

Investigation: Enzymes

Objectives

- Measure the effects of changes in temperature, pH, and enzyme concentration on reaction rates of an enzyme
- Explain how environmental factors affect the rate of enzyme-catalyzed reactions.

INTRODUCTION: What would happen to your cells if they made a poisonous chemical? You might think that they would die. In fact, your cells are always making poisonous chemicals. They do not die because your cells use enzymes to break down these poisonous chemicals into harmless substances. Enzymes are proteins that speed up the rate of reactions that would otherwise happen more slowly. The enzyme is not altered by the reaction. You have hundreds of different enzymes in each of your cells.

Each of these enzymes is responsible for one particular reaction that occurs in the cell. In this lab, you will study an enzyme that is found in the cells of many living tissues. The name of the enzyme is catalase; it speeds up a reaction which breaks down hydrogen peroxide, a toxic chemical, into two harmless substances → water and oxygen.



This reaction is important to cells because hydrogen peroxide (H_2O_2) is produced as a byproduct of many normal cellular reactions. If the cells did not break down the hydrogen peroxide, they would be poisoned and die. In this lab, you will study the catalase found in liver cells. You will be using chicken or beef liver. It might seem strange to use dead cells to study the function of enzymes. This is possible because when a cell dies, the enzymes remain intact and active for several weeks, as long as the tissue is kept refrigerated.

MATERIALS:			
6 Test tubes Test tube holders 3% Hydrogen peroxide	Straight-edged razor blade Scissors and Forceps Measuring Pipettes Stirring rod	Fresh liver, Apple, and Potato, Yeast Vinegar / Baking Soda HCL and NaOH pH paper (optional)	Ice bath Warm water bath Boiling water bath

PART A - Observe Normal Catalase Reaction

1. Place 2 ml of the 3% hydrogen peroxide solution into a clean test tube.
2. Using forceps and scissors cut a small piece of liver and add it to the test tube. Push it into the hydrogen peroxide with a stirring rod. Observe the bubbles.

What gas is being released? (Consider the equation.) _____

Throughout this investigation you will estimate the rate of the reaction (how rapidly the solution bubbles) on a scale of 0-5. (0=no reaction, 1=slow, 5= very fast). Assume that the reaction in step 2 proceeded at a rate of "4"

3. Recall that a reaction that absorbs heat is **endothermic**; a reaction that gives off heat is exothermic. Now, feel the temperature of the test tube with your hand.

Has it gotten warmer or colder _____ Is the reaction endothermic or exothermic? _____

4. Pour off the liquid into a second test tube. Assuming the reaction is complete.
What is this liquid composed of? _____
5. What do you think would happen if you added more liver to this liquid? _____
Test this and record the reaction rate. Reaction Rate _____ (1 – 5)
6. Add another 2 ml of hydrogen peroxide to the liver remaining in the first test tube.
What is the reaction rate? _____ (1 – 5)

Synthesis -- Answer the question: Is catalase reusable?

CLAIM:

EVIDENCE

REASONING.

Part B - What Tissues Contain Catalase

You will now test for the presence of catalase in tissues other than the liver. Place 2 ml of hydrogen peroxide in each of 3 clean test tubes and then add each of the three test substances to the tubes. As you add each test substance, record the reaction rate (0-5) for each tube.

Substance	Apple	Potato	Yeast	Raw chicken
Rate of Reaction (0-5)				

Synthesis -- Do all living tissues contain catalase?

Claim:

Evidence:

Reasoning: