

Exercise walk-through

Enzymes ■ 3.1

eXercise

You must be able to

- explain that an **enzyme 酶** lowers the **activation energy 活化能**
- describe the **active site 活性位点** and enzyme-substrate specificity
- explain the induced-fit model

Method — Enzymes lower activation energy

An **enzyme** is a biological **catalyst** — it speeds up a reaction by **lowering the activation energy**, without being used up. It does not change whether a reaction is favorable, only how fast it goes.

Method — The active site

The **active site** is the part of the enzyme where the **substrate** binds. Its specific shape means each enzyme works on **one** substrate (specificity), like a lock and key.

Method — Induced fit

In the **induced-fit** model, the active site changes shape slightly as the substrate binds, gripping it and straining bonds to help the reaction.

Method — A worked example

Catalase lowers the activation energy for breaking down hydrogen peroxide, so it reacts far faster; catalase is unchanged and reused.

Practice 2.1 ■ 1 mark

What does an enzyme do to the activation energy?

Solution 2.1

Method: Enzymes lower activation energy

Worked steps

Lowers it **B1**.

Practice 2.2 ■ 1 mark

What is the active site?

Solution 2.2

Worked steps

The region of the enzyme where the substrate binds **B1**.

Practice 2.3 ■ 1 mark

Why is an enzyme specific to one substrate?

Solution 2.3

Method: The active site

Worked steps

Its active site has a specific shape that fits only that substrate **B1**.

Exam-style 3.1 ■ 1 mark

An enzyme speeds up a reaction by

- A** raising the activation energy
- B** lowering the activation energy
- C** adding energy to the products
- D** changing ΔG

Solution 3.1

Method: Enzymes lower activation energy

- A raising the activation energy
- B lowering the activation energy
- C adding energy to the products
- D changing ΔG



Worked steps

B — lowering the activation energy.

Exam-style 3.2 ■ 2 marks

An enzyme binds only its specific substrate.

- (a) Explain why, in terms of the active site.
- (b) Describe the induced-fit model.

Solution 3.2

Worked steps

(a) The active site has a specific shape that only the matching substrate fits (like lock and key) **M1 A1**. (b) The active site changes shape slightly as the substrate binds, gripping it and helping the reaction **M1 A1**.

Exam-style 3.3 ■ 2 marks

Explain why an enzyme is not used up in the reaction it catalyzes.

Solution 3.3

Method: Enzymes lower activation energy

Worked steps

The enzyme is not consumed — it releases the products and returns to its original shape, ready to bind another substrate **M1** **A1**.