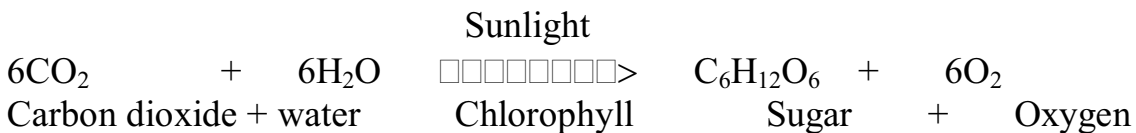


An investigation into how the amount of light affects the rate of photosynthesis

We are going to do an experiment on how the rate of photosynthesis is affected by the light intensity.

The plant that will be photosynthesising is called elodea. It is a pondweed therefore photosynthesises under water. We will now be able to count the oxygen bubbles or develop a method where we can collect the oxygen given off by the pondweed. Photosynthesis is what keeps a plant alive. The energy for photosynthesis to work comes from the sun the air and the ground. A substance called chlorophyll absorbs the sunlight. Chlorophyll is found in chloroplasts and chloroplasts are mostly found in cells in the palisade layer. Also for photosynthesis to be carried out it needs water and carbon dioxide. The carbon dioxide is dissolved into the water and the pondweed will get water and carbon dioxide through diffusion. The light is then used to make sugar out of carbon dioxide and water. The waste product is oxygen. Here is the equation



On our preliminary experiment we tried to measure the volume of oxygen produced but couldn't collect enough oxygen to measure, so instead we used a method where we counted the oxygen bubbles given off by the pondweed. The pondweed was put in a boiling tube and we started with the lamp 5cm away from the boiling tube and moved it back 5cm at a time until we got to 30cm. The boiling tube was filled with water so we could see the bubbles rise to the surface. We counted how many bubbles were produced in 1 minute and repeated this 3 times to get an average. We put 3cm of pondweed in the boiling tube and cut the pondweed at a diagonal angle (to increase the amount of water up take in the xylem) using a scalpel, on a white tile. The pondweed will be put in the boiling tube upside down. This is because the stomata are on the lower surface of the leaves. The stomata are where the oxygen escapes from the leaves. We will add a spatula of sodium hydrogen carbonate (NaH_2CO_3). This will increase the amount of carbon dioxide in the water meaning photosynthesis will be carried out faster. This makes sure we will get a result.

In the final experiment we made a few changes to the preliminary experiment. Instead of starting off with the lamp 5cm away and then moving it 5cm at a time to 30cm away from the pondweed. We changed it to start off with the lamp 2cm and move it back 2cm in till it reached 12cm. This was carried out because when the lamp was at 30cm away from the pondweed it gave off very few bubbles so by moving the lamp closer we felt it would give us better results. Also we had 10cm of pondweed instead of 3cm of pondweed. We did this because we were having trouble getting results and we decided this would increase are chance of getting results. Also instead of adding a spatula of sodium hydrogen carbonate we weighed it and put in 0.1g. We did this because it was a lot fairer as one spatula could vary from another. The boiling tube will be put in a beaker filled with water to keep the temperature constant. We will put a thermometer in the boiling tube to keep the temperature constant. We need to keep the temperature constant because heat affects photosynthesis by speeding up the cellular activity. But if you heat a plant up over 40°C photosynthesis will slow down and the plant will die. Our experiment is to see if the light intensity effects photosynthesis so we need to measure the light intensity to see how much it changed by. We measured the light intensity using a light sensor this went just by the boiling tube. A clamp, attached to a clamp stand, will hold up the light sensor. By doing this will mean I am conducting a fair experiment.

Summary of preliminary and final experiments

| | Preliminary experiment | Final experiment |
|---------------------------|---------------------------------|--|
| Pond weed length(cm) | 3 | 10 |
| Lamp distance | 5 10 15 20 25 30 | 2 4 6 8 10 12 |
| Sodium hydrogen carbonate | Spatula full | 0.1g |
| Pondweed container | Boiling tube | Boiling tube in a beaker full of water |

Prediction

I predict that the closer the light to the pondweed the faster it will photosynthesis. This is because there will be more light meaning more oxygen given off. This is shown by the equation for photosynthesis written in the plan. Also if there was more carbon dioxide it will speed up photosynthesis.

On this experiment there are few lethal dangers. One is the lamp could get hot. Also if you look directly into the lamp it could prove a hazard for your eyes. If the electrical wires get in contact with water it could be fatal. The scalpel could prove to be a danger. To stop all these dangers happening we must, never touch the metal lampshade to avoid getting burnt. Also we will not look directly into the lamp to avoid blindness. Around the electrical equipment we will make shore its dry. Also we are going to have to take care when handling the scalpel.

For my experiment I will use the following apparatus:

A lamp

A boiling tube full of water

10cm of pondweed

0.1g of NaH_2CO_3

A thermometer

A light sensor

A metre ruler

A beaker full of water

A clamp

A clamp stand

A scalpel

A white tile

Diagram

Analysing data

Table of results

Preliminary experiment

Number of bubbles per minute

| | 5cm | 10cm | 15cm | 20cm | 25cm | 30cm |
|----------|-----|------|------|------|------|------|
| Result 1 | 125 | 107 | 100 | 7 | 24 | 12 |
| Result 2 | 120 | 109 | 76 | 63 | 32 | 25 |
| Result 3 | 131 | 120 | 77 | 69 | 28 | 17 |
| Average | 125 | 112 | 84 | 70 | 28 | 18 |

Final experiment

| | 2cm | 4cm | 6cm | 8cm | 10cm | 12cm |
|----------------------|----------|----------|----------|----------|----------|----------|
| Result 1 | 54 | 41 | 40 | 32 | 26 | 23 |
| Result 2 | 58 | 43 | 34 | 28 | 25 | 22 |
| Result 3 | 56 | 44 | 36 | 31 | 25 | 21 |
| Average | 56 | 43 | 37 | 30 | 25 | 22 |
| Light intensity | 16.9 | 14.2 | 9.4 | 4.8 | 3.5 | 2.1 |
| Temp °C | 21/21/21 | 22/22/21 | 20/20/21 | 21/20/21 | 22/23/23 | 23/22/22 |
| Did it keep constant | / | / | / | / | / | / |

Graph

Prelim

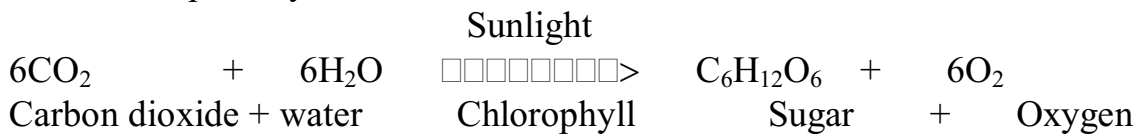
Final

Why straight line or curve?

From looking at my results I can tell that the amount of oxygen given off is affected by the light intensity. The graph shows the amount of bubbles decrease the further away the lamp. As you move the lamp further away the light intensity decrease.

Conclusion

By looking at my graphs and result tables I have found out that my prediction was right. The closer the lamp is to the pondweed the faster it photosynthesis. Also sciences back my result up because if you look at the formula for photosynthesis.



If you increase CO₂ or H₂O or sunlight it will increase the rate of the reaction but this can only work if there's enough of the other to limiting factor. Also if you decrease anything this will slow down the reaction. But H₂O is unlikely to be a limiting factor in are experiment as there is enough water because pondweed is an aquatic plant.