

WJEC (Wales) Biology GCSE
Topic 1.5 Plants and
Photosynthesis
Questions by Topic

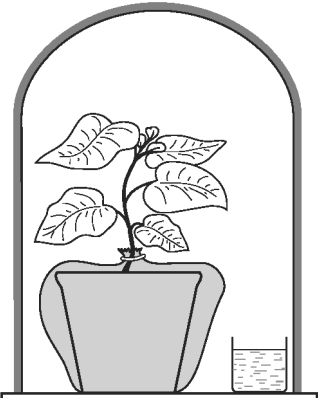
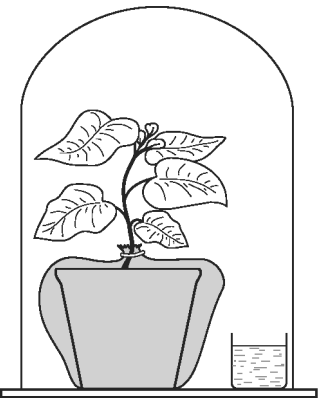
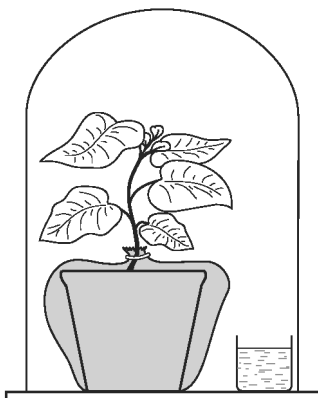
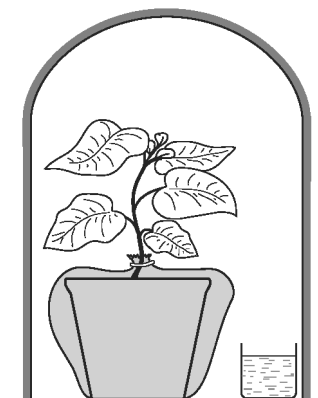
1.

(a) Complete the word equation for photosynthesis shown below.

[2]

carbon dioxide + \longrightarrow glucose +

(b) The diagrams below show four experiments used to investigate the conditions needed for photosynthesis. Four well-watered potted green plants were placed in glass bell jars, which were sealed onto greased glass plates. The soil in each pot was covered with a polythene sheet. Each apparatus was then subjected to different environmental conditions.

| | |
|--|---|
| <p>Experiment A</p> <ul style="list-style-type: none">• Bell jar covered in thick black paper• Beaker contains a chemical that produces carbon dioxide  | <p>Experiment B</p> <ul style="list-style-type: none">• Beaker contains a chemical that produces carbon dioxide  |
| <p>Experiment C</p> <ul style="list-style-type: none">• Beaker contains a chemical that absorbs carbon dioxide  | <p>Experiment D</p> <ul style="list-style-type: none">• Bell jar covered in thick black paper• Beaker contains a chemical that absorbs carbon dioxide  |

- (i) After 3 days, leaves from each of the four plants were tested for starch. Complete the table below by placing a ✓ or a X in each box to show the presence or absence of starch. [2]

| experiment | presence or absence of starch ✓ or X |
|------------|---|
| A | |
| B | |
| C | |
| D | |

- (ii) The results from which two experiments should be compared to show that

I. carbon dioxide is needed for photosynthesis, [1]

.....

II. light is needed for photosynthesis? [1]

.....

2.

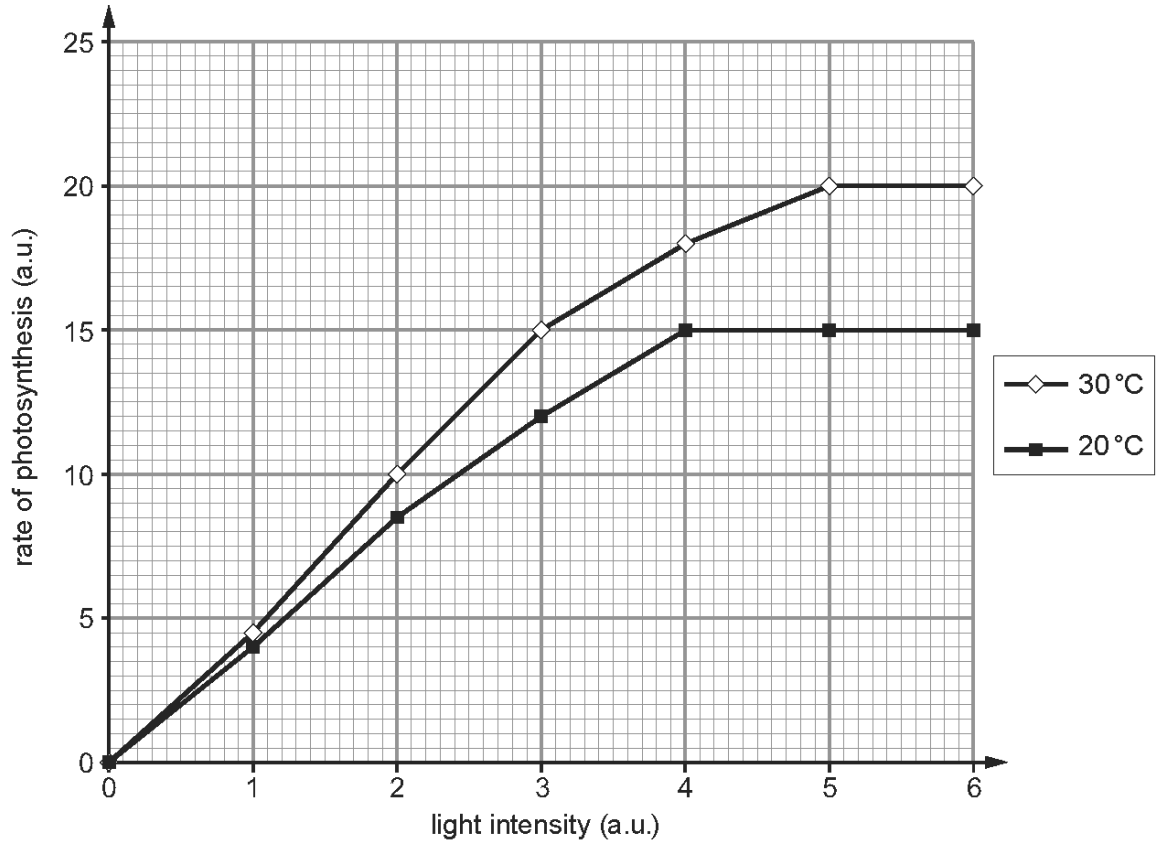
(a) (i) Complete the following equation for photosynthesis in green plants.



(ii) Name the chemical substance which absorbs the light needed for photosynthesis. [1]

.....

(b) A scientist investigated the rate of photosynthesis at different light intensities and temperatures. The results are shown in the graph.



Use the graph to:

(i) Describe in detail how light intensity affected the rate of photosynthesis at 20 °C. [2]

.....
.....

- (ii) Calculate the difference in the rate of photosynthesis between 20 °C and 30 °C at a light intensity of 3.5 a.u. [2]

difference in rate of photosynthesis a.u.

- (iii) Name one *other* environmental factor which can affect the rate of photosynthesis. [1]

.....

- (c) Complete the table to show two ways in which plants use the glucose produced in photosynthesis. [2]

| substance produced from glucose | how the substance is used in a green plant |
|---------------------------------|--|
| | storage |
| cellulose | |

| |
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| 9 |

4.

A plant was destarched. A leaf on the plant was treated as shown in diagram M below. The plant was then placed in bright sunlight for 6 hours. The leaf was removed and tested for starch. The result is shown in diagram N.

Diagram M

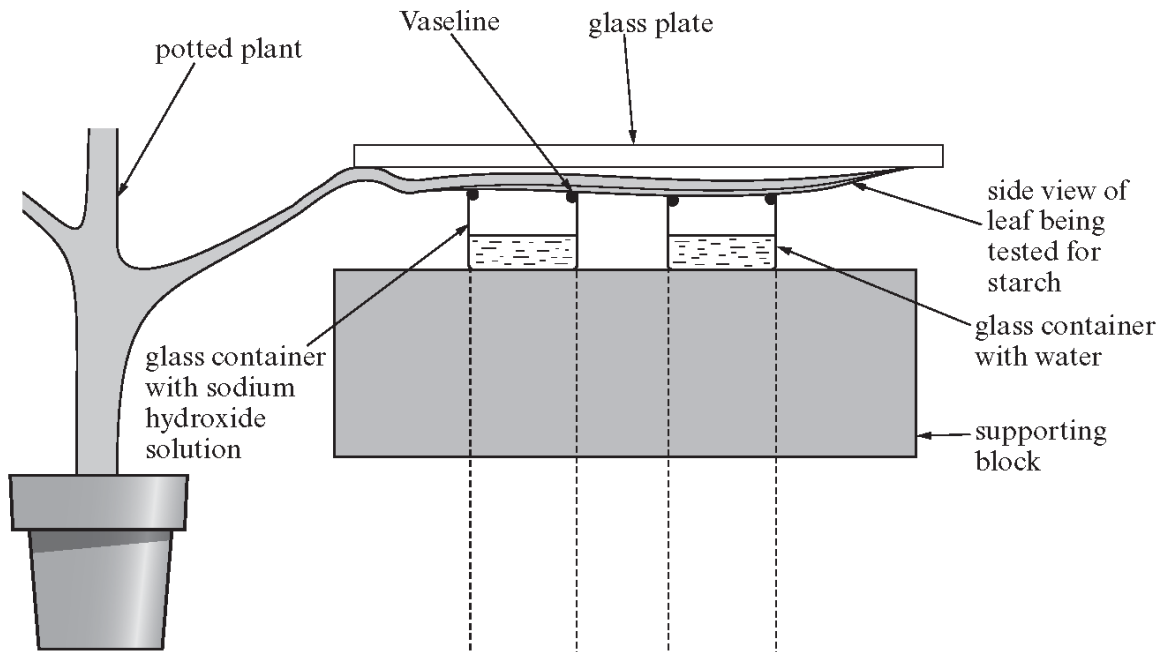
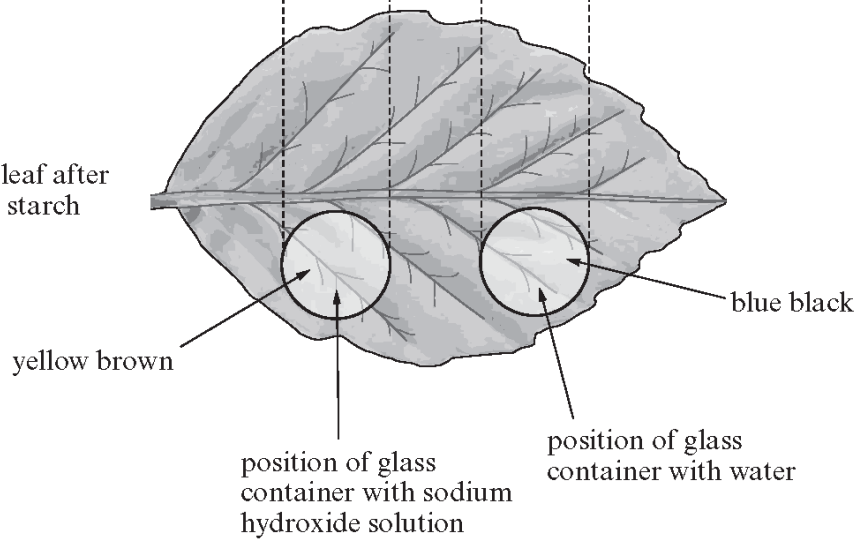


Diagram N

surface view of leaf after being tested for starch



(a) State what the investigation shown opposite demonstrates. [1]

.....

.....

(b) (i) How would you completely remove all the chlorophyll from the leaf before testing for starch? [1]

.....

.....

(ii) Name the chemical used to test for starch. [1]

.....

(iii) Explain why part of the leaf in diagram N is yellow-brown in colour. [3]

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(c) What was the purpose of the glass container with water? [1]

.....

(d) Why is it only possible to form a valid conclusion for this investigation if the glass plate and containers allow light through? [1]

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5. Some physical and chemical changes were measured in a rock pool on the sea shore at low tide. The measurements were made during daylight hours over a period of one week. The rock pool contained a high biodiversity of animals and algae.

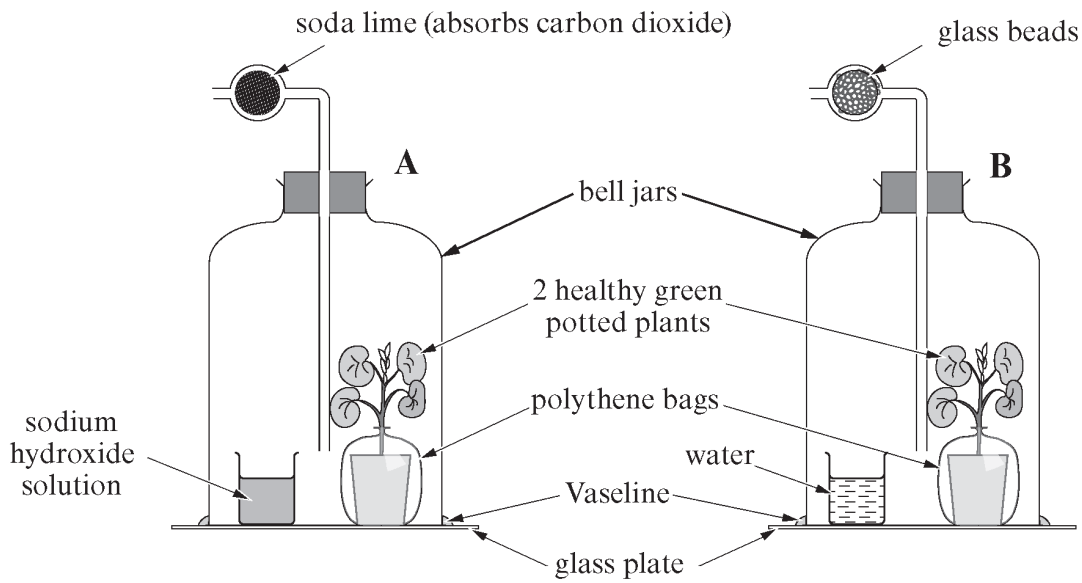
The results are shown in the table below.

| Physical and chemical conditions in rock pool water | | | | |
|---|-----------------------|---------------|------------------|----------|
| Time of day | Carbon dioxide (mg/l) | Oxygen (mg/l) | Temperature (°C) | Salt (%) |
| 10 am | 97.0 | 9.4 | 14.4 | 3.25 |
| 11 am | 84.7 | 10.9 | 14.7 | 3.26 |
| 12 noon | 74.3 | 13.9 | 15.6 | 3.27 |
| 1 pm | 60.6 | 14.0 | 20.8 | 3.29 |
| 2 pm | 50.8 | 17.4 | 21.3 | 3.41 |
| 3 pm | 65.1 | 15.1 | 19.6 | 3.33 |
| 4 pm | 85.0 | 13.2 | 15.3 | 3.26 |

- (a) Which limiting factor of photosynthesis is influenced by the animals in the rock pool? [1]

.....

6. The experiment was set up in a school laboratory using the apparatus shown below and left near a window for 4 days.



- (a) State the purpose of the experiment. [1]

.....

- (b) State the function of
- (i) the polythene bag [1]

.....

.....

- (ii) the sodium hydroxide solution [1]

.....

.....

- (iii) the apparatus labelled **B**. [1]

.....

.....

- (iv) the Vaseline. [1]

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.....

(c) Explain why the plants were placed in the dark for 48 hours prior to the experiment. [1]

.....
.....

(d) At the end of the experiment a leaf was taken from each plant and tested for starch. State the colour observed for each leaf and the reason.

(i) Apparatus A [1]

colour observed

reason

.....

(ii) Apparatus B [1]

colour observed

reason

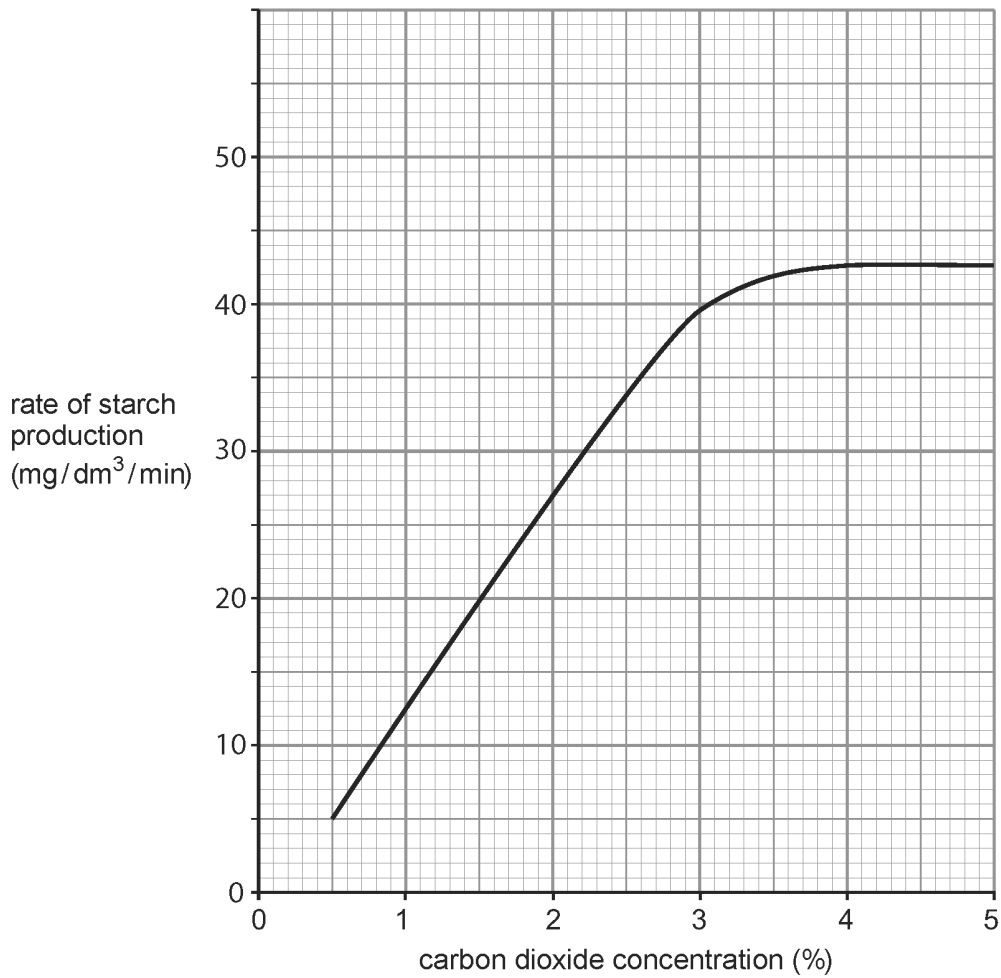
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7. (a) Complete the sentences below. [2]
- During photosynthesis chlorophyll absorbs energy. Carbon dioxide and are converted into glucose and
- (b) The glucose formed in photosynthesis may be stored as starch. Scientists investigated the effect of different concentrations of carbon dioxide on the rate of photosynthesis in algal cells. They recorded the mass of starch produced.



Large numbers of algal cells in containers with different concentrations of carbon dioxide.

The results of the investigation are shown on the graph below.



From the graph

- (i) Describe the effect of increasing carbon dioxide concentration on the rate of starch production. [2]

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.....

- (ii) Calculate the change in the rate of starch production between levels of 1.5% and 2.5% carbon dioxide. [2]

..... (mg/dm³/min)

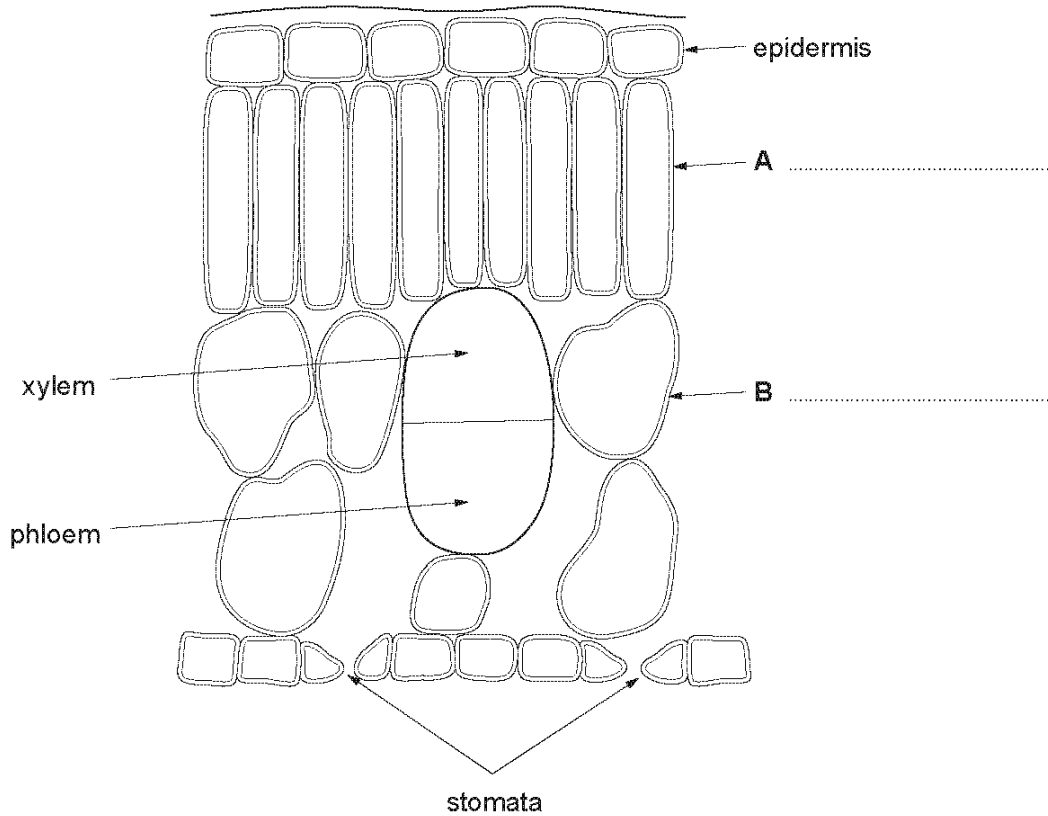
- (c) A chemical is used to indicate the presence of starch.
Name the chemical and describe the colour change that would indicate a positive result. [2]

Chemical:

Colour change:

8.

The diagram below shows a transverse section through a leaf.



(a) On the diagram above, name layers **A** and **B**. [2]

(b) (i) Name the process which occurs in layers **A** and **B** that produces sugars. [1]

.....

(ii) State the function of phloem. [1]

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(iii) Complete the sentence. [1]

Sugar is used by plant cells in the process of or it is converted to for storage.

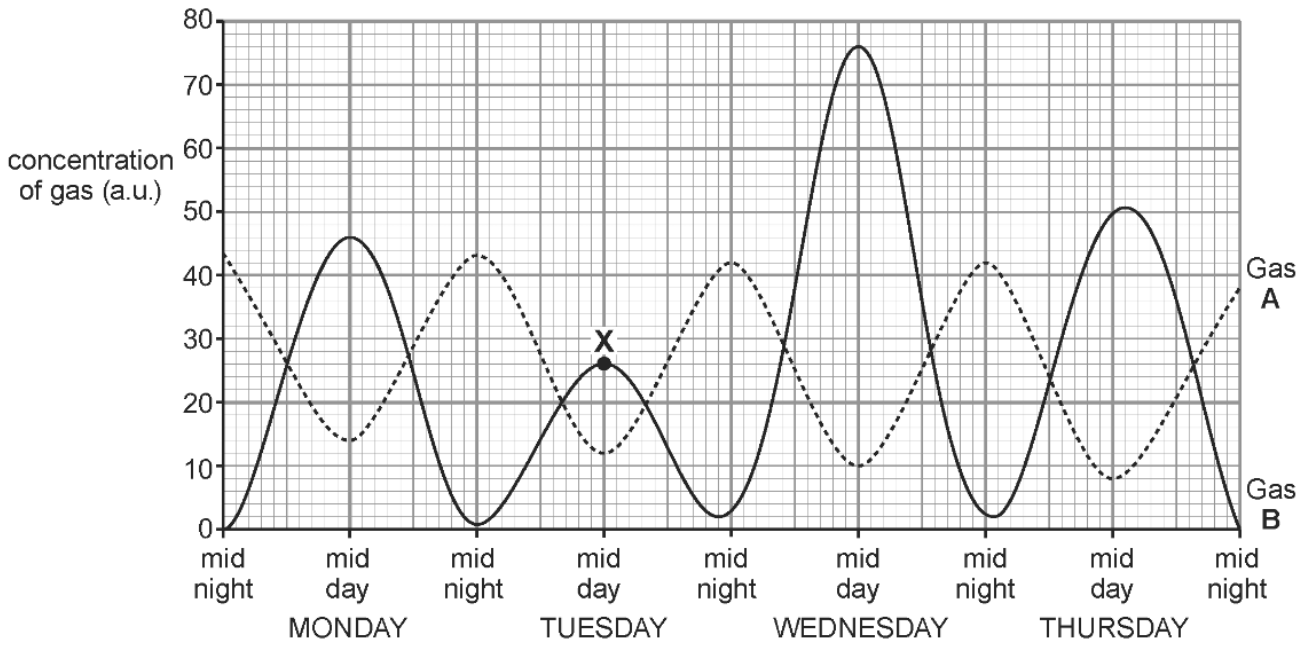
(c) State one function of the stomata. [1]

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| 6 |

9.

The graphs below show changes in the concentration of two gases, **A** and **B**, in a rock pool in St Brides Bay, Pembrokeshire over a 4-day period. The rock pool has a high biomass of plants.



(a) (i) Identify gases **A** and **B**. [2]

Gas A

Gas B

(ii) Explain the results at midday for gas: [4]

A;

.....

.....

B.

.....

.....

(iii) Suggest a reason for the lowest peak at point **X**. [1]

.....

(iv) Calculate the mean maximum concentration of gas B over 4 days. [2]

mean maximum concentration of gas B = a.u.

(b) Name the limiting factor that can be deduced from the data in the graph. [1]

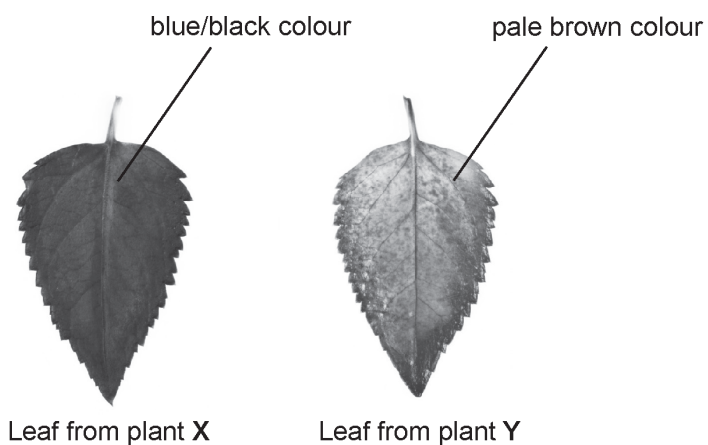
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| 10 |

10. (a) Complete the word equation for photosynthesis. [2]

..... + → glucose +

(b) A leaf from each of two plants (X and Y) was tested for the presence of starch using iodine solution. The results are shown in the diagrams below.



Plant X had been growing in the light before testing. Plant Y had been taken from the light and placed in the dark for 48 hours before the test. Explain the results for both leaves. [4]

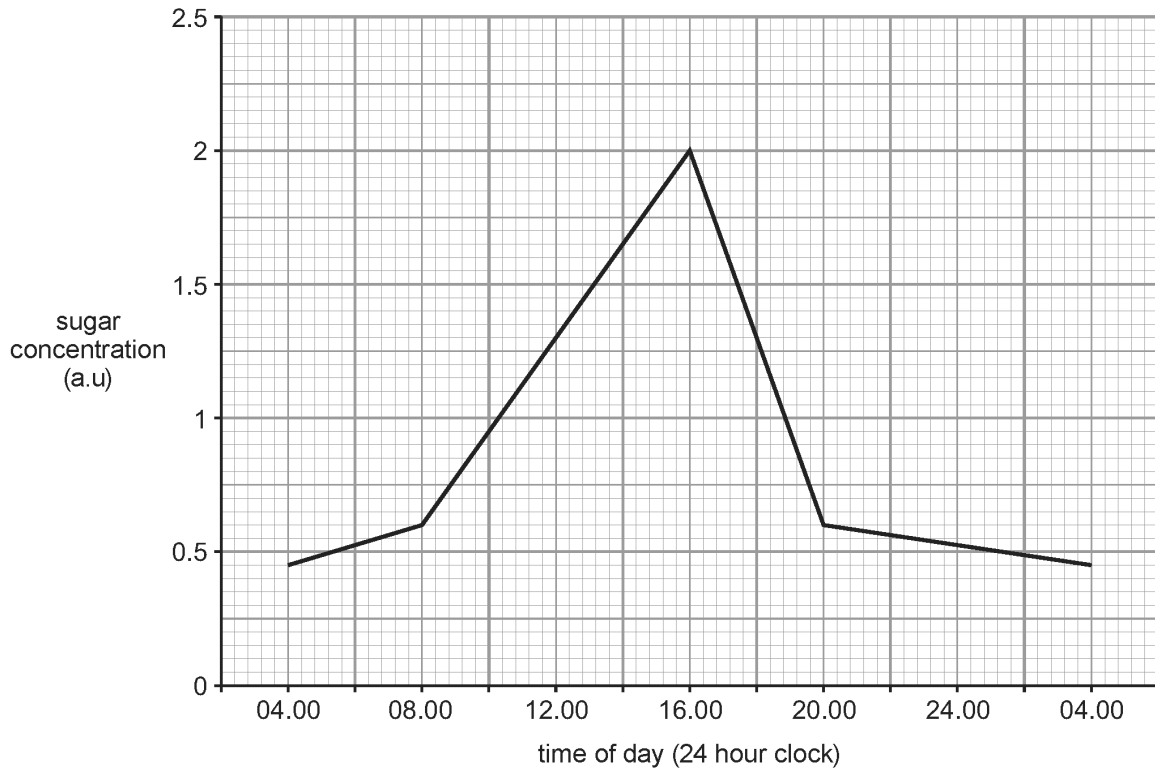
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11.

(a) Write out the word equation for photosynthesis.

[1]

(b) The graph below shows how the sugar concentration in maize plants changes during a 24 hour period.



Describe and explain the changes in the sugar concentration between

(i) 08.00 hours and 16.00 hours.

[2]

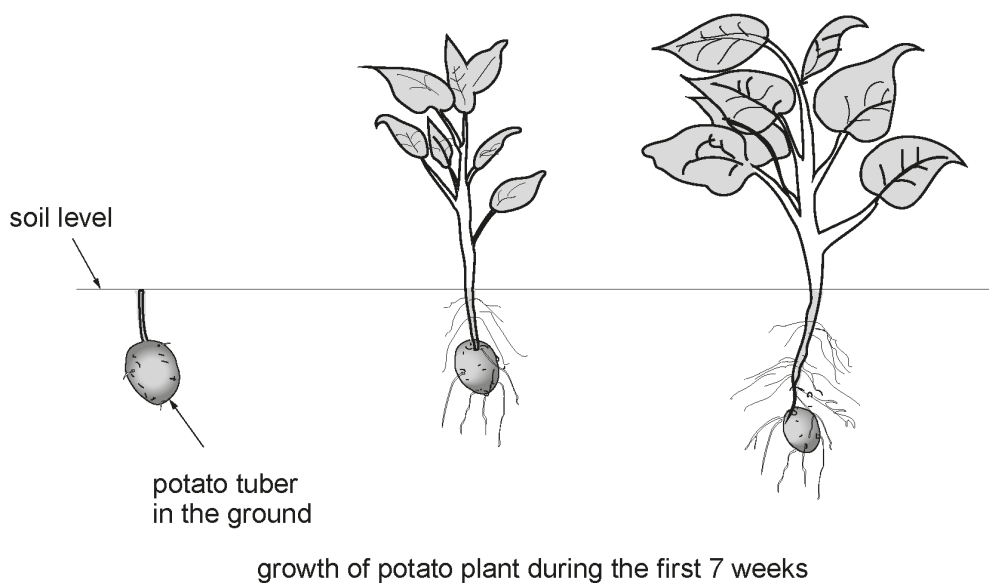
(ii) 20.00 hours and 04.00 hours.

[3]

12. The photograph shows a potato tuber with leaves and stems starting to grow.



In order to grow potato plants, potato tubers are planted in the ground. Soon after planting, roots, stems and leaves start to grow from the tuber.

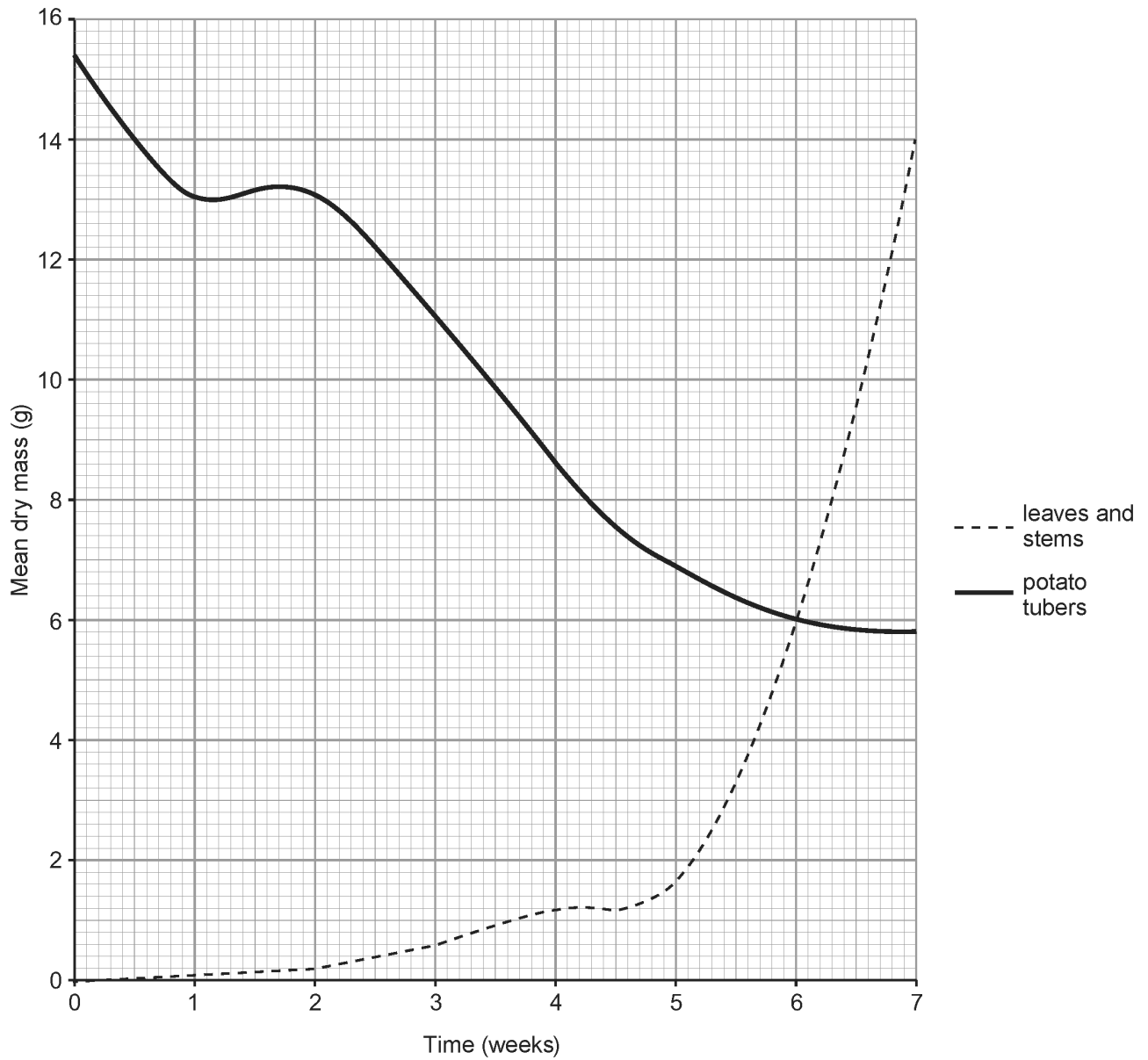


A scientist investigated the changes in the dry mass of the leaves, stems and potato tubers of a group of plants during their first 7 weeks of growth.

dry mass = fresh mass – mass of water contained in plant

The plants were grown in identical conditions. Each week 10 plants were collected and their mean dry mass was recorded.

The following graph shows the changes in the mean dry mass of the potato tubers and the mean dry mass of the leaves and stems during the 7 week period.



(a) From the graph state:

- (i) the relationship between the dry mass of the potato tubers and the dry mass of the leaves and stems. [1]

.....

- (ii) the time taken for the mean dry mass of the stem and leaves to equal the mean dry mass of the potato tubers. [1]

..... weeks

(b) A potato tuber was cut in half and its surface was flooded with iodine solution. The iodine changed from a brown to a blue-black colour.

(i) Name the substance that caused this colour change. [1]

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(ii) Explain the changes in mean dry mass of the potato tubers during the first 7 weeks of growth of the plants. [2]

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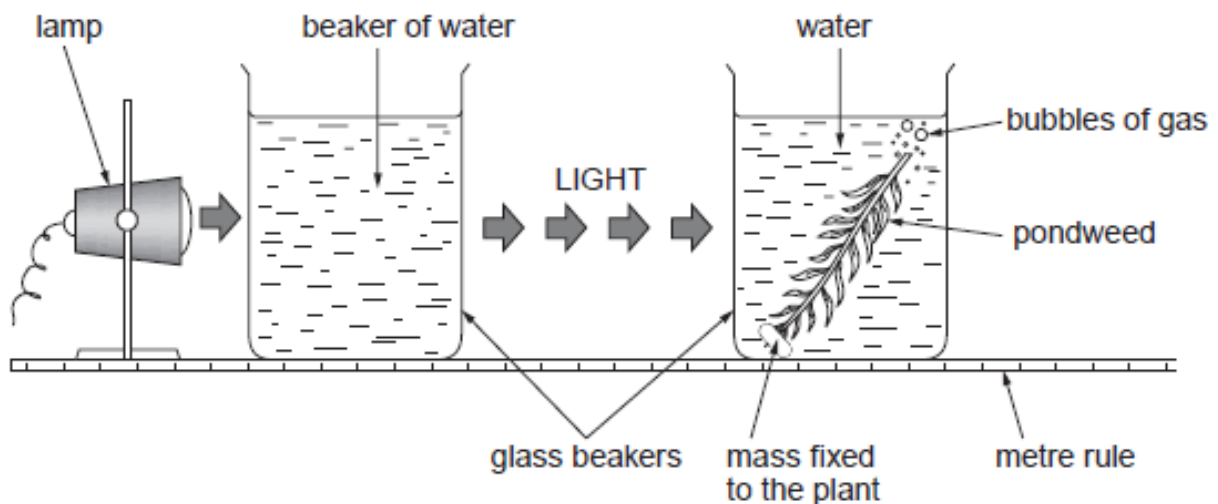
(iii) Between weeks 6 and 7 the mean dry mass of the tuber decreased by 0.2 g but the mean dry mass of the leaves and stems increased by 8.0 g. Explain how a process taking place in the plant caused the dry mass of the leaves and stems to increase. [2]

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.....

13. (a) (i) Write the **word** equation for photosynthesis. [2]

(ii) State the name of the pigment present in plant cells which absorbs light. [1]

Phoebe and Adam used the apparatus below to study the rate of photosynthesis in the pondweed (*Elodea sp.*).



The number of gas bubbles per minute produced by the pondweed was counted at different distances from the light.

The experiment was carried out three times at each distance.

The results are shown below. Means were calculated to the nearest whole number.

| Distance of lamp from pondweed (cm) | Number of bubbles per minute | | | |
|-------------------------------------|------------------------------|--------|--------|-------|
| | Test 1 | Test 2 | Test 3 | Mean |
| 10 | 19 | 32 | 25 | 25 |
| 20 | 14 | 20 | 20 | 18 |
| 30 | 11 | 15 | 17 | |
| 40 | 7 | 10 | 13 | 10 |
| 50 | 5 | 9 | 11 | 8 |

(b) **Complete the table** opposite by calculating the mean number of bubbles for a distance of 30 cm. **Write your answer in the table.** [2]

(c) State the relationship between the distance of the lamp from the pondweed and number of bubbles produced per minute. Explain your answer. [3]

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(d) Explain why a beaker of water was placed between the lamp and the pondweed. [1]

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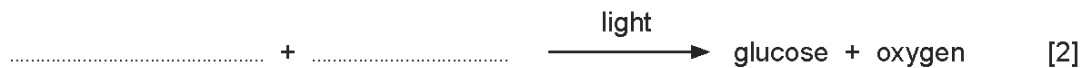
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(e) State how you could improve the accuracy of this investigation. [1]

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14.

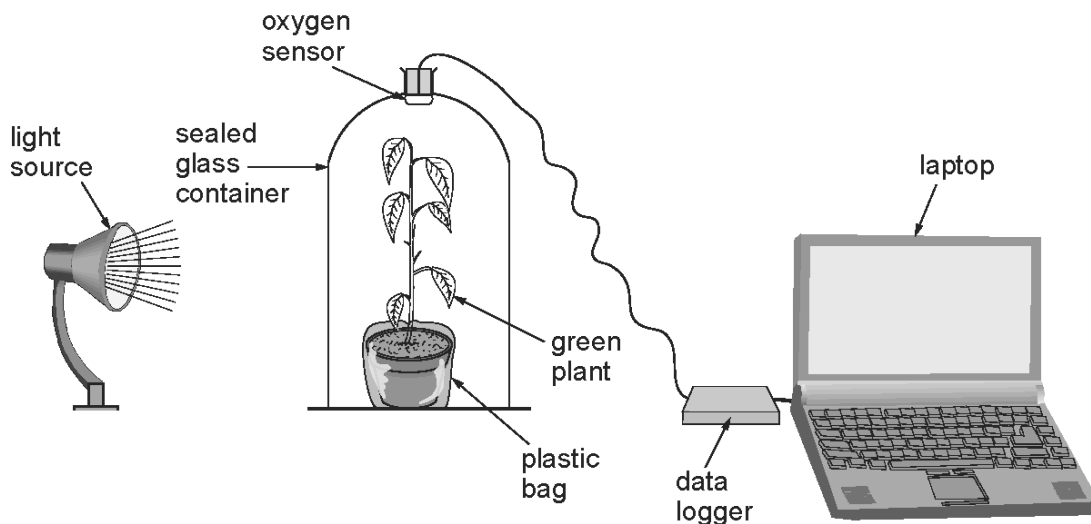
(a) (i) Complete the word equation for photosynthesis below.



(ii) Name the substance in plant cells which absorbs light. [1]

.....

(b) Students investigated photosynthesis in a plant. They used a data logger to monitor the oxygen given out by the plant at different light intensities, as shown in the diagram below. They used the same plant for the same time at each light intensity.



The results of the investigation are shown in the table below.

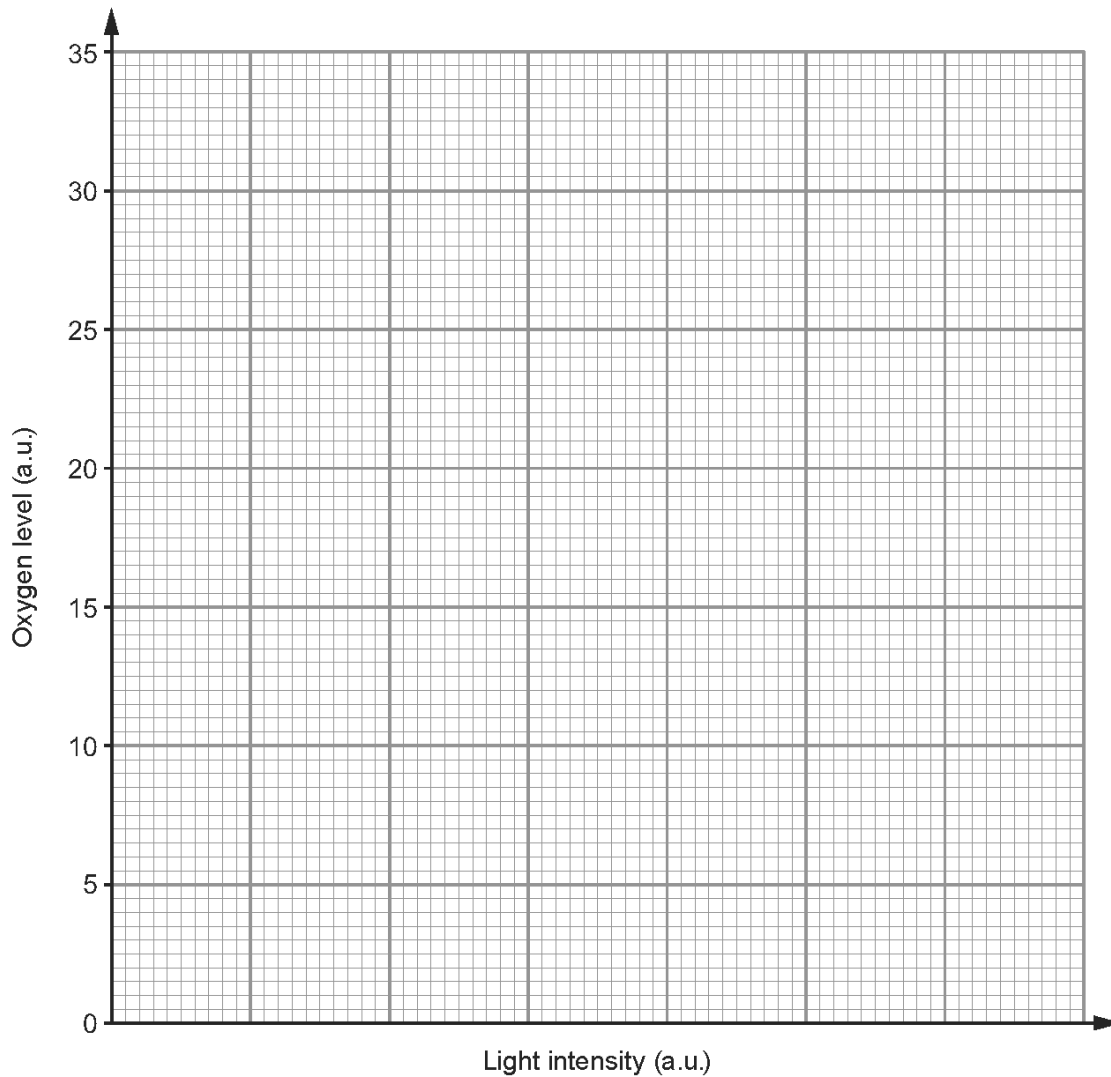
| Light intensity (a.u.) | Oxygen level (a.u.) |
|------------------------|---------------------|
| 10 | 5 |
| 15 | 7 |
| 20 | 11 |
| 25 | 20 |
| 30 | 29 |
| 35 | 34 |

(i) Draw a line graph of the data above on the grid opposite by:

I. choosing a suitable scale for light intensity; [1]

II. plotting the points shown above; [2]

III. joining your plots, using a ruler. [1]



(ii) Use your graph to answer the following questions.

I. How does the concentration of oxygen change as light intensity increases? [1]

.....

II. Which change in light intensity shown below causes the greatest change in the oxygen concentration? Circle the correct answer. [1]

12 – 15 a.u. 22 – 25 a.u. 32 – 35 a.u.

(iii) State one way in which the students tried to make their investigation a fair test. [1]

.....

(c) State one way in which the glucose produced in photosynthesis is used in plant cells. [1]

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15. Describe the process of photosynthesis with reference to the production of materials in plant cells. In your account, identify relevant limiting factors. [6 QWC]

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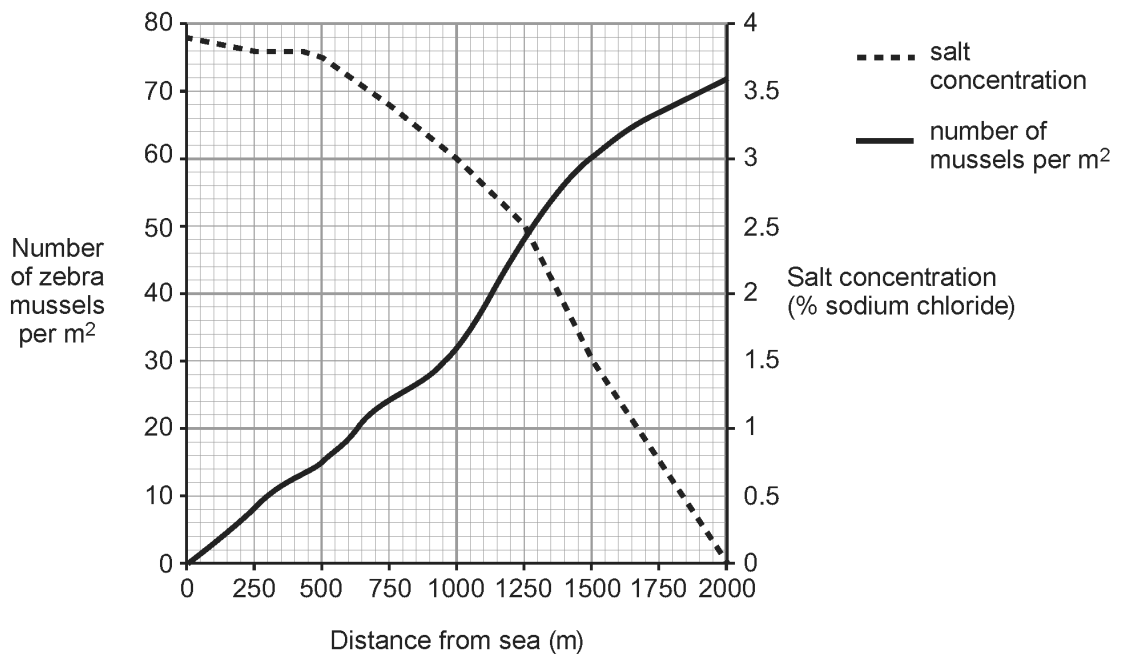
16. In 1824 zebra mussels, *Dreissena polymorpha*, were accidentally brought to the River Thames in London from South East Europe. By 1840, they had spread to many rivers in England and Scotland and by the 20th century the species was clogging up pipes leading to the fresh water treatment plants throughout most of the United Kingdom.



The zebra mussel, *Dreissena polymorpha*

The distribution of zebra mussels was studied along 2 000 m of a river in England.

- The number of zebra mussels per m² were counted at intervals of 250 m.
- The salt concentration (% sodium chloride) of the water was measured at the same 250 m intervals.
- The results are shown in the graph below:



- (a) Describe the relationship between the distribution of zebra mussels and salt concentration. [1]

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.....

- (b) Large numbers of zebra mussels filter suspended mud from the rivers, allowing more light to reach the river bed.

Suggest how this would affect the plants and animals in the rivers. [3]

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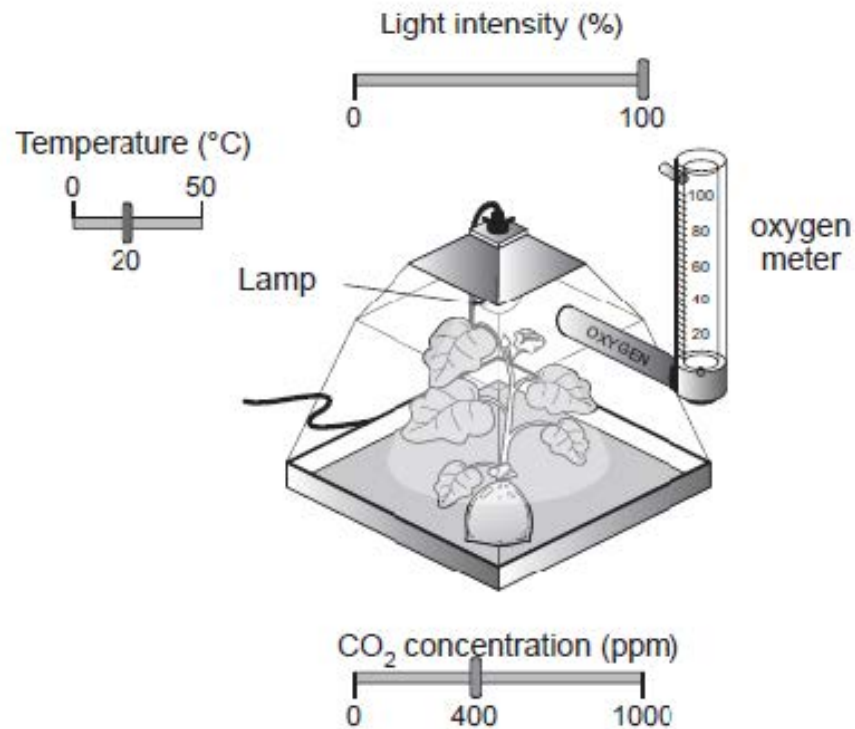
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17.

In a classroom exercise some students used a computer simulation to investigate the factors affecting the rate of photosynthesis. A well-watered plant, was placed inside a transparent sealed container with a high intensity lamp above the plant. The air in the airtight container was continually monitored in order to measure the rate of O₂ production

- The light intensity of the lamp could be varied between 0 - 100 %.
- The CO₂ concentration of the air inside the sealed container could be varied between 0 – 1000 ppm.
- The temperature inside the sealed container could be varied between 0 – 50 °C.



The table below shows the results obtained by one of the students.

| Reading number | Light intensity (%) | Temperature (°C) | CO ₂ concentration (ppm) | O ₂ production (cm ³ /h) |
|----------------|---------------------|------------------|-------------------------------------|--|
| 1 | 0 | 10 | 0 | 0.0 |
| 2 | 20 | 10 | 200 | 3.1 |
| 3 | 40 | 10 | 200 | 3.1 |
| 4 | 40 | 10 | 400 | 3.1 |
| 5 | 40 | 20 | 400 | 34.7 |
| 6 | 60 | 20 | 400 | 41.7 |
| 7 | 80 | 20 | 400 | 41.7 |
| 8 | 100 | 25 | 400 | 41.7 |
| 9 | 100 | 25 | 600 | 47.3 |

(a) Explain how oxygen production can be used as a measure of the rate of photosynthesis. [3]

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(b) Explain why oxygen production remains at $3.1 \text{ cm}^3/\text{h}$ for readings 2, 3 and 4. [2]

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(c) Identify the limiting factor for readings 6, 7, 8 and 9 and explain your answer. [2]

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(d) State why the container must be sealed. [1]

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(e) Sian and Dafydd are students who carried out the computer simulation. Sian suggested that they try to set up a 'live version' of the apparatus in the laboratory. Dafydd said that if they did this, a problem could arise which would affect the validity of the experiment. Suggest the problem that may arise and how this could be solved. [2]

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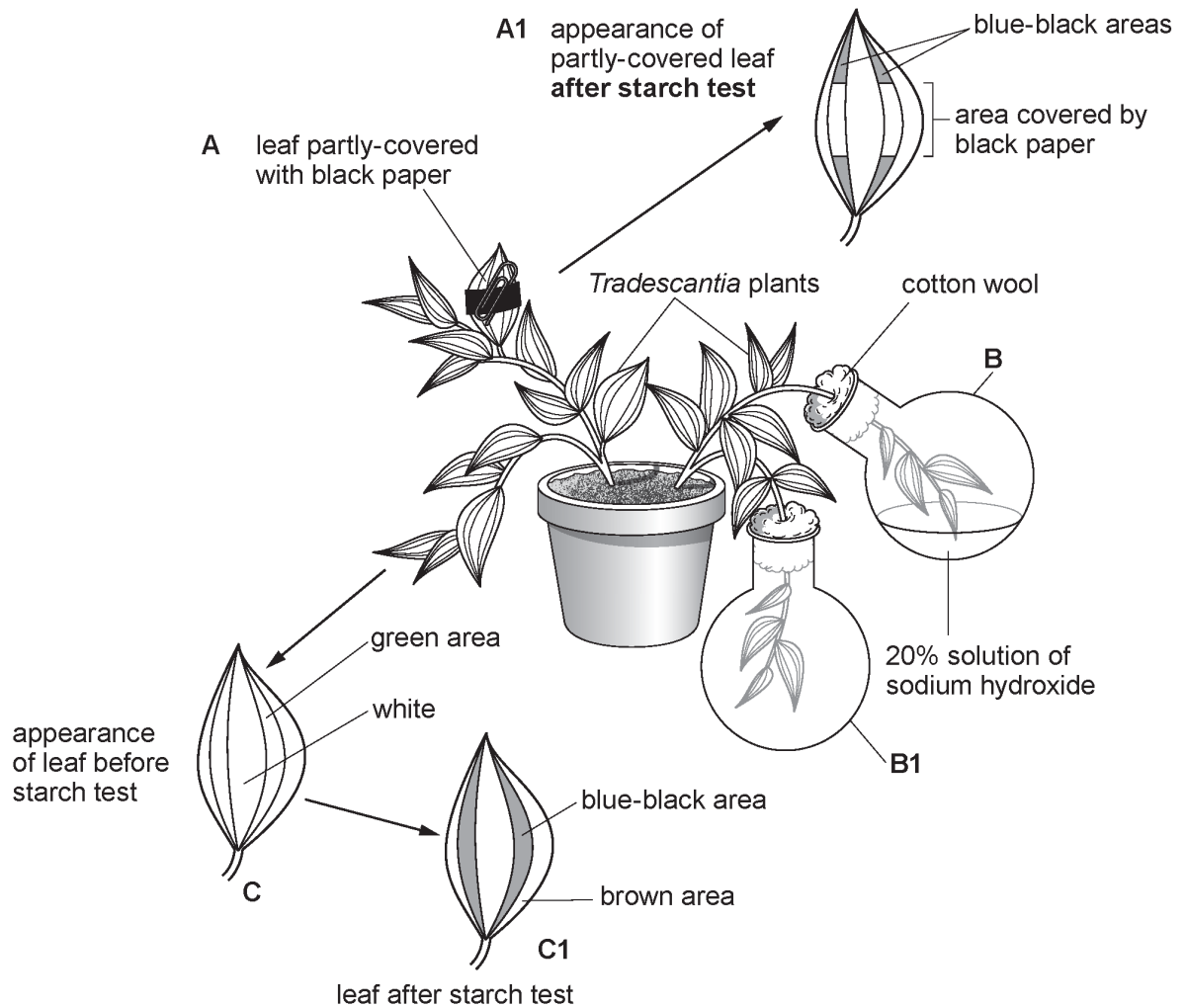
18.

Tradescantia is a plant whose leaves have green and white areas.



Tradescantia leaves

In the experiment below, a *Tradescantia* plant is used in an investigation to demonstrate **three** factors, **A**, **B** and **C**, needed for photosynthesis.



(a) (i) State the factor needed for photosynthesis, which is being demonstrated in each of the following: [3]

A

B

C

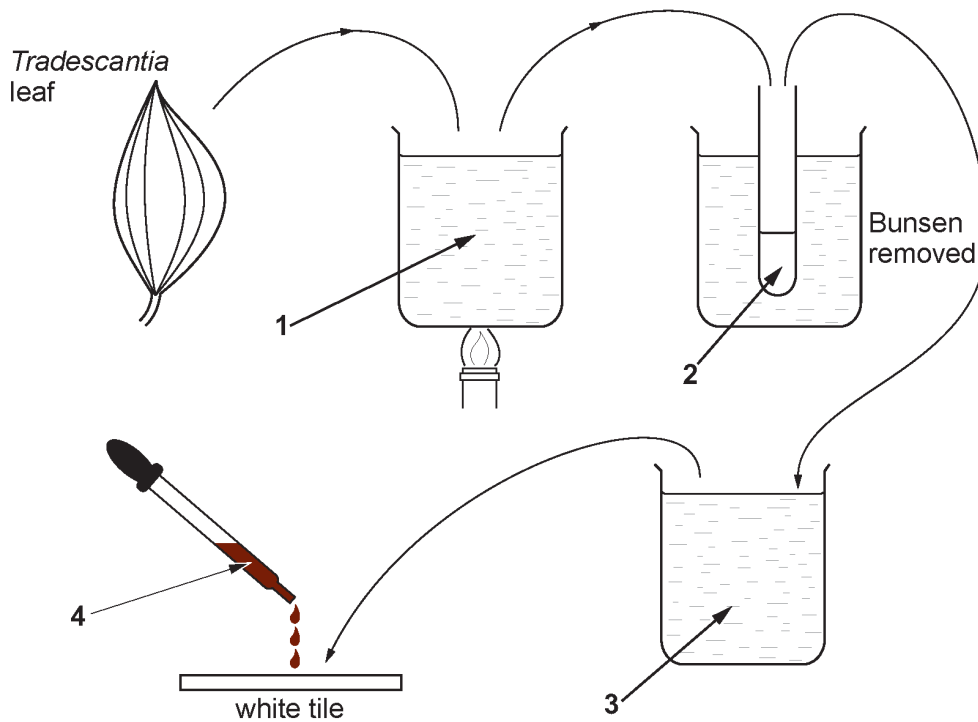
(ii) How could the experiment in flasks B and B1 be improved? Explain your answer. [2]

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.....

(iii) Before the apparatus was set up, the *Tradescantia* plant was kept in a dark cupboard for 48 hours. Explain the reason for this. [2]

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(b) The diagram below shows the stages in testing a leaf for starch.



Name the liquids 1, 2, 3 and 4 shown in the diagram. [3]

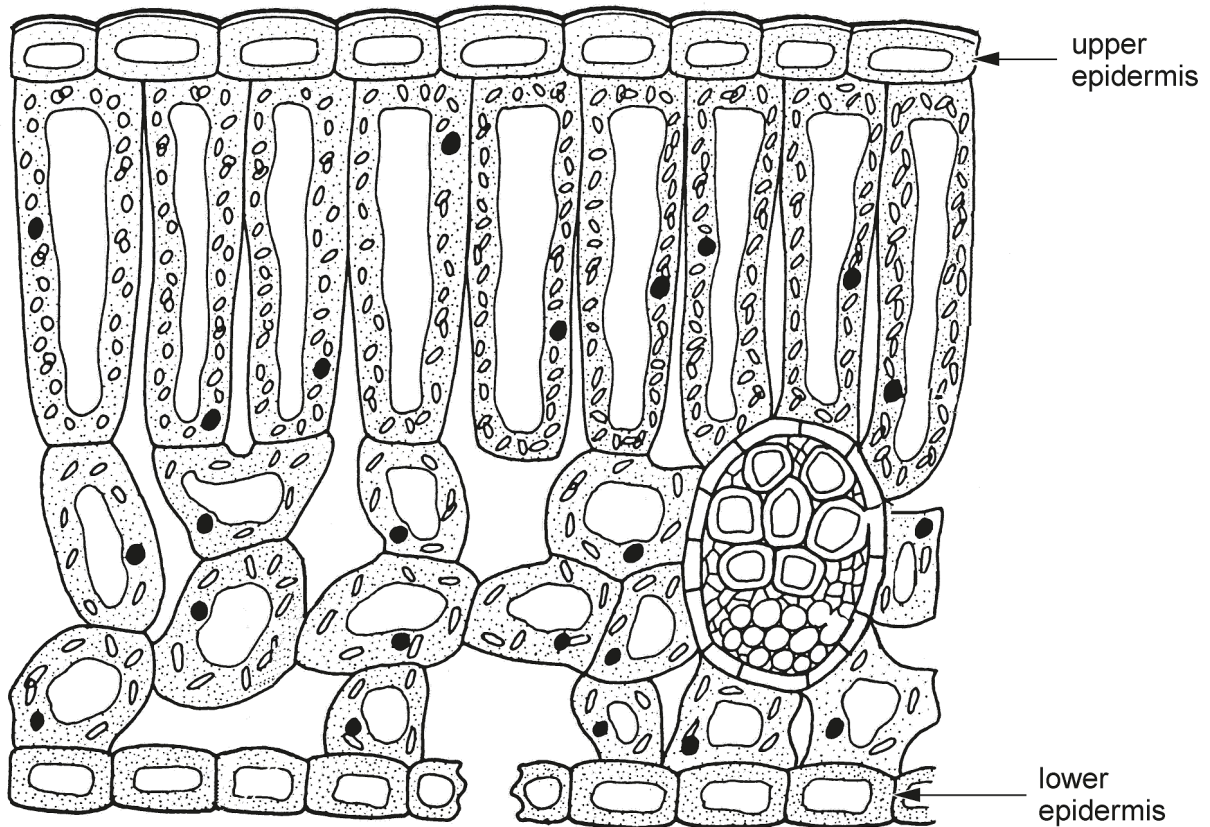
1

2

3

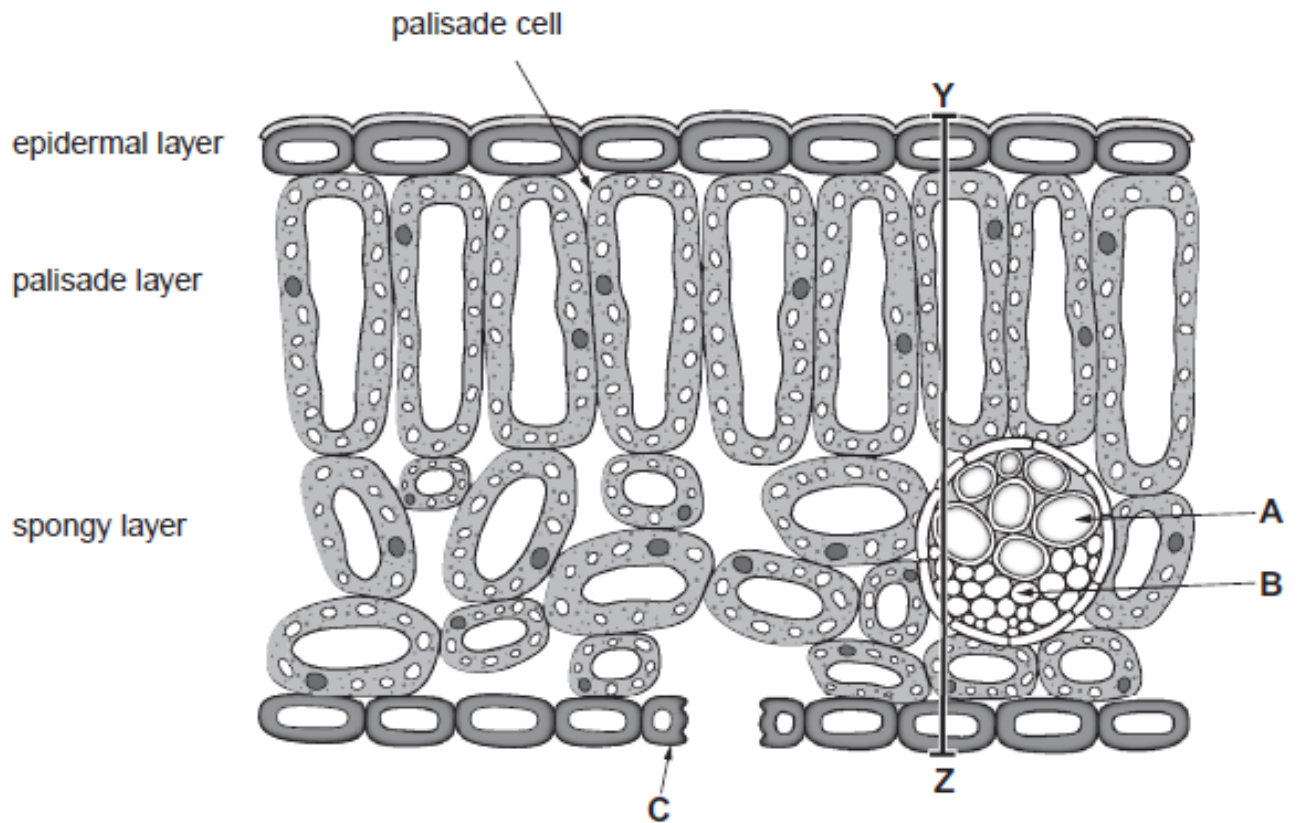
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20. (a) The diagram below shows a leaf in section.



- (i) State the name of the tissue in a leaf that transports sugar. [1]
.....
- (ii) On the diagram above, label this tissue with the letter **A**. [1]
- (b) Complete the following sentence. [1]
Sugar cannot be stored in a plant, it has to be converted into
for storage.

21. The diagram below shows a section through a leaf of a sunflower (*Helianthus sp.*).



- (a) State the name of structures **A**, **B** and **C**.

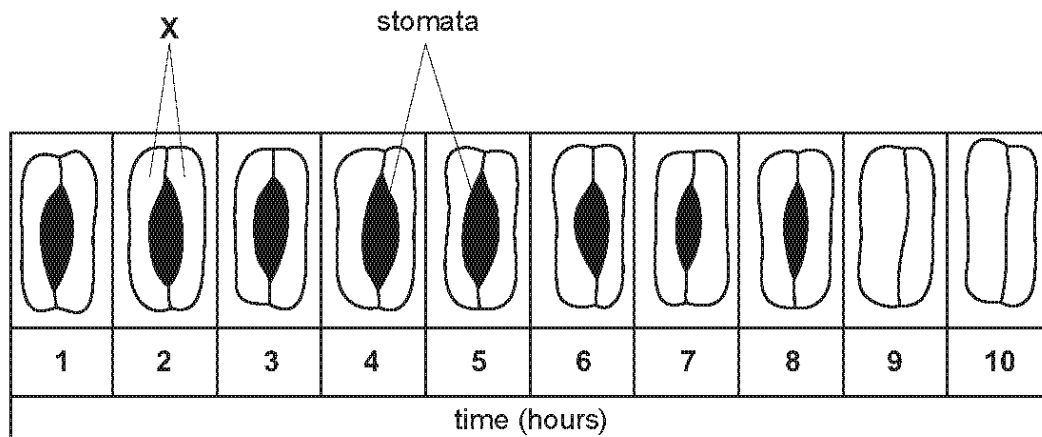
[2]

A

B

C

22. A potted plant was left in a hot, brightly lit room for ten hours. The plant was not watered during this period. The drawings below show how the mean width of the stomata (pores) changed over the ten hour period.



- (a) Give two functions of stomata. [1]

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.....

- (b) Name the cells labelled X on the drawing above. [1]

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- (c) The width of the stomata changed over the ten hour period. State the advantage to the plant of this change. [1]

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- (d) Suggest how the time taken for the change in width to occur would be affected by:

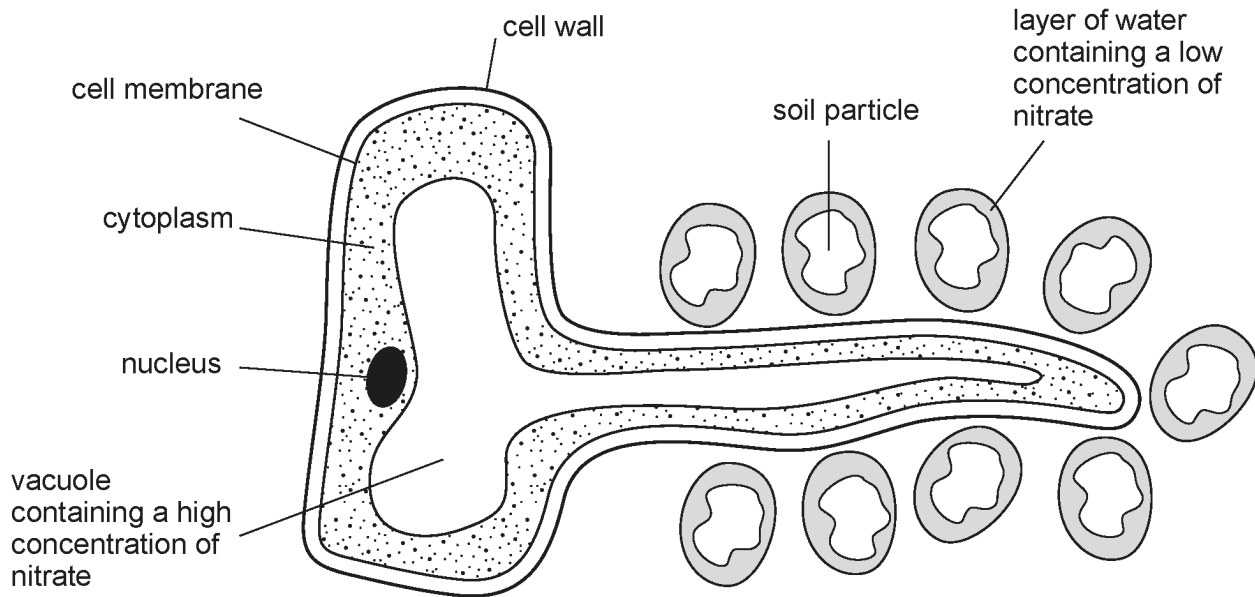
- (i) an increase in airflow over the plant; [1]

.....

- (ii) an increase in water vapour around the plant. [1]

.....

23. The diagram below shows a **section** through a root hair cell in well-watered soil.



(a) State the method used by the root hair cell to take up nitrate from the soil. [1]

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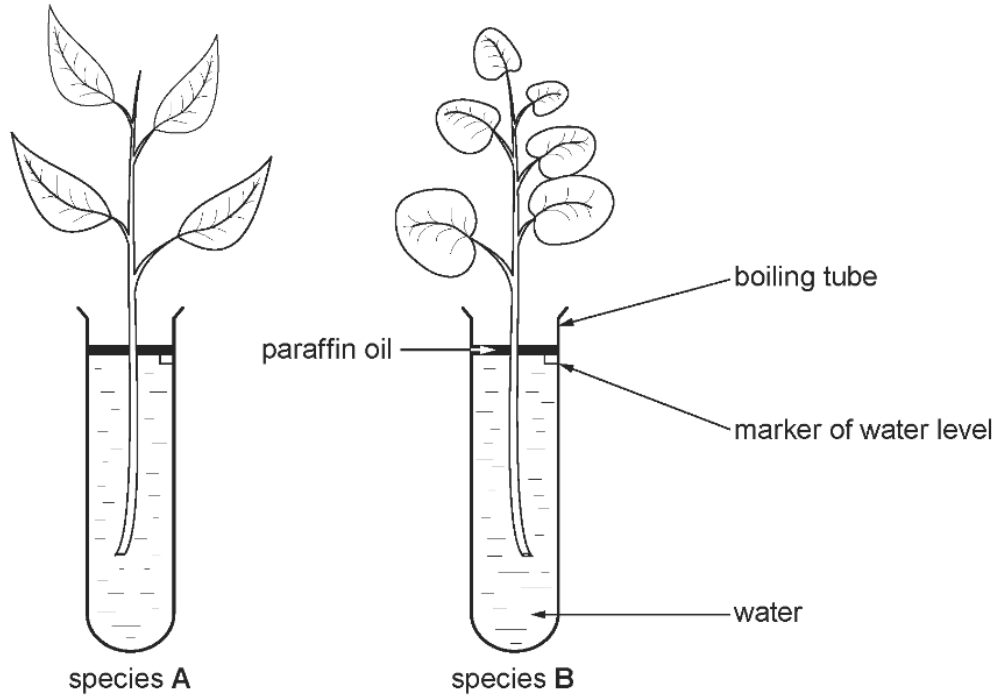
(b) Gardeners dig soil to let more air into it. Explain why this increases the uptake of nitrate by root hair cells. [2]

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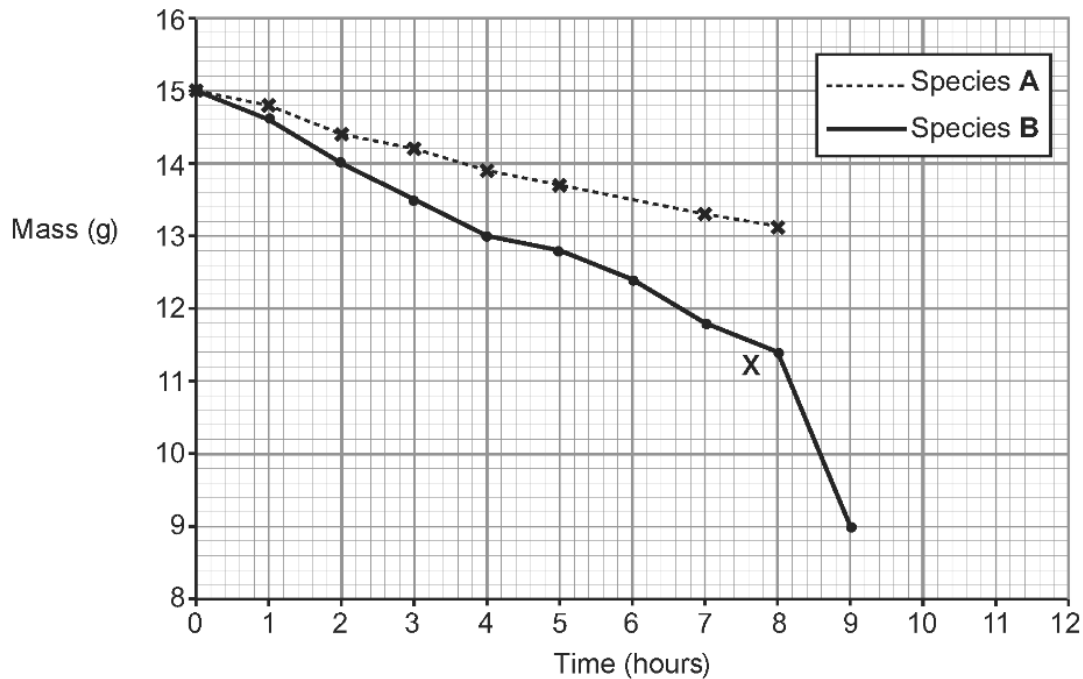
(c) Describe how the root hair cell takes up water by osmosis. [3]

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24. Shoots from two different species of plants, A and B, were placed in water in boiling tubes as shown below.



Both species were kept in the same conditions and their mass recorded at hourly intervals for eight hours. The results were recorded as line graphs shown below.



- (a) (i) Use the data to help you calculate the difference in the loss in mass between species **A** and **B** at 8 hours. [1]

Difference in loss of mass = g

- (ii) State the term given to the process responsible for this loss of mass in plants. [1]

- (iii) Suggest **two** reasons for the difference in loss of mass between the two different species, **A** and **B**. [2]

- (iv) State the purpose of the paraffin oil in the boiling tubes. [1]

- (b) Which **one** of the following treatments was applied to species **B**, at point **X** on the graph, to produce the result shown at 9 hours?

Underline the correct answer. [1]

Enclosed in a bell jar

Upper surface of leaves coated with Vaseline

Half the leaves removed

Air directed at the leaves by a fan

- (c) What would you expect to happen to the rate of loss of mass if species **A** and **B** had roots? Give a reason for your answer. [2]

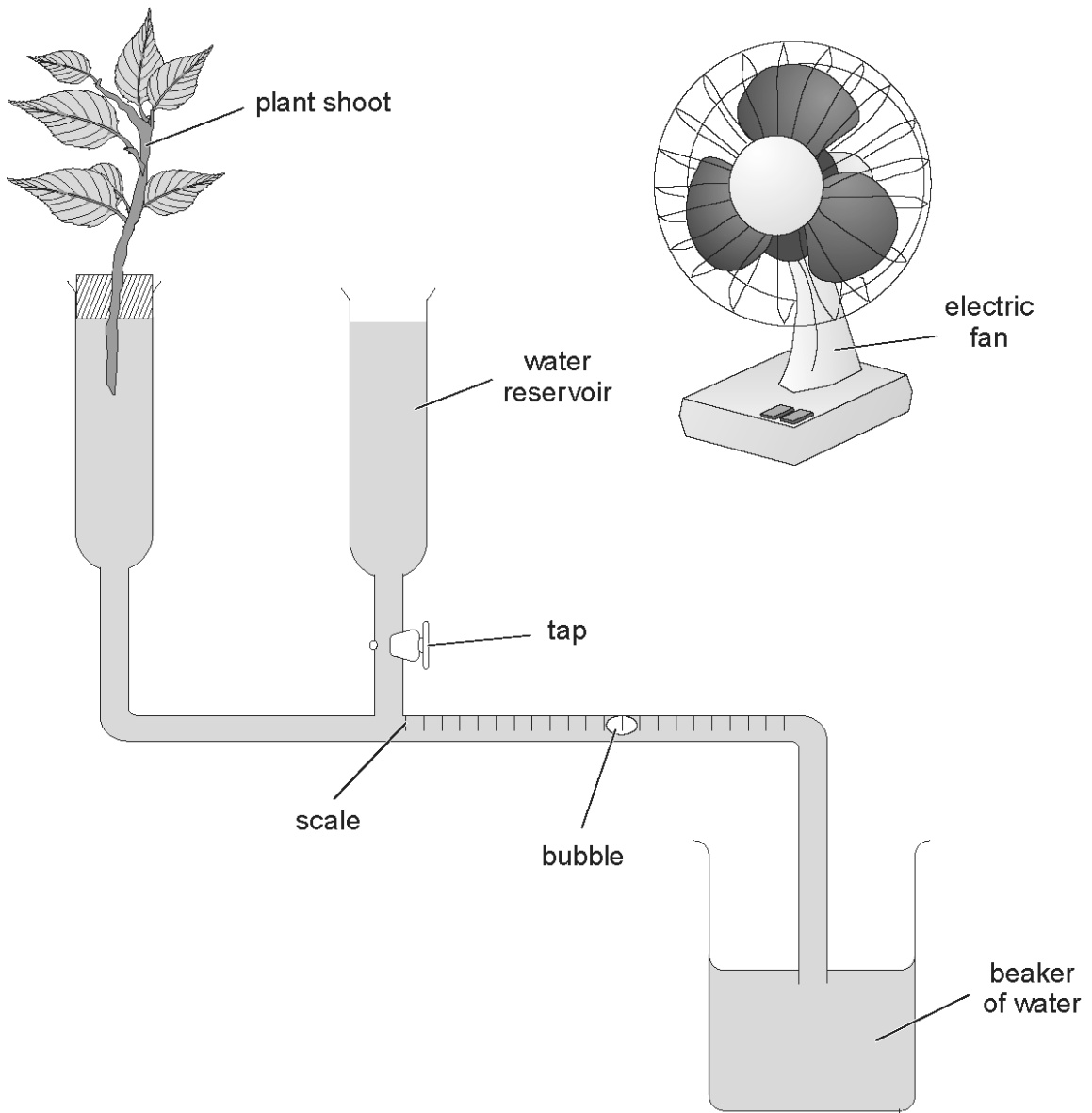
25.

(a) What word is used to describe water loss from the leaves of a plant?

[1]

.....

The diagram below shows a plant shoot in a simple potometer and an electric fan.



(c) Apart from air movement, give two *other* environmental factors that affect the rate of water loss from a plant. [2]

1.

2.

26.

The photograph below shows a tomato plant.



(a) Some of the sugar made in photosynthesis is transported to the tomato fruits.

State the name of the tissue in plants that transports sugar.

[1]

.....

(ii) Siân carried out a trial to find out the effect of using Topgrow on the tomato plants.

She used tap water only on half the plants and diluted Topgrow on the rest.

What else should Siân have done to make sure that the trial was a fair test? [2]

Give two suggestions.

I.

II.

(c) Apart from nitrates, give the names of two *other* nutrients required for healthy plant growth.

..... and [2]

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