Enzyme Activity Lab **Name: _____**

Biology - Biochemistry **Date: _____**

Enzymes found in Living Tissues **Period: _____**

Introduction:

Enzymes greatly speed up the rate of chemical reactions that take place in living organisms, including you. The enzymes are not consumed in these reactions, and are considered to be organic (biological) catalysts. Enzymes are unique in that each enzyme is very specific to the substrate it can break down and are often referred to acting like a "lock and key."

The enzyme **catalase** speeds up the breakdown of hydrogen peroxide. You may be familiar with hydrogen peroxide as a compound used as an antiseptic to clean skin. It is also used in bleaching.

$$2H_2O_2 \xrightarrow{Enzyme} 2H_2O + O_2\uparrow$$

Hydrogen peroxide is a waste product that accumulates in cells as a result of metabolic activity. It has toxic (poisonous) properties and would cause cell death if it were not removed. Catalase catalyzes the decomposition of hydrogen peroxide into oxygen gas and water.

In this investigation, you will test animal tissues for the presence of catalase. You will also compare it with an **inorganic** catalyst, manganese dioxide (MnO_2). It speeds up the same reaction.

Purpose: The purpose of this lab is to determine the catalytic activity of an enzyme found in living tissues.

Objectives: Upon Completing this lab, you will be able to:

A. Test for the presence of oxygen using a glowing splint.

B. Describe the relative effect of several materials, including tissues, in decomposing hydrogen peroxide.

C. Describe the effect of high heat on the action of catalase and identify the upper temperature limits under which catalase can function.

D. Compare the relative rates of decomposition of hydrogen peroxide with and without a catalyst present.

Procedures:

A. Pour 3% hydrogen peroxide into a test tube to a depth of about 2 cm. Into this test tube, sprinkle a pinch of fine sand. Place your thumb over the open end of the test tube and shake the tube vigorously. Observe for a reaction in the test tube. Place a glowing splint at the mouth of the tube. ***Record your observations:***

B. Rinse out the test tube from step A. Again, add 2 cm of hydrogen peroxide. Now sprinkle in a small amount of manganese dioxide powder. Shake the contents vigorously noting the reaction. Holding a glowing splint at the mouth of the test tube (get the splint at close to the mouth of the test tube as possible before removing your thumb, then insert the splint as quickly as possible). ***Record your observations:***

C. Rinse out the test tube from step B, and pour fresh hydrogen peroxide into it to a depth of 2 cm. Using forceps, pick up a small piece of fresh liver and drop it into the test tube. Shake the tube vigorously and observe the reaction. Test with a glowing splint. ***Record your observations:***

D. Rinse out the test tube from step C, and add hydrogen peroxide to a depth of 2 cm. Take a small piece of liver and place it in a mortar, along with a small amount of sand. Grind the liver with a pestle. Put the ground material (along with the sand) into your test tube. Shake vigorously, observe, and test with a glowing splint. ***Record your observations:***

E. Clean out the last test tube from step D. Place another piece of liver in to the test tube along with 2 cm of WATER. Boil the liver for 2 minutes by passing the test tube over the flame of a Bunsen burner. Once the liver appears to be boiled (darker brown), empty the water and add 2 cm of hydrogen peroxide. Carry out tests with a glowing splint. ***Record your observations:***

Data Table: Summarize your observations in the table below (use detailed descriptions)

Material	Observations of Glowing Splint	Catalytic Activity (none, little, a lot)
Sand		
Manganese Dioxide (MnO_2)		
Whole Liver		
Ground Liver (with sand)		
Boiled Liver		

Analysis/Questions:

1. Write the equation showing the breakdown of hydrogen peroxide. _____

   a. Which of the molecule(s) listed in the equation are compounds? _____

   b. Which of the molecules in the equation are NOT compounds? _____

   c. What contributed to the bubbling you observed? (use the equation to help you)

   d. Why is the "glowing splint" test used? What does it illustrate?

2. Which material showed the greater activity: whole or ground liver? Why?

3. Why did boiling the liver change the results? Look up and then use the word ***denatured*** in your answer.

4. Are all enzymes catalysts? Are all catalysts enzymes? Explain the differences.

5. What three conditions must be met to optimize the function of enzymes?
   a. b. c.

6. What subunits (monomers) comprise an enzyme (or any protein)?

7. a. Enzymes are said to work like a "lock and key". Explain what is meant by this expression?

   b. What sugars might the following enzymes break down?

   Sucrase: _____ maltase: _____ lactase: _____

8. Write a scientific title for this investigation. Don't forget to include both an IV & a DV as part of your title.

9. a. Label the X and Y axis according to what they represent.

   b. Were they unlabeled, how would you know the "with enzyme" was the lower graph?

   c. What does the distance labeled "x" represent?