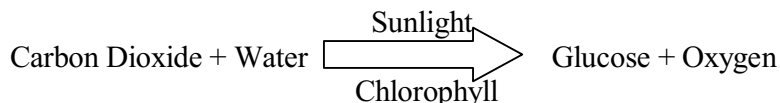


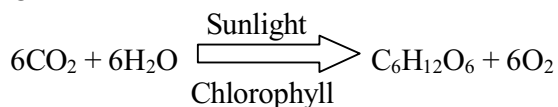
Investigation To Measure How Temperature Affects The Rate Of Photosynthesis In Water Plants

Photosynthesis is the method by which plants make oxygen and food (glucose).

This is the equation for photosynthesis;



OR



Four things that affect the speed of photosynthesis in plants are;

1. Concentration of Carbon Dioxide
2. Light Intensity
3. Temperature
4. Amount of Water

If any one of these factors is not present then photosynthesis will not happen or will happen slower.

Trial Experiment

In order for us to check that we can do the experiment in this way we will conduct a trial experiment.

We will cut a length of pond weed to 10cm and place it in a boiling tube. The end will be cut underwater so that the plant gets no air inside it. We will use a desk lamp to light the plant from 10cm away. The boiling tube will then be put in a beaker of water at 15°C to control the temperature of the boiling tube.

Results

Time (seconds)	Number of bubbles given off
0	0
60	56
120	108

From this we can see that you can use pond weed to measure the rate of photosynthesis, and that the oxygen is given off at a steady rate.

Prediction

I predict that by increasing the temperature of the water that the pond weed is in, you will also increase the rate at which the plant photosynthesises. This is because chlorophyll is

like an enzyme and so at a higher temperature the chlorophyll will have more energy so the reaction will produce glucose and oxygen faster.

But if the temperature goes above a certain point it will go above the optimal temperature at which the chlorophyll works and so the reaction will slow down again. I will have to keep all other variables the same throughout the experiments so that it will be a fair test. The light will therefore be positioned 10cm away from the beaker in all experiments and all other light sources will be blocked off. We will also use a water bath to act as a barrier between the pond weed and the heat from the lamp.

Method

1. Set up the apparatus as show in the diagram below.
2. Put 20 cm³ of water in the test tube.
3. Fill the beaker with 500cm³ of water. Use hot and cold water in different amounts to get the water to 20°C for the first experiment.
4. Add the test tube to the water bath.
5. Get 10 cm of pond weed and remove the upper leaves. Then submerge it in the test tube. Then, making sure that it is underwater cut the very end of the pond weed off with scissors.
6. Make sure the pond weed is bubbling. If it isn't then cut the end off again or use a different piece of pond weed.
7. Turn the light on and give the plant 2 minutes to adjust to the conditions.
8. Count the number of bubbles given off every minute for 3 minutes.
9. Repeat numbers 3 – 8 at 25, 30 and 40°C

Diagram

Results

Temperature	Time	No. of Bubbles per Minute
20	1	113
	2	230
	3	356
25	1	117
	2	249
	3	398
30	1	207
	2	414
	3	626
40	1	242
	2	486
	3	734

Temperature	Rate of Reaction (bubbles per min)
20	118.7
25	132.7
30	208.7
40	244.7

Conclusion

The results show that as you increase the temperature you also increase the rate of photosynthesis and so producing more bubbles. This is because the enzymes, which perform the chemical reactions of photosynthesis, will work faster at a higher temperature. The results support my prediction although the rate of reaction has not begun to slow down. This would probably be because the experiment was not done at a high enough temperature. The graph to show the rate of reaction shows that at 40°C the rate of reaction is increasing slower and would possibly reduce at a higher temperature. This would then support my prediction.

Evaluation

The results are quite accurate and the method used proved to be adequate for collecting the results. This method could have been improved. For one the light source was only coming from one side. This could have been improved by using more lights and lighting it from every side. Another thing that could have been improved is that the levels of carbon dioxide in the test tube were not kept to a uniform level. Adding sodium hydrogen carbonate to the water could have done this. The evidence wasn't really enough to draw a strong conclusion and support or undermine my prediction. To better this experiment and to further support my prediction I could re-do the experiment at a higher set of temperatures so that I could see if the rate of reaction would slow down above a certain point. It could also be done with a different type of plant to see if what has been proved here is true for all plants.