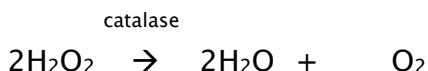


LAB: Factor Affecting Enzyme Activity

Background:

Enzymes are responsible for catalyzing all of the biochemical reactions that run your cells and keep them alive. Without enzymes, your cells would not be able to respond to your environment and maintain all the characteristics of life you have already defined. Enzymes work by speeding up the rate of a chemical reaction without being used. Chemically, enzymes are **proteins**. Enzymes are usually specific to a particular substrate and work best when conditions are optimal. If the conditions are inappropriate for the enzyme, the reaction will proceed at a slower rate or not at all.

Hydrogen Peroxide (H₂O₂) is a very reactive chemical formed as a by-product in cellular reactions. It is highly toxic to your cells and must be removed or it will disrupt other chemical reactions in the body. The enzyme, **catalase**, which is found in most tissues from living organisms, breaks hydrogen peroxide into water and oxygen.



In this experiment you will be using potato as the source of catalase.

Purpose: To investigate how enzyme concentration affects the rate of enzyme activity.

Materials:

- | | |
|---------------------------------|-----------------------|
| ✓ 3% hydrogen peroxide | ✓ test tubes & rack |
| ✓ distilled water | ✓ pipettes |
| ✓ fresh potato puree (catalase) | ✓ glass stirring rod |
| ✓ beaker | ✓ Vernier lab quest |
| ✓ 10 mL graduated cylinder | ✓ Gas pressure sensor |

Procedure:

1. Obtain and wear goggles.
2. Connect the Gas Pressure Sensor to the computer interface. Connect the plastic tubing to the valve on the Gas Pressure Sensor.
3. Obtain 2 beakers of 25 mL of hydrogen peroxide and 25 mL of distilled water.

Testing the Effect of Enzyme Concentration

4. Place six test tubes in a rack and label them 1–6.
5. Add 3 mL of water and 3 mL of 3% H₂O₂ to each test tube.

6. Using a clean dropper pipette, add 1 drop of water to Test Tube 1.

Note: Be sure not to let the drop fall against the side of the test tube.

7. Stopper the test tube and gently swirl to thoroughly mix the contents. The reaction should begin. The next step should be completed as rapidly as possible.

8. Connect the free-end of the plastic tubing to the connector in the rubber stopper. Click to begin data collection. Data collection will end after 3 minutes.

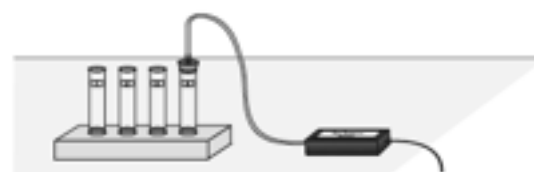


Figure 1

9. If the pressure exceeds 130 kPa, the pressure inside the tube will be too great and the rubber stopper is likely to pop off. Disconnect the plastic tubing from the Gas Pressure Sensor if the pressure exceeds 130 kPa.

10. When data collection has finished, disconnect the plastic tubing connector from the rubber stopper. Remove the rubber stopper from the test tube and discard the contents in a waste beaker.

11. Find the rate of enzyme activity:

- Move the mouse pointer to the point where the data values begin to increase. Hold down the mouse button. Drag the mouse pointer to the point where the pressure values no longer increase and release the mouse button.
- Click the Linear Fit button, to perform a linear regression. A floating box will appear with the formula for a best-fit line.
- Record the slope of the line, m , as the rate of enzyme activity.
- Close the linear regression floating box.

12. Find the rate of enzyme activity for test tubes 2–6:

- Add 1 drop of the enzyme solution to test tube 2. Repeat Steps 7–11.
- Add 2 drops of the enzyme solution to test tube 3. Repeat Steps 7–11.
- Add 3 drops of the enzyme solution to test tube 4. Repeat Steps 7–11.
- Add 4 drops of the enzyme solution to test tube 5. Repeat steps 7–11.
- Add 5 drops of the enzyme solution to test tube 6. Repeat steps 7–11

Data Collection & Processing

- Create a data table to record your results. If you use class, pooled data in your final lab report, you **must** indicate which data set you personally collected.
- Use the data to draw a graph of your results.

Conclusion:

Use your data chart and trends in your graph to draw conclusions about how enzyme concentration affects enzyme activity? Explain your results using what you know about how enzymes work and compare to literature values if appropriate.

Error Analysis: Discuss sources of experimental errors (consider the experimental procedure, management of time, and results) and give suggestions for improvement of these errors.

In the lab write up that you submit include the following:

- ✓ An appropriate and descriptive title
- ✓ Research question/Purpose (written fully and properly)
- ✓ Hypothesis (with explanation)
- ✓ Identify the independent, dependent, and control variables
- ✓ Raw data table & calculations (data processing)
- ✓ Graph (data processing)
- ✓ Conclusion with error analysis

This lab will be marked on IB Criteria DCP and CE.