GCSE Biology

Photosynthesis

Coursework

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Contents Page

Introduction

Photosynthesis is the combination of sugar from light, carbon dioxide and water with oxygen being a waste product. This process is possibly the most important biochemical path known. Nearly everything in our everyday lives depends on this process, we would not be alive right now if it weren't for this cycle, this is due to the fact that us humans breath in oxygen and breathe out carbon dioxide, with plants it is the opposite; they take in carbon dioxide and take out oxygen, which we breathe in making it extremely important for us to have plants in order to respire.

The process of photosynthesis is a very complex process.

Here is a picture of an ordinary leaf. The leaf plays a major part in the process of photosynthesis, as it takes in the light which is later on made to glucose

Photosynthesis uses the energy of light to make glucose which keeps the plant alive. Just like we eat food to keep us alive and healthy, plants use the energy of the sun and water in order to stay alive and healthy. Plants use the energy of light to make glucose to stay alive. Below is the general equation for the process of photosynthesis:

$$6\ CO_2 + 6\ H_2O + \text{light} \rightarrow C_6H_{12}O_6 + 6\ O_2$$

Carbon Dioxide + Water + Light energy → Glucose + Oxygen

The rate of photosynthesis depends on four factors: carbon dioxide, light intensity, chlorophyll and water (or other photosynthetic pigments). In order to find out the importance of these factors for photosynthesis, some experiments are carried out.

Aim: My main purpose or aim of this coursework is to find out whether photosynthesis relies on all factors or whether the process can function without the use of sunlight or carbon dioxide or water etc.

Factors that may affect photosynthesis

There are five main factors that may affect the rate of photosynthesis they are:

1. Light intensity
2. Co_2 concentration
3. Effect of chlorophyll
4. The effect of temperature (from chosen coursework area)

The experiments and how to undergo them

1. Light Intensity

The aim of this experiment is to find out whether or not the intensity of light would affect the rate of photosynthesis in a plant. To do this, I used a piece of foil which had a triangular shape in the middle of it and masked it on a plant where their was an exposed region and a shaded region.. After three hours the leaf was picked, observed and tested with iodine solution, following is the result..

Result

We can clearly see that the masked area has turned brown whilst the unmasked area has turned dark blue.

Evaluation

The masked part had given us a negative result to the iodine test which proves that there is no photosynthesis occurring if their is no light. Starch is available in the exposed region. This proves to us that photosynthesis can be carried out in the presence of light.

Conclusion

During this experiment we have concluded that photosynthesis almost mainly depends on the presence of light. If there is no light resource available photosynthesis will not occur forcing the plant to die.

2. Carbon dioxide concentration

The aim or purpose of this experiment is to prove that photosynthesis cannot function without carbon dioxide. The experiment will be as follows..

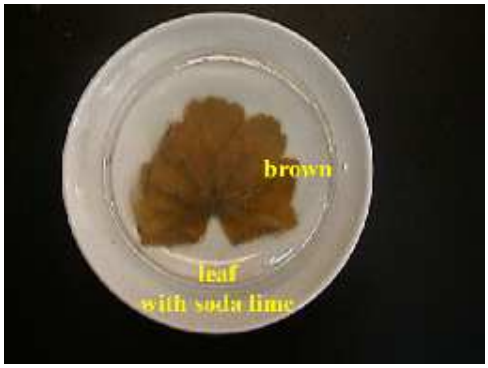
Two pots of the same type of plants are prepared inside plastic bags, both are kept in the same temperature with the same light intensity, the only difference is that soda lime has been added to plant A whilst there is no soda lime in plant B.

Plant A

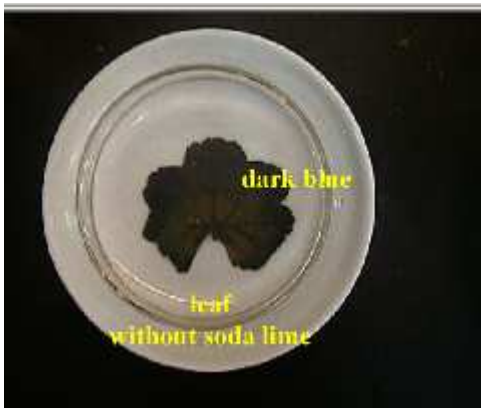
Plant B

After three hours, the leaves where picked up, observed and tested with iodine solution. Below are the results..

Plant A



Plant B



Result

Plant A remains brown whilst plant b has turned to dark blue.

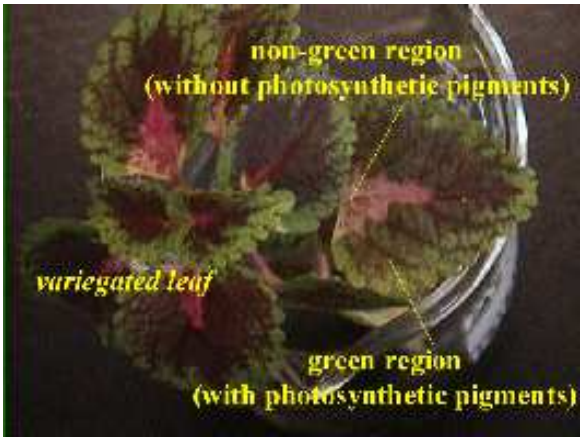
Evaluation

In plant A the soda lime has absorbed most of the carbon dioxide. In the absence of carbon dioxide the iodine test is negative. Starch is not produced throughout the experiment which proves that photosynthesis cannot take place without carbon dioxide. This means that carbon dioxide is one of the factors that are needed for photosynthesis. However in plant b, carbon dioxide is present in the plastic bag. The plant can produce starch which the iodine test has proved to us as it scored a positive score.

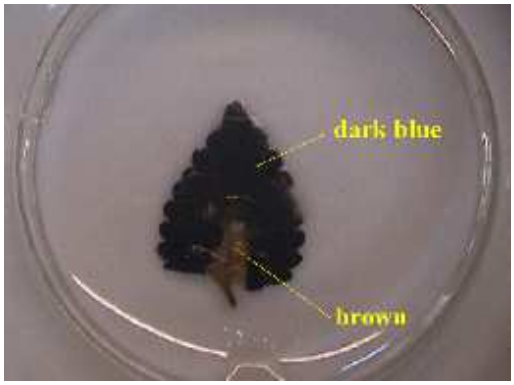
3. Effect of Chlorophyll

My aim here is to find out whether chlorophyll affects the rate of photosynthesis or not. To do this I will carry out the following experiment.

A pot of variegated plant is destarched by putting into a dark environment for one to two days before the experiment. A variegated leaf is used for testing because part of the leaf contains chlorophyll (or other photosynthetic pigments) while the rest does not. One of the variegated leaves is selected and exposed to light.



After three hours the leaf is picked up, observed and tested with iodine solution, the result is shown in the following diagram.



Result

The non-green region of the leaf has remained brown, whilst the green region of the leaf has turned dark blue.

Evaluation

Starch is present in the green region. This proves that photosynthesis can be carried out in the presence of chlorophyll. While the non-green region gives a negative result to the iodine test. This experiment has proved to us that chlorophyll does affect the rate of photosynthesis.

4. The effect of temperature

This is my main chosen point of interest throughout the coursework.

Aim

Our main aim is to find out whether temperature affects the rate of photosynthesis in a Canadian pondweed (this is a picture of Canadian pondweed).

Apparatus

To undergo the experiment we needed the following items and apparatus:

1. Sprigs of pondweed
2. Boiling tubes filled with water
3. Lamp
4. Thermometer
5. Ice
6. Supply of constant hot water
7. Tissues
8. Ruler
9. Beaker
10. Bubble counter
11. Scissors
12. Tweezers
13. Timer

Safety

Although this experiment may seem harmless we must take full precautions at all times to avoid any injury possible, below are some things we should bare in mind whilst performing the experiment to avoid serious damage or injury:

- Hot water can cause serious injury therefore we must be very wary and attentive to where we pour it.
- Scissors can also cause injury hence we should only stick to the task of cutting the pond weed not your partner's hair.
- The lamp is supplied by electricity and we are dealing with water in this experiment, splashing water around could cause an electric shock.

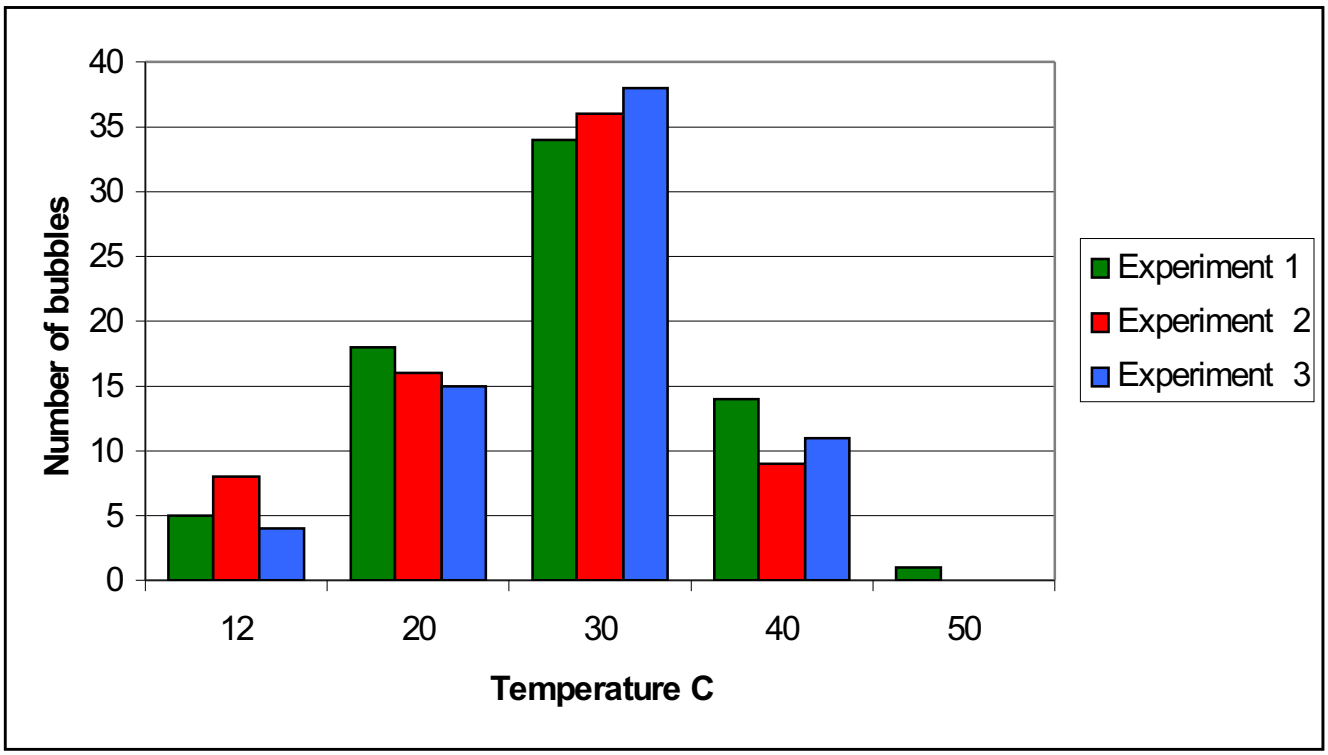
Following these safety tips will lead to a happy learning injury free environment.

Prediction

According to my knowledge and understanding of this experiment I strongly believe that temperature affects the rate of photosynthesis.
I also predict that 30˚C should be the best temperature for the pondweed to photosynthesize, this is because I believe that this temperature is neither to hot nor too cold for the pondweed, hence it produces more bubbles, which represent oxygen.

Results

Temp. °C	Experiment 1	Experiment 2	Experiment 3	Average
12	5	8	4	5.667
20	18	16	15	16.33
30	34	36	38	36
40	14	9	11	11.33
50	1	0	0	0.333



Analysis

According to our results in we can clearly see that 30˚C is the best temperature for photosynthesis to take place. We know this because out of all the other four temperatures, 30˚C is the most temperature that has produced the most bubbles. This is due to the fact that this temperature is neither too hot nor too cold it is the ideal temperature for photosynthesis to take place. Both 20˚C and 40˚C half produced approximately half the bubbles that 30˚C has produced, both temperatures have produced a decent number of bubbles but both are not as effective as 30˚C this is because 20˚C is slightly cold which makes it more difficult for the pondweed to produce bubbles. 40˚C was not as effective as 30˚C because the temperature 40˚C is somewhat hot and is not ideal for photosynthesis to take place in as the results have proven.

The results have proven that 12˚C is a temperature that negatively affects the rate of photosynthesis. It has been proven in the results to have released a low amount of bubbles during all 3 experiments; this is because this temperature is very low, too low for the pondweed to produce bubbles because it is too cold it may even die because of the cold temperature.

We can clearly see from the result that out of all the five different temperatures 50˚C was the least temperature to produce bubbles. This is because this temperature is very hot, too hot for the pondweed to produce bubbles. These temperatures may be to hot for the pondweed to take, resulting in the pondweed dyeing hence it produces little or no bubbles.

Conclusion

After analyzing, looking and observing our results we have concluded that 30˚C is the best temperature for photosynthesis to take place in plants. This is because this temperature is not too hot nor too cold for the plant to photosynthesize.

We have also concluded that temperature does affect the rate of photosynthesis in a plant. As we have tested the rate of photosynthesis at different temperatures and have come to realize that it plays an impact on the rate of photosynthesis which is represented in bubbles in this experiment.

Variables

There are some factors we must keep the same during the experiment to make it as fair as possible in order to get fair and accurate results, these factors are:

- Type of plant (we have used pondweed throughout the test).
- Volume of water.
- Lamp distance (the lamp was always 30cm away).
- All the experiments must be timed (5 minutes per experiment).

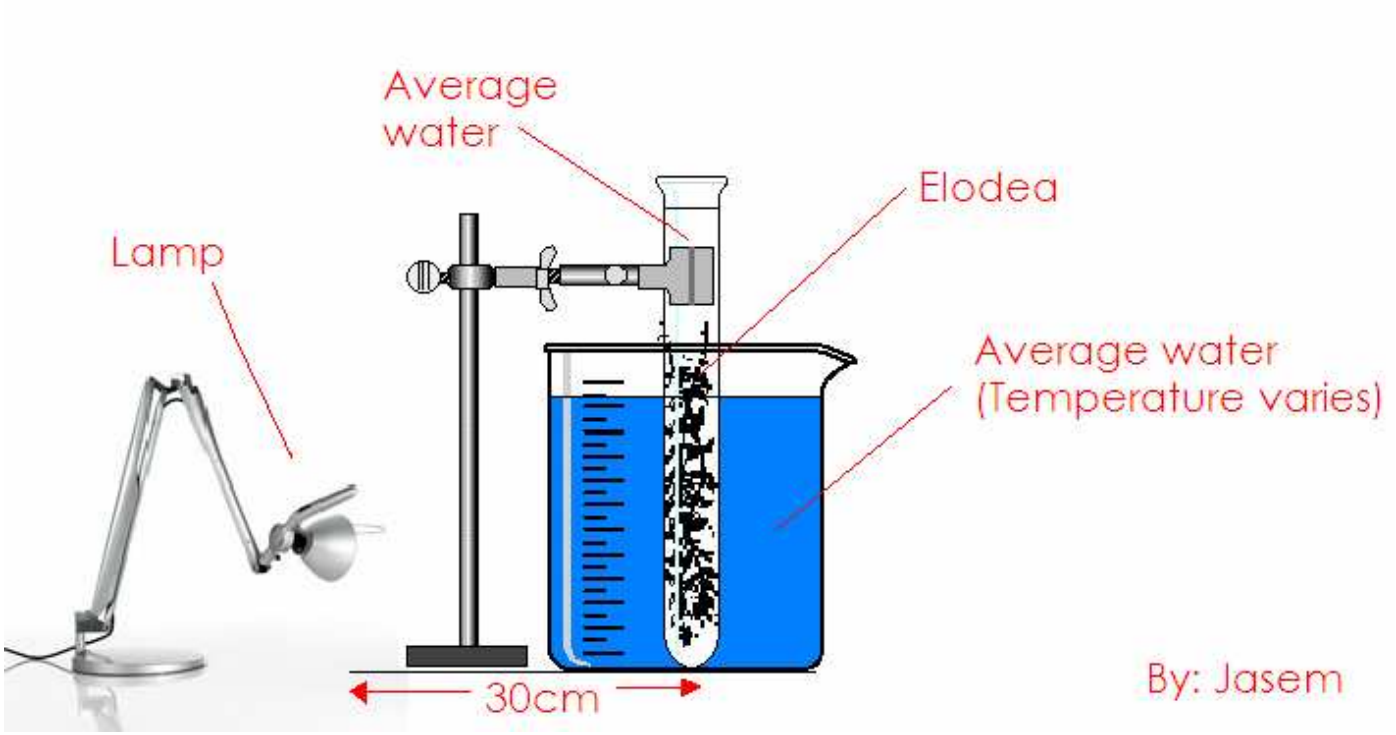
Whilst there are factors we must change as part of the experiment to make it as fair as possible, they are:

- Surrounding temperature.
- Change the weed from the last experiment.*

* You may think this factor is weird, but it is vital to change the pondweed in every experiment, this is just incase your pondweed has died because the last or present temperature is too hot or too cold. Therefore it is advised that you change the pondweed in every experiment.

Method

The method we used in order to undergo the experiment was basic and straight forward. We placed a standard pondweed in a testube filled with water, after diagonally cutting the end part of the weed in order to score sufficient and fair results.
We placed this testube inside a beaker; this beaker was filled with water which varied in temperature according to what temperature we needed. We placed a lamp 30cm away from the plant, and after ensuring we had used the right temperature of water by using a thermometer, we began the timer and began to look closely for bubbles. After a period of five minutes we stopped counting the bubbles, the results are available in the results section of the coursework. Here is a diagram of the experiment..



Evaluation

I believe the experiment went well just as planned and worked out very well. I am confident about this because the results I got where the pretty much the same as the professional scientific results.

I also believe that my results where accurate enough to prove that my prediction was correct. As I predicted that 30˚C would be the most suitable temperature for photosynthesis to take place. We can see that this prediction is correct by looking at the graph.

The method I used in order to carry out the experiment in my opinion was as fair as possible. I changed the pondweed every time in order to get a fair result, I also used the same volume of water each time to make sure that it does not effect the rate of bubbles released.

If I had the opportunity to repeat the experiment I would try to measure the rate of photosynthesis at more temperatures, this would give me a clearer result and will indicate to me perfectly which temperature is most suitable for the most amount of bubbles given of from the Elodea.

Bibliography

- www.google.com/images
- www.wikipedia.com
- Nelson Thorns GCSE Biology for you.
- CGP Biology the coursework book.

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