The effect of temperature on the activity of the enzyme catalase

Science IA Rough Draft The Effect of Temperature on The Activity of The Enzyme Catalase Introductions: Enzmyes are proteins that catalyze chemical reactions. All living things have catalase present in them. Catalase is a common HYPERLINK " http://en. wikipedia. org/wiki/Enzyme" enzyme found in nearly all living organisms that are exposed to oxygen, where it HYPERLINK " http://en. wikipedia. org/wiki/Catalyst" catalyzes the decomposition of HYPERLINK " http://en. wikipedia. org/wiki/Hydrogen_peroxide" hydrogen peroxide, which is damaging to the cells, into water and HYPERLINK " http://en. wikipedia. org/wiki/Oxygen" oxygen.

My investigation is the effect of temperature on the activity of enzyme catalase. In this investigation I wanted to determine the effect that temperature has on the enzyme catalase. Question: What is the effect of temperature on catalase enzyme activity? Variables- Independent- Temperature Dependant- Amount of gas produced -Amount of liquid left in test tube Controlled -Amount of Hydrogen Peroxide -Amount of potato enzyme Materials -Hot temperature water bath (set at 90 degrees C) -Cold temperature water bath (set at . 5 degrees C) -Room temperature water bath (set at 15 degrees C) – Hydrogen Peroxide – Potato Blender -Cheese cloth – Water -Pipette -5 small test tubes (5. 2 ml each) -5 regular size test tubes -Paper -Pencil -Refrigerator -Thermometer Method Collect all of materials on the materials list Make Potato Enzyme. To make this take 100 grams of potato and add 200 grams of water. Blend in a blender till liquified. Then filter liquid through 2 layers of cheese cloth. Once complete keep in the refridgerator at 40 degrees. Set up all water baths to correct temperatures.

Set hot water bath at 90 degrees C, Cold water bath at . 5 degrees C, and room temperature water bath at 15 degrees C Set up 5 small clean 5. ml test tubes on rack. Add to each test tube 2 ml hydrogen peroxide and 2 ml of the chilled potato enzyme. Invert the filled 5. 2 ml test tubes into larger test tubes Place the 5 inverted test tubes into the room temperature bath Wait 15 minutes, make sure during all time water stays at correct temperature Take the all the inverted test tubes out of the water bath. Take test tues over to the sink and extract the small 5. 2 ml test tube from the larger test tube. Measure the remaining liquid in each of the 5 small test tubes and record the amount in mL Subtract the amount of the remaining liquid in the test tubes from the 5. mL initial volume to get the amount of gas produced and record in table. Wash out all test tubes and repeat steps 4-11 for cold water bath Wash out all test tubes and repeat steps 4-11 for hot water bath Clean out all supplies and place back in correct spots Data Table Processed Data Overview- I performed calculations on the data to test if the null hypothesis was valid. The null hypothesis in this case is that temperature does not have an impact on the rate on enzyme activity. It turned out that this was not the case and temperature had a significant effect on enzyme activity.

To determine this I calculated the mean, the standard deviation, the T test, the degrees of freedom, and then compared the T value to the critical value at the 95% confidence limit. Sample Calculations- Mean (Average) EMBED Equation. 3 = EMBED Equation. 3 EMBED Equation. 3 = mean (average) xi = individual values in data set (= sum of values N = number of values in data set Standard Deviation s = EMBED Equation. 3 s = standard deviation xi = individual values in the data set EMBED Equation. 3 = mean of all values in

the data set N-1 = number of values in data set minus 1 (= Degrees of Freedom) Calculations Room Temperature

Mean- EMBED Equation. 3 = 5. 2+4. 7+3. 7+3. 8+5. 2 5 EMBED Equation. 3 = 4. 52 Standard Deviation- S= (5. 2-4. 42) + (4. 7-4. 52) + (3. 7-5. 2) + (3. 8-4. 52) + (5. 7-4. 52) 5-1 S= 0. 7695 = 0. 877 Cold Temperature Mean- EMBED Equation. 3 = 5. 2+4. 6+5+4. 5+4. 6 5 EMBED Equation. 3 = 4. 78 Standard Deviation- S= (5. 2-4. 78) + (4. 6-4. 78) + (5-4. 78) + (4. 5-4. 78) + (4. 6-4. 78) 5-1 S= 0. 3033 Hot Temperature Mean- EMBED Equation. 3 = 2. 9+3. 4+2. 2+2. 3+2. 4 5 EMBED Equation. 3 = 2. 64 Standard Deviation- S= ((2. 9-2. 64) + (3. 4-2. 64) + (2. 2-2. 6) + (2. 3-2. 64) + (2. 4-2. 64) 4 S= 0. 50299 Graph T-Test X = Cold mean X = Hot mean S = Cold Standard Deviation S = Hot Standard Deviation Null Hypothesis is that there is no difference between hot and cold temperatures relating to the rate of reaction. Alternative hypothesis would be that there is a significant difference between the hot and cold. t= (x -x) (S) + (S) n n t= 4. 78- 2. 64 (0. 3033) + (0. 50299) 5 5 t= 2. 14 0. 26267 = 9. 1987 Degrees of freedom Df= 5+5-2 = 8 Critical value of t at 5% when df= 8 ? 2. 306 9. 1987 is greater than 2. 06 therefore we can reject the null hypothesis Conclusion Interpreting the data, this experiment’s result show that temperature has a large effect on catalase enzyme activity. Looking at the graph you can see that the trend in increasing temperature from cold to room temperature moderately decreases catalase enzyme activity. Ur increasing temperature from room temperature to hot temperature decreases catalase enzyme activity even more significantly compared to the decrease in enzyme activity from cold to room temperature. The difference between the means from the

increase in temperature from cold to room temperature was . 26 (4. 78 – 4. 2) and the difference between the means from the increase in temperature from room temperature to hot was 1. 88 (4. 52-2. 64). As temperature increases, the movement of molecules increases and at a certain point bonds are broken and the enzyme loses it specific shape. The three dimensional shape of an enzyme id necessary for it to function. Evaluation This experiment of testing temperature on the enzyme catalase was designed well and overall excruciated well. The variables that came into place though were the time that the test tubes were taken out of the water bath and the correct measuring of potato enzyme and hydrogen peroxide.

Taking the test tubes all out at 15 minutes it was very hard since there were 5 test tubes and only one person to take them out. Therefore the test tubes were taking out in a span of about a minute, so some were taken out at 15 minutes other were taken out between and at 15-16 minutes. The measuring of the hydrogen peroxide and the potato enzyme was not always carefully drawn up to the line. To improve this variable the person performing the experiment would need to look closer at the measurements. This experiment would be considered