

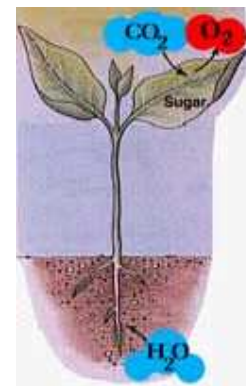
# How light intensity affects the rate of photosynthesis

## The Question

With this experiment I'm going to investigate how light affects the rate of photosynthesis.

## Introduction

Photosynthesis is the process by which green plants and other organisms transform light into energy. In green plants, light energy is captured by chlorophyll in the chloroplasts of the leaves and used to change water, carbon dioxide, and minerals into oxygen and rich energy organic compounds that are the basis of both plant and animal life. Photosynthesis consists of photochemical and enzymatic reactions. If the photosynthesis reaction is accelerated more organic compounds will be formed and there will be more plant growth.



## LEAVES



The leaf is a part of the plant that is charge of making food. This process is called photosynthesis. The leaf consists of the following parts:

**Petiole** - a thin stalk that connects the blade of the leaf to the plant's stem. These veins are called:

**Blade** - a thin, flat part of the leaf that extends off the end of the petiole. It is green as it contains chlorophyll which is necessary in making the plant's food. The blade contains veins which help to bring in the necessary water for photosynthesis and to transport food out to all parts of the plant. The xylem has to transport water and the phloem food.

The blade has several layers. The top layer is covered with a waterproof coat called the cuticle. Both the upper and lower layer contain pairs of guard cells. These guard cells protect the stomata, little openings in the leaf that allow the carbon dioxide to go in and oxygen to get out during photosynthesis. Water vapour is also emitted in a process called transpiration.

In between the top and bottom layers of the blade there are cells that are full of chlorophyll. These are essential for the plant to make its food during photosynthesis.

There are different types of leaves. They can change size, shape and colour. For this last change, they contain other substances called pigments that cause the beautiful autumn colours . These leaves are on deciduous trees, so they die and fall off and are replaced by new ones in spring. Conifers or trees that have cones can keep their needles for years and grow new ones as soon as they lose them.

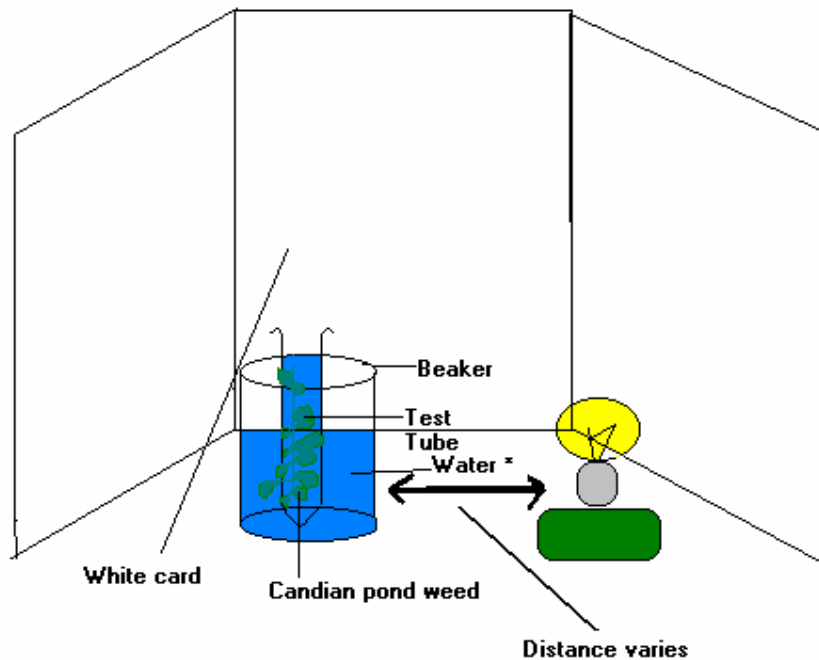
### Prediction

My prediction, is that the less light that gets to the plant, the slower the rate of photosynthesis . This is because light is the energy that activates the chloroplasts which cause the process called photosynthesis to happen. So I think that the less energy getting to the plant the fewer chloroplasts will be activated meaning that less photosynthesis takes place.

### Apparatus

1. Test Tube
2. Beaker
3. Canadian Pond Weed
4. 40ml. Water for test tube
5. 150ml. Water for beaker
6. Bicarbonate
7. 4 pieces white cardboard
8. 40 watt light bulb
9. Light bulb stand
10. Sellotape
11. Stop Watch

## Presentation



## Method

A Test tube was filled with 40ml. of  $H_2O$ . A short stem of Canadian Pond weed was then put in and the test tube was placed in a beaker containing 150ml. of  $H_2O$ . Next to this a 40 watt light bulb of in a light bulb holder was placed. To make it a fair test the whole setting was surrounded by white cardboard that stopped any rays of light reaching the plant and for extra accuracy all the lights in the lab were switched off. After that the light bulb was switched on and the experiment started.

At first there was a separation between plant and light-bulb of 5 cm. The number of  $H_2O$  bubbles coming out of the stem were recorded. This process was repeated 6 times, each time adding an extra 5 cm to the original distance, finally ending up with a distance of 30 cm. between weed and bulb. Each reading, for which the light bulb was turned on for 2 minutes took 2 minutes, was repeated three times and at intervals of 5 minutes. The bulb was turned on for every 2 minute reading.

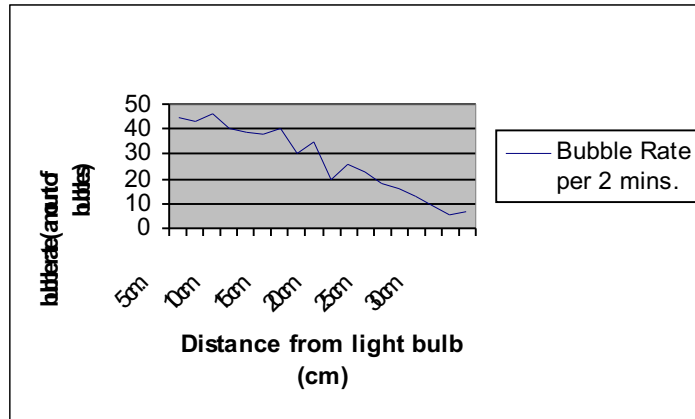
The measures taken to make it a fair test were the following ones:

- The amount of water in the test tube doesn't change.
- The plant doesn't change.
- The amount of water in the beaker doesn't change.
- The class lights weren't turned on.
- The setting was covered by the white card at all times.
- Three tries for each distance.

### Table of Results

Distance	Nº of try	Bubble rate per 2 mins.	per 2 mins.
5 cm.	1	45	
5 cm.	2	43	
5 cm.	3	46	
10 cm	1	40	
10 cm	2	39	
10 cm	3	38	
15 cm	1	40	
15 cm	2	30	
15 cm	3	35	
20 cm	1	20	
20 cm	2	26	
20 cm	3	23	
25 cm	1	18	
25 cm	2	16	
25 cm	3	13	
30 cm	1	9	
30 cm	2	5	
30 cm	3	7	

## Graph of results



## Conclusion

As we can see by the results, the rate of photosynthesis is affected by the distance between weed and light. We have been able to see a decrease in the rate of bubbles each time the source of light moved further away. This was expected, because as I said earlier on in my prediction, the less energy reaching the chloroplasts the fewer are activated, which makes the food-making process, that involves letting out oxygen, slower.

## Evaluation

On the whole I think that the experiment worked out quite successfully, for the readings weren't contradictory to my prediction. We were lucky that the pond weed didn't die half way through, otherwise we wouldn't have been able to take accurate readings.

If we had used a thermometer we would have been able to make sure that the water temperatures didn't rise.