Aim and Hypothesis

The investigation that we have chosen to do is how the effect of temperature affects the rate of reaction of hydrogen peroxide to water and oxygen using the enzyme catalase.

I predict that the higher the temperature the faster the rate of reaction will be and the more oxygen there will be given off. I've based this prediction on kinetic theory (every 10 degree rise in temperature the rate of reaction doubles.) This is because the substrate will lock on twice as fast, as it is travelling twice as fast.

To back up this prediction a pre experiment was carried out, one result was obtained, using this result here is a table of predicted values:

Temp of $2H_2O$ °C	Amount of Oxygen produced CM^3
7	3.5
17	7
27	14
37	28
47	56
57	112
67	0 - Denatured

Red = initial experiment average.

- Note: although most enzymes denature above the bodies natural temperature (35 - 37 degrees) catalase denatures at around 60 degrees.
- When the enzyme is denatured the active site is destroyed so it cannot lock onto the substrate)

Method: For the pre experiment, we measured the oxygen produced not water because it is a gas and therefore easier to collect. We decided on a time of 2 minutes 30 seconds, much longer than this would have taken up too much time. ASK MR LOVE ABOUT THIS BIT

To work out the rate of reaction for the predicted results this formula was used:

$$\text{Rate of reaction (cm oxygen/sec)} = \frac{\text{Volume of Oxygen produced}}{\text{Time in seconds}}$$

Temp. of $2H_2O$ and catalase °C	Time in seconds	Volume of Oxygen Produced CM^3	Rate of Reaction (cm^3 oxygen/secs)	Rounded To 2 decimal places
7	150	3.5	0.0233333	0.02
17	150	7	0.0466666	0.05
27	150	14	0.0933333	0.09
37	150	28	0.1866666	0.19
47	150	56	0.3733333	0.37
57	150	112	0.7466666	0.75
67	150	0 -denatured	0- denatured	0

Attached are the 2 tables displayed graphically.

Using my pre experiment starting point I will now go on to prove or disprove my hypothesis.

Methodology

The Experiment will be repeated at various temperatures to get a wide range of results. To record the volume of oxygen being produced, the amount of bubbles being given off could be recorded. However this would be a very inaccurate method, as far too many bubbles would be given off to be able to count, there would also be a wide margin for human error.

A different method could be to measure the foam produced by the bubbles in the test tube, but this also wouldn't give precise results, as the bubbles near the top of the foam would burst, giving an inaccurate measurement.

The chosen method was to attach a stopper over the test tube containing the potatoe and $2H_2O$. A measuring cylinder full of water will then be submerged into a tub of water, the pressure of water will mean the water in the cylinder will stay in there. Rubber tubing is used to connect the stopper and the cylinder. Any oxygen produced will travel down the tube, and because it is less dense than water it will push the water out of the, measuring cylinder. This is the most accurate method of obtaining the volume of oxygen produced, as it can then be easily read, by the markings along the side of the measuring cylinder.

Equipment

- Test tube
- Measuring cylinder (- not a test tube because they don't have any markings along the side, to read off from.)
- Stopper
- Tubing
- Tub

Diagram

Things that could be variables:

- Amount of catalase
- Cut surface area of potatoe
- Volume of peroxide
- Concentration of peroxide
- Type of potatoe
- Temperature → Chosen Variable
- Where the tube of Potatoe is taken from
- Different light intensity

Things kept the same to ensure a fair test

- Surface area of Potatoe 230 cm^2 (rounded to 3 significant figures)
- Volume of Peroxide 6 ml^3

- Time experiment was left to run 150 Seconds

The experiment had to be running for a reasonable amount of time to get good results, but there was a time limit, of getting the experiment finished within the lesson so 150 seconds was chosen
We couldn't use vast amount of peroxide because we only had regular test tubes, so 6 ml^3 was used.
The same applies for the surface area of potatoes; it had to be to scale with the volume of peroxide, so 230 cm^2 was used.

At each temperature the experiment was repeated 3 times to get an average, this gave a more accurate result.