DATA TASK COURSEWORK - ENZYME AND TEMPERATURE

As a class we collected the results of the three experiments. After that I calculated the average of
the experiments. Then I plotted four (three experiments and one average) lines onto a graph with x-
axis, being temperature and the y-axis being the volume of gas collected.

<table>
<thead>
<tr>
<th>TEMP. (°C)</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
<th>Experiment 3</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
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<td>8</td>
<td>7</td>
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<td>60</td>
<td>12</td>
<td>11</td>
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</tbody>
</table>

**Analysis**

The table above shows the results collected in the experiment, I used these results to create a line
graph. They indicate that as the temperature increases, the amount of gas produced also increases.
At 40°C-50°C, the volume of gas produced peaks therefore the volume of gas produced starts to
decrease. This has happened because the enzyme (yeast) has passed its optimum temperature.
Optimum temperature is the temperature at which an enzyme produces the highest reaction rate.
After the optimum temperature has passed the enzyme stops working effectively as the shape of the
active site on the enzyme has changed therefore the substrate cannot fit as easily and the reaction
rate will decrease. This is called the denaturing of the enzyme.

In all three experiments, there is only one anomaly in experiment three. It is shown in the graph; the
volume of gas collected at 40°C on experiment three is higher than the rest of the results and is
much higher than the average result. This anomaly could be because different people were
recording so they could have made a mistake on the recording. Also the amount of enzyme added
could have altered slightly which means the reaction would be faster. And if the temperature was
changed the results would have varied.

**Reliability and Validity (Evaluation)**

The experiments carried out were very reliable as they were repeated three times. Also the volume
of gas produced, throughout the three experiments are very similar. In addition, the average result
of gas produced was very similar to the other three experiments; therefore the results collected
were accurate.

On the other hand the experiments were carried out by different people; this could mean the results
might have varied. The people collecting the data, timing the experiment and reading the amount of
gas produced was changed continuously. However, the results are very similar to one another, making them accurate.

To ensure more accurate results we could have used an electronic bath instead of an analogue bath to carry out the experiment in. This would have allowed the water temperature to remain constant so if there were any changes in temperature, it would have been easily noticed. An electronic bath would have been more accurate because an analogue bath requires someone to check the temperature constantly with a thermometer; this could have been recorded incorrectly.

Conclusion

In all three experiments, as the temperature increased so did the amount of gas produced until the optimum temperature (40°C). Optimum temperature is the temperature the enzyme works best and produces the fastest reaction at. At this point there are a lot of successful collisions between the hydrogen peroxide particles, resulting in more kinetic energy which means the reaction is faster, producing more gas. However after the optimum temperature passes the enzyme (yeast) denatures and slows down the reaction. Denaturing is when the active site of the enzyme changes therefore the substrate cannot fit properly this is when the key (substrate) cannot fit into the lock (enzyme).

The enzyme, which is used in this experiment, is sensitive to the temperature of hydrogen peroxide. The concentration and pH of the substrate also affects the sensitivity of the enzyme. The higher the temperature and concentration of hydrogen peroxide the more sensitive the enzyme.

http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway/living/dnaenzymesrev4.shtml

Further work- How does pH effect enzyme action?

In order to see the effects of pH on enzyme action, you could substitute the change in temperature with the change in pH level. I could use pH 4- 8 because pH 4 is an example of an acid, pH 7 because it is neutral and pH 8 because it is alkaline. Also I would use 25cm³ of hydrogen peroxide and 2g of enzyme. To ensure the experiment is reliable and accurate, the same equipment and enzyme should be used and it should be repeated, at least 3 times. The amount of hydrogen peroxide and enzyme will stay constant. Looking at the results an average should be worked out and then the results should be plotted on a graph, with an x-axis marked as pH levels and the y-axis marked as enzyme activity.
Changes in pH may not only affect the shape of an enzyme but it may also change the shape or charge properties of the substrate so that either the substrate cannot bind to the active site or it cannot catalyze. Enzymes have a pH optimum.

You can achieve different pH levels by using a buffer solution which resists changes in pH when small quantities of an acid or an alkali are added to it.

My prediction is the enzymes would work effectively but soon would reach an optimum pH, then it will denature. The optimum pH is pH 7 after this it will be too alkaline or acidic for the enzyme to work at. Therefore the enzyme activity will decrease and soon stop. This shows that enzymes have an optimum pH they work best at, where they produce the fastest reaction but after the optimum pH the enzyme denatures and stops working.

Appendix