

Science Investigation

Catalysts

I am investigating how the amount of Hydrogen Peroxide will affect the speed in which the Oxygen is separated from the water in Hydrogen Peroxide and the total oxygen collected.

Planning:

Task:

My task is to investigate what effects the action of Catalase, from Potato, have when adding hydrogen peroxide (H_2O_2) and having one variable each time.

Planning:

I have chosen my variable to be the amount of hydrogen peroxide (H_2O_2). I am also doing 5 different amounts of hydrogen peroxide (H_2O_2) increasing by $5cm^3$ each time so that I have a wide range of results. I am going to repeat each different temperature 3 times so that my results are more reliable. I am then going to work out an average for the result of each different hydrogen peroxide (H_2O_2). I am going to use a gas collecting tube to collect the amount of gas given off by the hydrogen peroxide (H_2O_2) when the Catalase is put into it. You then time it until the oxygen has stopped being given off (bubbles stop).

Equipment:

Safety Spectacles

15 conical flasks labelled 1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B and 5C.

Ice cream tub $\frac{1}{2}$ full of water

Gas Collecting Tube

Tube and bung

2 Clamps

Stand

Hydrogen Peroxide (H_2O_2)

Burette

Thermometer

Cork borer

Stop Clock

Method:

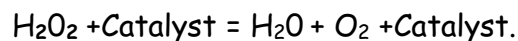
1. Cut 15 potato chips using the same cork borer every time and cutting it to 4cm long.
2. Get your ice cream tub $\frac{1}{2}$ full of water and insert the gas collecting tube into it.
3. Full a Gas collecting tube full of water and put your finger over it while you insert it upside down into the $\frac{1}{2}$ full tub of water.
4. Clamp it with the clamp and stand.
5. Put the tube into the test tube full of water.
6. Put a chip into a conical flask labelled 1A and fill it with 5 cm^3 of hydrogen peroxide (H_2O_2) using the burette.
7. Connect the boiling tube with hydrogen peroxide (H_2O_2) into the tube by the bung and start the stop clock.
8. check how much oxygen has collected every 15 seconds and record in a table.
9. When the bubbles stop, stop the clock stop.
10. Record the final time in which the oxygen has all been collected.
11. Repeat with the same amount of Hydrogen peroxide (H_2O_2) 2 times.
12. Repeat the whole experiment with 5 different amounts of hydrogen peroxide (H_2O_2).

Prediction:

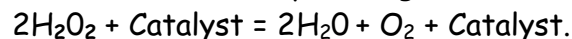
I predict that the more hydrogen peroxide (H_2O_2) the more gas will have been collected. I predict this because there is more oxygen to be given off, as there is more oxygen in the hydrogen peroxide (H_2O_2).

This is shown by the formula.

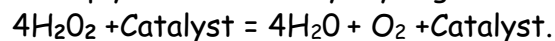
The formula is:



If you double the formula you will get:



If you multiply the formula by 4 you get:



I also predict that the more hydrogen peroxide (H_2O_2) the longer it will take for the reaction to happen as there is more oxygen to be given off with the same amount of Catalase so therefore the process is not being sped up at all or slowed down but as you are changing more it is taking longer.

This is proved here when it says:

"The amount of Catalase speeds or slows up a reaction, if there is more Catalase on the repeats than the reaction will happen quicker, if there is the same amount of Catalase on the repeats than the reaction will happen at the same speed and if there is less Catalase on the repeats than the reaction will happen slower"

Fair Test:

I'm going to make it a fair test by only changing the amount of Hydrogen peroxide (H_2O_2). This is my Variable. I am changing this because I am testing the time in which it takes to collect the oxygen and the speed in which it collects the oxygen, checking that it is the same all the way through as there is the same amount of Catalyst so it should not speed up nor slow down.

I'm going to repeat each amount of hydrogen peroxide 3 times so that my results are more accurate making it fairer.

I'm going to start and stop the stop clock at the same time so that it's a fair test.

I am going to check my results every 15 seconds so that I can see whether there is a problem, as if there was my results wouldn't be moving at similar rates as the catalyst is the same so that it should be moving at the same speed because it's the catalyst that decides the speed in which the oxygen would separate from the water in hydrogen peroxide (H_2O_2).

I'm going to make it a fair test by keeping the same amount of catalyst by using a cork borer.

I'm going to keep it at the same temperature (room temperature) so that the results don't change because of it.

I'm going to make sure that there are no bubbles in the gas collecting tube so that when I read off the measurements it is very accurate. I'm going to do this by when it's fill with water I'm going to put my finger over it so that no water will come out as I turn it upside down.

Preliminary Results:

I did the highest and smallest results to check that my method worked.

Time	5	5	25	25
0.15	1.5	0.3	0.0	1.6
0.30	2.1	0.3	0.0	2.2
0.45	2.1	0.3	0.0	2.5
1.00	2.1		0.0	2.8
1.15			0.0	3.2
1.30			0.0	3.9
1.45			0.0	4.2

2.00			0.0	4.7
2.15			0.0	5.1
2.30			0.5	5.1
2.45			0.5	5.7
3.00			1.0	6.0
3.15			1.0	6.3
3.30			1.3	6.5
3.45			2.0	6.9
4.00			2.0	7.3
4.15			2.0	7.8
4.30			2.5	8.0
4.45			2.5	8.0
4.00			2.5	8.5
4.15			2.5	8.5
4.30			2.5	9.0
4.45			2.5	9.0
5.00			2.5	9.5
5.15			2.5	9.5
5.30			2.5	9.5
5.45			2.5	10.0
6.00			2.5	10.0
6.15			2.5	10.0
6.30			2.5	10.5
6.45			2.5	10.9
7.00			2.5	11.0
7.15			2.5	11.1
7.30			2.5	11.4
7.45			2.5	11.4
8.00			2.5	11.4
8.15			2.5	11.7
8.30			3.0	11.9
8.45			3.0	11.9
9.00			3.0	11.9
9.15			3.0	12.4
9.30			3.0	12.4
9.45			3.0	12.4
10.00			3.5	12.9
10.15			3.5	12.9
10.30			3.5	12.9
10.45			3.5	
11.00			3.8	

11.15			3.8	
11.30			3.8	
11.45			4.3	
12.00			4.3	
12.15			5.0	
12.30			5.0	
12.45			5.0	
13.00			5.0	
13.15			5.0	
13.30			6.3	
13.45			6.3	
14.00			6.3	

Changes I made to correct my results:

The 5ml results were similar although they weren't very high this means that the results weren't very accurate this is because they were old Potatoes.

The second 25ml result was a better potato than the first 25ml's potato. If I keep the same potato the results will more similar and if I make it a newer potato the results will be more accurate.

I realised that for each repeat I had to use the same potato otherwise the results were better or worse depending on how new or old the potato was. If the potato was newer than the results were better and if the potato was older the results were worse. I think this is to do with how quickly the catalyst is working.

Once I've made sure the potato is the same I'm going to wait only 3 results the same until I stop the stop clock unless I can see any bubbles. This will save my time and will still be accurate.

Obtaining:

I collected my 5 ml results using the same potato

Results - 5ml:

Time	5	5	5	Average
0.15	1.4	1.0	1.2	
0.30	2.6	2.1	1.9	
0.45	3.4	2.7	2.4	
1.00	4.0	3.9	2.9	
1.15	4.6	4.4	3.6	
1.30	5.1	4.9	3.8	
1.45	5.7	5.4	4.1	

2.00	5.9	5.7	4.6	
2.15	6.6	6.2	4.8	
2.30	7.0	6.8	5.0	
2.45	7.3	7.2	5.2	
3.00	8.0	7.4	5.3	
3.15	8.0	7.9	5.6	
3.30	8.7	8.0	5.9	
3.45	8.7	8.2	6.0	
4.00	8.7	8.4	6.3	
4.15	8.7	8.6	6.9	
4.30	8.7	8.8	7.2	
4.45	8.7	9.2	7.6	
5.00	9.0	9.2	8.4	
5.15	9.0	9.2	8.4	
5.30	9.0		8.4	
		Average of final results:		

When there was 3 or more I could see the bubbles still left so I left it as I said I would, as I knew that it couldn't have finished.

Results - 10ml:

Time	10	10	10	Average
0.15	2.9	1.2	1.0	
0.30	3.0	2.0	1.0	
0.45	3.0	2.5	1.0	
1.00	3.0	3.0	1.3	
1.15	3.2	3.2	2.0	
1.30	3.4	4.5	3.2	
1.45	3.6	5.1	4.2	
2.00	3.9	6.7	4.8	
2.15	4.2	6.7	5.9	
2.30	5.2	6.7	6.3	
2.45	5.4	8.0	7.0	
3.00	5.7	8.5	7.8	
3.15	6.0	8.8	8.4	
3.30	6.3	9.6	9.2	
3.45	6.6	10.1	9.2	
4.00	6.7	10.4	9.6	
4.15	6.9	11.0	10.5	
4.30	7.1	11.2	11.2	

4.45	7.3	11.8	11.4	
5.00	7.6	12.3	12.3	
5.15	7.8	12.9	12.3	
5.30	8.0	13.1	12.3	
5.45	8.3	14.0		
6.00	8.4	14.3		
6.15	8.6	14.3		
6.30	8.7	14.3		
6.45	8.9			
7.00	9.1			
7.15	9.2			
7.30	9.4			
7.45	9.5			
8.00	9.7			
8.15	9.9			
8.30	9.9			
8.45	10.5			
9.00	10.9			
9.15	11.2			
9.30	11.5			
9.45	11.5			
10.00	11.8			
10.15	12.1			
10.30	12.5			
10.45	12.5			
11.00	12.6			
11.15	12.8			
11.30	13.1			
11.45	13.1			
12.00	13.1			
12.15	13.5			
12.30	13.9			
12.45	13.9			
13.00	13.9			
13.15	14.4			
13.30	14.5			
13.45	14.5			
14.00	14.5			
			Average of final results:	13.70

When there was 3 or more I could see the bubbles still left so I left it as I said I would, as I knew that it couldn't have finished.

Results - 15ml:

Time	15	15	15	Average
0.15	4.9	5.2	5	
0.30	5.0	6.0	5.4	
0.45	6.0	6.0	5.6	
1.00	7.0	6.2	6.6	
1.15	8.0	7.1	7.5	
1.30	9.2	7.1	8.2	
1.45	10.0	7.3	9.4	
2.00	10.7	7.8	10.5	
2.15	11.7	8.0	11.2	
2.30	12.3	8.5	11.7	
2.45	13.0	9.1	12.4	
3.00	13.8	9.2	13.1	
3.15	14.2	9.7	13.9	
3.30	15.0	10.2	14.6	
3.45	15.5	10.8	15.0	
4.00	16.0	11.1	15.5	
4.15	16.6	12.4	16.1	
4.30	16.9	13.4	16.4	
4.45	17.5	13.6	16.8	
5.00	17.9	14.2	17.1	
5.15	18.9	14.7	17.1	
5.30	19.4	15.3	17.7	
5.45	20.0	15.8	18.0	
6.00	20.3	16.0	18.0	
6.15	20.5	16.5	18.0	
6.30	20.7	17.1	18.5	
6.45	21.1	17.1	18.8	
7.00	21.1	17.1	18.8	
7.15	21.1	17.1	18.8	
7.30	21.6	17.3	18.8	
7.45	21.6	17.5	19.6	
8.00	21.8	17.6	19.6	
8.15	22.2	17.7	19.6	
8.30	22.5	17.7	20	
8.45	23.0	17.7	20.2	

9.00	23.0		20.5	
9.15	24.0		20.7	
9.30	24.5		21.0	
9.45	24.5		21.0	
10.00	24.5		21.0	
		Average of final results:		21.07

When there was 3 or more I could see the bubbles still left so I left it as I said I would, as I knew that it couldn't have finished.

Results - 20ml:

Time	20	20	20	Average
0.15	2.4	1.4	1.4	
0.30	2.9	2.0	2.1	
0.45	4.0	2.6	2.6	
1.00	4.5	3.0	3.0	
1.15	6.0	3.1	3.1	
1.30	6.7	5.0	4.4	
1.45	7.2	5.9	5.3	
2.00	8.2	7.0	5.9	
2.15	8.5	7.7	6.6	
2.30	9.0	8.4	7.5	
2.45	9.6	8.6	8.1	
3.00	10.0	9.1	9.0	
3.15	10.5	9.7	9.3	
3.30	10.9	1.4	9.8	
3.45	11.5	10.9	10.2	
4.00	11.9	11.2	10.6	
4.15	12.4	11.6	11.1	
4.30	13.0	11.6	11.6	
4.45	13.5	12.0	12.1	
5.00	13.6	12.1	12.3	
5.15	13.9	12.5	12.9	
5.30	14.2	12.5	13.0	
5.45	14.5	12.8	13.5	
6.00	14.7	13.1	13.5	
6.15	15.0	13.3	13.7	
6.30	15.3	14.0	14.0	
6.45	15.5	14.5	14.5	
7.00	15.5	14.9	15.0	

7.15	15.6	14.9	15.3	
7.30	15.8	14.9	15.5	
7.45	15.9	15.0	15.5	
8.00	16.1	15.3	16.1	
8.15	16.2	15.5	16.1	
8.30	16.5	16.0	16.3	
8.45	16.5	16.0	16.3	
9.00	16.8	16.1	16.8	
9.15	17.0	16.6	17.2	
9.30	17.2	16.6	17.2	
9.45	17.3	17.0	17.3	
10.00	17.4	17.5	17.3	
10.15	17.6	17.7	17.3	
10.30	17.7	17.7	17.4	
10.45	17.9	17.7	17.5	
11.00	17.9	17.9	17.5	
11.15	18.5	18.0	18.2	
11.30	18.8	18.0	18.2	
11.45	18.9	18.4	18.2	
12.00	19.1	18.7	18.5	
12.15	19.2	18.9	18.8	
12.30	19.5	19.0	19.0	
12.45	19.6	19.4	19.2	
13.00	19.9	19.4	19.2	
13.15	20.1	19.6	19.2	
13.30	20.2	19.9		
13.45	20.2	20.0		
14.00	20.2	20.1		
14.15		20.4		
14.30		20.5		
14.45		20.6		
15.00		21.3		
15.15		21.3		
15.30		21.3		
		Average of final results:		20.23

When there was 3 or more I could see the bubbles still left so I left it as I said I would, as I knew that it couldn't have finished.

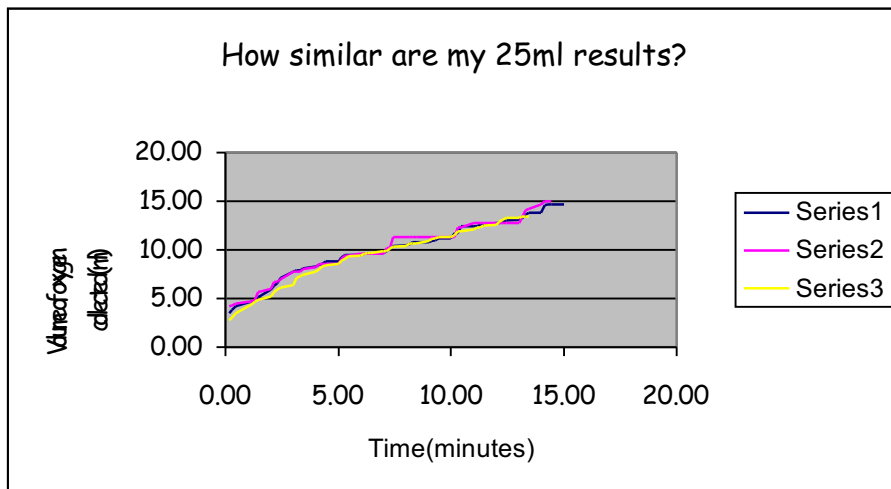
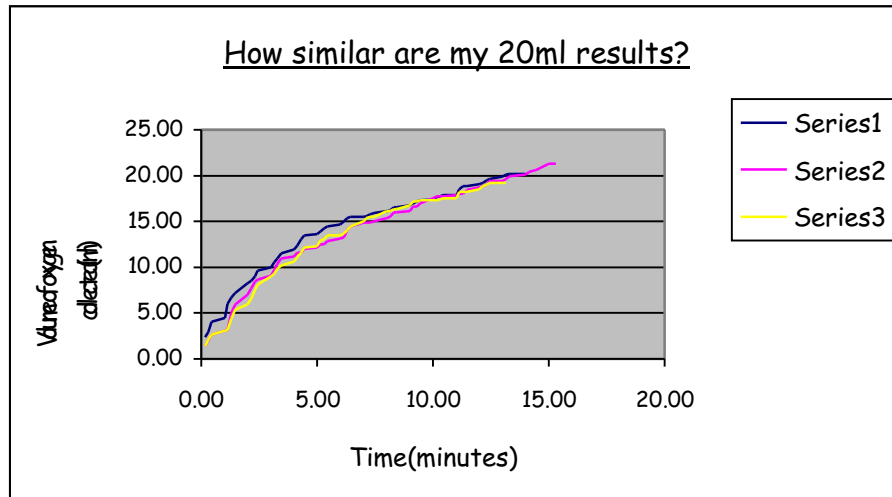
Results - 25ml:

Time	25	25	25	Average
0.15	3.5	4.2	2.8	3.50
0.30	3.8	4.3	3.0	3.70
0.45	4.2	4.5	3.5	4.07
1.00	4.6	4.7	4.2	4.50
1.15	4.7	4.7	4.4	4.60
1.30	4.8	4.9	4.7	4.80
1.45	5.1	5.7	4.9	5.23
2.00	5.9	6.0	5.2	5.70
2.15	6.3	6.7	5.7	6.23
2.30	6.6	6.7	5.9	6.40
2.45	7.1	7.0	6.1	6.73
3.00	7.8	7.8	6.4	7.33
3.15	7.9	7.8	7.1	7.60
3.30	7.9	7.8	7.3	7.67
3.45	8.1	8.0	7.5	7.87
4.00	8.3	8.2	7.8	8.10
4.15	8.5	8.6	8.0	8.37
4.30	8.6	8.6	8.3	8.50
4.45	8.8	8.6	8.4	8.60
5.00	8.8	8.6	8.6	8.67
5.15	9.2	9.1	8.9	9.07
5.30	9.5	9.4	9.1	9.33
5.45	9.5	9.4	9.3	9.40
6.00	9.5	9.6	9.4	9.50
6.15	9.6	9.6	9.6	9.60
6.30	9.6	9.6	9.7	9.63
6.45	9.6	9.6	9.7	9.63
7.00	9.7	9.6	9.9	9.73
7.15	9.9	10.2	9.9	10.00
7.30	10.1	10.2	10.1	10.13
7.45	10.4	11.3	10.3	10.67
8.00	10.5	11.3	10.4	10.73
8.15	10.6	11.3	10.7	10.87
8.30	10.8	11.3	10.7	10.93
8.45	10.8	11.3	10.7	10.93
9.00	10.8	11.3	10.9	11.00
9.15	10.9	11.3	11.1	11.10
9.30	11.0	11.3	11.2	11.17
9.45	11.2	11.3	11.3	11.27
10.00	11.2	11.3	11.3	11.27

10.15	11.7	11.3	11.5	11.50
10.30	11.7	12.3	11.9	11.97
10.45	12.4	12.3	11.9	12.20
11.00	12.4	12.8	12.1	12.43
11.15	12.4	12.8	12.3	12.50
11.30	12.6	12.8	12.3	12.57
11.45	12.6	12.8	12.5	12.63
12.00	12.8	12.8	12.6	12.73
12.15	12.8	12.8	12.9	12.83
12.30	12.9	12.8	13.1	12.93
12.45	13.0	12.8	13.3	13.03
13.00	13.1	12.8	13.3	13.07
13.15	13.2	13.3	13.4	13.30
13.30	13.6	14.1	13.4	13.70
13.45	13.8	14.2	13.4	13.80
14.00	13.8	14.7		9.50
14.15	14.6	15.0		9.87
14.30	14.7	15.0		9.90
14.45	14.7	15.0		9.90
15.00	14.7			4.90
		Average of final results:		14.90

When there was 3 or more I could see the bubbles still left so I left it as I said I would, as I knew that it couldn't have finished.

Analysis:



Evaluation:

I found out that I needed to use the same potatoes for the repeats cutting it fresh for each experiment and the same freshness of potato (same distance from use-by date) and type of potato for them all.