

Exercise walk-through

# 3.1

## Enzymes

---

AP Biology

# Enzymes as biological catalysts

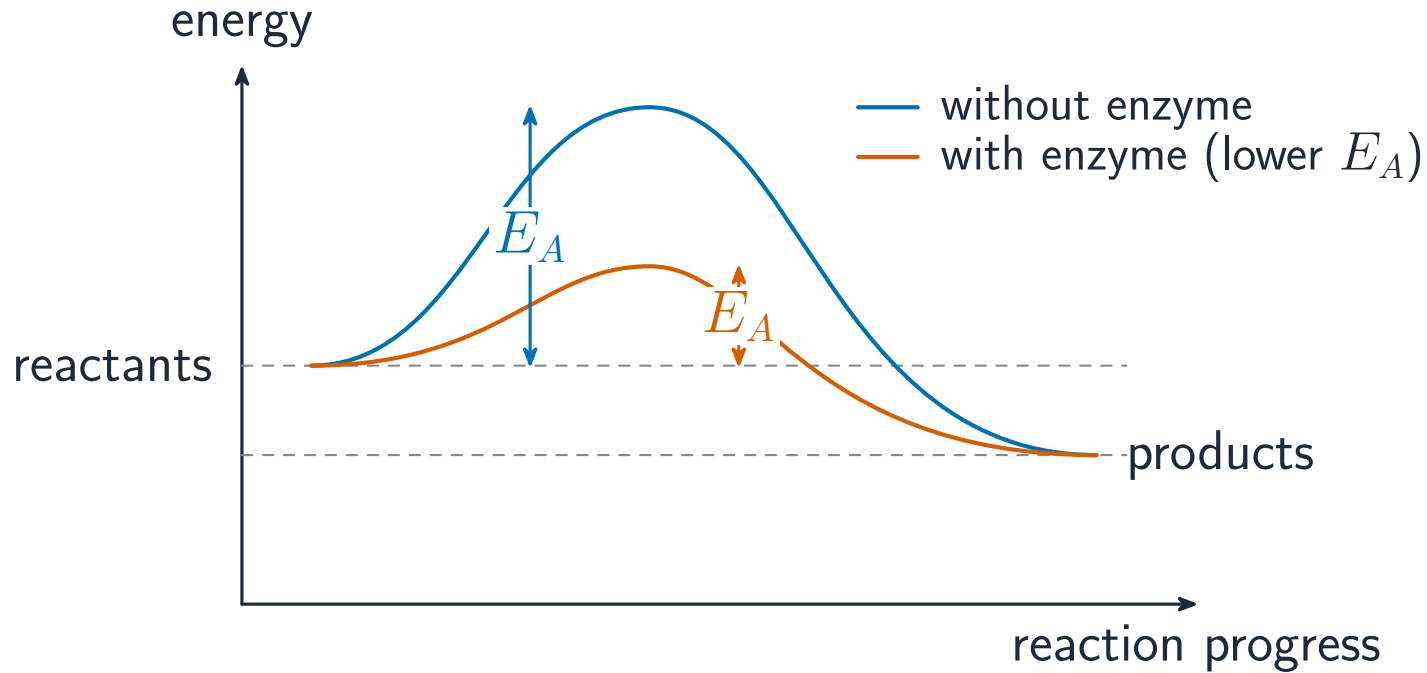
**Enzymes** speed reactions by **lowering the activation energy** – without being used up.

- the **substrate** binds the **active site**
- **induced fit** – the site reshapes to grip it
- each enzyme is **specific** to one reaction



*Enzymes lower activation energy in living systems*

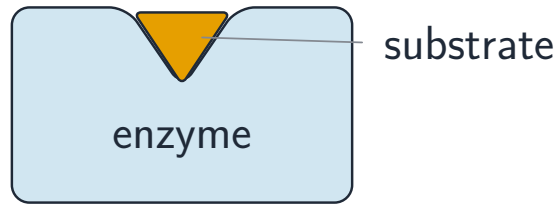
# An enzyme lowers the activation energy of a – one



An enzyme lowers the activation energy of a reaction

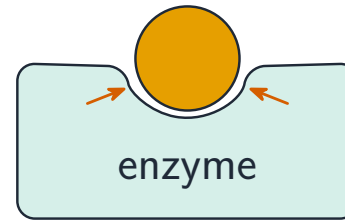
# An enzyme lowers the activation energy of a – two

## lock-and-key



active site is a  
fixed shape

## induced fit



active site moulds  
to fit the substrate

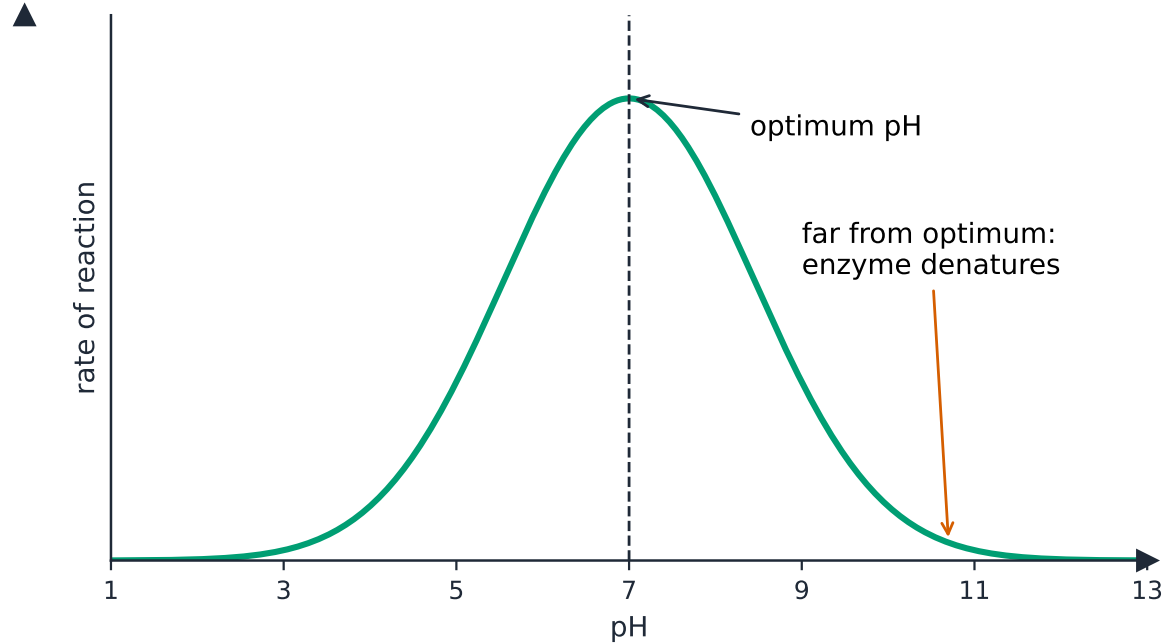
The lock-and-key and induced-fit models of enzyme action

# Environmental Impacts on Enzyme Function

Each enzyme has an **optimal** temperature and pH; beyond it, the protein **denatures** (loses shape) and stops working.

**Substrate concentration** raises the rate until the enzyme saturates.

# Environmental Impacts on Enzyme Function, in detail



Each enzyme has an optimum pH

## Exercises 2.1-2.3

---

**2.1** What does an enzyme do to the activation energy? [1]

---

**2.2** What is the active site? [1]

---

**2.3** Why is an enzyme specific to one substrate? [1]

## Exercises 2.1-2.3

---

**2.1** What does an enzyme do to the activation energy? [1]

**2.1**

- Lowers it
- 

**2.2** What is the active site? [1]

**2.2**

- The region of the enzyme where the substrate binds
- 

**2.3** Why is an enzyme specific to one substrate? [1]

**2.3**

- Its active site has a specific shape that fits only that substrate

## Exercise 3.1

---

3.1 An enzyme speeds up a reaction by

[1]

☐

- A raising the activation energy
- B lowering the activation energy
- C adding energy to the products
- D changing  $\Delta G$

## Exercise 3.1

---

3.1 An enzyme speeds up a reaction by

[1]

☐

- A raising the activation energy
- B lowering the activation energy
- C adding energy to the products
- D changing  $\Delta G$

3.1 B

- lowering the activation energy

## Exercise 3.2 (a)

---

**3.2** An enzyme binds only its specific substrate.

(a) Explain why, in terms of the active site.

[2]

## Exercise 3.2 (a)

---

**3.2** An enzyme binds only its specific substrate.

(a) Explain why, in terms of the active site.

[2]

(a)

- The active site has a specific shape that only the matching substrate fits (like lock and key)

## Exercise 3.2 (b)

---

**3.2** An enzyme binds only its specific substrate.

(b) Describe the induced-fit model.

[2]

## Exercise 3.2 (b)

---

**3.2** An enzyme binds only its specific substrate.

(b) Describe the induced-fit model.

[2]

(b)

- The active site changes shape slightly as the substrate binds, gripping it and helping the reaction

## Exercise 3.3

---

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

[2]

## Exercise 3.3

---

**3.3** Explain why an enzyme is not used up in the reaction it catalyzes. [2]

**3.3**

- The enzyme is not consumed – it releases the products and returns to its original shape, ready to bind another substrate