

Factors Affecting Enzyme Lab 2015

CONTROL EXPERIMENT

Introduction:

The enzyme catalase is present in animal tissues such as liver, kidney, and muscle. Catalase is extremely abundant in the liver, a reflection of the liver's cleansing function. It is also present, but much less so, in the kidneys, also a reflection cleansing function. Catalase is also in plants, where its presence is often mysterious. Plants of course are not producing waste products similar to what animals produce, so why would they need catalase? We can discover the answer partially by simply understanding the function of catalase.

This is what catalase does in general: Hydrogen Peroxide + Catalase → Water and Oxygen

Hydrogen peroxide is a highly oxidative molecule, meaning it causes processes similar to rusting to occur. Metals rust as they react with oxygen and oxidative molecules causing rusting to occur. Similar "rusting" or oxidative reactions can occur in plant or animal tissues if oxidative molecules are present. This is why anti-oxidants are such a big deal, they prevent tissue from oxidizing by getting rid of oxidizing molecules such as hydrogen peroxide. Catalase is such an anti-oxidant molecule. Catalase also converts reactive oxygen, which also oxidizes, into hydrogen peroxide and then into harmless water and oxygen. At the end of a reaction catalase is preserved and available to repeat the reaction over again with more oxidative molecules. Amazingly, one catalase enzyme can repeat these reaction up to 40 million times in one second!

Another catalase reaction: Reactive Oxygen + Catalase → Hydrogen Peroxide + Catalase → Water and Oxygen

In animals, such as us, oxidative molecules are most often produced through metabolizing of food molecules. So the presence of catalase makes sense. Plants do not eat, so why would they need catalase? When we study the process of photosynthesis we will come across a term called photorespiration. Photorespiration is when a plant receives too much light and not enough water. As a result, the plant can produce large amounts of hydrogen peroxide which can kill the plant. Fortunately, catalase prevents the accumulation of hydrogen peroxide by converting it to water and oxygen, and so saves the plant from oxidative damage.

Materials:

- Potato peelings
- 4 Test tubes & rack
- Hydrogen Peroxide
- Soap
- Graduated cylinder

Procedures:

1. Add 5 mL of water to each test tube
2. Place 3 potato peelings into each test tube. Swirl until potato pieces are at the bottom.
2. Add 2 drops of soap.
3. Add 5 mL of hydrogen peroxide
4. Record the height the bubbles rise in 5 min

Remember, the more foam produced the better the catalase enzyme is working. Less foam means it is not working as well, and no foam means it is not working at all.

Adapted from: <http://practicalbio.blogspot.ca/2012/03/easy-enzyme-experiment-potato-catalase.html>

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INDIVIDUAL EXPERIMENT

Design a series of mini-labs that examine how the following factors affect the rate of catalase reactions:

- pH
- temperature
- enzyme concentration
- substrate concentration

The following materials will be provided:

You MAY wish to bring some of your own materials

- | | | |
|--|------------------------------------|----------------------|
| - vinegar | - test tubes (up to 4 per person) | - cold fridge water |
| - baking soda | - test tube rack | - graduated cylinder |
| - hot plate (to be shared with others) | - potato peelings | - pH paper |
| - thermometer | - 3% H ₂ O ₂ | - water |

You will have **one 76 min period** to complete your lab on **THURSDAY OCT 1st**

Your **final lab** will include:

NO PERSONAL PRONOUNS IN FORMAL LABS (I, me, we...)

- Descriptive title
- Purpose question/statement & background information paragraph
- Hypothesis
- Procedures
- Observations (raw data, charts, tables, photographs)
- Results (graphs – 1 for each condition)
- Analysis & Conclusion (state if hypothesis was correct, summarize results, trends, state what was learned)

CATEGORY	Unsatisfactory (1)	Borderline (2)	Satisfactory (3)	Distinguished (4)
Question and Purpose	The purpose of the lab or the question to be answered during the lab is erroneous or irrelevant.	The purpose of the lab or the question to be answered during the lab is partially identified, and is stated in a somewhat unclear manner.	The purpose of the lab or the question to be answered during the lab is identified, but is stated in a somewhat unclear manner and/or background information briefly summarized.	The purpose of the lab or the question to be answered during the lab is clearly identified and stated and background information succinctly summarized.
Experimental Hypothesis	Hypothesis does not relate to the lab completed in class.	Hypothesized relationship between the variables and the predicted results has been stated, but appears to be based on flawed logic.	Hypothesized relationship between the variables and the predicted results is reasonable based on general knowledge and observations.	Hypothesized relationship between the variables and the predicted results is clear and reasonable based on what has been studied.
Experiment (Procedure Steps)	Procedures do not accurately list the steps of the experiment. Variables are not clearly accounted for	Procedures are listed but are not in a logical order or are difficult to follow. Variables are somewhat accounted for	Procedures are listed in a logical order, but steps are not numbered and/or are not vague at points. Variables are considerably accounted for.	Procedures are listed in clear steps. Each step is numbered and is a directive. Variables are thoroughly accounted for.
Observations and Data Collection	Data and observations are inaccurate.	Accurate representation of the data in written form, but no paragraphs, charts or tables are presented.	Accurate representation of the data in paragraphs, tables and/or graphs. Charts and tables are labeled and titled.	Professional looking and accurate representation of the data in paragraph, tables and/or charts. Charts and tables are labeled and titled.
Results & Graphs	Many of the 7 graph components are missing, ruler not used	Some of the 7 graph components are present, ruler was used sometimes	Most of the 7 graph components are present, a ruler was used all but once.	All 7 graph components are present, a ruler was used for all lines
Conclusion	Conclusion shows little effort, reflection or understanding	Conclusion includes what was learned from the experiment, but may be missing 1 part.	Conclusion includes whether the findings supported the hypothesis and what was learned from the experiment.	Conclusion includes whether the findings supported the hypothesis, explains in detail what was learned from the experiment.
Appearance and Organization	Lab report is not in the proper order with parts all over the notebook.	Lab report is somewhat organized but some parts may be out of place.	Lab report is in the correct order and well organized.	Lab report is neat, in order and there is visual organization to the material (ex. underlining, colour coding).
Participation	Participation was minimal OR student was reluctant to participate.	Did the lab but did not appear very interested. Focus was lost on several occasions.	Used time pretty well. Stayed focused on the experiment most of the time.	Used time well in lab and focused attention on the experiment.
Scientific Terms	Student did not use proper science terms.	Some science terms were used.	Many science terms were used.	Science terms were used with accuracy and precision.