**Aim**

Plants take in carbon dioxide and realise oxygen using photosynthesis so I am trying to determine the rate of photosynthesis. In this experiment I will investigate how sodium hydrogen carbonate affects the rate of photosynthesis.

**Apparatus Needed**

- ✓ Glass Funnel
- ✓ Desk lamp
- ✓ 1 Litre Beaker
- ✓ Test tube
- ✓ Aquatic Plant (Canadian Pond weed)
- ✓ A ball of plasticine
- ✓ Sodium Hydrogen Carbonate
- ✓ Razor Blade
- ✓ Bench lamp with a 40W bulb
- ✓ 30cm wooden ruler
- ✓ Clock
- ✓ Stirring rod

**Using the Apparatus**

- ✓ I will follow all the lab safe ty rules e.g. no running, no back packs etc)
- ✓ I will have to keep the lamp away from making contact with any water or moisture.
- ✓ When using the razor blade I must take extreme caution as it can easily cut my finger or cause harm to others.

**Fair Test**

To ensure that a fair test is carried out I will follow the following points promptly.

- ✓ I will have to keep all the different amounts of Sodium Hydrogen Carbonate at the same distance from the lamp I will measure the distance using the wooden ruler.
- ✓ I will take fresh tap water for each experiment.
- ✓ I will use the same part of the lab to keep the temperature and other light sources the same.
- ✓ I will make sure the lamp also stays in the same spot and I will use the same lamp and bulb for all the experiments.

**Hypothesis**

All green plants need to be able to make there own food they use a process called photosynthesis. For Photosynthesis to occur, the plant needs 4 main ingredients to be present, sunlight, water chlorophyll and carbon dioxide. With any one of these missing the plant will eventually die. Light is absorbed and turned into energy by green pigment in the leaf called chlorophyll the amount of energy produced depends on the speed or intensity of the light arriving. This energy combined with water (mainly from the soil) and carbon dioxide (mainly for the air) gives us starch a type of food and oxygen.

I predict that the amount of oxygen produced will be probably be smaller then a plant on the surface as there is less carbon dioxide in the water then in the air. But this does not mean there will be no carbon dioxide in the water because some $CO_2$ does dissolve in water and usually the air is only made up of 0.03% carbon dioxide. Carbon dioxide is quiet important for Photosynthesis the formula below shows how is works:-

Carbon Dioxide + Water $\longrightarrow$ Glucose + Oxygen

So I think the two main factors in this experiment that effect the rate of photosynthesis are the amount of energy produced by the light and the amount of carbon dioxide available to the plant so when the carbon dioxide starts running out the amount of oxygen produced will start dropping so as the level of sodium hydrogen carbonate increases the amount of oxygen produced will increase.

**Method**

- I will fill a 1 litre beaker ¾ full with water and dissolve a fixed concentration of sodium hydrogen carbonate in it, I will use the stirring rod to help dissolve the sodium hydrogen properly. For this experiment I will be using 4 different quantities of sodium hydrogen carbonate. One concentration per experiment.

    - Normal No Concentration
    - 0.0100 mol $dm^{-3}$
    - 0.0125 mol $dm^{-3}$
    - 0.0250 mol $dm^{-3}$
    - 0.0500 mol $dm^{-3}$

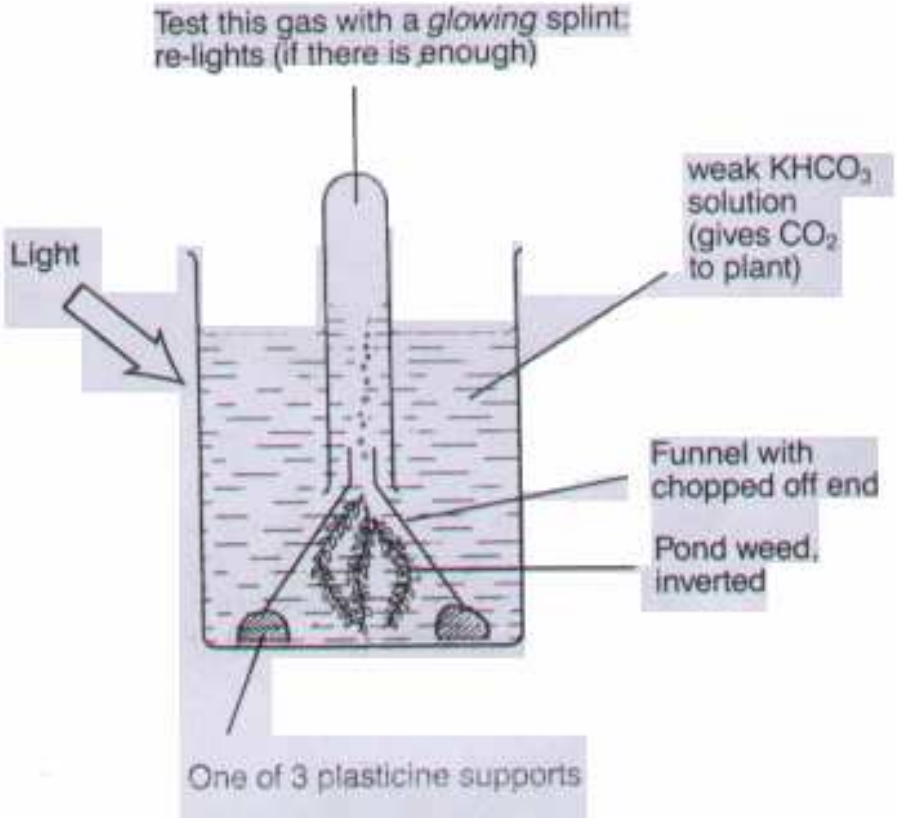
- Using a razor blade I will cut five equal size portions from the Canadian Pond weed, each from the top end of a different shoot.

- I will then place a portion of the Canadian pond weed on the bottom of the beaker and place the glass funnel over it. Using 3 lumps of plasticine I will raise the rim of the glass funnel to allow the liquid in the beaker to circulate freely and making sure the liquid level is above the end of the funnel.

- I will then place the beaker next to the bench lamp exactly 8 cm from the beaker measuring this with the wooden ruler. I will note the time on the clock and on the lamp. I will leave every experiment for 3 days for exactly 72 hours.

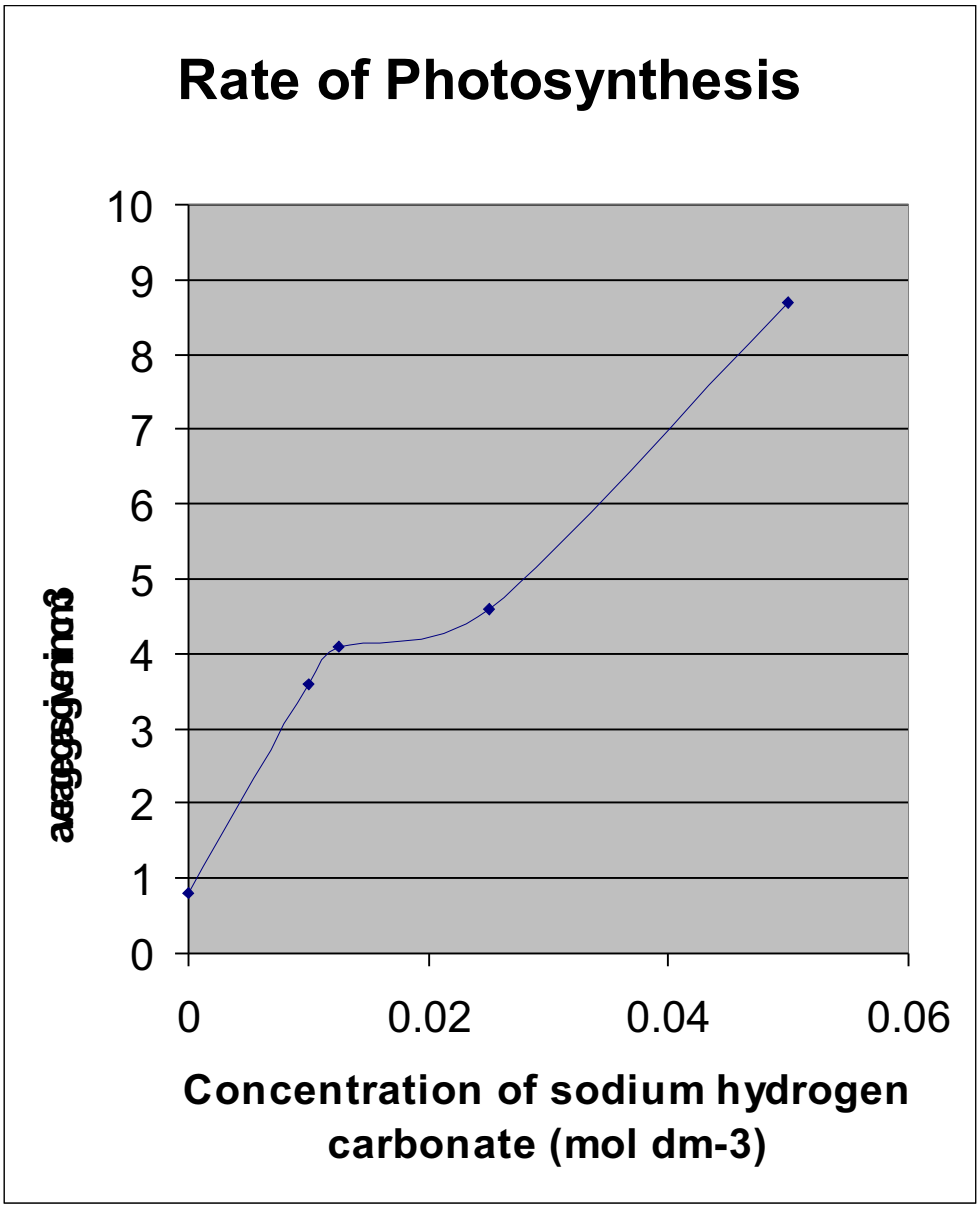
- I will perform the exact procedure for each experiment. After a experiment is complete I will note down the amount of gas produced.

**Diagram**


Test this gas with a *glowing* splint:
re-lights (if there is enough)
weak $KHCO_3$ solution (gives $CO_2$ to plant)
Light
Funnel with chopped off end
Pond weed, inverted
One of 3 plasticine supports

**Results**

| Amount of Sodium Hydrogen Carbonate dissolved in 1litre of water (mol $dm^{-3}$) | Gas Produced ($cm^3$) |
|---|---|
| 0.0000 (Normal Water) | 0.8 |
| 0.0100 | 3.6 |
| 0.0125 | 4.1 |
| 0.0250 | 4.6 |
| 0.0500 | 8.7 |


Rate of Photosynthesis
10
9
8
7
6
5
4
3
2
1
0
0
0.02
0.04
0.06
Concentration of sodium hydrogen carbonate (mol dm-3)

## Conclusion

Looking at my results I can see a significant increase in the rate of photosynthesis as the concentration of sodium hydrogen carbonate increase. All the results I occupied firmly prove my theory in the hypothesis that the greater the concentration of sodium hydrogen carbonate available the greater the amount of oxygen produced. Overall this tells me that sodium hydrogen carbonate does affect the rate of photosynthesis.

## Evaluation

I think overall my experiment was pretty straight forward not to mention it proved the photosynthesis theory correct making it a complete success. T he results I gathered were pretty much the expected results I believe one of the key features of the success of the results was the fresh Canadian pond weed I used as in the past I have heard numerous stories about other types of pond weed such as 'Elodea' not producing the rate of photosynthesis properly because the don't last fresh for long. I also calculated the average of the results and the answers were not very different, making the results even more reliable. But I had to keep in mind that there are a few variables that could have made my experiments results wrong or different such as the heat of the bulb increased as I left it on for longer, it is a common known fact that the increase in temperature could also affect the rate of photosynthesis but I believe even if it did affect the results they would not be much different then they the correct results.

Biology Coursework

# Rate of Photosynthesis

BY Mohammed Umar