PHOTOSYNTHESIS

Green plants make food through a process called photosynthesis, using the energy from the sun. Cells from the leave turn simple materials into rich energy food.

The key elements for photosynthesis are:

- Carbon dioxide
- Water
- Light energy

CARBON DIOXIDE + WATER + LIGHT ENERGY → GLUCOSE + OXYGEN

A plant must have all of these substances in order to produce its own food. During photosynthesis the plants produce glucose and release oxygen as a waste product.

The upper epidermis is the skin. Beneath the upper epidermis lies the palisade cells which are the chief food produces.
Spongy cells are partly surrounded with pockets of air which enable the cells to exchange gases with the atmosphere.
The stomata are small openings in the lower epidermis under the leaf.
Leaf veins carry water and nutrients from the roots.
Carbon dioxide enters through the stomata.
Chlorophyll contained in cells of the palisade cells and spongy layers help absorb the sunlight and transport light energy into chemical energy.
Carbon dioxide combines with water and photosynthesised into oxygen and sugar.
Oxygen escapes through the stomata. The sugar dissolved in water is carried throughout the plant providing energy for its growth.

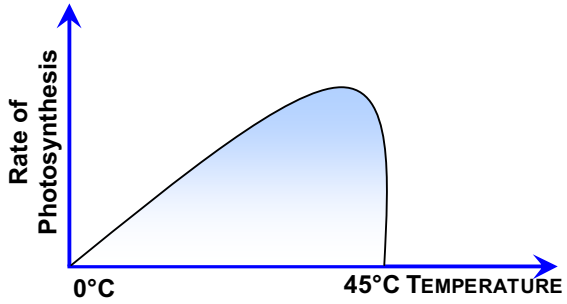
THE THREE FACTORS

The three factors which can limit the rate of photosynthesis are:

- Low Temperature
- Shortage of Carbon Dioxide
- Shortage of Light

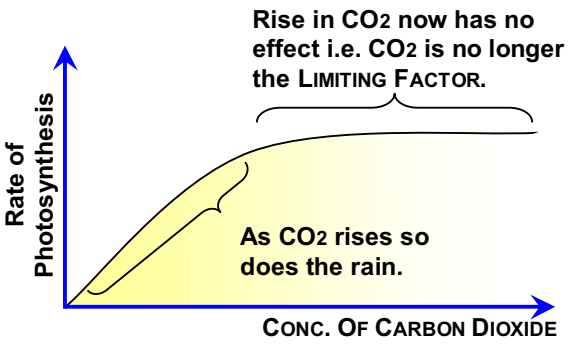
LOW TEMPERATURE

- Chemical reactions that occur in the plant (photosynthesis) are controlled by Enzymes.
- Enzymes are destroyed at temperatures of 45°C



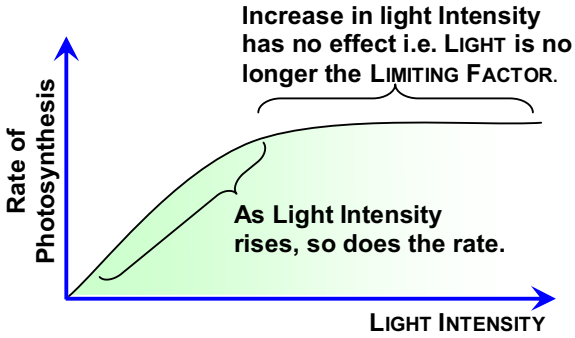
SHORTAGE OF CARBON DIOXIDE

- In the first part of the graph, Carbon Dioxide is clearly the limiting factor. As when the concentration rate is Increased.
- In the flat part of the graph, increasing the concentration has no affect and therefore the LIGHT INTENSITY or the WARMTH must be the LIMITING FACTOR.



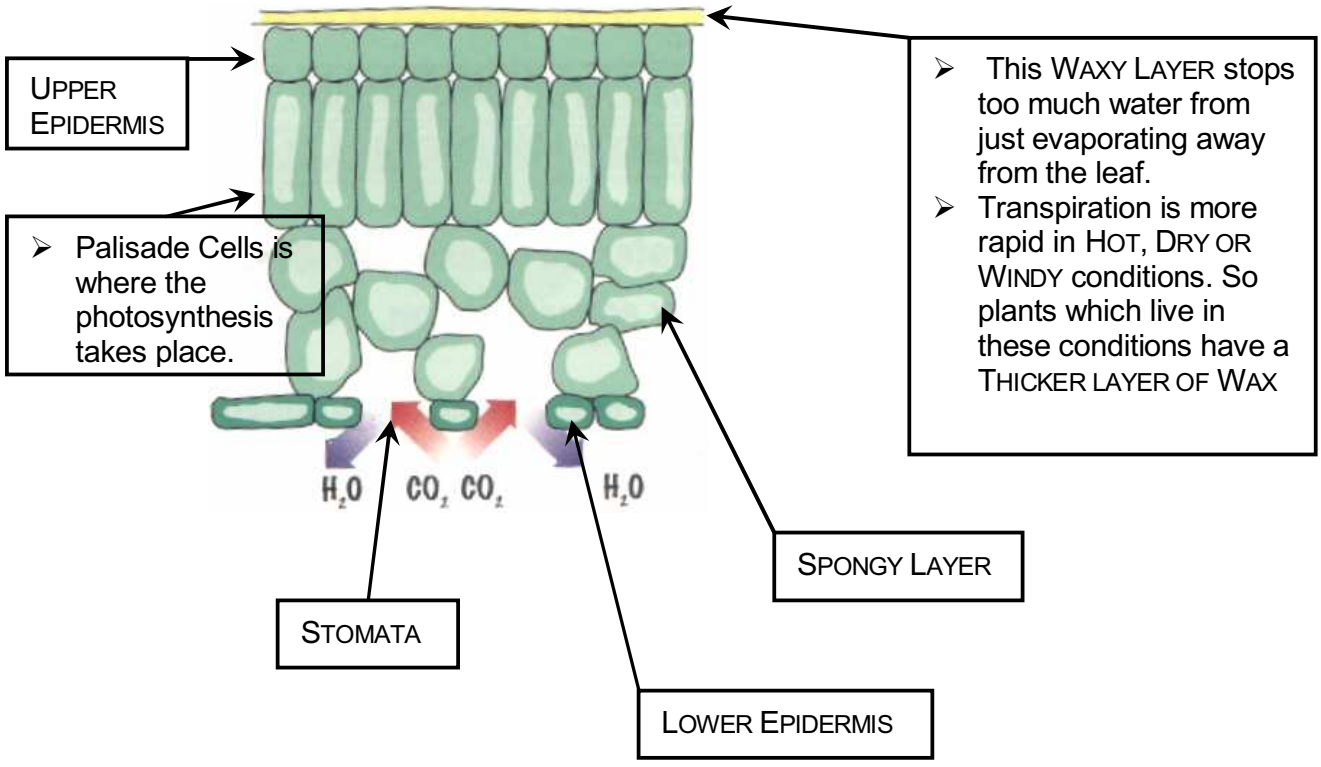
SHORTAGE OF LIGHT

- In the first part of the graph, light is clearly the limiting Factor, as increasing the light intensity increases the rate.
- In the flat part of the graph, increase in light intensity no has no affect. Therefore CARBON DIOXIDE CONCENTRATION or WARMTH must be the LIMITING FACTOR.

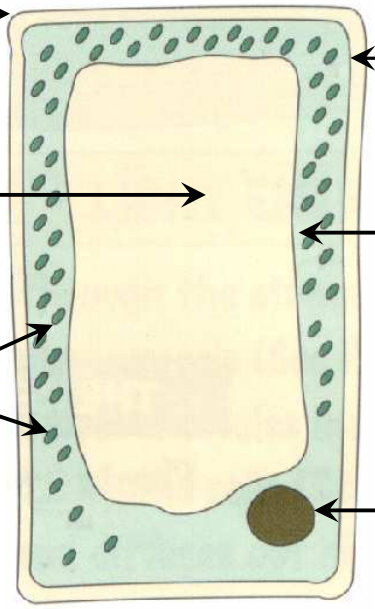


THE LEAF

A cross section of a leaf.



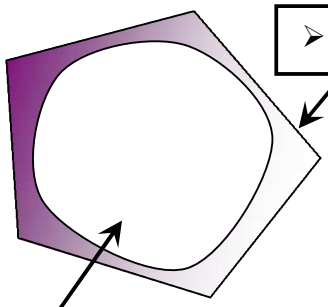
A PLANT CELL



- CELLULOSE CELL WALL strengthens the cell
- VACUOLE is a cell sap under pressure.
- CHLOROPLASTS is where the photosynthesis happens.
- CELL MEMBRANE controls movement in and out of cell.
- CYTOPLASM is where most chemical reactions take place. (Mitochondria)
- NUCLEUS controls what the cell does.

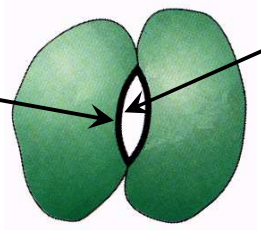
XYLEM TISSUE

XYLEM – For transporting water through the stem and root .



- Wall thickened with LIGNIN.
- Empty space – no cytoplasm

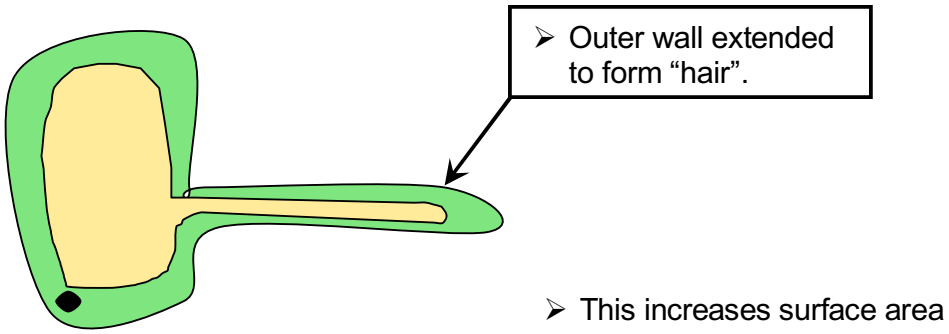
GUARD CELLS – Specialised for regulating water loss from the leaf.



- Wall thickened only here.
- STOMATA can be open or closed.

ROOT HAIR CELL

ROOT HAIR CELL – Thin hair like projections give a big surface area for efficient adsorption



PREDICTION:

If I increase the light intensity for the plant I will increase the rate of photosynthesis. But if I keep increasing it, it'll reach a point in which the amount of light won't be the limiting factor.

APPARATUS:

In this experiment I'll need the following tools to carry out the experiment:

- ✓ Pondweed
- ✓ Test tube
- ✓ Beaker
- ✓ Measuring Cylinder
- ✓ Thermometer
- ✓ Ruler
- ✓ Lamp

FAIR TEST:

To make this a fair test I'll use the same measuring cylinder and pondweed. I use the same amount of water in the test tube and in the beaker. I will also use the same light source.

SAFETY:

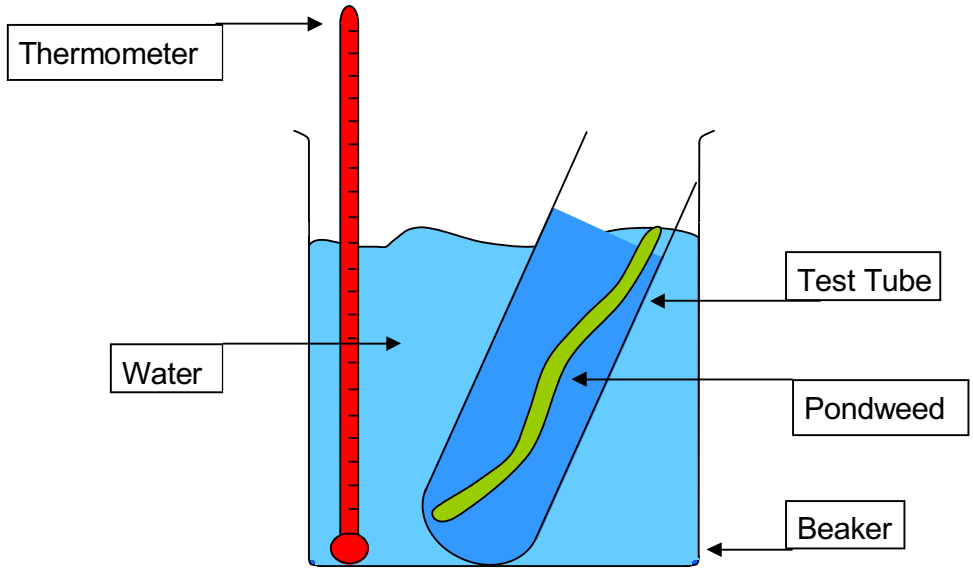
There isn't much to be worried about in this experiment when it comes down to safety issues, but there are a few problems that could be dangerous that I tried to minimize, and that is:

- ✓ To handle the light source very carefully
- ✓ Not to touch the light source when its just been used because it'll be very hot
- ✓ To switch the power supply off when moving the light source closer to the plant.
- ✓ And to wash your hands after finished doing the experiment.

METHOD:

I'll fill the beaker with 20ml of water. Then put the pondweed into the test tube and place the tube into the beaker. I'll then connect the I amp up to the power source and measure 35cms difference from the beaker and the lamp. I'll then turn the lamp on, and leave it for 1 minute. After that period I'll count the number of bubbles on the pondweed and take the results down. I'll then move the po ndweed around in the tube to get rid of the bubbles, and repeat the process, but this time I'll cut the distance between the beaker and the lamp. I'll cut the difference by 5cms each time until I'm left with a distance of 5cms between the pondweed and the lamp. I'll then repeat the same process another 2 times to clarify my results.

DIAGRAM:

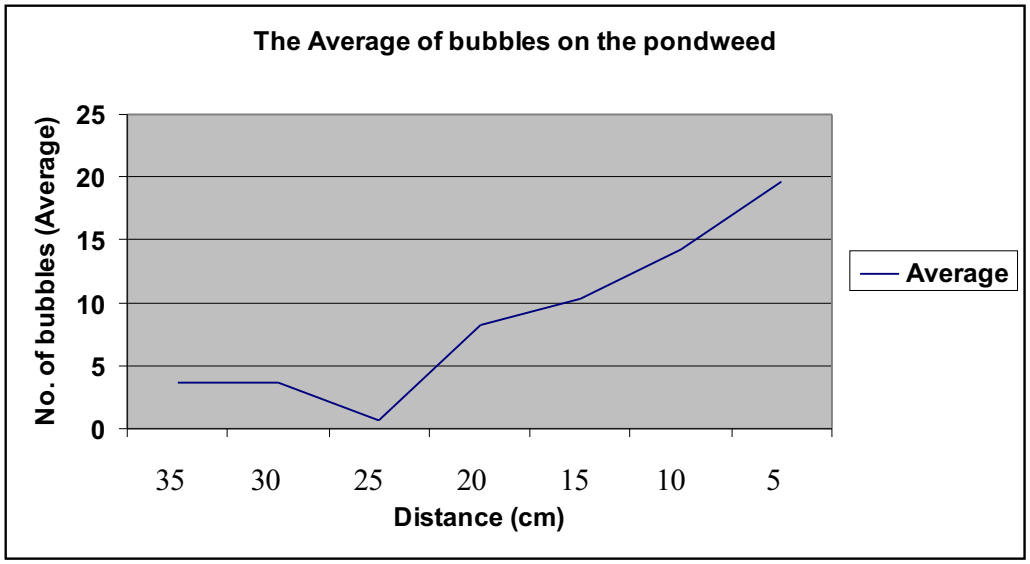


RESULTS:

Distance	Number of bubbles			
	1	2	3	Average
35	1	4	6	3.6
30	1	4	6	3.6
25	0	0	2	0.6
20	9	7	9	8.3
15	7	11	13	10.3
10	11	15	17	14.3
5	18	20	21	19.6

GRAPH:

The graph below will show the average:



Looking at the graph you can clearly see that an increase in light intensity has made a major difference in the number of bubbles being made. Therefore it is shown that the light intensity is a limiting factor, and once it has reached its limiting point then the light intensity will no longer be the limiting factor, then the limiting factor will either be carbon dioxide or the temperature. Once carbon dioxide has reached its limiting point then it'll no longer be the limiting factor, the limiting factor now will be the temperature. Once the temperature has reached its limiting point then that won't be the limiting factor. If the amount of carbon dioxide or amount of light intensity keep increasing there will be no further effect on the rate of photosynthesis, but if the temperature continues to rise then the plant enzymes will become de-natured. Therefore my prediction which is, "If I increase the light intensity for the plant I will increase the rate of photosynthesis. But if I keep increasing it, it'll reach a point in which the amount of light won't be the limiting factor", is correct. You can see on the graph that once I've increased the light intensity, the rate of photosynthesis increases and it can be shown by the increase in the number of bubbles.

EVALUATION:

I think that the experiment went smoothly. It turned out just the way I had planned. I managed to make it a fair test by: using the same amount of water, using the same measuring cylinder, the same light source and the same pondweed. Examining my results I located a change in results. At 25cms the number of bubbles that were made had dropped dramatically, from 4 bubbles to zero. This could have been caused by various reasons. One of them could have been because I continued the experiment on the next day and that could have been the reason for the drop. To gain more accurate results I could have done the experiment on the same day, and scan the test tube more closely for more bubbles.
To improve the experiment I could repeat the test a few more times to increase the accuracy of the results. I should have the experiment on the same day so I wouldn't get anomalous results. I could have prevented sunlight from getting into the room by covering the windows with blinds, and I could do the experiment on computer to get much more accurate results.
Overall I think that the results didn't come out accurate, this is because of the fault in the results, and the reason for this is because I did the experiment on two days instead of one.