Cut, Then Digest

Plan a fair test of food size and enzyme action

HAP.13.4 "Plan and conduct an experiment to illustrate the necessity of mechanical digestion for efficient chemical digestion."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline what changes between the gelatin groups, circle what stays the same, and number the steps used to test the results. These marks will help you judge whether the experiment isolates the effect of cutting.

Does Cutting Help an Enzyme?

1. Imagine two equal portions of firm gelatin dessert. One stays as a single block; the other is cut into many small cubes. Both contain the same amount of gelatin, a protein. Cutting does not break the protein molecules into nutrients. It does, however, expose more gelatin to the surrounding liquid. In the body, chewing likewise breaks food into smaller pieces before enzymes act. Protease enzymes split proteins into smaller molecules through chemical digestion. A test with gelatin and a food-safe protease can ask whether cutting lets the enzyme reach more protein during a fixed time.

2. Prepare four labeled cups, each with 5 grams of gelatin. Put one large piece in two cups and 20 small pieces in the other two. Add 50 milliliters of prepared protease solution to one cup of each piece size. Add 50 milliliters of plain water to the remaining cups. Start all four cups at the same time and keep them at the same room temperature for 30 minutes. The water cups show how much gelatin changes without the enzyme. Keeping the starting mass, liquid volume, time, and temperature alike makes piece size and enzyme presence the planned differences.

3. After 30 minutes, pour each cup through a fine strainer that catches even the small pieces. Gently blot and weigh the gelatin that remains in each cup. Record the remaining mass beside the starting mass of 5 grams. First compare the large and small pieces in water to check for loss without enzyme. Then compare the two protease cups. If the small pieces lose more mass with protease than the large piece does, beyond any difference seen in water, the result supports the idea that cutting makes chemical digestion more efficient. It does not show that cutting itself chemically digests protein.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why does the test use both one large piece and 20 small pieces with the same starting mass?

2. Why does each piece size also need a cup with plain water?

3. How will you measure the result, and which conditions must stay the same for a fair comparison?

4. What pattern across all four cups would support the claim that cutting helps chemical digestion?

3 YOUR TURN

Your own words

Design a different test using cooked starch gel and amylase, an enzyme that digests starch. Write one paragraph that names your size groups and controls, keeps the test fair, explains how you will use iodine solution to check the gel after a fixed time, and predicts the result that would support your claim. Iodine turns blue-black where starch remains.

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PART 1 · READ AND MARK

Underline what changes between the gelatin groups, circle what stays the same, and number the steps used to test the results. These marks will help you judge whether the experiment isolates the effect of cutting. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why does the test use both one large piece and 20 small pieces with the same starting mass?	**The equal masses keep the amount of gelatin the same, while the two piece sizes test whether exposing more gelatin changes how much the enzyme digests.**
2	Why does each piece size also need a cup with plain water?	**The water cups show whether gelatin is lost without protease, including whether cutting affects that loss.**
3	How will you measure the result, and which conditions must stay the same for a fair comparison?	**Strain, blot, and weigh the gelatin remaining after 30 minutes. Keep the starting mass, liquid volume, time, and temperature the same.**
4	What pattern across all four cups would support the claim that cutting helps chemical digestion?	**Small pieces would lose more mass than the large piece with protease, and that difference would be greater than any size-related difference in the water cups.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would put equal masses of cooked starch gel into four cups, using one large piece in two cups and many small pieces in two cups. I would add equal volumes of amylase solution to one cup of each size and equal volumes of water to the others. I would keep the cups at the same temperature for the same time. Then I would cut open a piece from each cup and add iodine to its cut surface. Less blue-black staining in the small pieces with amylase, beyond any difference in the water cups, would support my claim.

Accept plans that vary piece size while controlling starting mass, liquid volume, temperature, and time. A valid prediction compares the amylase groups with the water controls and treats weaker blue-black staining as evidence that less starch remains.