Rate of Photosynthesis

Aim: -

The aim of my investigation is to find the factors, which affect the rate of photosynthesis.

Introduction: -

Photosynthesis is the name given to the process in which plants make their food. In order for a plant to photos ynthesise, it needs carbon dioxide, sunlight, and water. The water and carbon dioxide are converted into glucose (food) and oxygen, sunlight is also needed as part of the reaction, and this sunlight is taken in by green pigment, called chlorophyll. Chlorop hyll is present in the leaves of all green plants, and it is in these leaves where photosynthesis occurs.

Here is the word equation for photosynthesis:

$$\text{Carbon dioxide + Water} \longrightarrow \text{Glucose + Oxygen}$$

Here is the chemical equation for photosynthesis;

$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2$$

Hypothesis: -

Qualitative Hypothesis:

1. I predict that the greater the light intensity, which the plant is receiving, the greater the rate in which the plants will photosynthesise (Canadian pondweed) and more oxygen is released.
2. I predict that the lower the concentration of carbon dioxide that the plant is receiving, the lower the rate in which the plant will photosynthesise and less oxygen is released.
3. I predict that the lower the light intensi ty that the plant is receiving, the lower the rate in which the plant will photosynthesise and less oxygen is released.
4. I predict that the greater the temperature in which the plant is in up to 40ºC, the greater the rate in which the plant will photosynthe sise and more oxygen is released. If the temperature is greater than 40ºC, than the enzymes (chlorophyll) in the plant will not function because the temperature is too great or hot for it to function.

5. I predict that the higher the concentration of carbon d ioxide that the plant is receiving the greater the rate in which the plants will photosynthesise and more oxygen is released.
6. I predict that the lower the temperature in which the plant is in, the lower the rate in which the plant will photosynthesise and the less oxygen is released. This is because the enzymes are less active.

Quantitative Hypothesis

1. I predict that if you Double the light intensity of the lamp the rate of photosynthesis will be doubled this will result in twice as much of oxygen being released.
2. I predict that if you halve the light intensity of the lamp the rate of photosynthesis will be halved this will result in halve the amount of oxygen being released.
3. I predict that if you double the concentration of carbon dioxide, you will double the rate of photosynthesis, this will result in twice as much oxygen being released.
4. I predict that if you halve the concentration of carbon dioxide you will reduce the rate of photosynthesis, this will result in half as much oxygen being released.

Variables: -

During my investigation, there will be different variables, which will affect the results.

1. Independent variables are factors throughout my investigation, whic h I can change.
2. Dependent variables are the factors affected by the changes of the independent variables. E.g. if I changed the intensity of light, the number of bubbles released will change.
3. Continuous variables are values, which can be measured. E.g. the volume of water that will be used.
4. Discrete variables are whole values or one value or another. E.g. the type of plant we will be using.

Here are some examples of variables:

- The volume of water, this is an independent and continuous variable.
- The length of the Canadian pondweed, this is an independent and continuous variable.
- The size of the beaker, this is an independent and a discontinuous variable.
- The distance of the lamp from the beaker, this is an independent and continuous variable.
- The temperature of the water, this is an independent and continuous variable.
- The concentration of carbon dioxide (CO_2), this is an independent and continuous variable.
- The room temperature, this is a dependent and continuous variable.

Apparatus: -

- $5cm^2$ of Sodium Hydrogen Carbonate (bicarbonate) solution,
- Two cut-shoots of pond weed,
- Two glass rods,
- 500ml beakers,
- Thermometer,
- Bench lamps,
- Stop clock,
- Scissors,

Fair test: -

In order to make my experiments as fair as possible I will carry out the following:

- I will alternate the temperature of the water for the specified experiments.
- I will alternate the concentration of bicarbonate for the specified experiments.
- I will alternate the intensity of light for the specified experiments.
- I will use the same amount of water for all of my experiments.
- I will use the same beaker for all my experiments.

Methodology: -

Method for light intensity:

1. Collect appropriate apparatus
2. Pour 400ml of water into the beaker.
3. Take the piece of pond weed and push it down with the glass r od
4. Take the lamp and place it 20cm away from the beaker, then turn on.
5. Wait until bubbles are being released at a minimum rate of 15 bubbles per minute, and then start counting the bubbles every minute for five minutes.
6. Every five minutes place the lamp firstly at a distance of 40cm, then 60cm, 80cm and finally 100cm away from the beaker.
7. Record and tabulate results.

Results:

Light Intensity experiment:

Distance of light source	Number of bubbles every minute			
	1st	2nd	3rd	Average
20cm	14	2	4	7
40cm	14	3	2	6
60cm	12	2	2	5

80cm	6	3	2	4
100cm	3	5	1	3
120cm	3	1	1	2

Graph 1 shows the distance between the beaker and light source against the average bubbles released.

Conclusion: -

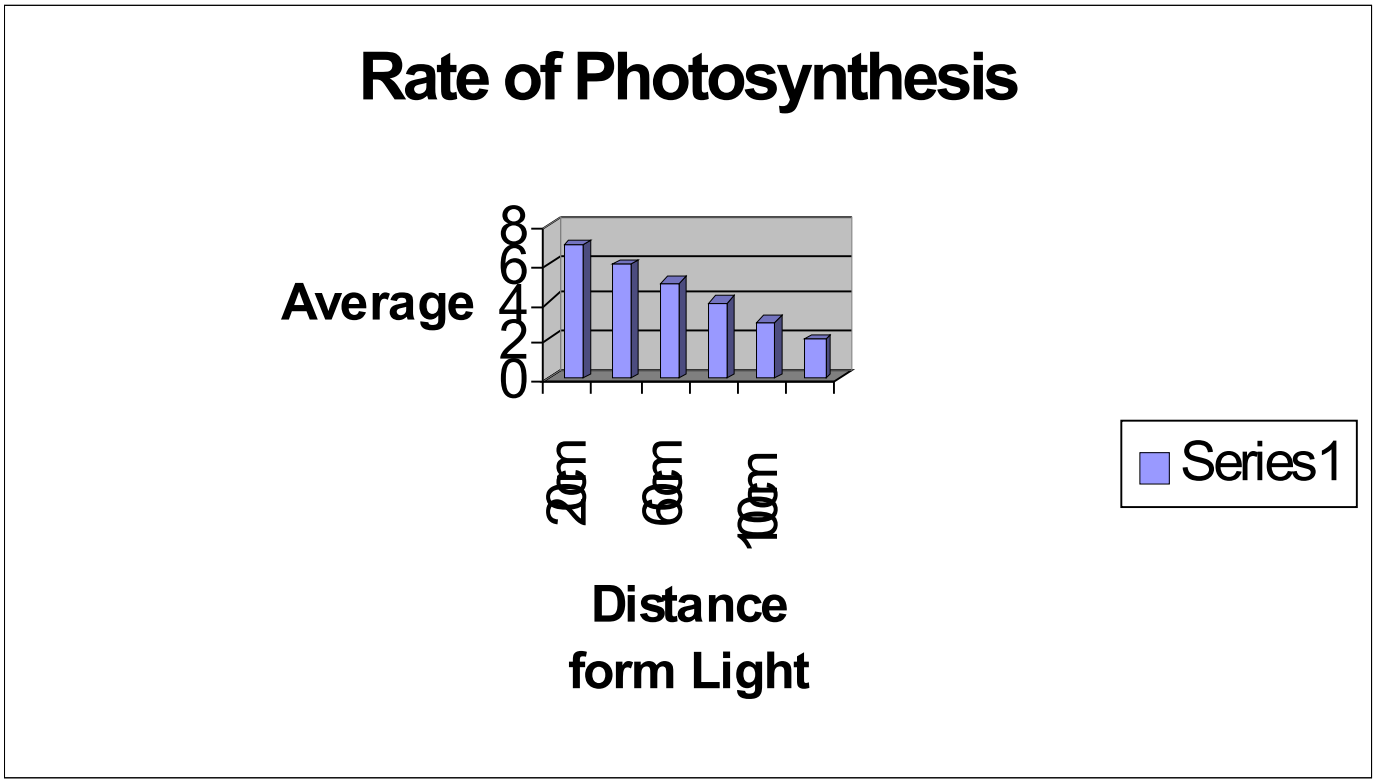
From my results I conclude that by averaging all my results, all of m y qualitative predictions were correct, proving that:

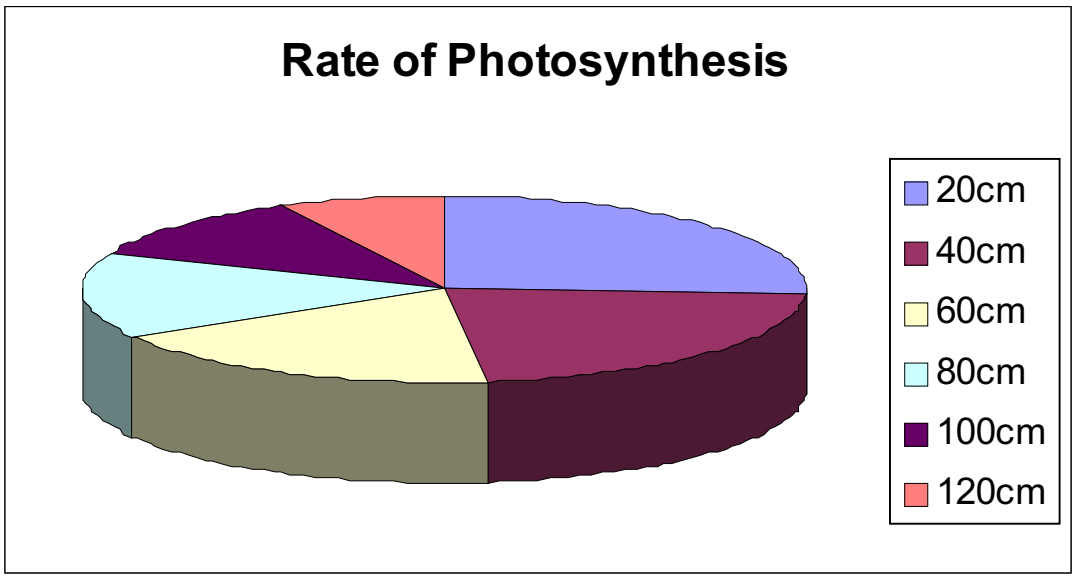
- If you increase the temperature up to a certain limit the rate of photosynthesis will increase. By carrying out my experiment I worked out that the limit in which most plants will photosynthesise best i s 40°C.
- If you decrease the temperature the rate of photosynthesis will decrease.
- If you increase the concentration of carbon dioxide the rate of photosynthesis will increase.
- If you decrease the concentration of carbon dioxide the rate of photosynthesis will decrease.
- If you increase the light intensity the rate of photosynthesis will increase.
- If you decrease the light intensity the rate of photosynthesis will decrease.

I also conclude that all my qualitative predictions were correct, however all my quantitative predictions were incorrect as my results will prove. My results can also be scientifically proven, as it is well known that as part of photosynthesis plants need carbon dioxide, sunlight and water.
The carbon dioxide is absorbed through tiny pours called stomata, water is absorbed from the soil by the roots, this passes up the root stem through narrow tubes called xylem vessels, and sunlight is absorbed through the leaves by tiny green pigment called Chlorophyll.

Evaluation: -

Even though I tried my best, my results could still be more accurate. I could improve this by using a computer to help me count the number of bubbles released per minute as sometimes during the experiment bubbles were being released too fast for me to count. This failure t o count the exact number of bubbles released would have effected the accuracy of my results.
My results could have been much clearer if I had used a fresher bunch of pondweed, this is because the bunch which I used a couple of days earlier. Using an old bunch of pondweed would have effected my results, as the number of bubbles released would have been less than normal.


Rate of Photosynthesis
Average
8
6
4
2
0
20cm
60cm
100cm
Distance form Light
Series1


Rate of Photosynthesis
20cm
40cm
60cm
80cm
100cm
120cm

A Very Good Piece of coursework Dan. I have corrected some minor mistakes and your current coursework grade for this piece is a B.
In the future please try and hand in your Coursework on time!