AP BIOLOGY • EXERCISE SHEET

3.1 Enzymes as Biological Catalysts

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

Build the skills to answer exam questions on **enzymes as biological catalysts**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

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.

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.

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.

A worked example

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

2 Practice

Now apply the methods above.

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]

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3 Exam-style questions

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 ΔG

3.2 An enzyme binds only its specific substrate.

(a) Explain why, in terms of the active site. [2]

(b) Describe the induced-fit model. [2]

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

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **3.1 Enzymes as Biological Catalysts** lesson on the **Learn** page;
- read the **Enzymes as Biological Catalysts** section of the AP Biology handout on the **Know** page.

Solutions

2.1 Lowers it.

2.2 The region of the enzyme where the substrate binds.

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

3.1 B —lowering the activation energy.

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

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