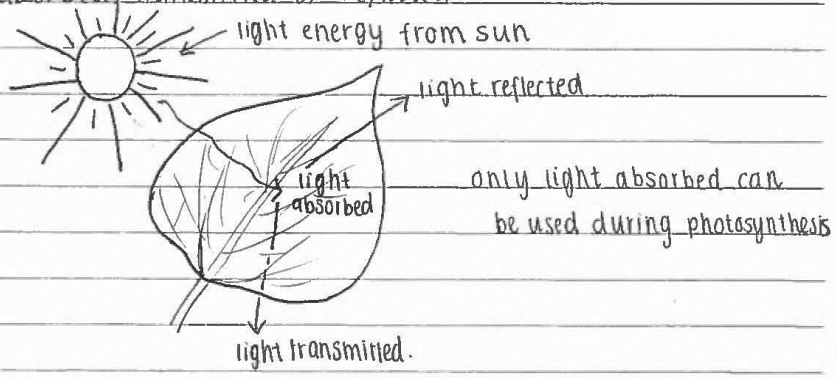
Candidate 2 evidence

Effect of light intensity on the rate of photosynthesis.

Aim: To invesigate if increasing the percentage of light intensity would affect the rate of photosynthesis.

Underlying Biology: Photosynthesis is a chemical reaction in which plants absorb light energy and use it to produce food and survive. The plant uses carbon dioxide from the air and combines it with water collected from the soil to produce glucose. The process of photosynthesis can however, only be carried out in green plants. Light energy moves in waves. There are many pigments present in green plants that have the ability to absorb light energy. Examples of these pigments would be Chlorophyll a and b and Carotenoids. Each pigment absorbs a different wave length of light. Upon hitting a pigment molecule light is either absorbed, transmitted or reflected.



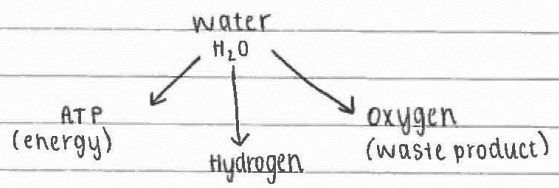
The absorption spectrum is used to show the range to which every individual wavelength of light is absorbed by the different pigments. The action spectrum is able to portray the range to which the wavelengths of light can be used within a green plant in the photosynthesis reaction.

To produce energy in the form of glucose, electrons

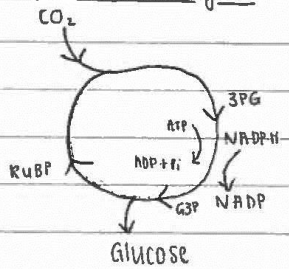
move to the electron transport chain however, to first do this the electrons have to get 'excited'. So, when the pigments in the leaf absorb the light, the chemical energy here gets electrons 'excited' and allows them to move through electron carriers which releases their energy in the form of ATP.

There are two main stages to photosynthesis: the light-dependant stage known as Photolysis and the Calvin cycle.

Photolysis



The Calvin Cycle



The Glucose produced by a plant during the Calvin cycle can be used for many different things within a plant, it can be converted into starch (a storage carbohydrate) or could be used as cellulose for cell walls.

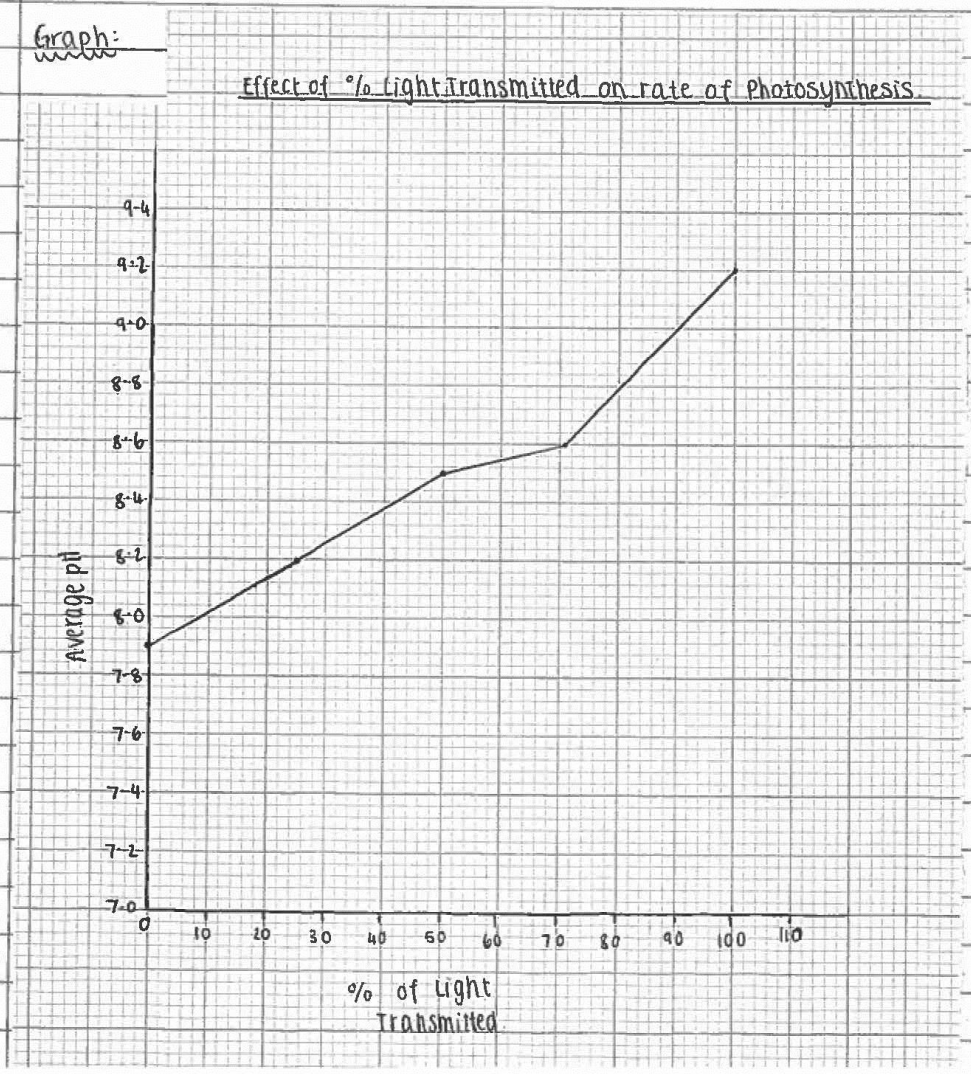
Method: 4cm of pondweed put into each bouji bottle. Bottles filled to brim with hydrogen-carbonate and different light intensity filters wrapped around bottles. Bottles placed in lightbox for one hour. Then removed and filters removed so that pH

could be determined using pH colour chart. pH of each bottle recorded. No safety measures were needed.

Results:

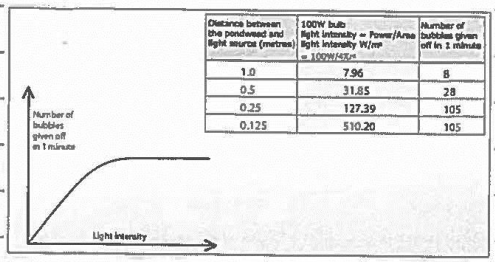
% of Light Transmitted	pH			
	Trial 1	Trial 2	Trial 3	Average
0%	8·0	8·0	7·8	7·9
25%	8·2	8·4	8·0	8·2
50%	8·4	8·8	8·2	8·5
71%	8·4	9·0	8·4	8·6
100%	9·2	9·2	9·2	9·2

Graph:



Data from second source:

Distance between the pondweed and light source (metres)	100W bulb light intensity = Power/Area light intensity W/m² = 100W/4πr²	Number of bubbles given off in 1 minute
1.0	7.96	8
0.5	31.85	28
0.25	127.39	105
0.125	510.20	105



Citation ①: The number of bubbles given off is an indirect measurement of the rate of photosynthesis - in our graph this was measured by the average pH.

Analysis: Our source and my chosen internet source are not directly compatiable as our experiment looked at carbon dioxide being used up to produce oxygen which affected the pH. However, our internet source looks at number of bubbles given off. Although they are not directly compatiable they both do show that, as you increase the light intensity the rate of photosynthesis also increases. As in ours you can observe an increase in pH whereas in theirs it is shown as an increase in number of bubbles given off.

Conclusion: Increasing the percentage of light intensity will affect the rate of photosynthesis, as it will also increase. Plants need CO_2 to photosynthesize as well as light: so as the plants use up the CO_2 from the Hydrogen carbonate and produce Oxygen the pH increases. This is shown as the higher the light intensity the higher the pH therefore showing that the rate of photosynthesis is also increasing.

Evaluation: Our experiment could be made more accurate by remove human error if we used a colourimeter as our end pH colours were determined by ourselves

which could result in differing of opinions. A colourimeter would eliminate this. our experiment can be deemed reliabu as our sample size was adequate as there was not a wide range between our results. In our experiment we controlled the type and concentration of hydrogen carbonate, colour of the light in the lightbox and the size of the pondweed sample. If we were to repeat our experiment for more validity we could try using different coloured lights in the lightboxes as well as having different light intensity percentage filters around bottles.

Sources/ References:

① Second source: http://www.passmyexams.co.uk/GCSE/biology/light-affecting-rate-of-photosynthesis.html

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