

3.2 Environmental Impacts on Enzyme Function

Name: _____ Class: _____ Date: _____ **Total: 10 marks****KEY WORDS** denatures 变性 • enzyme 酶 • substrate 底物 • active site 活性位点

Objective

Build the skills to answer exam questions on **environmental impacts on enzyme function**.

You must be able to:

- describe how **temperature** and **pH** affect enzyme rate
- explain **denaturation** 变性 at extremes
- describe the effect of substrate concentration (saturation)

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.

■ Temperature

Rate rises with temperature up to an **optimum**, then falls sharply as the enzyme **denatures** (its shape and active site are destroyed). Too cold = slow; too hot = denatured.

■ pH

Each enzyme has an **optimum pH**. Far from it, the active site's shape is disrupted, lowering the rate; extreme pH can denature the enzyme.

■ Substrate concentration

Rate rises with more substrate until all active sites are busy (**saturation**); then adding more substrate does not increase the rate (the plateau).

■ A worked graph reading

An enzyme's rate-vs-temperature curve rises to a peak at ~37°C (human optimum) and then drops steeply — the drop is denaturation, not just slowing.

2 Practice

Now apply the methods above.

2.1 What happens to an enzyme's shape at very high temperature? [1]

2.2 What is meant by an enzyme's optimum pH? [1]

2.3 Why does rate level off at high substrate concentration? [1]

3 Exam-style questions

3.1 Above its optimum temperature, an enzyme's rate falls sharply because the enzyme [1]

A	B
C	D

A speeds up

B denatures

C gains substrate

D freezes

3.2 An enzyme's activity is measured at pH 2, 7, and 11, with the highest activity at pH 7.

(a) State the optimum pH. [1]

(b) Explain why activity is low at pH 2 and pH 11. [2]

3.3 Describe and explain the shape of a graph of reaction rate against substrate concentration. [3]