Investigating the rate of Photosynthesis

Aim

To investigate what changes the rate of photosynthesis.

Variables

For the experiment there are two types of variables, them being dependent and independent. The dependant variable is the condition that will be used to experiment with, in this case the light intensity. The independent variables are those that are either kept constant or change.

The possible variables for this experiment are:

- Distance of the lamp
- Power of light (light bulb)
- Length of elodea
- Amount of water
- Size of test tube
- Time spent counting

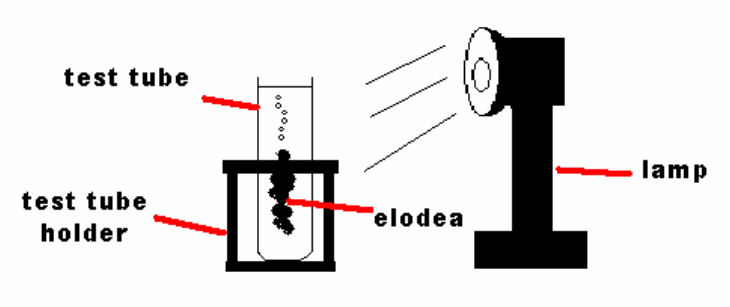
If the power or the amount of light varies, this will affect the results as I know from scientific knowledge that the more light there is the higher the rate of photosynthesis will be. The length of the elodea will have a dramatic effect on the results, as I know from a past experiment that the bigger the elodea the higher the rate of photosynthesis will be therefore it is crucial to keep it constant. The amount of water will mainly depend on the size on the test tube, but it is important to keep them constant, if they were to change it would affect the results. The main factor of keeping the experiment a fair one is to spend the same time on counting the bubbles each time. If they time spent counting was to be different, this wouldn't give an accurate set of results, so it is vital to keep that constant.

The dependent or the input variable for this experiment is the distance of the lamp from the test tube and elodea. Therefore

my experiment will be based on how light intensity affects the rate of photosynthesis.

Apparatus

- Lamp
- Elodea
- Ruler
- Test tube
- Test tube holder
- Stopwatch



Procedure

1) Anchor the pondweed to the bottom of the boiling tube, with the cut end projecting upwards. Three-quarters fill the tube with water.

2) Place the boiling tube x cm from a bench lamp. [measure of the light intensity].

3) Wait two minutes, to get a steady reliable rate.

4) Count the number of bubbles rising from the cut end during the next minute.

5) Record your results in an orderly fashion (table).

6) Repeat steps 2-5 but with the tube at 0 cm., then 5 cm., and finally 25 cm, going up in 5 cm each time, from the light.

When I change the light intensity, I will count the amount of bubbles, and compare the results to see how they affect the rate

of photosynthesis. Light intensity is going to be measured based on the distance the lamp is from the elodea, as the lamp moves further away the light intensity decreases. This is known using the formula, light intensity = $\frac{1}{d^2}$

Preliminary work showed to be of a good use when planning the experiment, as I knew an interval of 5cm between six different distances will give a decent set of results. To enhance the level of accuracy of the results the experiment will be repeated three times.

The safety aspect for this experiment is that I need to be cautious while handling water around the lamp, and that no water should be dropped.

Prediction

I predict that the closer the lamp is to the test tube and elodea, the more bubbles will be produced. Therefore when I increase the light intensity I expect there to be an increase in the amount of bubbles. From scientific knowledge I know that as you increase the light intensity more carbon dioxide and water combine to make sugar and oxygen, which is given off as a gas, so there will be more bubbles per minute at a higher light intensity.

Results

Distance from lamp (cm)	Test Number...			
	1	2	3	average
0	79	71	69	72
5	65	68	69	67
10	59	58	61	59
15	37	37	38	37
20	24	17	23	21
25	11	8	13	11

NB. Averages to nearest whole number.

Analysis and Conclusion

My results showed that the rate of oxygen production increased as the light intensity increased because photosynthesis needs energy from light to combine carbon dioxide and water to make sugar and oxygen. At higher light intensities did not increase dramatically because photosynthesis needs other factors such as carbon dioxide and high temperatures, and these were limiting.

The results from the experiment confirm what I predicted would happen, and the graph that shows the average rate of photosynthesis, shows that as I increased the light intensity the rate of photosynthesis increased at first in direct proportion, but gradually levelled off and did not show a major increase, although there was an increase.

Evaluation

The experiment that was conducted worked well and backed the prediction, although there were not many anomalous results, there were some, which are shown in the table of results, highlighted in red.

These anomalies could be eliminated, if the experiment was to be repeated in a different way. A better way would be to collect oxygen given off in a burette, over a longer time, i.e. about 5 minutes, with more repeats, and measure the total volume of the oxygen. This was the experiment would exclude anomalies as the measure will be more accurate and reliable, than counting bubbles.

Another reason why the results may not have been totally reliable is because when the lamp gave out light it also gave off heat, and this would have also as well as the light intensity increased the rate of photosynthesis. Therefore if the experiment was to be repeated a heat shield should be used, i.e. a tank of water to absorb heat but allow light to pass through.