PLANNING

Aim:

To find out how changing light intensity affects the rate of photosynthesis in pondweed.

Prediction:

I think that as I change the light intensity the rate of photosynthesis will increase while the temperature will also increase. I will be able to observe this by counting how many bubbles are produced, this happens because during photosynthesis oxygen is a waste product being produced in the air which we can see as bubbles.

Preliminary work:

I have done some preliminary work in class to predict how I will get my final results. I found out from my preliminary results that as the distance of the lamp is more far away from the pondweed then the average amount of bubbles will decrease and that the temperature will stay constant. I can now see that my prediction for the temperature to increase did not come out true. Now I know what I will be expecting to get out of this experiment I will get a general idea from my preliminary work that I may find trends and patterns that I will get finally in my graphs and how the line of best fit will look like, which then I can compare with my graph that I have done for my final results. My prediction for my final results will be that to see if the bubbles given off are the same in size, in my preliminary work I can clearly see that this prediction wasn't correct. For my final experiment I will keep my distance ranges the same and also keep my timing for 2 minutes the same as I did in my preliminary results. My aim is now to see if my results will change or stay similar even though I have not changed my method.

I recorded my preliminary results in the following table…….

Distance (cm)	No. of bubbles given off in 2 minutes	Temperature (Celsius)

	1st	2nd	3rd	Average	1st	2nd	3rd	Average
15	264	314	298	292	33	33	33	33
20	208	227	228	221	33	33	33	33
25	196	189	191	192	33	33	33	33
30	109	114	119	114	33	33	33	33
35	83	88	87	86	33	33	33	33

Variables/Key factors I control in my experiment:

In my experiment the key factors I will be controlling are:

- Amount of pondweed
- Temperature
- Amount of water
- Sodium hydrogen carbonate

My independent variable will be the one I will constantly change; in this case my independent variable will be the distance of the lamp because I will change it 5 times with a different range each time.The values of the independent variable will be 15cm, 20cm, 25cm, 30cm and 35cm.

My dependent variable will be the one that changes as in result of what I do and the result I obtain; in this case my dependent variable will be the amount of oxygen given off in 2 minutes.

My controlled variables will be all the things that I will manage to keep the same during the experiment to make it a fair test; in this case they will be….

1] Amount of carbon dioxide because there is not much carbon dioxide present, Therefore making carbon dioxide a limiting factor. In my experiment carbon dioxide will be used up so I will need to add sodium hydrogen carbonate in the water to ensure that I have a plenty of carbon dioxide in my experiment.

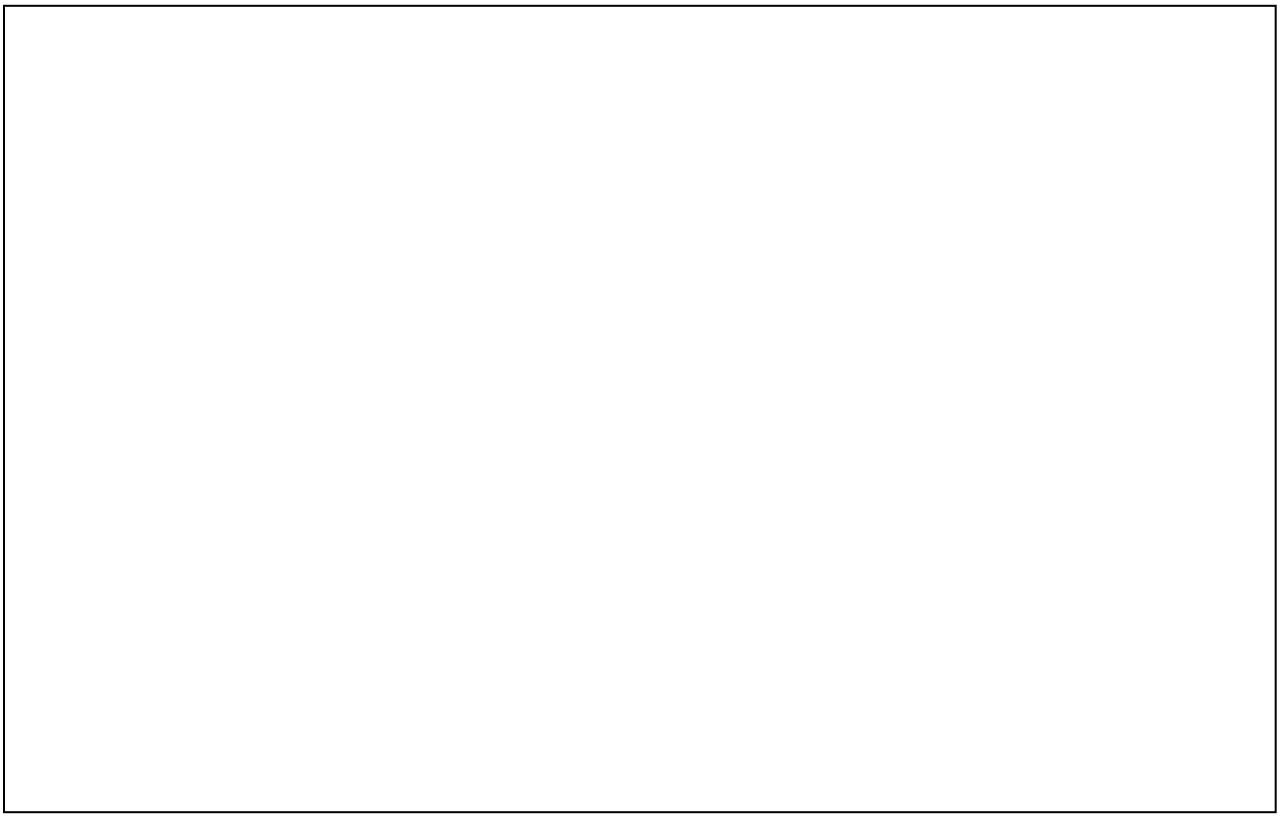
2] Amount of water

3] Temperature (limiting factor)

Apparatus/Equipment used:

The following apparatus/equipment I will use in my equipment are:-

- Boiling tubes
- Lamp
- Spatula
- Stop clock/Watch
- Mass Balance
- Meter ruler
- Funnel
- Water bath
- Thermometer
- Sodium hydrogen carbonate
- Pondweed



Method:

1] Get all equipment named in equipment list ready.

2] Set up equipment as drawn in diagram.

3] Set the distance between the lamp and the pondweed to 15cm.

4] Switch on the lamp and start counting the amount of bubbles for exact 2minutes. Remember to put a thermometer into the water bath to measure the temperature.

5] Stop the cock after 2 minutes and record your result for the amount of bubbles given off and the temperature obtained.

6] Repeat this 2 more times so in total you will have 3 results for this distance.

7] Now you can work out the average from the three results obtained.

8] Repeat this whole method for the distances 20cm, 25cm, 30cm and 35 cm.

9] You should have a table of results showing that you have used 5 variables each stating 3 results for the amount of bubbles given off with the average worked out and 3 results for the temperature with its average also worked out.

Fair Test

- Use clean Equipment at all times when starting a new experiment.
- Use same amount of sodium hydrogen carbonate when added to produce CO_2.
- Make sure Temperature and amount of water being used is kept constant
- Do not change the person who is counting the number of bubbles given off. Always keep that person to do his/her job in each experiment.

Heath and Safety:

To carry out my experiment in a safe way I will definitely have to consider the following:-

- Hair should be tied back
- Not to touch the lamp with your hands
- Not to use electrical equipment with wet hands
- Not to look directly into the lamp

Range:

I have chosen to do 5 different ranges in my experiment which will in this case be 5 dissimilar distances from the pond weed to the lamp.
I have decided to choose: - 15cm
- 20cm
- 25cm
- 30cm
- 35cm

I have chosen these ranges because I can now predict what kind of results I will achieve by using a sequence which goes up in 5cm each time. My prophecy will be that using these ranges I will get 50 bubbles decreasing as I continually carry out my experiment.

The difference between reliable and accurate results is that reliable meaning is the results obtained fully how you expected them to be and that if the experiment had been done once or twice again will the results be the same or near about the same. Accurate meaning that the results are exactly perfect and that they should not be any mistakes or anomalies.

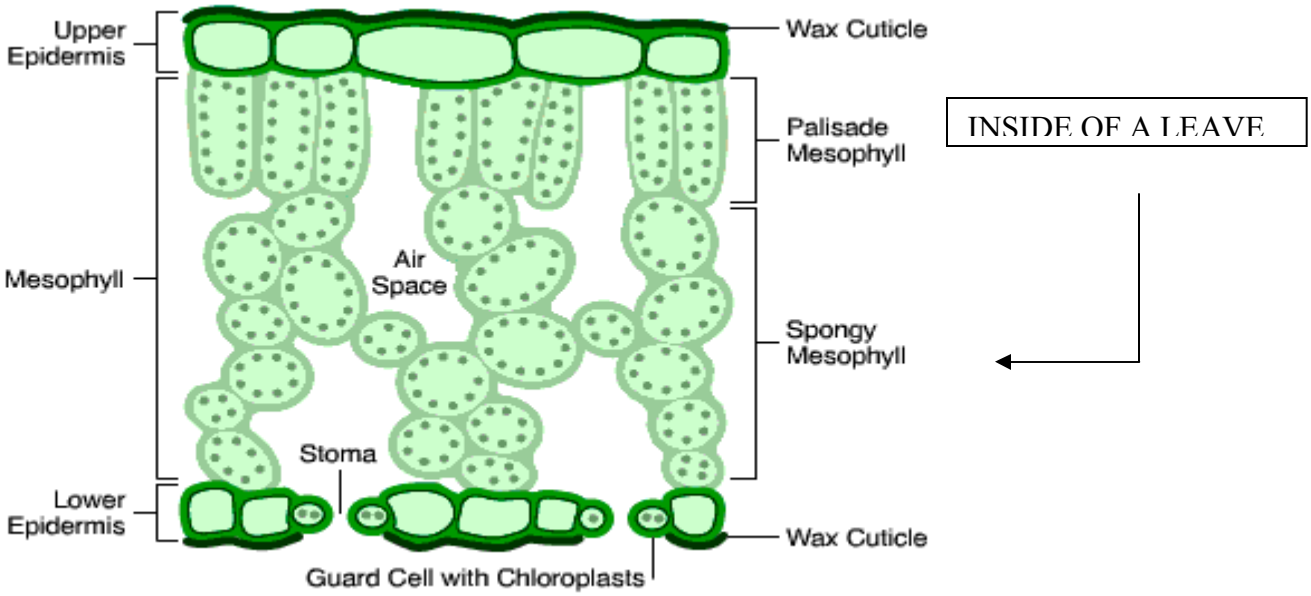
In my range that I have chosen, I have got adequate ranges meaning enough because it gives me something to find out about the rate of photosynthesis during light intensity. When I use these ranges, I shall have different results which then I can plot graphs for and find patterns and trends to help me refer back to my prediction and preliminary work to see if I have got reliable and accurate results.

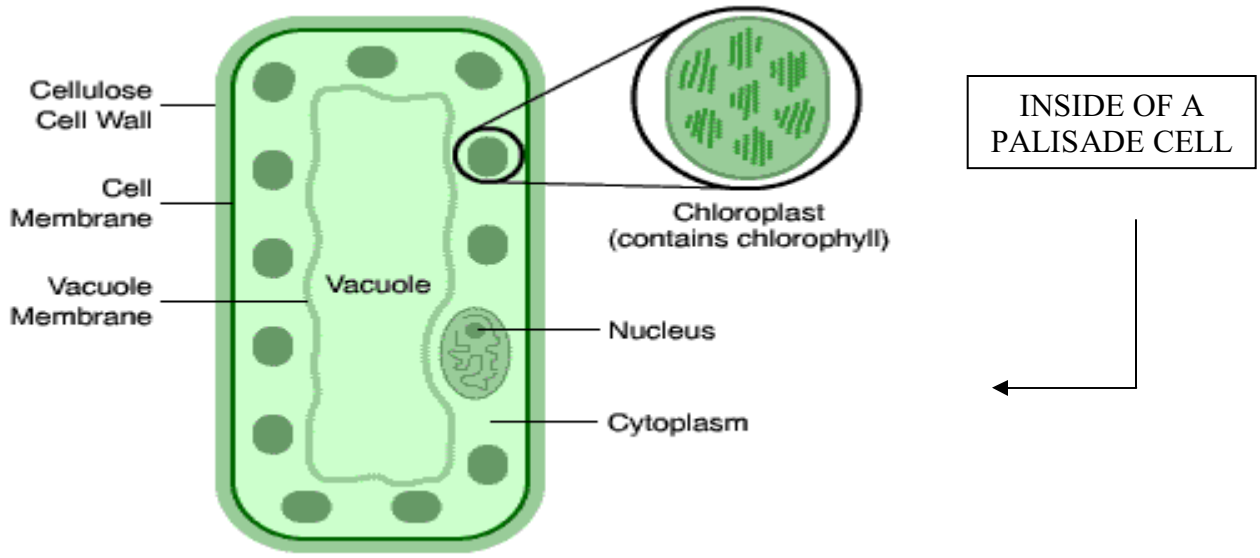
Scientific Research;

For photosynthesis to occur a producer is needed at the beginning of the reaction. In this case it must be green plants because they make their own food by photosynthesis and then energy is loss and transformed to the rest of the food chain.
The green pants execute this by absorbing the suns light energy by chloroplast contained in their leaves and so can then be converted into glucose which is used in respiration or converted into starch which can be turned back to glucose and used for respiration again. The glucose is also converted to sucrose which is carried in vessels called Phloem vessels to the rest of the plant.

Photosynthesis is a chemical reaction which occurs in a plants leave for them to make food for themselves and ultimately for everyone in the surrounding. For this reaction to take place chlorophyll must be present in a plants leaves and also as much carbon dioxide must be in the atmosphere. Oxygen and water are the products produced after the reaction of photosynthesis and can be used for respiration.

The diagrams below show the inside of a leave and a palisade mesophyll cell.
They show the two kinds of mesophyll cells where photosynthesis takes place in, there are the palisade mesophyll and the spongy mesophyll. These cells have chloroplast which also contains a green substance called chlorophyll which enables the light energy from sunlight to be turned into chemical for the photosynthesis reaction to take place.



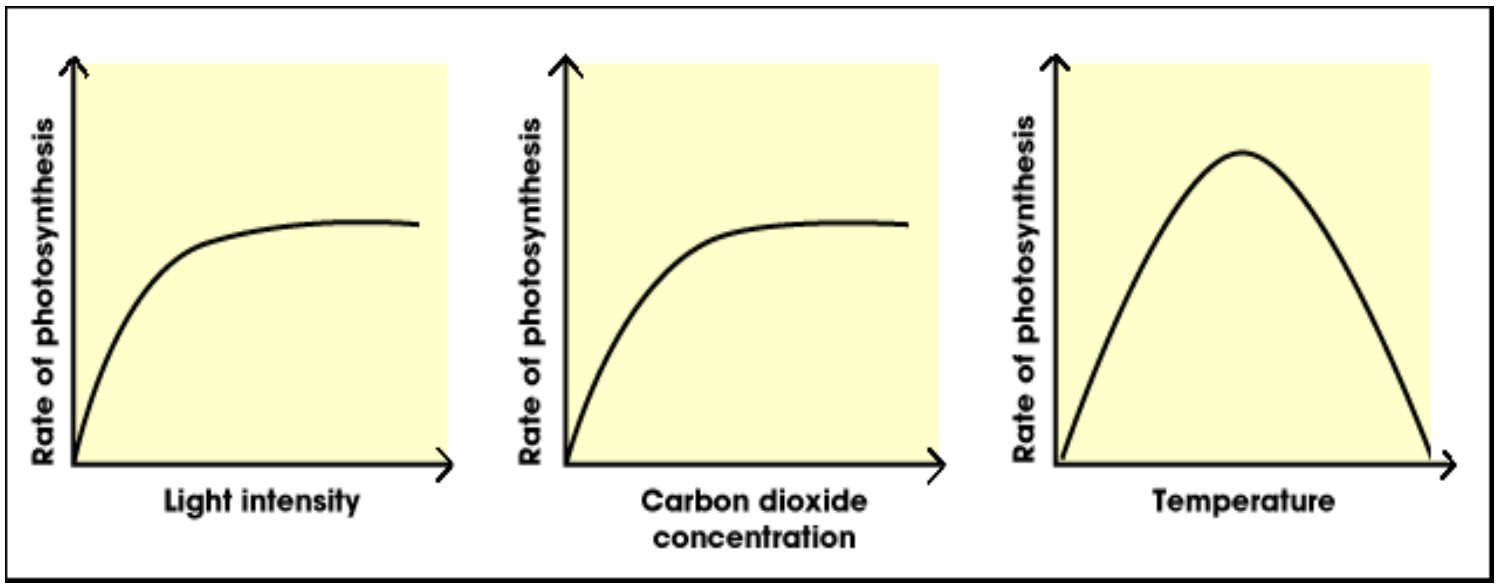


Chlorophyll and light energy in the reaction of photosynthesis are not used up at all. they are the conditions needed for the reaction happen. The other main conditions for the reaction to occur are water form the soil and carbon dioxide from the atmosphere. The word and symbol equation for photosynthesis will be:-

$$\text{CARBON DIOXIDE + WATER} \xrightarrow[\text{Chlorophyll}]{\text{Light}} \text{OXYGEN + GLUCOSE}$$

$$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$$

Photosynthesis will not be successful if there is no light energy in the winter. For this problem to be solved the green plants must be kept in a green house where temperature is increased by heaters, light intensity is increased by paraffin lamps and carbon dioxide increased by chemicals or paraffin lamps because burning paraffin produces carbon dioxide as well as heat. These three important factors that increase photosynthesis can be limited and become limited factors eventually in the reaction.



LIGHT INTENSITY

As the light intensity increases so will the rate of photosynthesis meaning light intensity is limiting the reaction. This is basically saying that the plant will photosynthesise slower even if there is a lot of carbon dioxide and water present in the reaction. Looking at the graph above the light intensity gradually decreases into a steady line where light intensity is no longer the limiting factor. This means carbon dioxide or temperature is now the limiting factor.

CARBON DIOXIDE

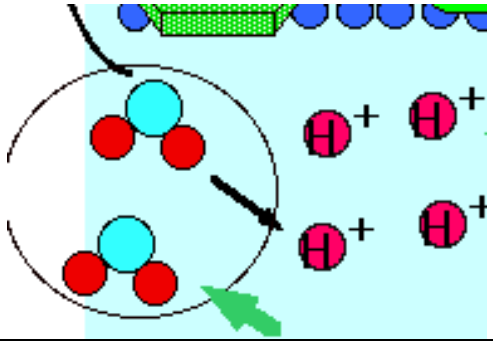
As the carbon dioxide increases so will the rate of photosynthesis meaning carbon dioxide is limiting the reaction. This is basically saying that there is a possibility that the carbon dioxide can run out therefore the plant cannot photosynthesise and reaction will become slower without it even if there is light present. Looking at the graph above the amount of carbon dioxide gradually decreases into a steady line where carbon dioxide in no longer the limiting factor. This means light intensity or temperature is now the limiting factor.

TEMPERATURE

As the temperature increases so will the rate of photosynthesis meaning temperature is limiting the reaction. This is basically saying that photosynthesis mainly takes place outside and if the weather forecast is cold then the conditions for the plants to photosynthesise will become very slow. Looking at the graph above the temperature gradually comes to a point where the enzymes controlling photosynthesis become destroyed which causes the rate of photosynthesis to totally drop to zero.

Plants respire in order to release energy from producing glucose in photosynthesis and make it available in the form of ATP for chemical and osmotic work. Plants need to respire because they need to supply their energy to their requirements but are not capable
to use the ATP. One main way plants respire is using glycolysis, other ways are Krebs, cycle and oxidative phosphorylation.
Photosynthesis and respiration are link in a special way because in fact that in photosynthesis, oxygen is produced faster than used up in respiration and also carbon dioxide is used faster than being produced in respiration. In dark light photosynthesis can't occur because of no light intensity acting on the reaction to happen and here is where its time for the respiration to take place where photosynthesis is not occurring. In simple words this statement is suggesting that photosynthesis will occur in the daytime and respiration will occur in the night.

Photolysis is part of the process photosynthesis which occurs in the chloroplast (granum). In Water photolysis the light which has been taken in by chlorophyll is transformed into chemical energy which causes water to split into hydrogen and oxygen. This happens because in photosynthesis light energy is used to break up water molecules to obtain the electrons. By photolysis where the function of these electrons is to replace the old electrons which are lost by the photosystems to the electron transport systems. Photolysis involves a poorly understood proteins associated with photosystem II where in this process photolysis water is the electron contributor and is then comes apart to form hydrogen ions, oxygen and electrons. The diagram below states what has happened when the electron contributor has come apart.



This diagram is showing that water molecules are being split into hydrogen oxygen gas and two electrons

In this process the oxygen release from photolysis is a waste product and the hydrogen binds with NADP to form $NADPH_2$.

Apart from water photolysis, it can also happen in the atmosphere where primary pollutants such as hydrocarbons and nitrogen oxides react to produce secondary pollutants such as peroxyacyl nitrates. The two most important photolysis reactions in the troposphere are.

1] $O_3 + h\nu \rightarrow O_2 + O^1D \ \lambda < 320 \text{ nm}$

This generates an excited oxygen atom which can go on to react with water to give the hydroxyl radical:

$$O^1D + H_2O \rightarrow 2OH$$

The hydroxyl radical is central to atmospheric chemistry as it initiates the oxidation of hydrocarbons in the atmosphere and so acts like a detergent.

2] $NO_2 + h\nu \rightarrow NO + O$

Is a key reaction in the formation of tropospheric ozone.

The formation of the ozone layer is cause by photolysis. Ozone in the earth's stratosphere is created by ultraviolet light striking oxygen molecules containing two oxygen atoms and splitting them into individual oxygen atoms (atomic oxygen); the atomic oxygen then combines with unbroken O_2 to create ozone, O_3. In addition, photolysis is the process by which CFCs are broken down in the upper atmosphere to form ozone-destroying chlorine free radicals.

Bibliography

This scientific information I researched was from two websites:

- www.gcsebitesize.co.uk
- www.wikipedia.co.uk