**Name:**

**Period:**

**Date:**

# Enzyme Lab

**Pre-lab Questions:**

1. Explain the relationship between an enzyme and its substrate.
2. What might happen if the shape of an enzyme were to be changed?
3. Make two hypotheses, one for each of the following tests which will be done in lab using the enzyme catalase. In each hypothesis, you should predict under which condition the enzyme will work best. **Follow the example shown**.
   1. **Concentration** (High concentration vs Low concentration)

**Hypothesis statement**: If the enzyme catalase is in low concentration, then it will work better than if it were in high concentration.

* 1. **Temperature** (Room temperature 25oC vs Boiling temperature 100oC)

**Hypothesis statement**:

* 1. **pH level** (Neutral ph (7), acidic pH (0-6.9), or a basic pH (7.1-14)

**Hypothesis statement**:

**Introduction:**

**Catalase** is an enzyme that speeds up the break down of **hydrogen peroxide** (H2O2) into **water** (H2O) and **oxygen gas** (O2). Hydrogen peroxide is a poisonous by-product of cell metabolism. Without catalase, the cells would be damaged by the hydrogen peroxide they produce. In this activity, you will use the catalase in potato cells to see how various factors such as concentration, temperature, and pH level affect enzyme activity.

**Materials:**

Test tube rack

3 test tubes

20 ml Hydrogen peroxide

Potato cubes

Mortar and pestle

Hot water bath

Test tube holder

Graduated cylinders

Test tube cleaners

Waste container

Water

Hydrochloric acid (HCl)

Sodium hydroxide (NaOH)

**Estimating the Reaction:** For each test, estimate the reaction rate on a scale of 0-3.

0 = no reaction (like flat soda)

1 = slow reaction (like old soda)

2 = moderate reaction (like fresh soda)

3 = fast reaction (like shaken soda)

## Procedures

**Test 1: Enzyme Concentration** (High vs Low Concentration)

1. Set up a test tube rack with 3 test tubes.

Pour **2ml** of hydrogen peroxide into tubes 1 and 2.

1. Grind one pea-sized piece of potato in a mortar and pestle. (Grinding releases the enzyme from the cells, which will cause an **increase** in the concentration of the enzyme.) Add the ground potato to tube 1.
2. Place an **unground** piece of potato in tube 2.
3. Estimate the rate of reaction and record your results in the data table.
4. **Clean the test tubes** as instructed and move on to the next section.

## Test 2: Temperature (Room 25oC vs Boiling 100oC)

1. To tube 1, add one piece of potato that has been ground like in test 1.
2. To tube 2, add one piece of potato that has been ground like in test 1.

**NOTE: YOU HAVE ADDED NO CHEMICALS AT THIS POINT!!!!!**

1. Place tube 2 in a hot water bath for 5 minutes. Caution: Follow instructions exactly as demonstrated when using the hot water bath! Use a test tube holder to remove the tube from the hot water. Place the hot test tube in the test tube rack, and wait five minutes.
2. **After** the five minutes has passed, **add** 2mls of hydrogen peroxide to test tube 1 and test tube 2.
3. Record your reaction rates in your data table.
4. **Clean test tubes** as instructed and move to the next section.

**Test 3: pH level** (Neutral pH, acidic pH, or basic pH)

1. Add one piece of potato **that has been ground** to test tubes 1, 2, and 3. (Just like you have done for the other two tests.)
2. Add **2 ml of water** to test tube 1. Now **add 2 ml of hydrogen peroxide** to test tube 1. Record the reaction rate in your data table.
3. Add **2 ml of hydrochloric** **acid** to test tube 2. Now **add 2 ml of hydrogen peroxide** to test tube 2. Record the reaction rate in your data table.
4. Add **2 ml of sodium hydroxide** to test tube 3. Now **add 2 ml of hydrogen peroxide** to test tube 3. Record the reaction rate in your data table.
5. **Thoroughly clean all test tubes, mortars and pestles, and table area. Return all equipment to its assigned location**.

**Data Table:**

**Test 1: Concentration**

|  |  |  |
| --- | --- | --- |
|  | Contents | Reaction rate |
| Test tube 1 |  |  |
| Test tube 2 |  |  |

**Test 2: Temperature**

|  |  |  |
| --- | --- | --- |
|  | Contents | Reaction rate |
| Test tube 1 |  |  |
| Test tube 2 |  |  |

**Test 3: pH**

|  |  |  |  |
| --- | --- | --- | --- |
|  | pH | Contents | Reaction rate |
| Test tube 1 |  |  |  |
| Test tube 2 |  |  |  |
| Test tube 3 |  |  |  |

**Post-Lab Summary Requirements:**

Write a summary to demonstrate your understanding of how enzyme function is affected by changes in concentration, pH, and temperature. Your summary **MUST** include the following parts described below (and therefore, should be **NO SHORTER** than 5 paragraphs in length).

\*An introductory paragraph that explains basic enzyme functioning. Discuss the enzyme, substrate, and products made as a result of the enzyme-substrate interaction used in this lab.

\*The body of the summary should include three paragraphs to explain the three different experiments conducted. There should be a paragraph devoted to each of the three factors to explain HOW each was tested and the WHAT the outcome of the tests were.

\*A concluding paragraph that should summarize the OVERALL BEST conditions for this enzyme’s activity based on the results of your lab data.