TITLE: *MEASURING PONDWEED PHOTOSYNTHESIS*

PLANNING:

AIM:

The aim of this coursework is to find out the factors that affect the rate of photosynthesis.

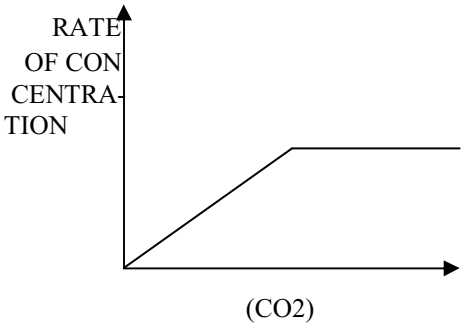
INTRODUCTION:

Photosynthesis is the process of making food by plants to produce glucose and oxygen. The equation for photosynthesis is as follows-

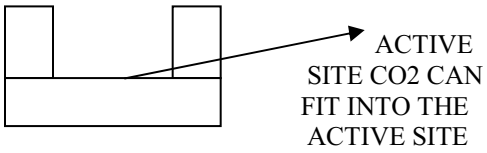
$$\text{CARBON DIOXIDE + WATER} \xrightarrow[\text{CHLOROPHYLL}]{\text{SUNLIGHT}} \text{GLUCOSE+ OXYGEN}$$

In this process Carbon Dioxide (CO2) and Water (H2O) react together with the help of Sunlight and Chlorophyll to form Glucose and Oxygen. Photosynthesis is affected by four main factors. They are as follows-

1. Carbon Dioxide Concentration (CO2):



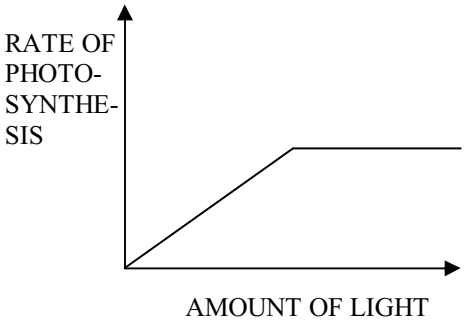
The enzyme Carboxylase has active sites on it.



In a plant leaf there is a fixed amount of Carboxylase enzymes. This enzyme allows (C02) to fit into its active site. As the (CO2) rises the active sites all fill up and the rate of photosynthesis levels off. This chemical called Sodium Hydrogen Carbonate provides green pond weed with CO2.

2. Sunlight: Chlorophyll traps sunlight

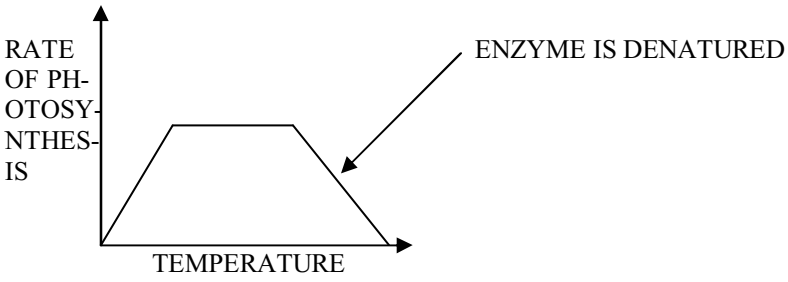
There are a fixed number of chlorophyll molecules in a leaf. As the light level increases all the chlorophyll molecules get saturated with light and the rate of photosynthesis levels off.



Light energy is used to split water (H2O). This splitting of water is called PHOTOLYSIS. The Hydrogen combines with (CO2) to produce sugar and Oxygen is released as a gas. An enzyme is involved in photosynthesis.

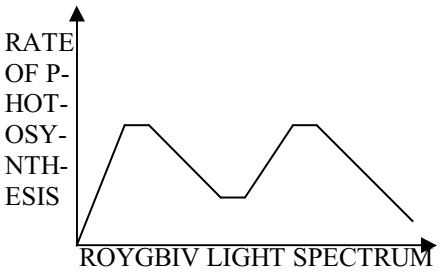
3. Effect of temperature on Carboxylase:

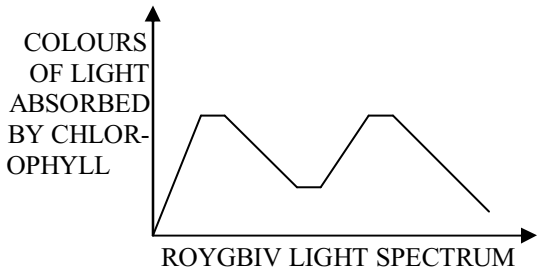
Enzymes are proteins which break down when heated strongly. They become DENATURED and no longer work. At low temperatures an enzyme works very slowly because it is inactive.



4. Colour of light:

A plant does not photosynthesise in green light because green light is reflected and not absorbed by a green leaf. However, red and blue lights are absorbed by chlorophyll. So, with these two colours the highest rate of photosynthesis occurs.



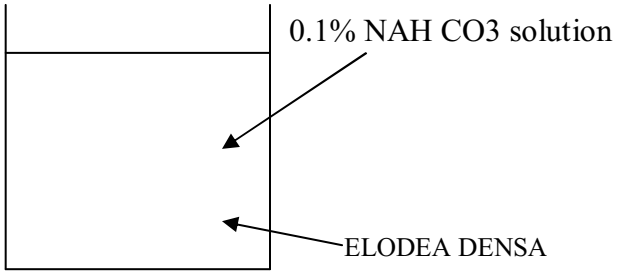


The similar pattern tells us that the two colours which the plant absorbs produce the highest rate of photosynthesis.

All these factors influence the rate of photosynthesis.

METHOD:

1. Measure 200cm3 of water into a beaker containing 0.2gms of Sodium Carbonate powder; stir the mixture with a spatula.
2. Cut a pondweed and attach a paper clip to the uncut end,
3. Submerge the pondweed into a beaker containing 0.1% Sodium Carbonate solution.



4. Place light bulb as close as possible to the beaker and count all the bubbles coming out only from the cut end of elodea densa for 5 minutes, measure the water temperature before and at the end of 5 minutes. Repeat for another 5 minutes. Repeat all results in a table.
5. Repeat stage 4 again with the light bulb 5cms away from the beaker.
6. Repeat stage 4 once again with the lamp 10cms away from the beaker.

APPARATUS:

1. Beaker containing water
2. Sodium Carbonate powder
3. Spatula
4. Pondweed
5. Paper clips
6. Light bulb

PREDICTION:

I predict that if the lamp is closer to the beaker then more bubbles will come out, but when the lamp is a little far from the beaker, then less bubbles will come out from the beaker.

VARIABLES:

1. LIGHT WAVELENGTH
2. CARBON DIOXIDE

3. WATER

FAIR TEST:

To ensure that the experiment is a fair test, the following things need to be carried out-
1. The same pondweed must be used every time we change the light distance.
2. Repeat the experiment 4 times to make it more accurate.
3. The main variable source is the distance of the lamp from the beaker.
4. Perform the experiment at the same temperature.
5. Note down the results after every 5 minutes.

SAFETY:

1. Keep the lamp away from the water.
2. The experimenters must be careful while using the spatula.
3. Keep the beaker away from the edge of the table because if it falls it can harm the students.

OBTAINING EVIDENCE:

NO.	LIGHT INTENSITY IN CM3	NO. OF BUBBLES IN EX.1	NO. OF BUBBLES IN EXP. 2	NO. OF BUBBLES IN EXP. 3	NO. OF BUBBLES IN EXP. 4	AVERAGE NO. OF BUBBLES
1	0	27	20	22	25	23.5
2	5	21	20	18	18	19
3	10	15	16	18	21	17.5
4	15	12	13	15	11	13
5	20	8	9	6	10	8

ANALYSING THE EVIDENCE:

According to the graph on the next page, it gives evidence to my prediction that if the lamp is closer to the beaker then more bubbles will come out, whereas, if the lamp is further away from it less bubbles will come out. For example, when the lamp was 0cm3 away from the beaker the amount of bubbles coming out were 24 whereas; when the lamp was 20cm3 away from the beaker there were 8 bubbles coming out. This is because

when lamp is close to the pondweed more of the pondweeds surface area has light energy shining upon it which means more photosynthesis will occur in less time.

EVALUATION:

Altogether, I would state this experiment as a success since my results supported my predictions. I was able to understand the key facts of this investigation by performing the experiment successfully. During this experiment we faced a few problems as well. One of them was that we were running out of time. We did not schedule all our experiments properly and because of that we ended the experiment quite late. The effects of being late are that the results obtained might not be accurate. Therefore before doing any experiment one should schedule the timings of their investigation.

The second problem that we faced was setting the apparatus. To cut the pondweed from the end is quite tricky and that is where we got stuck. The reason behind this is that if we cut the wrong end of the pondweed, then the whole experiment might be useless since that would not be the right way to perform it. In order to set up the right apparatus one should note down the stages that he/she are going to perform in the experiment so that fewer mistakes are made.

The last problem that I faced during the investigation was timing the experiment accurately. This was mainly because of human error. Although we used a stop watch to measure our results, we were always late at stopping the watch exactly at 5 minutes. To improve this error, the experiment should be repeated as many times as possible so that we are sure of out results being accurate. If time had permitted we could have done it more then 4 times to make sure that the data collected is accurate.

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