



## **IB Foundation Years (9 & 10) Lab Report**

### **1) Writing a fully focused research question**

- o Must include the range of the independent variable with units
- o Must include the dependent variable
- o Method of measuring the dependent variable

What is the effect of temperature ( 25,37,70 celsius) on the rate of the reaction catalyzed by enzyme (enzyme activity) measured by volume of gas connected in the tube (cm<sup>3</sup>) on 3 trials for each temperature, this will be done by measuring the volume of gas produced using a measuring tube.

### **2) Scientific background**

- o Research your independent variable
- o Research its effect on your dependent variable
- o Research the **method** of measuring the dependent variable
- o Include citation

**As the temperature increases so does the rate of enzyme activity.** An optimum activity is reached at the enzyme's optimum temperature. A continued increase in temperature results in a sharp decrease in activity as the enzyme's active site changes shape, As with many chemical reactions, the rate of an enzyme-catalyzed reaction increases as the temperature increases. However, at high temperatures the rate decreases again because the enzyme reaches its optimum temperature and becomes denatured and can no longer function. The method of measuring the dependent variable (volume) while changing the independent variable (temperature) is counting the bubbles produced (gas) in one minute for each temperature (25,37,70 C)

Citations/References:

**3) Hypothesis:** Outline a hypothesis to predict the outcome of the experiment and explain it using logical scientific *reasoning* (*what do you think is going to happen*)

As the temperature increases then the volume of gas produced increases until a certain point hence when the enzyme reaches its optimum temperature, enzyme denatures, and the volume of gas will start decreasing

**Scientific explanation for hypothesis** (This is the explanation to the previous hypothesis. Why do you think that your hypothesis is correct? Explain it in detail with reasons and causes. You may also find research at this point if allowed).

**Because:**

Raising temperature generally speeds up a reaction, and lowering temperature slows down a reaction. However, extreme high temperatures can cause an enzyme to lose its shape (denature) and stop working. Enzymes work best at 37 degrees (optimum temperature for the enzyme). Above this temperature the enzyme structure begins to break down (denature) since at higher temperatures intra- and intermolecular bonds are broken as the enzyme molecules gain even more kinetic energy.

**Citation:**

*Enzymes* - *rsb.org.uk* (no date). Available at: [https://www.rsb.org.uk/images/07\\_Enzymes.pdf](https://www.rsb.org.uk/images/07_Enzymes.pdf) (Accessed: March 7, 2023).

#### 4) Manipulating the variables:

##### What is your independent variable?

- What are the units?
- How will it be changed stating the instruments that you will be using
- Will you be doing a control experiment?
- Why did you choose this range?

##### Discuss your dependent variable [ the method of measurements + units+ time frame]

- Independent variable: temperature (25, 37,70-degree Celsius). This range was chosen to measure the effect of temperature on the enzyme's activity since 25 is considered to be the room temperature, 37 is the optimum temperature for the enzyme, and 70 is a very high temperature that will result in denaturation of the enzyme.
- Dependent variable: volume of gas (cm<sup>3</sup> ) by counting the number of bubbles produced as time passes using a measuring tube.

Controlled Variable	How will you keep this controlled? <b>Stating the values and the equipment that you will be using</b>	How could it affect your results if not controlled?
Time	Using a stopwatch, specify 1 minutes for the experiment before taking the final results	Offering very little time for the enzyme to work will not be effective, on the other hand too much time will result in the enzyme to denature and stop working therefore specifying the time for which the enzyme works at for all trials and temperatures will give accurate results
Amount of catalyst used	Measuring and using the exact same amount of catalyst for all trials. This will be done by	Changing the amount of catalyst will give us inaccurate results since increasing the amount/concentration of

	keeping it constant for 5%mol for all trials on all temperatures	catalyst will increase the rate of the reaction
Type of catalyst	Using the same type of the catalase for all trials, thus using the enzyme for yeast sugar for all trials on all temperatures	Using different catalyst types, It will give us inaccurate results since some catalysts are more effective than others

Temperature of water	Keeping a constant temperature of water in the water bath	To make sure the enzyme is working at constant and same environmental surroundings
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### 5) Materials and Method:

State your materials [ number needed + units] (Be descriptive, example: 10cm<sup>3</sup> graduated cylinder) include the uncertainties for each piece of apparatus

#### **Method: What are the steps of the investigation?**

- 1-measure enzyme to be at the same size and weight
- 2- measure 5cm of hydrogen peroxide for 3 samples
- 3-label each tube for (25c,70c,37c)
- 4- put them into water bath for different temperatures
- 5- set up inverted measuring cylinder
- 6- connect them via a tube into the underwater cylinder
- 7-after one minute count the number of bubbles produced
- 8-repeat them for all different trials

**Materials:**

- 1 plate
- 1 conical flask (500 ml)
- 1 water bath (25c,70c,37c)
- 1 rubber tube
- 1 stopwatch

\*These are the materials for only 1 trial, multiply by 3 to get what's needed for 1 temperature value. \*

**6) Safety, Ethical and Environmental issues**

- Use goggles while doing the experiment
- Handle hydrogen peroxide carefully by using gloves
- Take care while handling the glass

**Environmental:**

Disposing hydrogen peroxide carefully down the sink and be careful of splashing it as it is corrosive

**7) Results**

Add a table for qualitative results e.g. Variation within the organism/biological material being are dealt with; Color, texture, shape, size, heat changes; Anything you notice that might affect results.

**Raw Data**

- Construct a table to add your raw data , add a fully detailed title to your table .
- Label your table (table 1, table 2...)
- Add suitable headings with units and uncertainties to your table.
- Unify your decimal points

Temperature (c )	Trial 1 (volume of gas collected) (cm <sup>3</sup> )	Trial 2 (volume of gas collected) (cm <sup>3</sup> )	Trial 3 (volume of gas collected ) (cm <sup>3</sup> )
25	20	21	20
37	63	61	65

70	05	03	00
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### Processed data

- Justify the reason for data processing
- Add screenshots from excel to provide evidence for your work, or provide a sample calculation
- Construct a table to add your results
- Add a title for your table and label it
- Unify your decimal points

Sample calculation:

This table shows the average volumes of the 3 trials in  $\text{cm}^3$  for each temperature (Celsius)

Temperature (Celsius)	Trial 1 ( volume $\text{cm}^3$ )	Trial 2 ( volume $\text{cm}^3$ )	Trial 3 ( volume $\text{cm}^3$ )
25.00	0.30	0.35	0.33
37.00	1.05	1.01	1.08
70.00	0.08	0.05	0.00

**Commented [M1]:** 1.You have to number your tables  
2. A table showing the rate of reaction is missing

