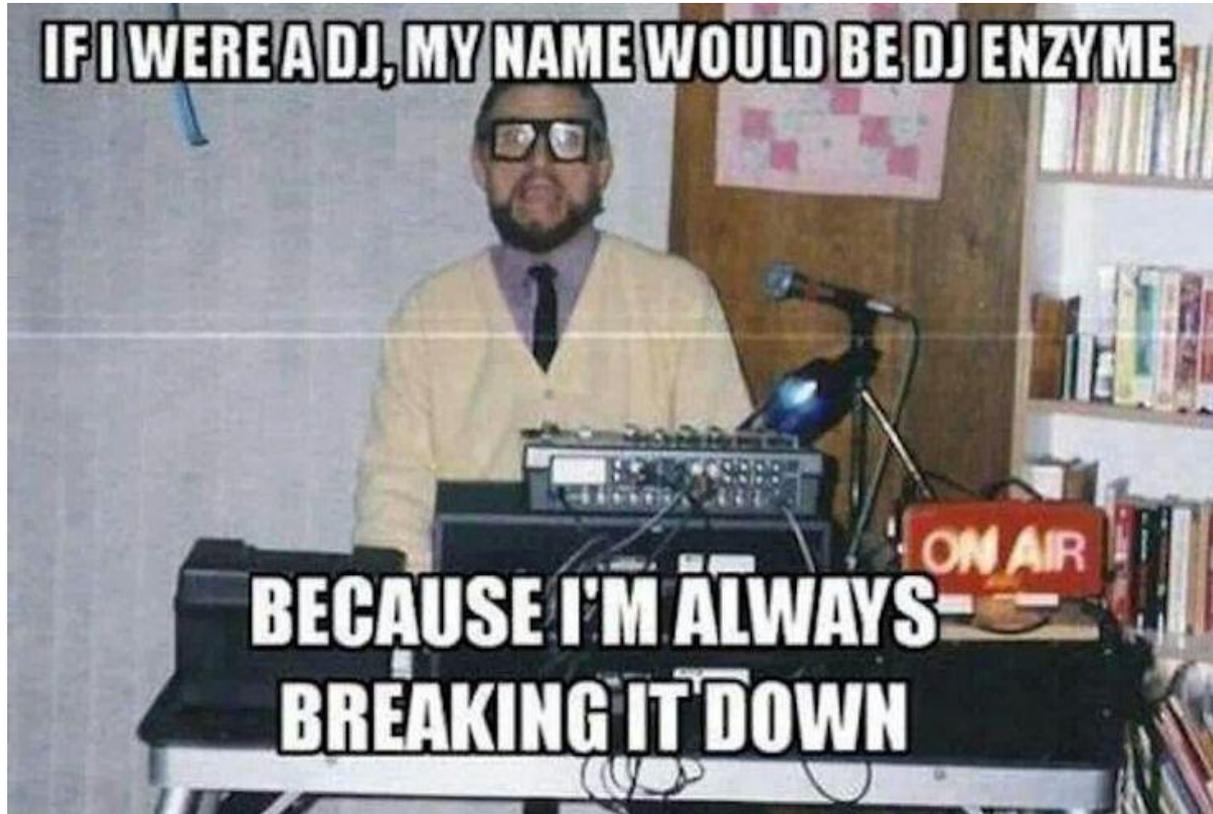


Catalase Liver Lab



Joke Time!

A guy and his friend walk into a bar.

The first man says, "I'd like a glass of H₂O."

The second man says, "I'd like a glass of H₂O too."

They sit down with their drinks and the second man dies.

Why is this funny, and/or sick?!

What is Catalase and How Does it Behave?

What would happen to your cells if they made a poisonous chemical? You might think that they would die.

In fact, your cells are always making poisonous chemicals. They do not die because your cells use enzymes to break down these poisonous chemicals into harmless substances.

Enzymes are proteins that speed up the rate of reactions that would otherwise happen more slowly. The enzyme is not altered by the reaction. You have hundreds of different enzymes in each of your cells.

Each of these enzymes is responsible for one particular reaction that occurs in the cell. In this lab, you will study an enzyme that is found in the cells of many living tissues.

The name of the enzyme is catalase (KAT-uh-LAYSS); it speeds up a reaction which breaks down hydrogen peroxide, a toxic chemical, into 2 harmless substances--water and oxygen

Here's the Reaction



Hydrogen peroxide (H₂O₂) is the **substrate** that the **enzyme** catalase will break down.

What will we do?

In this lab, you will study the catalase found in plant and animal tissue.

It might seem strange to use dead cells to study the function of enzymes. This is possible because when a cell dies, the enzymes remain intact and active for several weeks, as long as the tissue is kept refrigerated.

What to do tonight?

Tonight, using your Lab Write Up Guidelines, I need you to write the following components of a lab report in an electronic format.

A **Title**, use the IV and DV for your testing. “An experiment to determine...” Name, date, period, and class.

An **Introduction** to our research. Explain why we are doing this lab.

Explain what we are going to discover

Write this in the third-person.

Be clear and concise!

A **Hypothesis** for what you think will happen. Remember; If..., Then..., Because... You will have two of these for the two tests you must complete.

A **Materials** list based off of the procedures you are responsible for. You are responsible for test 1 if your group is 1, 4, or 7, test 2 if you are group 2, 5, or 8, and test 3 if you are groups 3, 6, or 9.

A **Procedure** based off of the tests you are responsible for. This can be a cut and paste process from this power point.

Observing a Normal Catalase Reaction - Everyone

1. Place 2 ml of the 3% hydrogen peroxide solution into a clean test tube.

2. Using forceps and scissors cut a small piece of liver and add it to the test tube. Push it into the hydrogen peroxide with a stirring rod. Observe the bubbles. What gas is being released? (consider the equation) _____

Throughout this investigation you will estimate the rate of the reaction (how rapidly the solution bubbles) on a scale of 0-5 (0=no reaction, 1=slow, 5= very fast). This is *very subjective*, but assume that the reaction in step 2 proceeded at a rate of "4" Recall that a reaction that absorbs heat is endothermic; a reaction that gives off heat is exothermic. This is now our **control**, or baseline data for comparisons.

3. Now, feel the temperature of the test tube with your hand.

Has it gotten warmer or colder _____ Is the reaction endothermic or exothermic? _____

4. Pour off the liquid into a second test tube. Assuming the reaction is complete. What is this liquid composed of (consider the equation again)? _____

5. What do you think would happen if you added more liver to the liquid in the second test tube? _____

Test this and record the reaction rate. Reaction Rate _____ (0 – 5)

6. Add another 2 ml of hydrogen peroxide to the liver remaining in the first test tube. What is the reaction rate? _____

7. Now that you have completed your test, **Is catalase reusable? Explain how you know.**

Establishing a Baseline - What do we do with this data?

Tonight you will create a graph. This graph will have the following:

- 1) It will be a **bar** graph with three bars (control, new liver in old solution, and new solution in old liver)
- 2) It should have all appropriate units, label, and titles.
- 3) The independent variable (manipulated) will be on the X-Axis
- 4) The dependent variable (responding, measured) will be on the Y-Axis
- 5) A brief description explaining the graph will also be present below the graph.

Note: Don't forget that you have a reference sheet in your notebook to help you with graphing data, use it!

Test 1 - Where is Catalase Found?

You will now test for the presence of catalase in tissues other than liver.

1. Place 2 ml of hydrogen peroxide in each of 3 clean test tubes and then add each of the three test substances to the tubes.
2. As you add each test substance, record the reaction rate (0-5) for each tube.
3. Based on your observations, which tissues contained catalase?
4. Do some contain more catalase than others? How can you tell?

Your
Data
Table

Substance	Beef Liver	Chicken	Potato	Apple
Reactivity (0-5)	4			

Now, have one partner record your reaction rates on the class record sheet up front.

Test 1 - What do we do with this data?

Tonight you will create a graph. This graph will have the following:

- 1) It will be a **bar** graph
- 2) It should have all appropriate units, label, and titles.
- 3) The independent variable (manipulated) will be on the X-Axis
- 4) The dependent variable (responding, measured) will be on the Y-Axis
- 5) A brief description explaining the graph will also be present below the graph.

Note: Don't forget that you have a reference sheet in your notebook to help you with graphing data, use it!

Test 1 - Graphing Help

The first graph will have two bars. The first bar will show the activity level for the liver and hydrogen peroxide, and another bar for the activity level when you added the second amount of hydrogen peroxide to the original liver.

The second graph will have four bars showing the activity levels of the liver, chicken, apple, and the potato.

Test 2 - Effect of Temperature on Catalase

Hot Temp (2)

1. Put a piece of liver into the bottom of a clean test tube and cover it with a small amount of sink water. Place this test tube in a hot water bath for 5 minutes. **CAUTION:** Use a test-tube holder for hot test tubes.

2. Remove the test tube from the hot water bath, record the temperature of water, and then pour out the water in the tube. Add 2 ml of hydrogen peroxide. What is the reaction rate (0-5)? _____

3. Repeat this test for the warm water bath as well.

Cold Temp (1)

4. Put a piece of liver into a clean test tube and 1 ml H_2O_2 into another test tube. Put one test tube of liver and one of H_2O_2 into an ice bath.

After 3 minutes, measure the temperature and pour the tube of H_2O_2 into the corresponding tube of liver and observe the reaction

5. What is the reaction rate for the cold liver/peroxide? _____

Air Temp

6. Look back in your notes and rewrite the normal reaction rate (4) and the room temperature of 25 degrees C.

Test 2 - Graphing Help

The first graph will be a line graph showing the temperature vs. activity level of the catalysis. This means that you will graph low temperature to high temperature (IV) (0-100 degrees) vs. activity (DV) as points, and then connect those points.

Test 2 - What do I do now?

Tonight you need to take the data that you found on Temperature and create a line graph from your data.

This graph will be a **line** graph

- 1) The should have all appropriate units, label, and titles.
- 2) The independent variable (manipulated) will be on the X-Axis.
- 3) The dependent variable (responding, measured) will be on the Y-Axis
- 4) A brief description explaining the graph will also be present below the graph.
- 5) The two graphs may be on the same page

Note: Don't forget that you have a reference sheet in your notebook to help you with graphing data, use it!

Test 3 - What is the Effect of pH on Catalase?

1. FIRST, Add 2 ml hydrogen peroxide to each of 5 clean test tubes.

2. To Tube 1--add 4 drops of solution 1 with a pH = 3

3. To Tube 2--add 4 drops of solution 2 with a pH = 5

4. To Tube 3--add 4 drops of solution 3 with a pH = 7

5. To Tube 4 – add 4 drops of solution 4 with a pH = 9

6. To Tube 5 – add 4 drops of solution 5 with a pH = 11

7. Now add liver to each of the test tubes (try to do it all at about the same time, so you can easily compare)

8. Record the Rate of Reaction (0-5) for each:

Test 3 - What do I do now?

Tonight you need to take the data that you found on pH and to create a line graph using your data.

This graph will be a **line** graph

- 1) The should have all appropriate units, label, and titles.
- 2) The independent variable (manipulated) will be on the X-Axis.
- 3) The dependent variable (responding, measured) will be on the Y-Axis
- 4) A brief description explaining the graph will also be present below the graph.
- 5) The two graphs may be on the same page

Note: Don't forget that you have a reference sheet in your notebook to help you with graphing data, use it!

Test 3 - Graphing Help

This graph will be a line graph showing the pH scale from 0-14 (IV) vs. activity levels (DV) 0-5. This means that your graph will have pH vs. activity level expressed as points on the graph. Then connect the points.

Analysis - Everyone

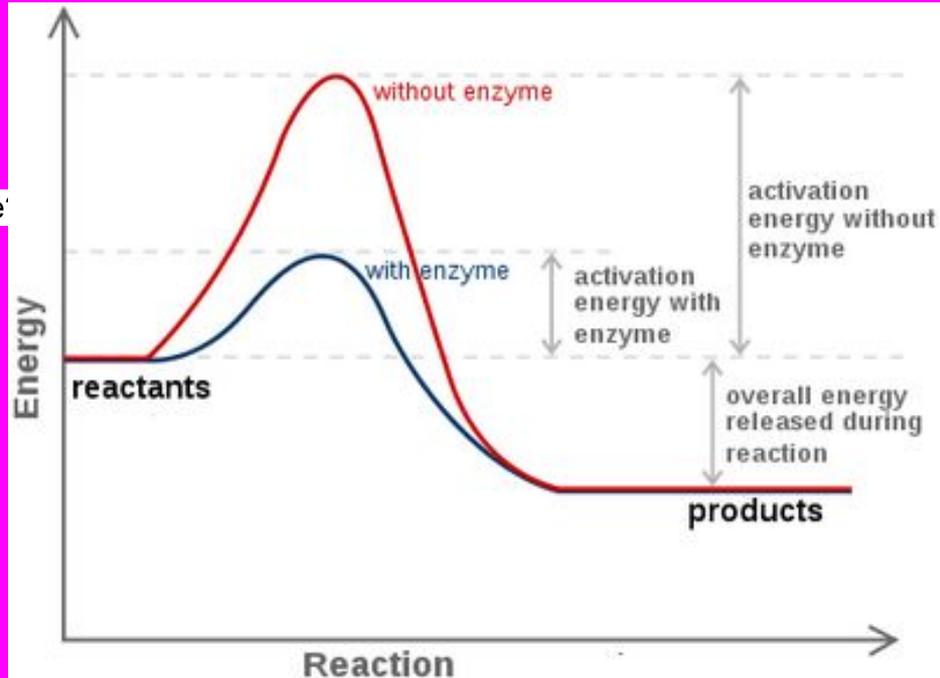
1. Describe the relationship between catalase and hydrogen peroxide. Indicate which is the enzyme, which is the substrate and what occurs during the reaction. It may be helpful to write the equation.

2. Is catalase reusable? Use your **data** to support your answer.

3. How does temperature and pH affect the reaction rate of catalase? OPTIMAL pH and temperature of catalase.

4. In 2-3 sentences, summarize the data and information displayed in this graph.

5. Why is this enzyme (catalase), and any enzyme, important?



What do I do now?

Please put your answers into an expository format (write it as if you were telling someone about what you learned, but still maintain 3rd person voice).

- 1) Be clear and concise
- 2) Be sure to use the terms: substrate, enzyme, catalase, reusable, variable, and graph in your explanation. Underline these words.
- 3) This will be about 4 paragraphs and each of these paragraphs, if done well, will be worth a point.
 - a) Describe what an enzyme is and how it works. Use the equation.
 - b) Describe the process of your testing
 - c) What did you find (best/worst activity levels, denaturing, etc.)
 - d) Why is this enzyme, and all enzymes, so important to everyone.
 - e) For a 5th point get deep by adding additional information, clear insight, new avenues to test, or ???