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Biology Coursework
Photosyntesis in a Pond Weed

Aim:
The aim of this experiment is to find out what effects the amount of photosynthesis happening in a pond weed.

Introduction:
A piece of pondweed will be cut and placed into a test tube containing water and sodium hydrogen carbonate, which is placed inside a beaker containing water. 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. The amount of bubbles will be counted for a period of one minute. The temperature of the water would be recorded at the start and end of the minute.

Photosynthesis Equation:
$$6CO_2 + 12H_2O \xrightarrow{\text{SUNLIGHT}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

Preliminary Work:
The problems that arose whilst doing the preliminary experiment was that too much sodium hydrogen carbonate was placed inside of the test tube and all the water had turned cloudy so it was impossible to count the amount of bubbles. Also the beaker was placed too far away from the light which meant that the light wasn't reaching the beaker. The preliminary experiments showed that the closer the light is to the beaker the more bubbles appear.

Distance (cm)	Start Temp (ºC)	End Temp (ºC)	Amount of bubbles in 1 minute
10	32	29	32
20	30	28	22
30	29	28	13
40	29	29	6
50	28	28	2
60	27	28	2

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Fair Test:

The experiment will be made fair by adding the same amount of sodium hydrogen carbonate each time so that this will not change the amount of bubbles for the change of distance. Also the same lamp will be used each time so that the same light is reaching the beaker each time. The experiment will take place in the same place each time so that the light coming from outside or the ceiling will be kept the same each time. The same amount of water will be in the beaker and test tube each time. The distance of the light will be changed each time so that results can be made for different lengths. The temperature will be kept roughly the same so that the temperature doesn't affect the amount of bubbles, a thermometer will be used so that the temperature can be seen and judged. The piece of pond weed inside the test tube will be the same throughout the experiment so that the results are all based on the same pond weed. The same person will be counting the bubbles, time, temperature and amount of sodium hydrogen carbonate each time to make it fair.

Prediction:

I predict that the closer the beaker is to the light the more bubbles will appear, this is because the closer it is the more light can be absorbed by the plant causing more photosynthesis to happen. Also the light may heat up the water which will make the enzymes move more and faster because they have more energy and that will increase the reaction speed. At 100cm there will be the least amount of bubbles and at 0cm there will be the most amounts of bubbles. As more particles are involved then there is more chance of there being an effective collision, this will mean the closer the light is the more light reaches and there will be more particles and the closer the light the more light intensity there will be.

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Attempts	Light Intensity (LUX)	Amount of sodium hydrogen carbonate (spatulas)	Distance (cm)	Starting Temperature (ºC)	Ending Temperature (ºC)	Amount of bubbles in 1 minute
1	284	2	100	28	29	104
2	287			28	27	102
3	283			28	27	107
Average	**284.7**			**28**	**27.7**	**104.3**
1	312	2	90	27	27	118
2	317			29	28	115
3	325			27	27	109
Average	**318**			**27.7**	**27.3**	**114**
1	338	2	80	28	28	137
2	329			27	27	138
3	343			28	27	142
Average	**336.7**			**27.7**	**27.3**	**139**
1	382	2	70	27	29	148
2	376			28	29	142
3	393			28	28	152
Average	**383.7**			**27.7**	**28.7**	**147.3**
1	460	2	60	28	28	110
2	452			28	29	152
3	473			30	28	163
Average	**461.7**			**28.7**	**28.3**	**141.7**
1	601	2	50	28	27	152
2	593			29	27	159
3	615			27	28	165
Average	**603**			**28**	**27.3**	**158.7**
1	762	2	40	28	28	158
2	753			28	29	168
3	787			27	27	152
Average	**767.3**			**27.7**	**28**	**159.3**
1	895	2	30	27	27	185
2	903			27	28	176
3	892			28	28	189
Average	**896.7**			**27.3**	**27.7**	**183.3**
1	920	2	20	27	26	178
2	917			28	27	192
3	933			28	27	186
Average	**923.3**			**27.7**	**26.7**	**185.3**
1	980	2	10	27	27	183
2	977			28	27	187
3	989			28	27	191
Average	**982**			**27.7**	**27**	**187**
1	1000+	2	0	28	29	197
2	1000+			29	28	201
3	1000+			28	28	195
Average	**1000+**			**28.3**	**28.3**	**197.7**

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Materials:

- Beaker
- Test tube
- Pond weed
- Lamp
- Meter rule
- Thermometer
- Sodium hydrogen carbonate
- Apron
- Light intensity box
- Goggles
- Timer

Method:

1. Put on your apron and goggles
2. Set up the experiment
3. Measure the temperature
4. Put the sodium hydrogen carbonate in the test tube
5. Start the timer
6. Count the bubbles
7. After 1min stop the timer
8. Measure the temperature
9. Change distance
10. Repeat

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Analysis:

The graph shows that as the distance away from the light decreases, the amount of bubbles produced increases. This is because more light can reach the pondweed which suggests that more photosynthesis will happen in the plant causing more bubbles. It also shows that the closer the distance, the more light reaches the pond weed, there fore the more light intensity. There were a couple of anomalies within the test and they have been identified on the graph but the majority of the results matched with the best fit line. This might have been because the bubbles were being produced too fast to count them probably or it might have been that bubbles had been added accidentally. For 30cm the result should have been around 165 bubbles according to our best fit line but our result was 185 bubbles, and for 60cm our result should have been around 150-155 bubbles but was 110 bubbles. The light intensity graph doesn't have any anomalies and all points ran along the best fit line. The results didn't show that much of a difference at further distance but then increased rapidly through 30cm-70cm and then slowed down at close distances. From this graph we can tell that if the light intensity is 700 then the distance would be 45cm. My prediction was right because I suggested that as the length decreased more bubbles would appear because of the amount of light reaching the pondweed.

Evaluation:

The repeats in the results showed a consistency and all of the repeats showed that roughly the same amount of bubbles were produced each time, as well as the same amount of light intensity. The results showed that the amount of bubbles rose rapidly within the first 40cm and then slowly rose, but rapidly rose again in the last 30cm. The results fell quite neatly into a best fit line and are clear and easy to understand. There were a couple of anomalies in the results which may be because the bubbles were appearing to fast to count or some bubbles may have been added accidentally. I think that our group had a good method because our results showed what we were trying to find out, which was to test if distance of a light affects the amount of photosynthesis in a pondweed. To get rid of any anomalies we could have used a gas chamber to collect the bubbles and we could test to see the amount of gas produced. Also because the bubbles only had to travel a short way until they reached the top and disappeared, if we had a longer test tube then we might have been able to count the bubbles more accurately. I think that the procedure that we had used was adequate to test and that it was reasonably reliable. In my prediction I had stated that as length decreases the amount of bubbles would increase because of the fact that there would be more particles in the pondweed to collide with each other and more chance of there being an effective collision. In future experiments we could increase the range of results as well as having more intermediate values.

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