An Investigation to Determine the Effect of the Amount of Light Available on Rate of Photosynthesis in Pondweed

Aim

To determine to what extent the amount of light available to pondweed affects the rate of photosynthesis.

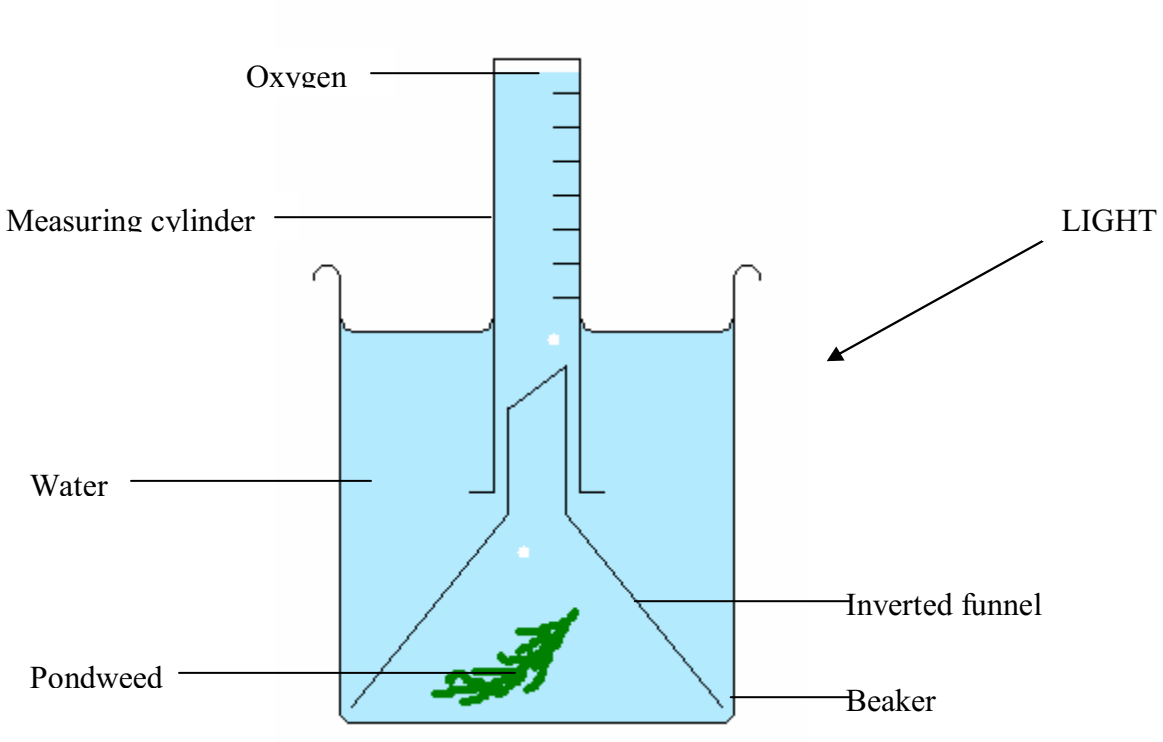
Prediction

I predict that as the amount of light increases the rate of photosynthesis will increase, however, above a certain level of light, other limiting factors such as heat, carbon dioxide and available nutrients will stop photosynthesis occurring any faster, and unless these other factors are made more available, increase in light will make no difference. If light is decreased from a natural level, photosynthesis would slow and eventually stop because the equation for photosynthesis is not complete without any energy from light.

Equipment

Measuring Cylinder
Water
Pondweed
Funnel
Beaker
Lamp

Diagram



Plan

Firstly, a beaker will be taken and filled with water as close to room temperature as possible, to prevent the temperature from changing during the experiment, then a 5cm piece of pondweed will be laid at the bottom of the beaker. An inverted funnel will then be placed over the pondweed inside the beaker, to 'catch' any oxygen that the pondweed produces. A lamp is then set up 50cm away from the beaker, pointing at the pondweed, and turned on to provide a controlled amount of light to the pondweed.

Finally, to measure the amount of oxygen given off a measuring cylinder will be filled with water (at room temperature), then sealed, then inverted and placed so that its top is under the beaker, the seal will then be removed and the measuring cylinder placed over the end of the funnel, so that it will contain any oxygen given off by the pondweed, without having any oxygen in it to start with. If this is impossible, and some air is always present before the start of the experiment, we will measure that amount of air and deduct it from the final result.

We will then repeat this experiment with, if possible, 5 different lamp distances and a control. At 50cm (as shown), 40cm, 30cm, 20cm, 10cm and with no lamp (control). The measuring cylinder will be refilled at the end of each experiment and timing will begin as soon as it is put over the funnel. The pondweed should also not be allowed to move during the experiment or changing of equipment at all, because if it drifts or rotates, a different surface are could be exposed to the light, affecting the result.

Each test should be timed and last for 10 minutes, at the end of the 10 minutes the volume of oxygen is measured using the reading on the measuring cylinder and recorded.

Fair Test

All of the possible variables in the experiment will be kept constant apart from the distance of the beaker from the light which we are testing, in this way test conditions will remain the same throughout the experiment.

Variables

Unfortunately there will be several unavoidable variables in the experiment beyond our control, but they should not make a significant impact on the experiment's results, these include the ambient light within the classroom changing as time goes by, and the room temperature of the classroom may change slightly. Other than those, the following variables are controlled and kept constant, apart from distance of lamp.

Water temperature
Minerals available in the water
Position of beaker (different positions in the room could have a different temperature or light available)
Light available (controlled partially by the distance of the lamp)
Piece of pondweed (the same piece will be used in all experiments.

Method

The method we used to conduct the experiment was exactly the same as the planned experiment, however, we found that during the 50cm test not enough oxygen was given off to make measurement of the oxygen by volume possible. Instead of measuring the oxygen in millilitres, we were forced to count the bubbles given off by the pondweed.

Evaluation

There were several unavoidable flaws in our experiment. Firstly the method of counting bubbles given off was inaccurate, and introduces uncontrollable variables such as the varying size of bubbles. Also the mineral content of the water would decrease as the pondweed consumed the available minerals, introducing another variable, although this would likely have had a negligible effect on the results.

However the results collected were as expected with no anomalies, and other than those mentioned the experiment went without problems.

Results

These were the results gathered from the experiment

Distance of the light from the beaker	Control (No lamp)	50cm	40cm	30cm	20cm	10cm
Number of bubbles given off						

These results are also shown on a separate graph

Analysis / Conclusion

The experiment showed my prediction to be correct, however it did not show my predicted stop of light making any effect on the speed of photosynthesis, this may be because the light was never intense enough to prevent it being a limiting factor during the experiment. The graph shows a steady increase in rate of photosynthesis, according to oxygen given off, as the light is brought closer to the beaker, and therefore a positive correlation between the rate of photosynthesis and the intensity of light absorbed by the plant, and ultimately that light is a limiting factor in photosynthesis. The conclusion can also be drawn that as, during the control, no bubbles were given off and therefore photosynthesis was taking place either very slowly or not at all, it is reasonable to assume then that with no light at all present, photosynthesis could not occur, despite heat and carbon dioxide being available.