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| **SBI4U** | **Factors that Affect Enzyme Activity** |
| Biochemistry |

Enzymes are functional proteins that catalyze the reactions in metabolic pathways of living organisms. They lower the activation energy required to initiate chemical reactions, thereby speeding up the rate at which these reactions occur. Most enzymes are proteins in tertiary or quaternary structure whose overall shape affects their performances.

**What would happen to your cells if they made a poisonous chemical?** You might think they would die. In fact, your cells are always making poisonous chemicals, but they do not die because your cells use enzymes to break down these poisonous chemicals into harmless substances. An example of this is the production of hydrogen peroxide (H2O2), which is a harmful by‐product of many normal metabolic processes. To prevent damage, your cells must quickly convert hydrogen peroxide into other, less dangerous substances. To this end, the enzyme catalase is frequently used by cells to rapidly catalyze the decomposition of hydrogen peroxide into less harmful gaseous oxygen and water molecules.

Catalase is found in the cells of most organisms and may be easily obtained from beef or chicken liver or potato. Catalase catalyzes the decomposition of hydrogen peroxide, H2O2 (aq), into water, H2O(l), and oxygen, O2(g), according to the following equation: **2H2O2(aq)** **2H2O(l) + O2(g)**

Although hydrogen peroxide decomposes spontaneously under normal conditions, the rate of reaction is greatly increased by the action of catalase.

**Objective**

In this experiment you will investigate how various factors, enzyme concentration, temperature, and pH, affect the rate of enzyme activity. You will be using the lab protocol from *Biology with Vernier* using a labquest and gas pressure sensor.

**Part 1 - Lab Report Write-Up:** Your lab write up should include the following components:

**Research Question** – What are you testing?

**Hypothesis -** State your hypothesis using an “If…then” statement. Justify your hypothesis using background research on your factor.

**Variables**  - Identify your dependent variable (how you are measuring it), independent variable (and how you are manipulating it) & at least 3 control variables (and how they are controlled)

**Procedure** - Write out a step by step procedure for your factor. You may reference the vernier manual you were provided for the basic labquest use.

**Results –** Present your data in a clearly organized table. Calculate the average rate of enzyme activity (including units of measurement)

**Graph** –Present your results (average enzyme activity) in an appropriate graphical format (Using excel), complete with a descriptive title and fully labeled axes with units of measurement. Plot the independent variable on the x‐axis and the dependent variable on the y‐axis.

**Conclusion -** Write a conclusion statement. Make sure you explain the biology behind your results.

**Sources of Error** – What sources of error could have affected the outcome of your investigation?

**LAB MARKING SCHEME**

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|  | **Expectation** | **Marks Allocated** |
| **Lab****Report****(TI)** | **Title –** Clear and descriptive | 0 1  |
| **Research Question** – clear and descriptive | 0 1 2 |
| **Hypothesis** – “if, then” statement with justification | 0 1 2 |
| **Variables** – DV, IV and CV’s identified and explained | 0 1 2 3 4 5 |
| **Procedure –** Clear and easy to follow. Repeatable.  | 0 1 2 3 |
| **Results Table** – Clearly labeled table, with appropriate title and units. 3 trials shown. Average enzyme activity calculated.  | 0 1 2 3 4 |
| **Graphical Presentation** – Appropriate graph, fully labeled with title, axes and units of measurement.  | 0 1 2 3 4 5 |
| **Conclusion** – Statement of conclusion. Hypothesis referenced. Biology explained. | 0 1 2 3 4 |
| **Sources of Error** – Possible sources of error are identified  | 0 1 2  |
| **Lab Conduct****(TI)** | **Safety** – Proper use of equipment, safety procedures followed | 0 1 |
| **Clean up** – Lab station left clean, equipment clean properly | 0 1 |
| **TOTAL MARK (TI)** | **/30** |