In this investigation I am going to examine if the concentration of hydrogen peroxide affects the rate at which it is broken down by enzymes in the liver known as catylase.

I think that the more hydrogen peroxide used (the higher the concentration), the more oxygen will be produced. I think this because I have researched enzymes and catalysts and have found out the following information on chemical reactions, enzymes, catalysts and concentration of acid :

A chemical reaction is the process in which chemical substances are converted into other substances. A reactant is a chemical that can be converted into another substance through a chemical reaction.

A catalyst is a substance that speeds up the rate of a chemical reaction without being used up itself. Before a reactant can turn into a product it needs the energy to start off the reaction. The energy needed to start a reaction is called activation energy. A catalyst lowers the activation energy, making it easier for particles to react. Using a catalyst a lot more particles have enough energy to react.

Enzymes are biological catalysts. They are large molecules, each with their own special shape. Reactants fit into the enzymes active sight, and then broken down in to new products. In this experiment the enzyme is catylase in the liver, the reactant is hydrogen peroxide and the new products are oxygen and water.

Enzyme in Liver

Hydrogen Peroxide → Water + Oxygen

The concentration of hydrogen peroxide will affect the speed at which solutions react. More concentrated solutions will react more quickly. The reason for this is that hydrogen peroxide particles move randomly through water. They will only react with the liver if they collide with it. As the concentration of hydrogen peroxide is increased there will be more hydrogen peroxide particles in the same volume of solution. This will mean there will be a greater chance of the hydrogen peroxide particles colliding with the liver.

A 10% Solution of Hydrogen Peroxide

A 20% Solution of Hydrogen Peroxide

When the hydrogen peroxide solution is doubled there are twice as many hydrogen peroxide particles in the sam volume of water.

For this experiment the following equipment will be needed:

Water Bath
Beehive Shell
Delivery Tube
Conical Flask
Small Piece Of Fresh Liver
Hyrogen Peroxide
2 250ml Measuring Cylinders
2 100ml Measuring Tubes
Stopwatch

Set up the equipment as shown below:

Put 5ml of hydrogen peroxide in one measuring tube. Put 45ml of water in the other measuring tube. Pour both the water and hydrogen peroxide into the conical flask and start the stop watch. Oxygen will be sent down the delivery tube and into the measuring cylinder. If the measuring cylinder becomes filled with oxygen replace it with the other water filled measuring cylinder. After a minute is up remove the delivery tube from the beehive shell so that no more oxygen will enter the measuring clinder. Measure how much oxygen entered the measuring cylinder and record it. Now do the experiment again, but this time use 5ml more of hydrogen peroxide and 5ml less of water. Continue to repeat the experiment, increasing the amount of hydrogen peroxide by 5ml each time and decreasing the amount of water by 5ml, until you have 50ml of hydrogen peroxide and no water. Record your results each time. Now repeat the entire experiment twice more and record your results.

To keep this investigation fair the experiment will need to carried out more than once (in this case 3 times) to gain better average results. The liver will need to be kept at the same temperature, as this could affect the rate at which the catalysts inside it work.
The amount of hydrogen peroxide and water will need to be measured very carefully.
The stopwatch will need to be started when the water and hydrogen peroxide are poured over the liver and stopped after exactly a minute.

To keep this investigation safe plastic gloves will need to be worn to prevent hygrogen peroxide making contact with the skin and to stop any germs on the liver spreading. Safety glasses will also need to be worn to prevent hydrogen peroxide splashing into the eyes. After the experiment your hands will need to be washed incase any hydrogen peroxide did make contact with your skin.

Here are the tables of the results from my three experiments:

% Solution	Amount of Hydrogen Peroxide (ml)	Amount (ml)	Total Amount of Water (ml)	Volume of of Solution	Oxygen Produce in 1 Minute (ml)
10	5		45	50	10
20	10		40	50	60
30	15		35	50	120
40	20		30	50	170
50	25		25	50	320
60	30		20	50	330
70	35		15	50	380
80	40		10	50	400
90	45		5	50	420
100	50		0	50	440

% Solution	Amount of Hydrogen Peroxide (ml)	Amount (ml)	Total Amount of Water (ml)	Volume of of Solution	Oxygen Produce in 1 Minute (ml)
10	5		45	50	5
20	10		40	50	40
30	15		35	50	110
40	20		30	50	140
50	25		25	50	180
60	30		20	50	210
70	35		15	50	250
80	40		10	50	310
90	45		5	50	350
100	50		0	50	380

% Solution	Amount of Hydrogen Peroxide (ml)	Amount (ml)	Total Amount of Water (ml)	Volume of of Solution	Oxygen Produce in 1 Minute (ml)
10	5		45	50	10
20	10		40	50	30
30	15		35	50	90
40	20		30	50	130
50	25		25	50	170
60	30		20	50	220
70	35		15	50	230
80	40		10	50	280
90	45		5	50	320
100	50		0	50	350

I then produced a results table to show my average results :

% Solution	Amount of Hydrogen Peroxide (ml)	Amount of Water (ml)	Total Amount (ml)	Volume of of Solution	Oxygen Produce in 1 Minute (ml)
10	5		45	50	8.33
20	10		40	50	43.33
30	15		35	50	106.66
40	20		30	50	146.66
50	25		25	50	223.33
60	30		20	50	253.33
70	35		15	50	286.66
80	40		10	50	330
90	45		5	50	363.33
100	50		0	50	390

My results show that my prediction was right. The higher the concentration of hydrogen peroxide the more oxygen was produced. The reason why this happened was because enzymes in the liver known as catylase reacted with the hydrogen peroxide and broke it down into oxygen and water. The reason why as the concentration of hydrogen peroxide was increased the more oxygen was produced was because for the hydrogen peroxide particles to react with the liver they had to collide with it. Increasing the amount of hydrogen peroxide meant there would be more hydrogen particles in the same volume of solution. This would increase the chances of the particles colliding with the liver and reacting with it.

A 10% Solution Of Hydrogen Peroxide

A 20% Solution Of Hydrogen Peroxide

When the solution is doubled there is twice as much chance of the hydrogen peroxide particles colliding with the liver.

I did have 2 anomolous results. These could be wrong for number of reasons :
There could have been a change in room temperature, causing enzymes in the liver to work at a different rate.
Too much or not enough hydrogen peroxide or water could have been added.
The stop-watch could have been started to early or to late, or could have been faulty.

I could make my investigation better by :
Doing my experiment more times to obtain better average results.

Keeping the liver at the same temperature throughout the experiment.

To investigate further I could :
Investigate how temperature affects the way enzymes in the liver work.
Investigate how much hydrogen peroxide would be needed to produce a certain amount of oxygen.
Investigate how long it would take for hydrogen peroxide to produce a certain amount of oxygen.
Investigate how the size or surface area of the liver would affect the amount of oxygen produced.