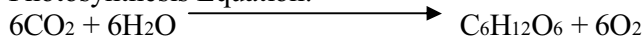


# An Experiment To Investigate The Factors That Affect The Rate Of Photosynthesis.

## PLAN

A piece of pondweed will be cut and placed into a beaker containing water and sodium hydrogen carbonate. A lamp will be shined on to the pondweed and the amount of bubbles released from the plant will be counted. The lamp will be adjusted to different distances from the plant to try and obtain different results. I shall complete a trial run, to see how long to measure the amount of oxygen is produced. The trial run will also highlight any other errors which might occur, and will help us to see how long to leave the lamp turned off for, to let the pondweed adjust to normal, and repeat the experiment again at that distance.

Photosynthesis Equation:



Variables:

Experimental Variable- Light intensity is to be the variable explored in this investigation.

Increasing or decreasing the distance from the light source to the plant can vary light intensity.

Putting a glass screen in front of the beaker will control this. This also stops the heat of the water (although only a small quantity) from the lamp bulb.

Fixed Variables-

Carbon Dioxide- CO<sub>2</sub> concentration can affect the rate of photosynthesis since the more CO<sub>2</sub> in the air, the more CO<sub>2</sub> that can diffuse into the leaf. This variable can be fixed by adding a fixed amount of sodium hydrogen carbonate to the beaker and plant, to stop the levels of CO<sub>2</sub> to change.

Water- Water is required in the photosynthetic reaction. When plants lack water, their stomata close to prevent further water loss. At the same time, closing the stomata cells doesn't allow CO<sub>2</sub> to diffuse into the leaf. Water is also therefore, linked to the carbon dioxide factor. Water can be kept a constant by keeping the same amount of water in the beaker.

Temperature- Enzymes are used in photosynthesis and the respiration of the plant. Therefore, increasing the temperature will increase enzyme reaction and the photosynthetic rate until a certain point is reached when the enzymes denature. The temperature can be kept somewhat a constant by performing the experiment in one session, when the air temperature shouldn't change enough to affect water temperature. To check that the temperature is kept constant, I will measure it before and after the experiment. As well as this, I shall check the temperature every time that I change the distance of the lamp from the pondweed.

Prediction: I predict that increasing the light intensity will increase the rate of photosynthesis.

Hypothesis: When chlorophyll absorbs light energy, the light energy cannot be immediately used for energy conversion. Instead the light energy is transferred to a special protein environment where energy conversion occurs. This happens by using the energy of a photon to transfer electrons from a chlorophyll pigment to the next. During this reaction, oxygen is produced as a by-product and it is the oxygen bubbles that are being measured in the experiment. The greater the light intensity, the more light energy that can be transferred and harnessed to fuel reaction in photosynthesis.

## METHOD

- 1) Fill the beaker with 450 cm<sup>3</sup> of water and 50 cm<sup>3</sup> of NaHCO<sub>3</sub>.
- 2) Select 1 or 2 pieces of pondweed each roughly 5-10 cm long and cut off the stems.
- 3) Place the pondweed in the beaker and secure the funnel upside down over (on top of) the pondweed.

- 4) Place a water-filled test tube upside down and over the funnel.
- 5) Place the ruler so that the "0" measurement is aligned with the side of the beaker. (Distance measured from side of beaker to edge of light bulb)
- 6) I will leave it here for 1minut, for the temperature of the pondweed to adjust.
- 7) Take 3 readings at the current distance and move the lamp 5cm further away from the plant.
- 8) Repeat step 6 and 7 until 3 readings from at least 5 intervals of 5 cm have been taken.