Catalase Under Heat

Use experimental data to explain changes in enzyme activity.

BIO.1B.2 "Design and conduct an experiment to determine how enzymes react given various environmental conditions (i.e., pH, temperature, and concentration). Analyze, interpret, graph…"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle the condition changed between trials, underline two conditions kept the same, and number the two sentences that use data to explain enzyme activity.

How Temperature Changes Catalase Activity

1. Potato cells contain catalase, an enzyme that breaks down hydrogen peroxide into water and oxygen. In a lab, students can collect the oxygen in a gas syringe. The volume of oxygen made in one minute shows the reaction rate: more oxygen per minute means faster enzyme activity.

2. To test temperature, students prepared fresh potato extract and placed equal volumes in four water baths. They added the same volume and concentration of hydrogen peroxide to each sample, then collected oxygen for one minute. They repeated each temperature three times and calculated the mean oxygen volume. Only the bath temperature changed between groups.

MEAN OXYGEN COLLECTED IN ONE MINUTE

Bath temperature (°C)	Mean oxygen volume (mL)
5	0.4
20	1.2
35	2.0
55	0.2

3. The mean oxygen volume rose from 0.4 mL at 5°C to 2.0 mL at 35°C, so catalase worked faster at 35°C in this test. At 55°C, the mean fell to 0.2 mL, suggesting that high heat reduced catalase activity, possibly by changing its shape. These results do not show how pH or peroxide concentration affects the enzyme.

2 ANSWER WITH EVIDENCE

Use the passage

1. How did the reaction rate at 20°C compare with the rate at 5°C? Use the data in your answer.

2. What happened to catalase activity between 35°C and 55°C? Give a possible explanation from the passage.

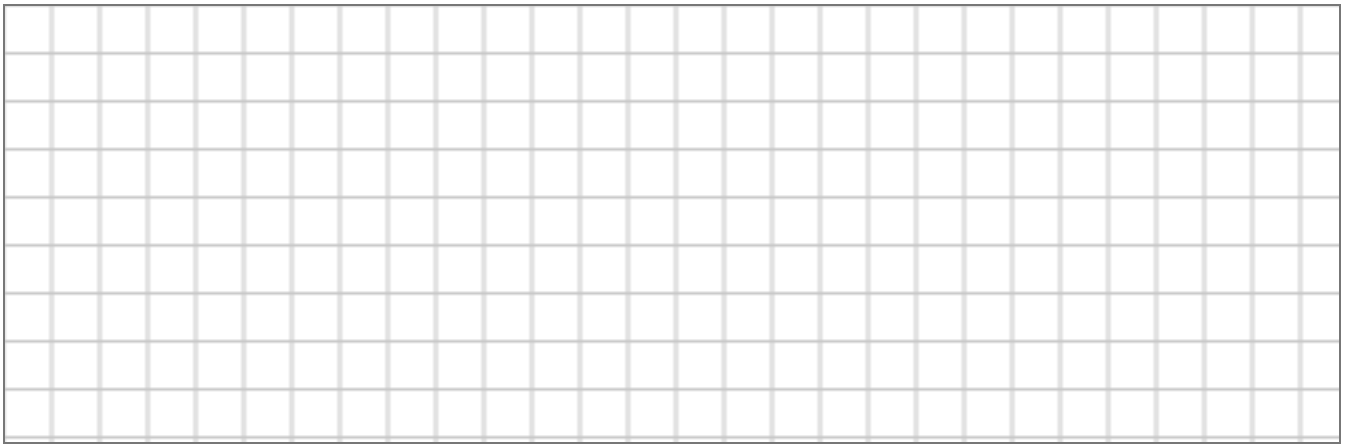
3. Name two conditions the students kept the same. Why was that important when comparing reaction rates?

4. Do these results prove that catalase works fastest at exactly 35°C? Explain using the experiment.

3 YOUR TURN

Your own words

A second experiment measured 0.3, 1.1, 1.5, and 0.2 mL of oxygen per minute at pH 4, 6, 8, and 10, in that order. Label both axes and graph the results, then write a claim about pH and name one condition to keep constant in a follow-up test.



ANSWER KEY

Catalase Under Heat

PART 1 · READ AND MARK

Circle the condition changed between trials, underline two conditions kept the same, and number the two sentences that use data to explain enzyme activity. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How did the reaction rate at 20°C compare with the rate at 5°C? Use the data in your answer.	**The rate at 20°C was three times the rate at 5°C: 1.2 mL versus 0.4 mL of oxygen per minute.**
2	What happened to catalase activity between 35°C and 55°C? Give a possible explanation from the passage.	**Activity fell from 2.0 to 0.2 mL of oxygen per minute. High heat may have changed the enzyme's shape.**
3	Name two conditions the students kept the same. Why was that important when comparing reaction rates?	**They kept the volume of potato extract and the concentration of hydrogen peroxide the same. This helped them compare the effect of temperature.**
4	Do these results prove that catalase works fastest at exactly 35°C? Explain using the experiment.	**No. Of the four temperatures tested, 35°C had the highest rate, but an untested temperature might have a higher rate.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The horizontal axis is pH, and the vertical axis is oxygen produced (mL per minute). The plotted points are (4, 0.3), (6, 1.1), (8, 1.5), and (10, 0.2). Catalase was most active at pH 8 of the values tested. Keep temperature constant in a follow-up test.

Accept another valid constant condition, such as the volume of potato extract or the concentration of hydrogen peroxide. Claims should distinguish the highest tested rate from an exact optimum pH.