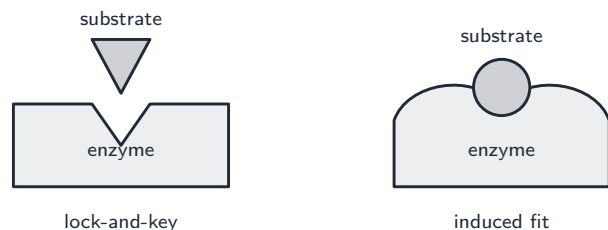
Each enzyme has a pocket called the **active site**. The molecule it acts on is the **substrate**. The substrate fits into the active site to form an **enzyme-substrate complex**. The reaction happens, and the **products** leave.

An enzyme is **specific** – it usually works on only one substrate, because the active site shape is **complementary** (a matching fit) to that substrate only.

■ 3 Lock-and-key and induced fit

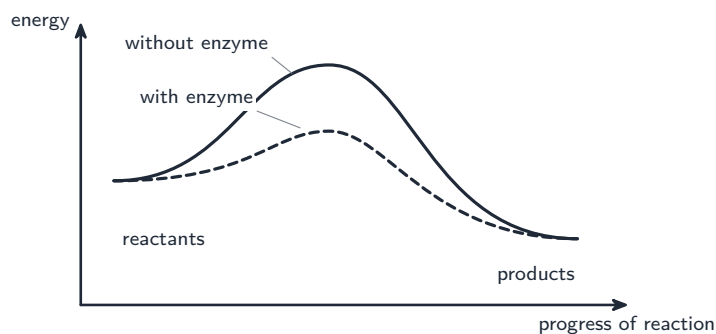
Two ideas explain the fit:

- **lock-and-key** – the active site is a fixed shape; only the matching substrate fits, like a key in a lock.
- **induced fit** – the active site changes shape slightly to grip the substrate as it binds. This fits the evidence better.



■ 4 Lowering activation energy

Every reaction needs a small push of energy to start – the **activation energy**. An enzyme **lowers** the activation energy, so the reaction goes quickly at the cell's normal **temperature** instead of needing high heat.



Worked example. The enzyme does not change the reactants or products – only the size of the “hill” between them.

Watch out: an enzyme *lowers* the activation energy but does *not* change the reactants, products or overall energy change – only the size of the “hill”. Enzymes are *specific* because the active-site shape is complementary to just one substrate.

Practice

Try these in order.

3.1 What type of molecule are all enzymes? [1]

3.2 State the difference between an *intracellular* and an *extracellular* enzyme. [2]

3.3 Name (a) the pocket where the substrate binds, (b) the structure formed when substrate binds. [2]

3.4 Explain why an enzyme usually works on only one substrate. [2]

3.5 State one way the *induced-fit* model differs from the *lock-and-key* model. [1]

3.6 Explain how an enzyme speeds up a reaction, using the idea of activation energy. [2]

3.7 **Challenge.** A poison binds permanently inside an enzyme's active site so the substrate can no longer fit. Explain why this stops the enzyme working. [2]