

Enzymes Lab Report

*Instructions: In this lesson, we briefly discussed how **cyclin-kinase complexes can malfunction due to mutations to their genetic coding**. In this lab activity, **you will investigate the direct effects of environmental factors on enzymes**. How could things like **fever, hyperthermia, changes in blood pH, or the concentration of the enzyme** affect **how these protein complexes function in the molecular control system of cell division**? You will **select two of these three factors** to test during your experiment. Submit your lab report to your instructor when completed.*

Title: Make this information and descriptive; try this model: The effect of (independent variable) on (dependent variable) as measured by (how are you measuring the dependent variable) on (subject)

Objective(s):

What are you learning in this investigation? Think about your independent and dependent variables.

Hypothesis:

As described above, you will be testing the effects of temperature, concentration, or pH on enzyme activity. **Select two** of these factors for your investigation and create a hypothesis for each. Remember, each part of your experiment will have a different independent variable. Review the procedures section. Then write a prediction for each part of your investigation. Be sure to compare your independent variable to your dependent variable using an "if /then/because" format for each hypothesis statement.

I recommend an "if/then/because" statement

IF (I do this...a short explanation of your procedure, eg, the variables you are manipulating and testing)

THEN (I think...your prediction)

BECAUSE (what background knowledge do you have to support your prediction? Include that support for why you predicted the way you did)

Lab Safety:

- Cover your work surface with newspaper or other covering to protect from spills.
- Protect your eyes using goggles or protective glasses
- If sodium bicarbonate or vinegar solution gets in the eye or on the skin, flush with water.
- Oven mitt or glove for handling hot liquids should be used.

Procedure:

A list of materials and summary of steps is provided for you. You should select the procedures that match the factor you are testing. **You only need to test two factors, not all three.**

Materials:

- Pick **one** of the following: potatoes, kiwi, peaches, cherries, apricots, bananas, watermelon, or pineapple
- Baking soda (if testing pH)
- Water (and a way to warm it if testing temperature)
- Ice cubes (if testing temperature)
- Vinegar (if testing pH)
- Hydrogen peroxide (can be purchased at a grocery store)
- Glasses, cups, small bowls, or jars
- Something to crush fruit or veggie
- Large containers to hold hot and cold water (if testing temperature)
- Measuring cups
- Marker, paper, and tape for labeling
- Timer

Summary of Steps:

Procedures for All Tests:

1. Catalase breaks down hydrogen peroxide into water and oxygen. The oxygen will appear as bubbles in solution. For each test, allow the reaction to complete in ALL test tubes before recording results.
2. Rank the test tubes in by the reactivity scale below and record your results in the data section.

REACTIVITY SCALE

0 = no reaction (no foam or bubbling)

1 = minor reaction (very few bubbles or very slow to bubble, delayed reaction)

2 = moderate reaction (medium amount of bubbles, medium speed, delayed reaction)

3 = major reaction (a lot of bubbles, bubbles quickly and immediately)

Pick TWO of the tests from below. You do not have to do all three. Delete the procedural steps for the test you do not choose to experiment.

Test A: Enzyme Concentration

1. Set up three glasses, cups, small bowls, or jars. Label each with a number.
2. Cut fruit or potato into cubes. Place one cube into glass 1.
3. Cut a second cube of fruit or potato into four smaller pieces. Put these pieces into glass 2.
4. Take third cube of fruit or potato and crush it down with the mortar and pestle or another utensil used for crushing. Place the crushed fruit or potato in glass 3.
5. Pour $\frac{1}{4}$ cup of hydrogen peroxide into each glass.
6. Using your timer and the reactivity scale provided above, estimate the rate of reaction in each glass. Record your results in [Table 1](#).
7. Clean the glasses for the next test.

Test B: Temperature

1. Add one cube of fruit or potato to glasses 1, 2, and 3.
2. Boil water (100°) and carefully place this water in a large container to create a hot water bath. Place glass 1 in the hot water bath for five minutes.
3. Add ice to a second container to create an ice water bath (0°C). Place glass 3 in the ice water bath for five minutes.
4. Glass 2 will remain at room temperature, which is approximately 25°C .
5. After five minutes, using protective glove or oven mitt, remove the glasses from the ice and hot water baths.
6. Pour $\frac{1}{4}$ cup of hydrogen peroxide into each glass.
7. Using your timer and the reactivity scale provided above, estimate the rate of reaction in each glass. Record your results in [Table 2](#).
8. Clean the glasses for the next test.

Test C: pH level

1. In glass 1, mix equal amounts of baking soda with water. Add $\frac{1}{4}$ cup of hydrogen peroxide into glass 1. This is your basic solution with a pH above 7.
2. In glass 3, mix equal amounts of vinegar with water. Add $\frac{1}{4}$ cup of hydrogen peroxide into glass 3. This is your acidic solution with a pH below 7.

3. In glass 2, add $\frac{1}{4}$ cup of hydrogen peroxide, then add water to equal the volume of the solutions in glass 1 and 3. This is your neutral solution with a pH around 7.
4. Add one cube of **fruit or potato** to glasses 1, 2, and 3.
5. Using your timer and the reactivity scale provided above, estimate the rate of reaction in each glass. Record your results in [Table 3](#).
6. Clean the glasses for the next test.

Variables:

You selected **two tests** for this investigation. *Just pick two of the sections below that match what you tested and delete the others.* List and explain your controlled variables, independent variable, and dependent variable **for each part of the investigation**.

Remember, controlled variables are factors that remain the same throughout the experiment (**You should have an exhaustive list for your controlled variables.**). An independent (test) variable (**What I change**) changes so that the experimenter can see the effect on other variables. The dependent (outcome) variable (**What I measure**) will change in response to the test variable.

ENZYME CONCENTRATION

Controlled variables:

Independent variable:

Dependent variable:

TEMPERATURE

Controlled variables:

Independent variable:

Dependent variable:

pH LEVEL

Controlled variables:

Independent variable:

Dependent variable:

Data:

Complete the tables below that correspond to the tests you selected:

Table 1 – Enzyme concentration

Glass label the enzyme concentration below	Contents and Observations	Reactivity Value
1		
2		
3		

Table 2 – Temperature

Glass label the temperature below	Contents and Observations	Reactivity Value
1		
2		
3		

Table 3 – pH Level

Glass label the pH level below	Contents and Observations	Reactivity Value
1		
2		
3		

Conclusion:

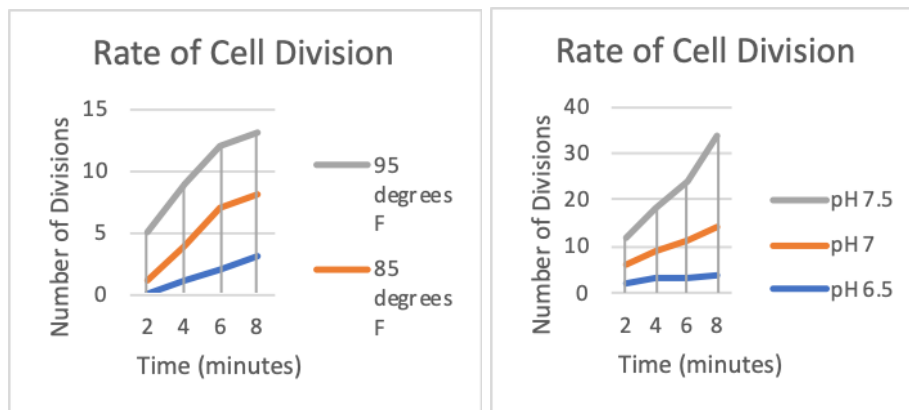
Write a conclusion statement that addresses the following questions:

- How did your experimental factors affect enzyme behavior in both tests? **Explain your results.** **How do you know this? What does your data mean?**
- Does your data support or fail to support your hypotheses? **Be sure to explain.**
- Discuss any possible sources of error that could have impacted the results of this investigation.

Post-lab Reflection Questions

Answer the reflection questions using what you have learned from the lesson and your experimental data. It will be helpful to refer to your class notes. Answer questions in complete sentences.

1. What kind of scenarios could change the temperature, pH, or enzyme concentration level **in the human body**? (Describe at least two.)
2. Predict the **two possible outcomes** if temperature or pH were changed within the **molecular control system of cell division**. *Be sure to include information that you learned about cyclin-kinase complexes.*
3. Samples from Streptococcus cultures are tested to determine the rate of cell division under different conditions. The average results of the tests performed are presented in the graphs below:



- a) **Predict** what would happen to this species of bacteria if it infected a human body with a body temperature of 98.6 °F and a pH range of 7.35 - 7.45.
- b) **Provide reasoning** to **support the claim** that a medication that *lowers fever* could **increase** cell division in this bacterium.