pH and enzyme activity

Student activity • observation and reasoning

YEAR 10 / LESSON 11 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

Why can two enzymes work best at different pH values?

Use the supplied examples, record your reasoning and correct it using evidence.

Equipment

- Student booklet, paper models, pencil and ruler

Paper, modelling and written reasoning only. No chemicals or biological samples are handled.

Course coverage: Shared Biology / Double Award: 2.13. pH and the active site.

Plan, model or apparatus sketch

Draw and label the apparatus or biological model; identify one limitation.

Method and reasoning

Read the whole sequence before starting

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1. Draw an active site and a matching substrate. State that pH can change interactions maintaining protein structure and affect substrate binding or catalysis.

2. Plot the illustrative profiles: at pH 2, 4, 6, 8, enzyme A has activities 9, 4, 1, 0 and enzyme B has 0, 2, 8, 5 arbitrary units.

3. Identify the greatest sampled activity for each enzyme. Explain why the profiles do not establish a universal optimum pH for all enzymes.

4. Use a stomach protease and an intestinal enzyme as examples of different environments; do not infer every enzyme's optimum from these invented values.

5. Design a fair test changing buffer pH while holding temperature, enzyme/substrate stocks, volumes and timing constant.

6. Explain why adding different quantities of acid without controlling final volume or measuring pH would confound a comparison.

Cleanup

- Return models and keep the corrected work.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Illustrative dataset: pH 2, 4, 6, 8; enzyme A = 9, 4, 1, 0; enzyme B = 0, 2, 8, 5 arbitrary activity units. These are invented model profiles, not measured enzyme identities. A buffer helps stabilise pH; the final mixture may need checking. Distilled water exposed to air is not guaranteed to remain exactly pH 7.

Example / trial	Observation / evidence	Explanation / limit
Profile A		
Profile B		
Fair-test plan		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. What feature of an enzyme is affected by pH?

2. Where is enzyme A's greatest sampled activity?

3. Where is enzyme B's greatest sampled activity?

4. Why use a buffer?

5. Name three variables to control.

6. Does low activity by itself prove irreversible denaturation?