Data Sheet: Activity - Enzymes

Name	Course	Date

Activity Data Code _____

Procedure I - Enzyme Reaction Rate - Concentration Dependence

Complete the tables below using your data and information found under the Background tab (see the Summary of Needed Formulas section)

Trial	Concentration Level	Oxygen Concentration Change Data (ppt)	Elapsed Time (s)	Enzyme Reaction Rate (ppt/s)
1	2.5%	5.64	20.0	0.282
2	5.0%	11.82	20.0	0.564
3	10%	22.56	20.0	1.128

Observations and Questions

[1] Sample Calculation: Show your enzyme reaction rate calculation for Trial 1.

Enzyme reaction rate= $\frac{\text{Change in } O_2}{\text{Time interval}}$

O_2 rate = $\frac{5.64 \text{ ppt}}{20.0 \text{ s}}$ = 0.282 ppt/s

[2] Convert enzyme concentrations of 2.5%, 5.0%, and 10% to ppt units.

1% = 10ppt
2.5% = ?

$$\frac{2.5 \times 10}{1} = 25\text{ppt}$$

1% = 10ppt. $\frac{5 \times 10}{1} = 50ppt$
5% = ?

1% = 10ppt $\frac{10 \times 10}{1} = 100ppt$
10% = ?

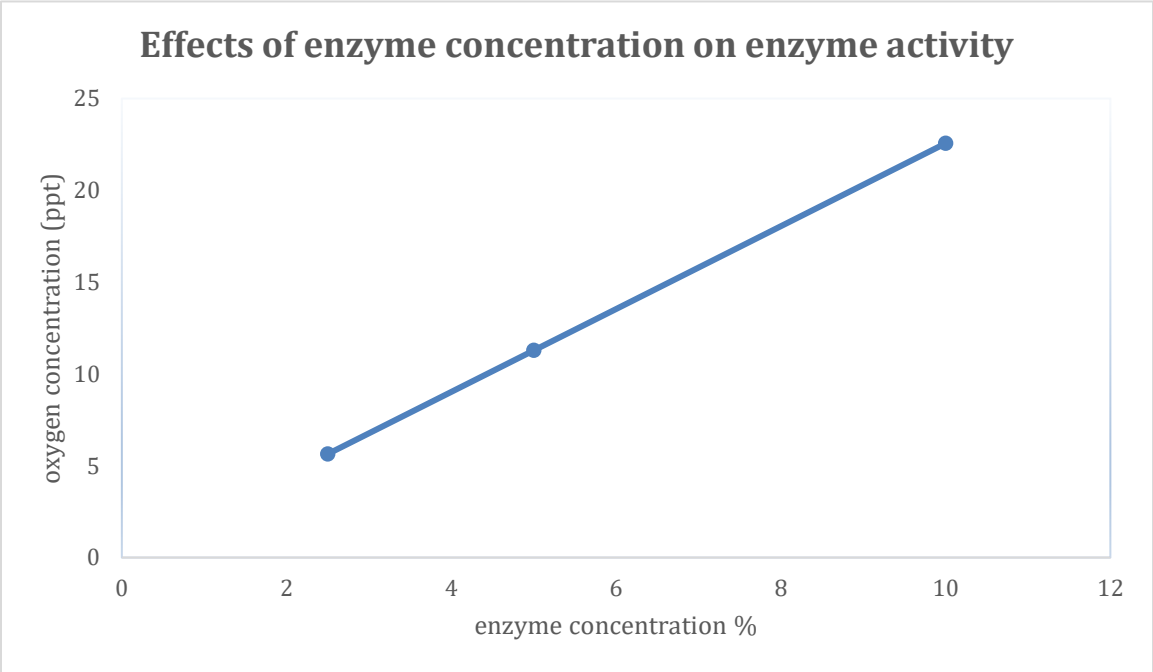
[3] For Procedure I/Table I, identify:

Independent variable: **Enzyme concentration**

Dependent variable: **Oxygen concentration**

Control variables: **Time (elapsed)**

[4] Draw a graph of the independent variable on the x-axis (abscissa) and the dependent variable on the y-axis (ordinate). Label the axis titles and units.



Procedure II - Enzyme Reaction Rate - Temperature Dependence

Complete the tables below using your data and information found under the Background tab (see the Summary of Needed Formulas section)

Trial	Temperature (°C)	Oxygen Concentration Change Data (ppt)	Elapsed Time (s)	Enzyme Reaction Rate (ppt/s)
1	20.0	7.95	20.0	0.3975
2	30.0	16.01	20.0	0.8005
3	55.0	2.49	20.0	0.1245

Observations and Questions

[5] Sample Calculation: Show your enzyme reaction rate calculation for Trial 1.

Enzyme reaction rate= Change in O_2
Time interval

O_2 rate = 7.95 ppt / 20. 0s = 0.3975 ppt/s

[6] Using the data you reported in the Table above, describe the effect of temperature on the reaction rate.

Increase in temperature leads to increase in the reaction rate i.e from 20^0c to 30^0c, up to a point where further increase in temperature (to 50^0c) lead to reduced reaction rate. This is because enzymes (protein) are sensitive to high temperature and can lose their shape and functionality since they will be denatured, thus reduction in the reaction rate.

Procedure III - Enzyme Reaction Rate - pH Dependence

Complete the table below using your data and information found under the Background tab (see the Summary of Needed Formulas section)

Trial	pH Level	Oxygen Concentration Change Data (ppt)	Elapsed Time (s)	Enzyme Reaction Rate (ppt/s)
1	6.0	6.85	20.0	0.3425

Trial	pH Level	Oxygen Concentration Change Data (ppt)	Elapsed Time (s)	Enzyme Reaction Rate (ppt/s)
2	7.0	11.28	20.0	0.564
3	9.0	1.52	20.0	0.076

Observations and Questions

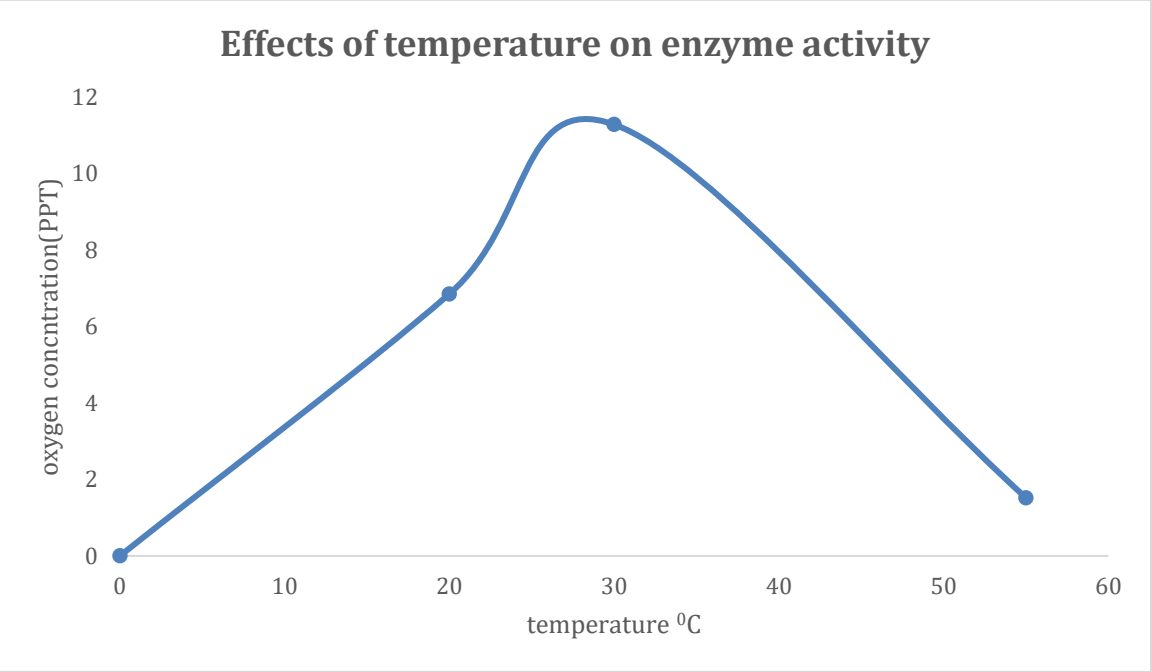
[7] Sample Calculation: Show your enzyme reaction rate calculation for Trial 1.

Enzyme reaction rate= $\frac{\text{Change in } O_2}{\text{Time interval}}$

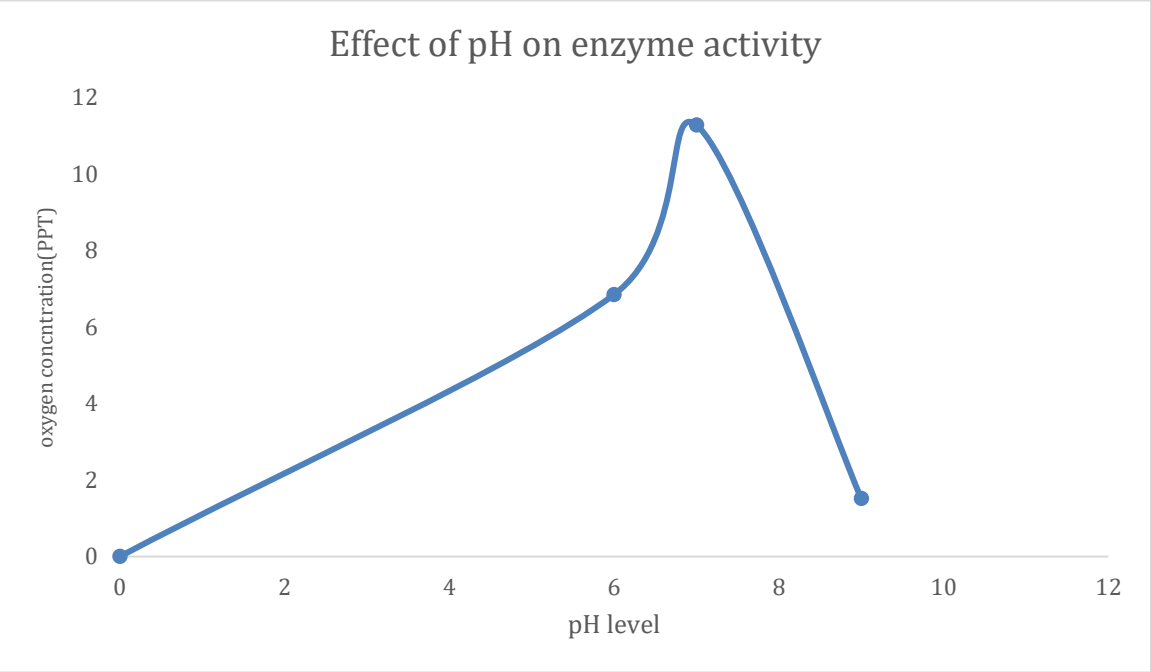
O_2 rate = $\frac{6.85 \text{ ppt}}{20.0 \text{ s}}$ = 0.3425 ppt/s

[8] Choose either a bar graph or a line graph format and plot the data for Procedures II and III. Plot the data for each Procedure on a separate plot.

Procedure II



Procedure III



[9] Compare the plot of the data for Procedures I, II, and III. Describe the differences among the three plots.

Procedure I – The graph shows an increase in oxygen concentration as the concentration of enzyme is increasing

Procedure II – The graph shows an increase in the amount of oxygen concentration as temperature increases up to a point where further increase in temperature results in decreased amounts of oxygen concentration.

Procedure III – The graph shows an increase in amount of oxygen concentration up to neutral pH 7 where there is maximum oxygen concentration, with increase further in pH level there is a decrease in oxygen concentration.

[10] What conclusions can draw about the effects of concentration, temperature and pH on the reaction rate after comparing the plots from the three different Procedures?

It can be concluded that the rate of reaction of enzyme is affected by temperature, pH and enzyme concentration.

This is to say that as temperature increase will result in increased reaction rate up to the optimum temperature where further increase past this temperature results in a decreasing reaction rate, since the enzyme will be denatured by the high temperatures.

pH will affect the reaction rate in that enzymes work best at their optimum pH level and any change from that level will result in reduced reaction rate.

Enzyme concentration will result in an increase in reaction rate since every substrate will have an active site to attach too thus an increase in reaction rate.

[11] Choose one of the factors that impacts reaction rate (concentration, temperature, or pH) and, in your own words, provide a plausible biological explanation for your experimental results for that factor.

Temperature
Temperature impacts reaction rate in that it excites the molecules providing enough energy for the reaction to continue. Temperature also influences the reaction rate since biological catalysts, enzymes will work best a given optimum temperature where at this temperature the reaction rate will be high. Increasing temperatures above this optimum temperature results in decline in reaction rate, possibly due to the fact that the enzymes have been destroyed by the high temperatures. Extreme low temperatures reduce the excitement of the reactants molecules and renders the enzymes in active thus a reduced reaction rate.

