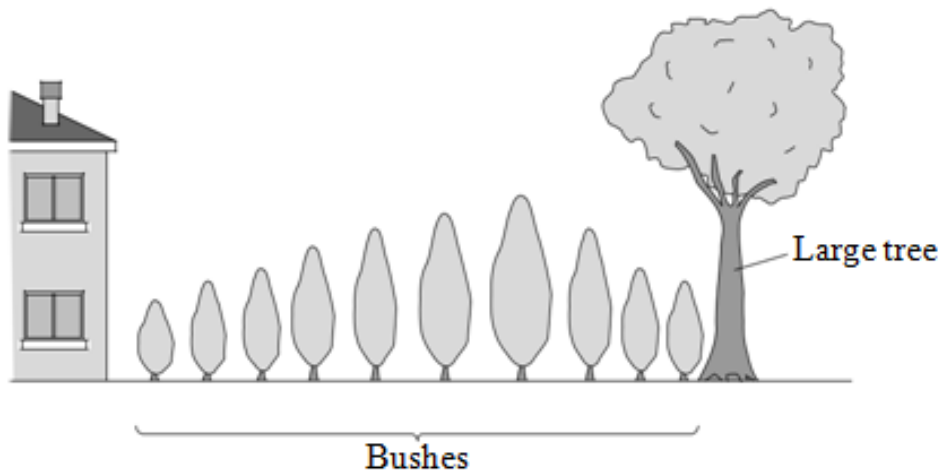


Photosynthesis

Q:1 The diagram shows bushes in a hedge growing near to a house. The bushes were the same species and the same age.



(a) (i) The student said, "I have noticed that the short bushes grow next to the house. I think that the more light the bushes get, the faster they will grow."

Draw lines to match each of the student's statements to the correct term.

Draw only two lines.

Statement	Term
The short bushes grow next to the house.	A conclusion
Plants will grow faster if they get more light.	A prediction
	An observation

(2 marks)

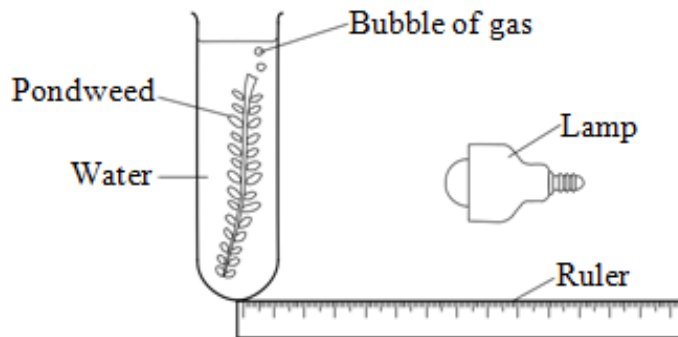
(ii) Complete the word equation for photosynthesis.

_____ + water (+ light energy) → _____ + oxygen

(2 marks)

(b) The student decided to investigate the effect of light intensity on the rate of photosynthesis.

She used the apparatus shown in the diagram.

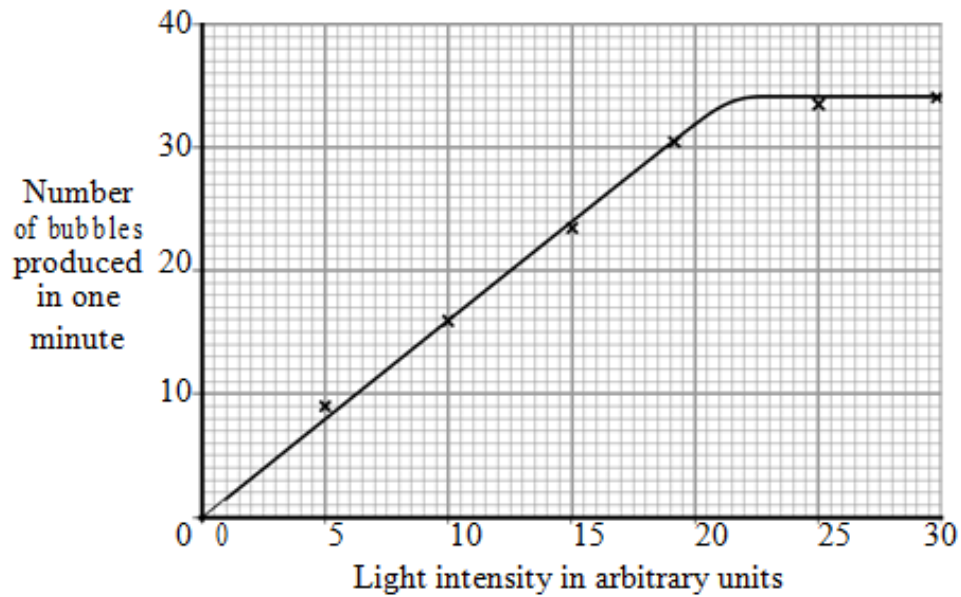


She measured the rate of photosynthesis by counting the number of gas bubbles given off each minute.

(i) Suggest how the student varied the intensity of the light received by the pondweed.

(1 mark)

(ii) The student's results are shown on the graph.



Describe the pattern shown on the graph.

(2 marks)

(iii) This is what the student wrote for her conclusion.

“Increasing the light intensity increases the rate of photosynthesis of the pondweed.”

Why was her conclusion incomplete?

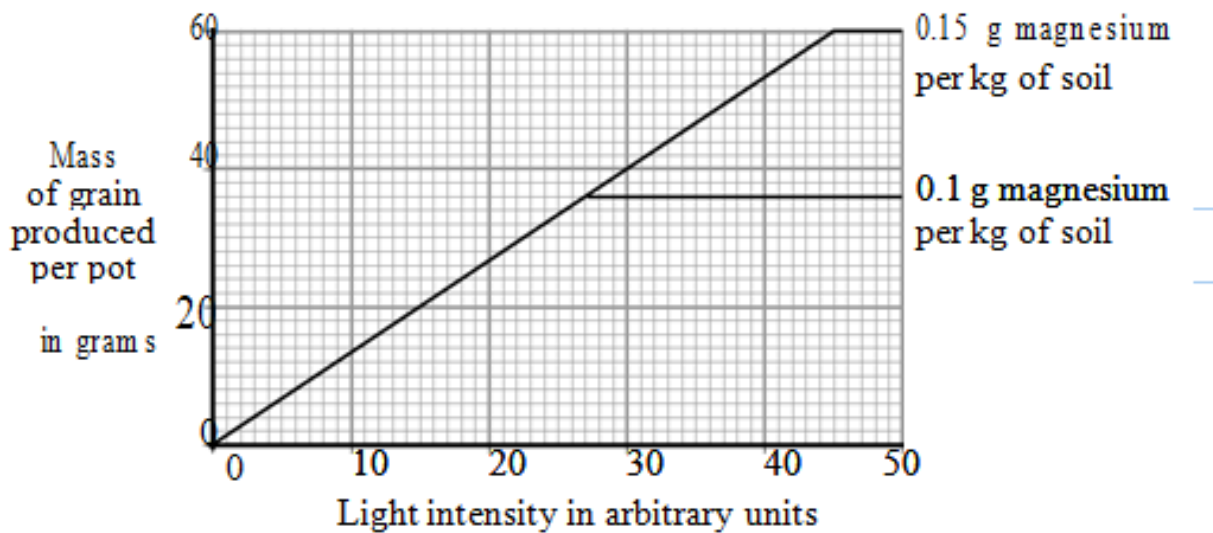
(1 mark)

Q:2 A student investigated the effect of magnesium salts on the production of grain by wheat plants kept at different light intensities.

He planted 15 wheat seeds in each of 10 pots of similar soil. Each pot contained one of two different concentrations of magnesium salts. He kept all the pots well watered. Each pot was kept at a different light intensity.

All the plants were maintained at 20 °C for six months. The grain produced by the plants in each pot was collected and weighed.

The student's results are shown on the graph.



(a) In the pot supplied with 0.1 g of magnesium per kg of soil and kept at a light intensity of 20 arbitrary units, the yield of grain is 26.5 g.

(i) Name the factor limiting the yield of grain under these conditions.

(1 mark)

(ii) Using evidence from the graph, explain why the amount of magnesium is not the limiting factor under these conditions.

(1 mark)

(iii) Explain why the mass of magnesium available to the plants affects the yield of grain.

(2 marks)

(b) The average light intensity received by wheat crops in Britain is 30 arbitrary units.

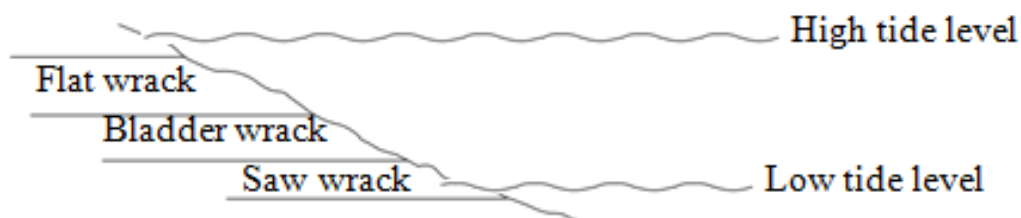
Farmers are advised to add enough magnesium fertiliser to the soil to give a magnesium concentration of 0.1 g per kg of soil when growing wheat.

Suggest why farmers are advised not to add more magnesium fertiliser than would produce a concentration of 0.1 g of magnesium per kg of soil.

(1 mark)

Q:3 The diagram shows where three seaweeds live on a seashore.

As the tide moves in and out, these seaweeds are covered with seawater for different lengths of time.

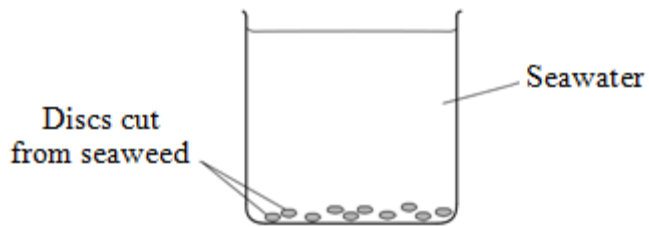


Some students investigated the rate of photosynthesis in these seaweeds.

They cut ten small discs from one seaweed.

They dropped the discs into seawater in a beaker.

They recorded the time taken for the fifth disc to float to the surface. They repeated this experiment with the other two seaweeds.



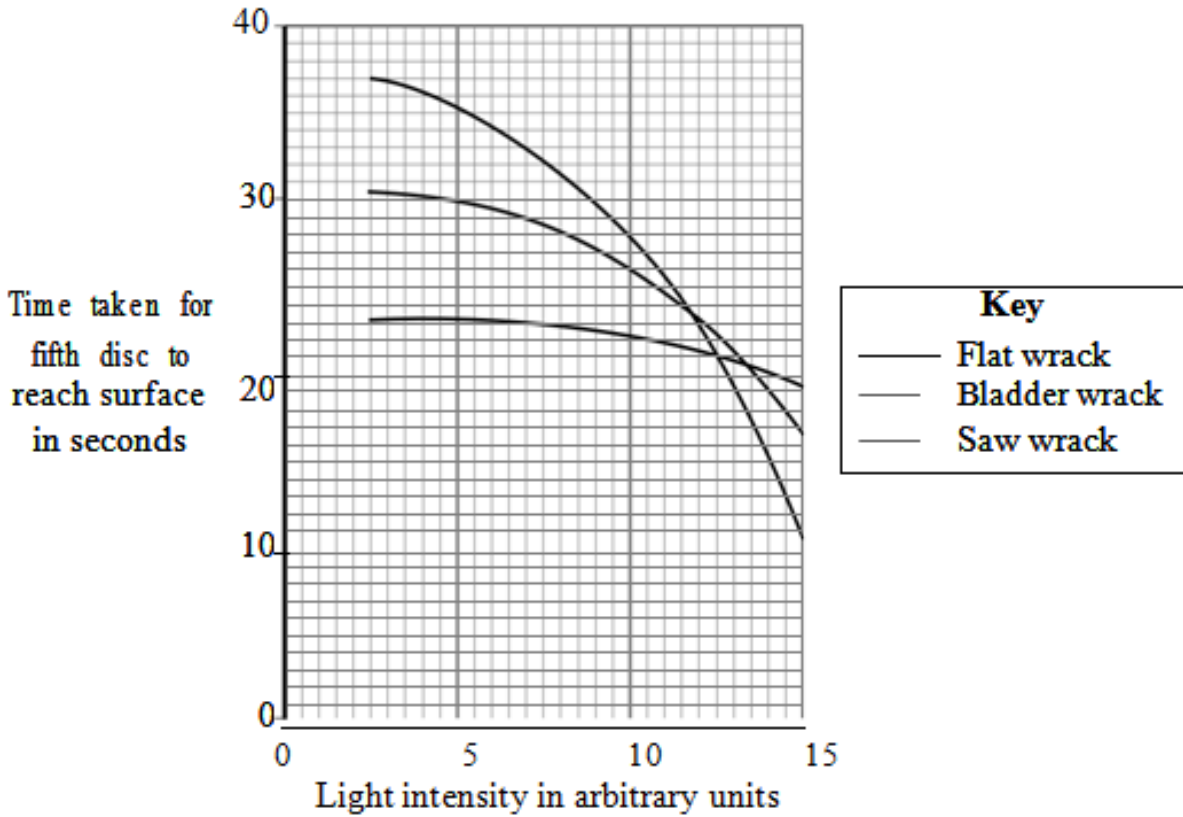
(a)(i) Suggest why the discs floated to the surface.

(1 mark)

(a)(ii) Suggest the advantage of recording the time taken for the fifth disc to reach the surface, rather than for the tenth disc.

(1 mark)

(b) The students carried out their experiments at different light intensities. The graph shows the results they collected.



(b)(i) Compare the rate of photosynthesis for flat wrack with the rate for saw wrack at different light intensities.

(2 marks)

(b)(ii) Seawater absorbs light. The growth rate of saw wrack is less than the growth rate of bladder wrack. Suggest why.

(2 marks)

Q:4 A group of pupils investigated the way in which the colour of light affects photosynthesis.

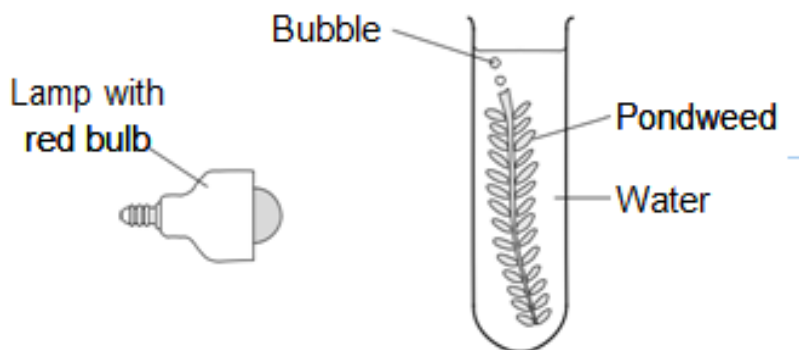
The pupils:

put a piece of pondweed into a test tube of water

shone light from a lamp with a red light bulb onto the pondweed

counted the bubbles of gas produced by the pondweed every minute for three minutes.

The diagram shows the experiment.



The pupils repeated their experiment using a yellow light bulb, a green light bulb and a blue light bulb.

(a) (i) What was the independent variable in the investigation?

(1 mark)

(a) (ii) To make the investigation fair the pupils needed to control some variables.

Suggest one variable that the pupils should have controlled during their investigation.

(1 mark)

(a) (iii) It is better to count the bubbles every minute for three minutes than to count all the bubbles in three minutes.

Why?

(1 mark)

(b) The table shows the pupils' results.

Colour of bulb	Number of bubbles produced in one minute			
	1st minute	2nd minute	3rd minute	Mean
Red	24	19	21	21
Yellow	18	14	15	16
Green	6	4	3	4
Blue	32	34	32	33

Algae are tiny organisms that photosynthesise.

In natural light algae grow very quickly on the sides of a fish tank.

The algae make it difficult to see the fish.

(b) (i) What would be the best colour of light bulb to illuminate the fish tank to reduce the growth of algae?

Use the results in the table to help you to decide.

Draw a ring around one answer.

red yellow green blue

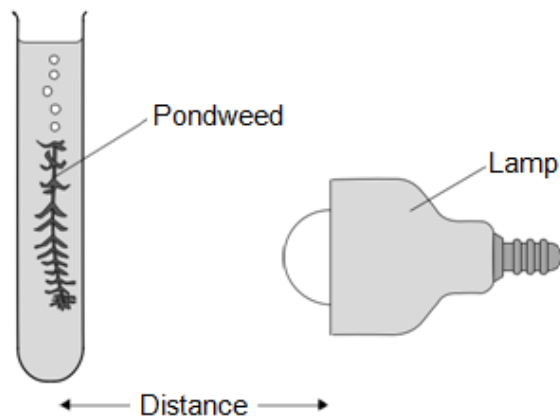
(1 mark)

(b) (ii) Explain why the colour you have chosen is the best.

(2 marks)

Q:5 Some students investigated the effect of light intensity on the rate of photosynthesis. They used the apparatus shown in Diagram 1.

Diagram 1



The students:

- placed the lamp 10 cm from the pondweed
- counted the number of bubbles of gas released from the pondweed in 1 minute and repeated this for different distances between the lamp and the pondweed.

(a) The lamp gives out heat as well as light.

What could the students do to make sure that heat from the lamp did not affect the rate of photosynthesis?

(1 mark)

(b) The table shows the students' results.

Distance in cm	Number of bubbles per minute
10	84
15	84
20	76
40	52
50	26

(b) (i) At distances between 15 cm and 50 cm, light was a limiting factor for photosynthesis.

What evidence is there for this in the table?

(1 mark)

(b) (ii) Give one factor that could have limited the rate of photosynthesis when the distance was between 10 cm and 15 cm.

(1 mark)

TOTAL MARKS=28