BIOLOGY COURSEWORK
YEAR 11
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TITLE: "AN EXPERIMENT TO INVESTIGATE HOW A FACTOR AFFECTS THE RATE OF PHOTOSYNTHESIS"

PLANNING EXPERIMENTAL PROCEDURES

Photosynthesis is a process in which plants make their own food. Photosynthesis uses carbon dioxide, water light and chlorophyll to produce glucose and oxygen. They do this by taking in the carbon dioxide (CO_2) from the air around it. The plant also needs water (H_2O) and light (either from the sun or from other sources such as a light bulb). Most of the plants food is made in the palisade cell, which is in the leaf of a plant. Leaves are perfect for photosynthesis because they are flat and thin providing a large surface area for the absorption of light and gases. Photosynthesis happens in the leaf because there are a large number of chloroplasts there, each chloroplast contains the green pigment chlorophyll that gives the leaf its green colour and also captures light energy for use in the process of photosynthesis.
In photosynthesis the light absorbed by chlorophyll powers the reaction that converts water and carbon dioxide into glucose and oxygen. Both animals and plants for respiration use oxygen produced by photosynthesis. The word equation for photosynthesis is:

$$\text{Carbon dioxide + Water} \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} \text{Glucose + Oxygen}$$

The balanced chemical equation for photosynthesis is:

$$6CO_2 + 6H2O \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} C_6H_{12}0_6 + 6O_2$$

A water plant is ideal for doing this experiment because it can photosynthesise in the water and when it does it produces oxygen bubbles, which can be counted easily. I am going to use Elodea (Canadian pondweed) for my experiment because it is a water plant and

therefore when it photosynthesises I can count the number of oxygen bubbles it will produce.

KEY FACTORS

The factors that can be changed in this investigation are:

- The amount of leaves – I can change the number of leaves, thus varying the amount of chlorophyll, on the Canadian pondweed plant and see how many oxygen bubbles it produces.
- Amount of carbon dioxide – I can change the amount carbon dioxide in the water in which the Elodea is in and see how many oxygen bubbles it produces.
- Intensity of the light – I can vary the intensity of the light. I can change the amount of light the plant is receiving to see how many oxygen bubbles it produces.
- Temperature – I can change the temperature of the water in which the Elodea is in, thus changing the rate of photosynthesis.
- Light colour – I can change the colour of the light to different colours such as red, blue or green to see how the colour of the light affects the rate of photosynthesis.

I have chosen 'intensity of light' as a factor to change in my investigation. I will change the amount of light that is reaching the plant. I will increase and decrease the light intensity to see how it affects the rate of photosynthesis in a plant.

PREDICTION

I predict that in my investigation as the intensity of the light goes up the rate at which the plant photosynthesises will increase and as I lower the light intensity the rate of photosynthesis will decrease. This is because the plant needs light to photosynthesise as well as other things such as water, carbon dioxide and chlorophyll. By varying the amount of light and keeping other factors the same we will be able to how the intensity of light affects the rate of photosynthesis.

APPARATUS

The equipment that I will use for my experiment is listed below.

- Lamp
- 40cm ruler
- Beaker
- Water
- Potassium hydrogen carbonate
- Elodea (Canadian pondweed)
- Light intensity meter
- Stopwatch

METHOD

Set out the apparatus as shown in the diagram and then follow the procedure written below:

1. Set out the apparatus as shown in the diagram above.
2. Darken the room as much as possible so there is other source of light except from the lamp. Switch on the lamp.
3. Put some potassium hydrogen carbonate in the beaker with the water to supply the plant with carbon dioxide (carbon dioxide is one of the main factors that affect the rate of photosynthesis and by adding potassium hydrogen carbonate in the water we can keep the amount of carbon dioxide the same).

4. Place a paper clip at the end of Elodea to avoid it from floating to the top and to also avoid the release of oxygen bubbles from the end. Add the Elodea to the water. Put a light intensity meter in front of the beaker, the beaker and the light intensity meter should be as close to lamp as possible. Measure and note down the strength of the light and remove the light intensity meter.
5. Start the clock and count how many oxygen bubbles the plant give out. After 1 minute stop the clock and write down the total number of bubbles given out by the plant.
6. Repeat the procedure two more times and note down the results.
7. Move the beaker 10cm away from the lamp.
8. Repeat the whole procedure moving the beaker 10 cm away each time until you get to 40cm.

SAFETY

To make my investigation safe I will do the following:

- I will keep the water away from the lamp.
- I will keep the water away the electrical switch and socket.
- I will keep the water from other pupils.
- I will keep the lamp away from other pupils.
- I will keep my bag and coat out of the way and put them in a safe place.

FAIR TEST

To make my investigation safe I will do the following:

- Using the same piece of Elodea through the experiment.
- Using the same lamp through out the experiment.
- Supplying the plant with enough carbon dioxide to photosynthesise by adding potassium hydrogen carbonate to the water.
- Using the same light intensity meter through the experiment.
- Keeping the temperature the same (room temperature) through out the experiment.
- Doing whole the experiment on the same day so that the room temperature doesn't vary.
- Making the room as dark as possible so that the plant doesn't get any extra light from anywhere else.
- Doing the experiment three times and taking the mean result.

RESULTS TO BE TAKEN

The results that I will take in my experiment are the distance of the beaker from the lamp – I will firstly place the beaker closest to the lamp at 0 cm and I will keep moving the beaker 10cm away each time until it reaches 40 cm.
I will measure the intensity of the light by using a light intensity meter. I will also measure the number of oxygen bubbles and I will do this three times.
The results that I will take should be reliable enough to write a good conclusion.

INFORMATION USED

The information that I have used in this investigation is from the Heinemann biology textbook, CJP biology revision guide and also from the notes in my notebook.

OBTAINING EVIDENCE

RESULTS

I have obtained the following results from my experiments:

Distance of beaker from the lamp (cm)	Light intensity	Number of oxygen bubbles produced by the plant (per minute)		
		1st run	2nd run	3rd run
0	4.5	61	65	64
10	3.1	35	34	39
20	2.5	15	18	15
30	2	8	9	9
40	1.6	1	2	0

I have worked out the mean number of oxygen bubble per minute and I have recorded that in the table below:

Distance of beaker from the lamp (cm)	Number of oxygen bubbles produced by the plant (per minute)			Mean number of oxygen bubbles produced by the plant (per minute). (Nearest whole number).	
	1st run	2nd run	3rd run	Working	
0	61	65	64	(61+65+64) 3=	63
10	35	34	39	(35+34+39) 3=	30
20	15	18	15	(15+18+15) 3=	16
30	8	9	9	(8+9+9) 3=	9
40	1	2	0	(1+2+0) 3=	1

ANALYSING EVIDENCE AND CONCLUDING