

An Experiment to Investigate Factors Affecting the Rate of Photosynthesis

In this investigation I will be looking at how the rate of photosynthesis is affected in Canadian pond weed by light intensity. Photosynthesis requires 5 things: Carbon dioxide, water, chlorophyll, light and warmth, these are all called limiting factors. A limiting factor is a factor that determines the rate of a reaction. I will set up the experiment by filling a test tube with water and putting some pond weed in it. I will then turn the test tube upside down and place it in a beaker. I will use a lamp for the light source and to collect the result data I will count the number of bubbles given off by the pond weed per minute.

In this graph the rate of photosynthesis increases proportionally to the light intensity.

To make the experiment a fair test I must ensure that all the key variables are equal apart from the light intensity. The most common biological variables that could effect the experiment are temperature, pH, light intensity, the amount of carbon dioxide present, Light colour, minerals in the water, chemicals in the water, Health of plant, size of plant and the amount of water . I will be investigating the light intensity. The other most important variables that must be controlled are temperature and carbon dioxide. I will make sure that the temperature is of an acceptable temperature and stays at that temperature thorough out the experiment. I will also have to make sure that there is a normal carbon dioxide level and that it is not too high. However there are some variables that I can not control such as the health of the pond weed and any additives in the water such as potassium which might affect the experiment.

A Prediction and Hypothesis of the Experiment

I predict that when the light intensity is increased the rate of photosynthesis will also increase. This is shown on the graph underneath

In this prediction graph as the light intensity decreases so does the number of bubbles given off per minuet.

Observations

During the experiment I will observe bubbles of gas being given off by the pond weed and being collected at the top of the test tube. As the light intensity increases the number of gas bubbles given off per minute will increase. I will measure the amount of gas bubbles given off per minute by use of tally marks. Every time a gas bubble is let off I will put a tally mark on a piece of paper.

Range

In my preliminary work, I found that the best range for my experimental variable was to move the light source between 15cm and 1m away from the pond weed because if I was to move the light source too close to the pond weed it would possibly increase the temperature therefor making it an unfair test. And if I was to move the light source to far away from the pond weed it would not effect the experiment. Therefor if I keep the light source within my distances I should get a good result.

Number

To get more accurate results I will take five readings. This should be enough for me to plot a graph. I will also make sure my results are accurate enough to estimate the average number of bubbles given off per minute.

Apparatus

Beaker to place the boiling tube in (filled half way with water)
Boiling tube to put pond weed in (filled to the brim with water)
Bench lamp for the light source
A piece of pond weed about 10cm long
1 m ruler to use to measure the different distances to place the lamp
Water to put in the boiling tube and beaker.

Method

1. Draw up a result table like this.

A table showing the number of bubbles given off/minute to the amount of light intensity.

2. First cut a small piece of pond weed about 10 cm long and put it into a boiling tube with the cut end facing up.
3. Then fill a large beaker half full of water.
4. From the beaker with use of a 1m ruler mark on the work surface 10, 30,50,75 and 100cm which indicates the different distances to place the lamp. Once you've measured the points do not move the beaker
5. Fill the boiling tube with the pond weed in it up to the brim with water
6. Place your thumb over the end of the boiling tube so no water comes out and submerge it in the beaker half full of water. Take your thumb off and make sure that the boiling tube stands up rite.
7. Then place the lamp on the 10cm mark that you marked onto the work surface earlier. Your apparatus should look like this.

8. Start recording your results in the result table and for every different distance move the lamp back like so. And remember to count every bubble you see per minuet and then move onto the next distance.

Record all the results in the result table and repeat experiment 3 times using the same bit of pondweed throughout the whole experiment

Obtaining evidence

Here are my results.

Tables Showing the Results of 5 Different Experiments with the Distance of Light Source on the Left(cm) and the Amount of Bubbles Given off /Minuet on the Right

Averages

*Column 1= Light intensity

*Column 2= number of bubbles given off / minuet

Analysing Evidence and Drawing Conclusions

A Graph to show my results for an experiment on the effect of light intensity on photosynthesis

Trend/pattern

The plant took some time to get started before it was photosynthesising at its full rate. Its peak in its rate of photosynthesis was at its highest during the second experiment. After the second experiment the rate died down every time a new reading was taken. At 75cm and 100cm all the experiments have the same value apart from the 5th experiment.

If the light intensity increases, the amount of bubbles given off per minuet increases.

Conclusion

If the light intensity increases the number of bubbles given off per minute increases. This is because light intensity is 1 of the 5 limiting factors, which determine photosynthesis. Therefore when a limiting factor is increased so does the rate of photosynthesis.

My graph shows that when the independent variable increases so does the dependant variable. It also has a steep negative gradient where the number of bubbles given off /minuet declines between 10cm and 30 cm.

My prediction at the beginning of the experiment was correct and what I expected to happen did. My results turned out well but they could have been interfered by the other experiments around me. My results are correct because they solve the experiment and make sense.

Evaluating My Evidence

My results were pretty good because they were not just random numbers but numbers, which I could take good readings from, and draw a good quality graph. My first results were more consistent than the other 4 results but the other 4 results had greater values. There also my have been a few sources of error in the experiment, such as the health of my pond weed which might effect its ability to photosynthesis, the heating of the water from the light and the light from other peoples experiment effecting mine. My conclusion is only valid over the range of values investigated i.e. 10cm-100cm and for the particular organisms and materials used in this experiment.

To improve the reliability of the experiment I could do the experiment in a room by myself so my experiment doesn't get effected by others, I could take a wider range of values, use a more accurate way of knowing

the amount of bubbles or amount gas given off and I could investigate with other species of plant.

Some further work I could carry out to provide additional and further evidence for the experiment would be to take more readings from the experiment and draw up a larger graph so it would be easier to make out the results and there would be more of them to make the experiment more accurate.