photosynthesis

Introduction
Plants also take in energy, like humans, who get their energy from raw materials-such as food, however plants do not seem to be in taking food their mostly common source of raw materials comes from the soil. A statement from GCSE Biology states'…*Experiments show that the weight gained by a growing plant is far greater than the weight lost by the soil it is growing in.'* This statement implies that there must be an increase in the raw materials such as water and air. A hypothesis to show a source of food in plants is from the air, water and soil salts. Glucose contains three elements carbon, hydrogen, and oxygen ($C_6H_{12}O_6$). The carbon and oxygen is mainly supplied by (CO_2) from the air and the hydrogen from water (H_2O), in the soil.

What is photosynthesis?
Photosynthesis the building up of complicated food molecules from simple substances better known as 'synthesis.' In order for this process to take place, it requires enzymes and energy. The first stage where synthesis begins is from the sun. The sun supplies the plant as a source of light, which is essential for photosynthesis. This is where we get the word 'photo' from as it means 'light'. Therefore this process is referred to as photosynthesis.

So, what is the process of photosynthesis, and where does it take place?
Photosynthesis takes place in the green substance known as chlorophyll. Chlorophyll plays an important role in the whole process it can be found in the chloroplast of plant cells. The chlorophyll absorbs sunlight and makes the energy from sunlight available for chemical reactions. This process effects the function of chlorophyll is to convert light energy to chemical energy.

A chemical equation for photosynthesis is:

$$6CO_2 + 6H_2O \xrightarrow{\text{Light energy.}} C_6H_{12}O_6 + 6O_2$$

Carbon dioxide + Water $\xrightarrow{\text{Light energy.}}$ Glucose + Oxygen.

To keep the equation simple, glucose is shown as the food compound produced.

Aim
The aim of this experiment is to investigate how light intensity affects the rate of photosynthesis. The other factors that I could have investigated were:
Temperature and the amount of carbon dioxide needed in order for photosynthesis to take place.

Hypothesis:
My hypothesis is that as the intensity of light is increases so does the rate of photosynthesis. The reason behind this is because light is an essential source for photosynthesis to take place. In order to test this I will use a lamp, which will be the source of light and set it up as shown

in the diagram overleaf. I will try to make it a fair test. This light energy will be absorbed into the pigment of the leaf. Also found in the leaf is a part called chlorophyll, which is essential within the plant.
The chlorophyll pigments occur in the green plant cells, the stacked discs of membranes found in the chloroplasts. Unlike most pigments of plants chlorophyll is largely insoluble in water, but may be extracted using organic solvents. This light absorbed which is then transformed into chemical energy through a series of reaction the process but of course this energy cannot be used in photosynthesis. The result of the light energy is absorbed by chlorophyll in solution is re-mitted as red fluorence.

Method

- Collect the above apparatus. Make sure they are washed in clean water using detergent as otherwise bubbles may stick to the apparatus.
- Using a measuring tube collect $10cm^3$ of sodium hydrogen carbonate.
- Add it to$250cm^3$of water (H_2O)

The reason for this is to maintain the level of carbon dioxide (CO_2)

- Collect 5cm of Canadian pondweed (Elodea)
- Place this into a beaker but DO NOT PUT IT IN THE WATER AND $NaHCO_3$ SOLUTION JUST YET!
- The reason for this is because the rest of the apparatus has not been set up and it will make the results unreliable.
- Attach the photosynthometer to the stand + clamp.
- Set it up as shown in the diagram.
- Keep the metre stick in a secure place avoid it from moving. (A suggestion you keep it stuck down by using a bit of masking tape at the bottom of it.)
- Have the lamp ready to switch on. BUT NOT YET!
- When ready put Elodea in the solution (water and $NaHCO_3$) and attach it to the micro-burette.
- Turn on the lamp, which should be at the appropriate distance on the meter stick.
- NOTE: lamp and stopwatch should be switched at the same time.
- Take the results after every minute.
- Repeat the last 3 steps 10 times. However change water every time, use same amount of $NaHCO_3$ ($10cm_3$). Finally keep the temperature the same to make it a fair test.

Apparatus

Beaker
Water- $250cm_3$
Elodea
Thermometer
Metre stick
Lamp bulb –60W
Stopwatch or clock with a second hand.
Measuring cylinder
Photosynthometer
Capillary tube- graduated.
Clamp + stand
Tripod to support the beaker containing
Elodea.

$10cm^3$ sodium hydrogen carbonate solution
Micro-burette (that is washed in clean water to avoid the bubbles from sticking to it.)

Diagram:

Results table.

Distance of lamp from elodea (cm)										
Number of bubbles/ minute.										

The results from the experiment will be recorded 10 times.

Evaluation.
In order to prove my hypothesis, a graph was plotted. The results revealed that the distance of the lamp from the Elodea was 100cm; the number of bubbles per minute was 13. When the distance was 80cm, the number of bubbles per minute appeared to be 12. I would have assumed that the number of bubbles in this case would have been higher as stated in my hypothesis. The rest of my results were as I had expected.

To ensure that the experiment was accurate the lamp had to be moved 20cm from its original 100cm every minute an then stopped it when it reached 0cm.therefore I had to make sure that I monitored the time accurately. The test was repeated 10 times in order to make it fair. This gave me an average. Another way of making it a fair test would be to use oxygen to keep the plant alive- this is indirect of photosynthesis. By using oxygen I can use the same piece of Elodea several times without destroying it when using glucose.

As you can see by referring to the graph only 6 out of 10 results were recorded, as it was clear that my initial hypothesis was correct.

Instead of using the sophisticated apparatus: photosynathermetre and the graduated capillary tube I could have simply used a beaker, test tube, stop watch, a lamp, a metre stick and the same solution (water and $NaCHO_3$). However this experiment would have been inaccurate because I would have had to count the bubbles myself and measure the gas quantity. The other disadvantages I may encounter would be the following:

- When the lamp is at its furthest distance (100cm) from the Elodea the bubbles are going to reduce by quantity and size, therefore the bubbles maybe too small to see which would have made them difficult to count as a result.

- The lamp could be too close to the test tube and heat up the water quickly making the temperature to be inaccurate and the rate of photosynthesis would vary.

- When the lamp is at its closest distance (0cm) from the Elodea the bubbles are going to be rapidly produced therefore once again making it difficult to count.

- If the lamp heated the water up, the temperature would have increased giving me two limiting factors: temperature and light intensity, instead of just one. This would have gone against my hypothesis.

- The whole experiment would not be as accurate as the photosynthometer.

The main advantage in using the above apparatus' has been that it is easy to set-up and use.