

Name:	Target Grade:	Actual Grade:
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NUTRITION AND TRANSPORT IN FLOWERING PLANTS MCQ and STRUCTURED QUESTIONS

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a quiet, comfortable spot free place from distractions.
2. Spend one minute on each mark.
3. Time yourself for every single question.
4. Every chapter has their own question types. Ensure that you know the different question type for each chapter.
5. Make a conscientious effort to remember your mistakes, especially in terms of answering techniques. E.g Take a picture for the mistakes that you made, keep it in a photo album, and revise it over and over again.
6. Highlight question types that you tend to keep making mistakes and review them nearing exams.
7. Always review the common questions and question type that you tend to make mistakes nearing exams.
8. During exams, classify the question type and recall what you have learnt, how you need to analyse the questions for the different question type, what you need to take note of and answer with the correct answering techniques!

✨ Wishing you all the best for this test!

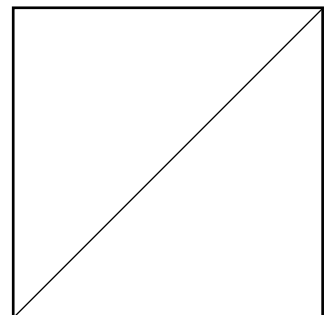
You've got this!

💡 With lots of love,
Bright Culture 🍷



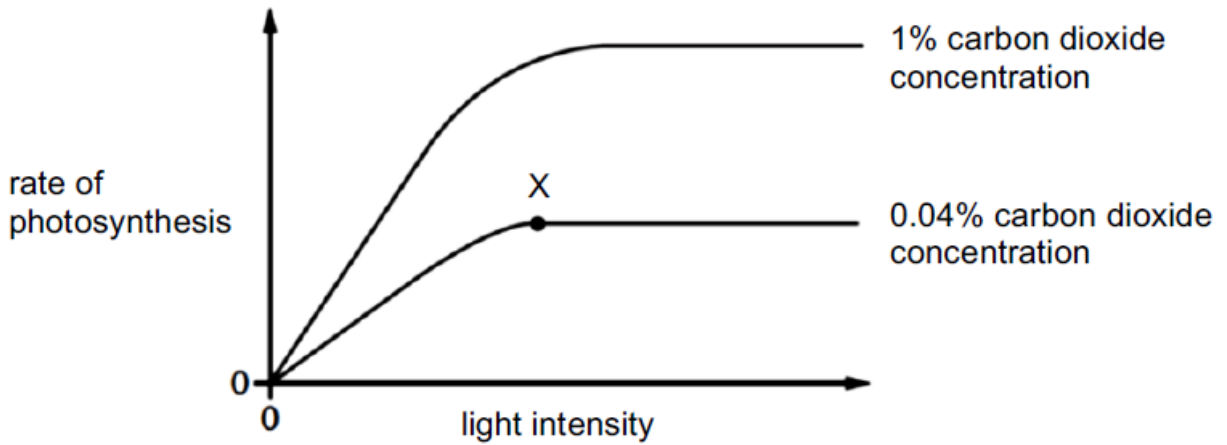
**GOOD LUCK
FOR YOUR EXAM!**

MARKS

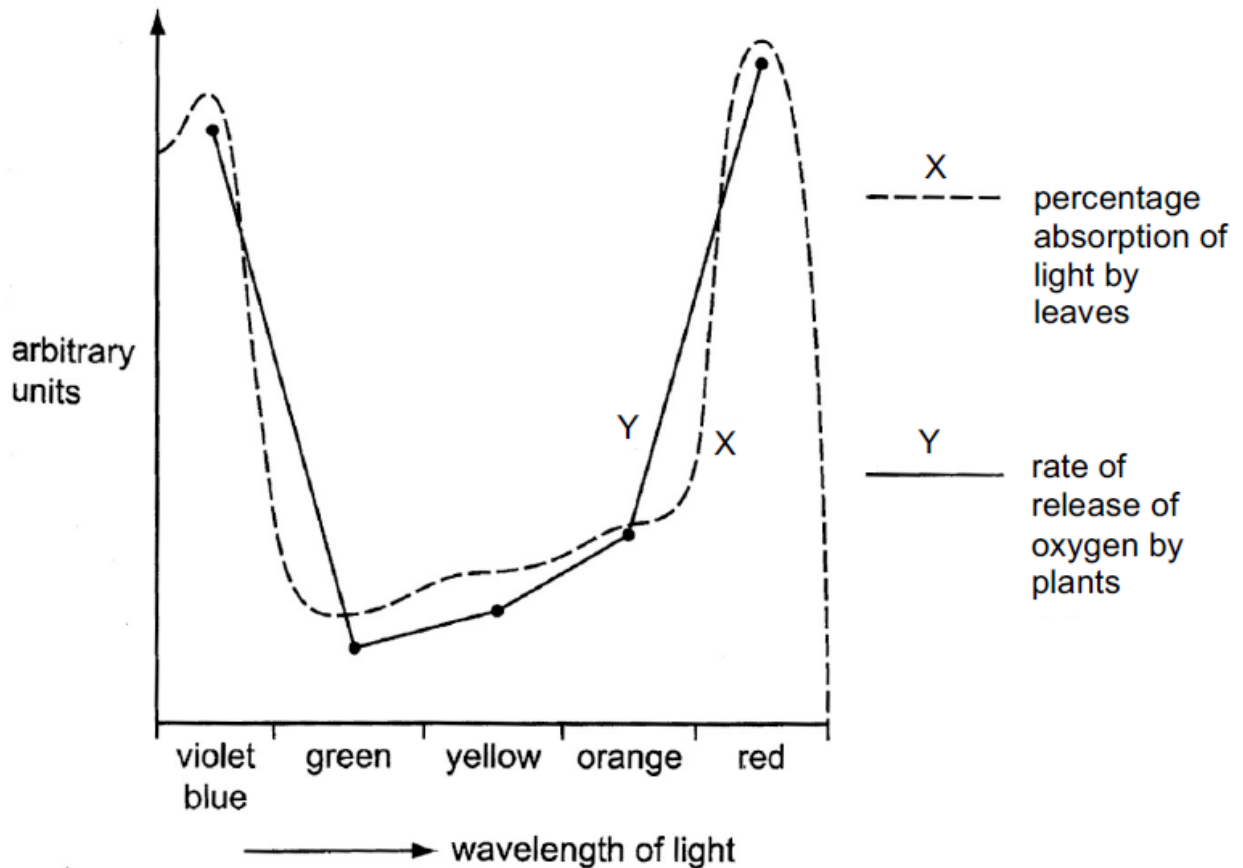


NUTRITION AND TRANSPORT IN FLOWERING PLANTS MCQ

- 1 The graph shows how the rate of photosynthesis of a plant varies with light intensity at two different carbon dioxide concentrations. The temperature is kept at 20°C. Which factor is limiting the rate of photosynthesis at point X?



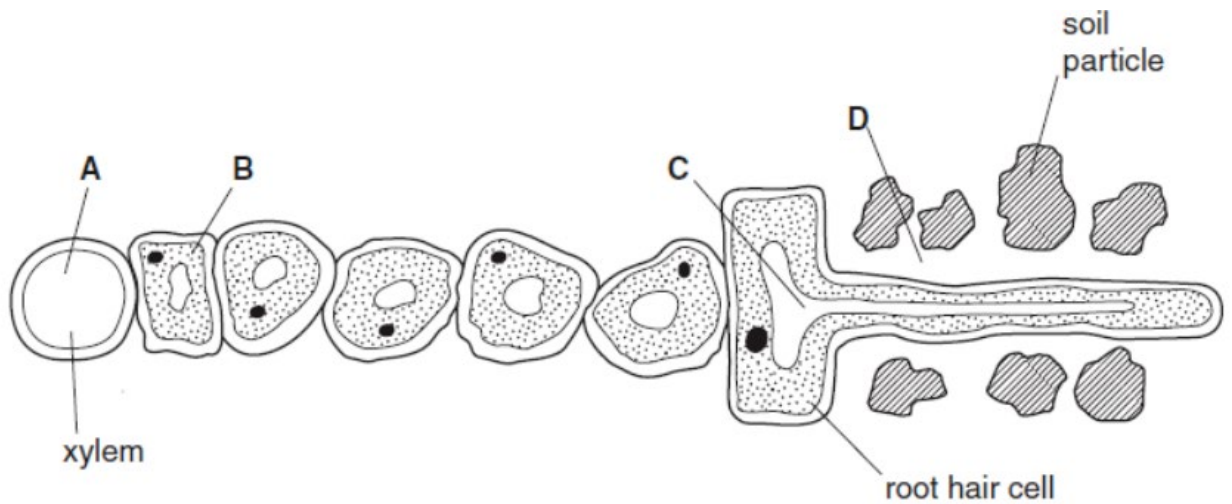
- A temperature
 - B light intensity
 - C availability of water
 - D carbon dioxide concentration
- 2 The graph shows the effect of different wavelengths of light on processes taking place in green plants.



What can be deduced from solid line Y?

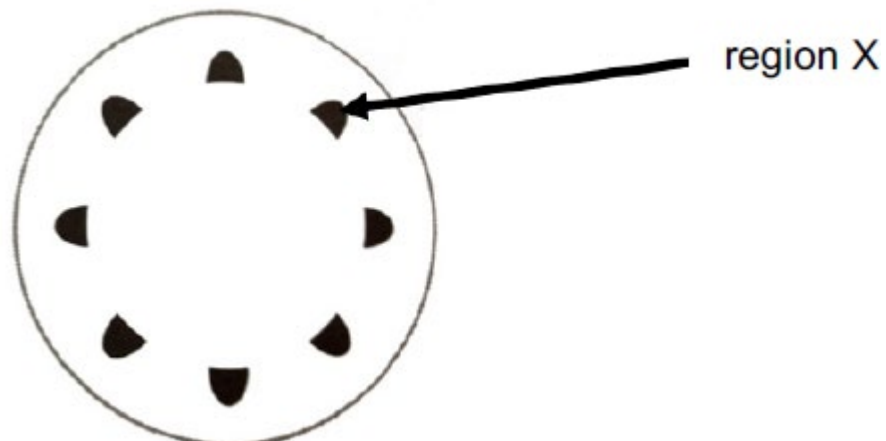
- A Respiration is least active in green light and most active in blue and red light.
- B Respiration is most active in green light and least active in blue and red light.
- C Photosynthesis is least active in green light and most active in blue and red light.
- D Photosynthesis is most active in green light and least active in blue and red light.

3 The diagram shows part of a plant root in the soil. The root is absorbing water. Which labelled point has the highest water potential?



The leaves of a plant were exposed to carbon dioxide containing the radioactive isotope ^{14}C for three hours under sunlight. A section of the plant's stem was cut off and placed on an X-ray film that darkens when exposed to radioactivity.

The transverse section of the stem showing the autoradiograph result is shown below:

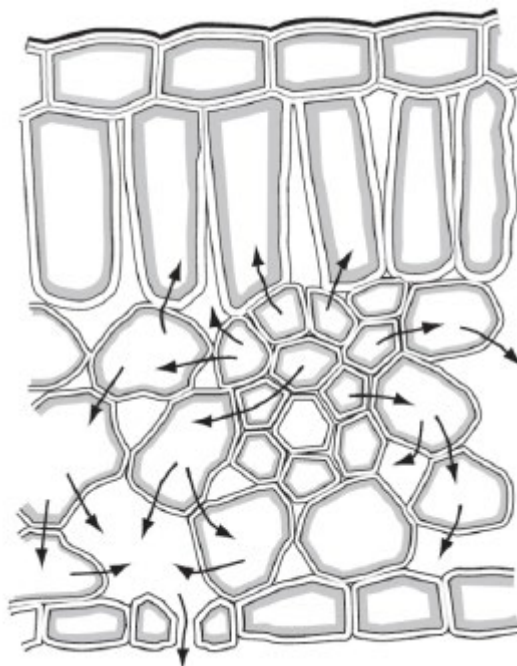


Which of the following are the likely compounds that could be radioactive and found in X?

(1)	(2)	(3)	(4)	(5)
starch	water	sucrose	amino acids	glucose

- A** (3) only
- B** (3) and (4) only
- C** (1), (3) and (4) only
- D** (2), (3), (4) and (5) only

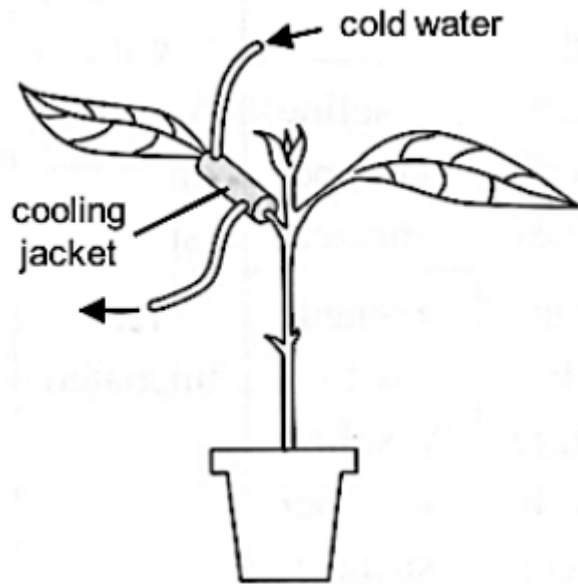
4 The diagram shows a section through a green leaf.



The arrows in the diagram represent the movement of

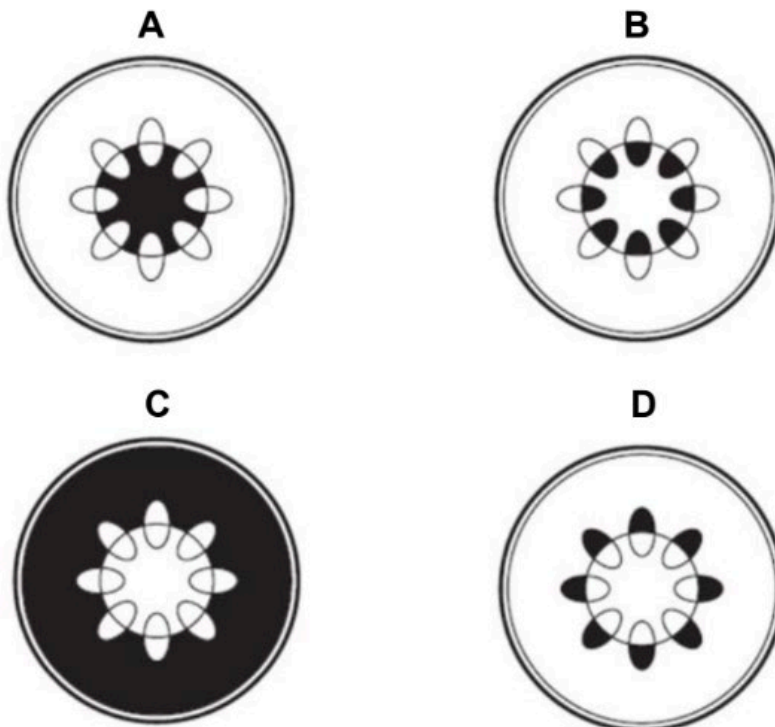
- A** carbon dioxide during respiration.
- B** carbon dioxide during photosynthesis.
- C** oxygen during photosynthesis.
- D** water during transpiration.

- 5 The diagram shows leaf stalks of a plant chilled with a cooling jacket.



What is the likely impact on the plant?

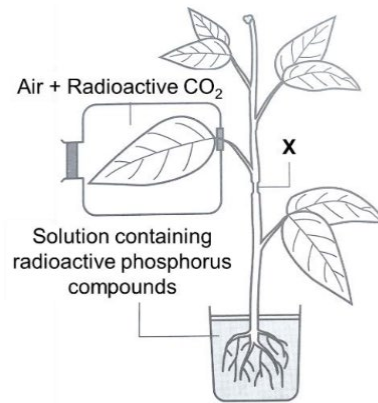
- A The rate of movement of sugars to the roots increases.
 - B The rate of movement of water and mineral salts to the leaves decreases.
 - C The rate of photosynthesis in the leaves increases.
 - D The rate of photosynthesis in the leaves falls to zero.
- 6 A plant has its roots chopped off, and is placed in a vase containing black food dye. After 2 hours, the stem of the plant is cut and observed



7 Which row shows the changes in the guard cells and stomata of a typical plant under various lighting conditions?

	guard cells	stomata	lighting conditions
A	flaccid	close	dark
B	flaccid	open	light
C	turgid	close	light
D	turgid	open	dark

8 The diagram below shows a plant with the section **X** removed from the stem. After a few hours, the amounts of radioactive carbon and phosphorus in various parts of the plant were determined.

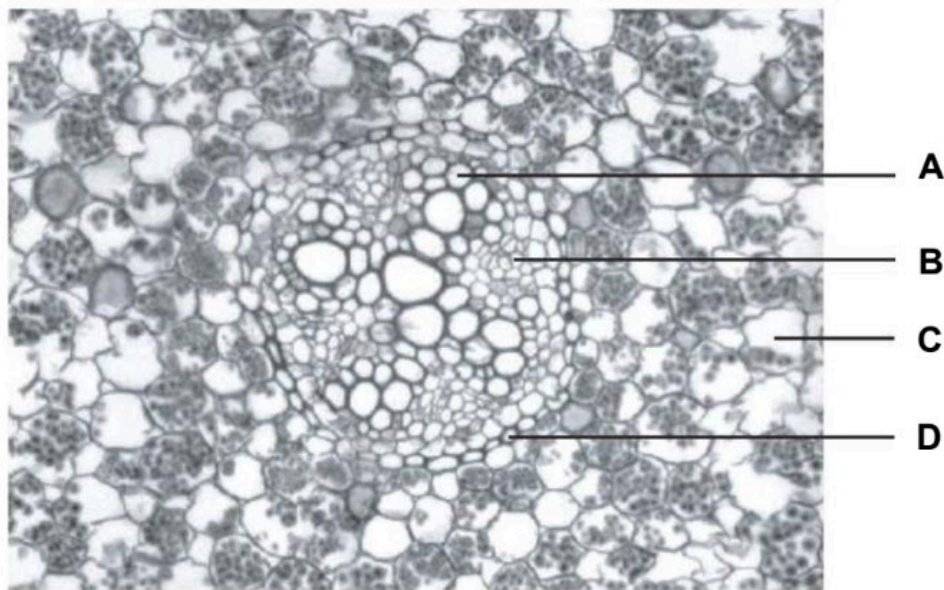


Which row shows the possible locations where radioactive carbon and phosphorus will be detected?

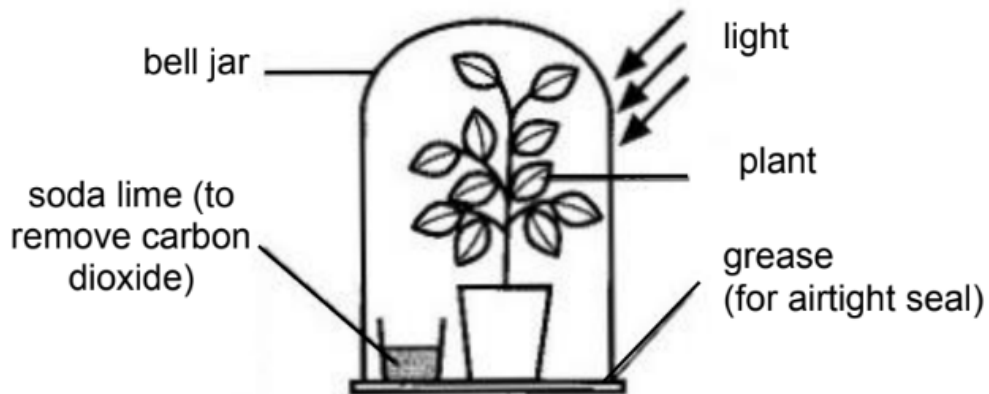
	radioactive carbon	radioactive phosphorus
A	leaves above X	leaves above X
B	leaves below X	leaves above X
C	roots	stem below X
D	stem below X	stem above X

- 9 The diagram shows a transverse section from the middle of a root of a dicotyledonous plant.

In which tissue are sugars and amino acids transported?



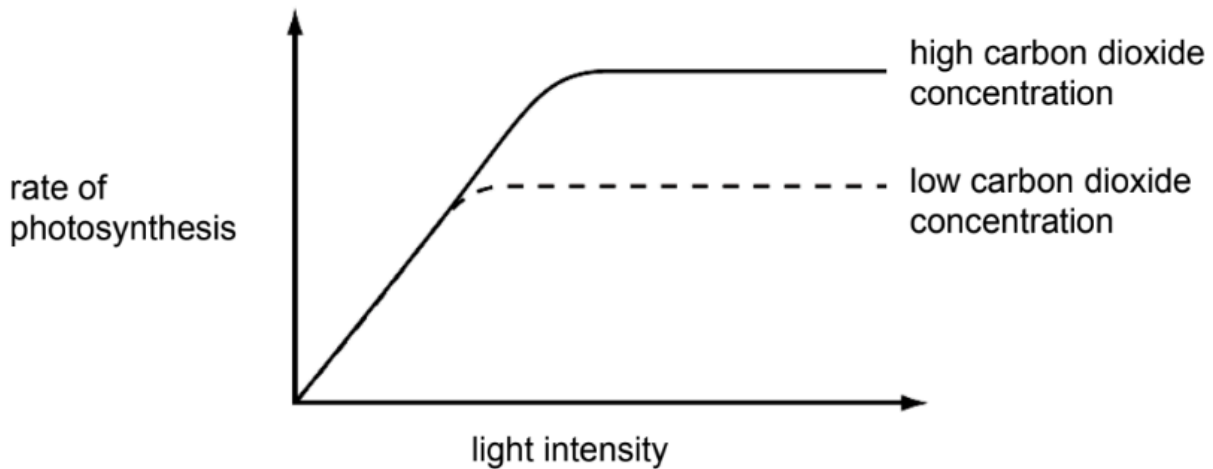
- 10 The diagram below shows an experiment to find out whether carbon dioxide is needed for photosynthesis.



Why is it crucial to destarch plants by placing them in the dark for twenty-four hours before carrying out the experiment?

- A** to ensure that starch was not made before the experiment began
- B** to maximise the rate of photosynthesis during the experiment by depriving the plant of an energy source
- C** to ensure that all of the starch subsequently found in the plant is due to photosynthesis during the experiment
- D** to allow enzymes in the leaf to rest before the experiment begins

- 11 The graph shows the effect of changing light intensity on the rate of photosynthesis in a plant at two different carbon dioxide concentrations.

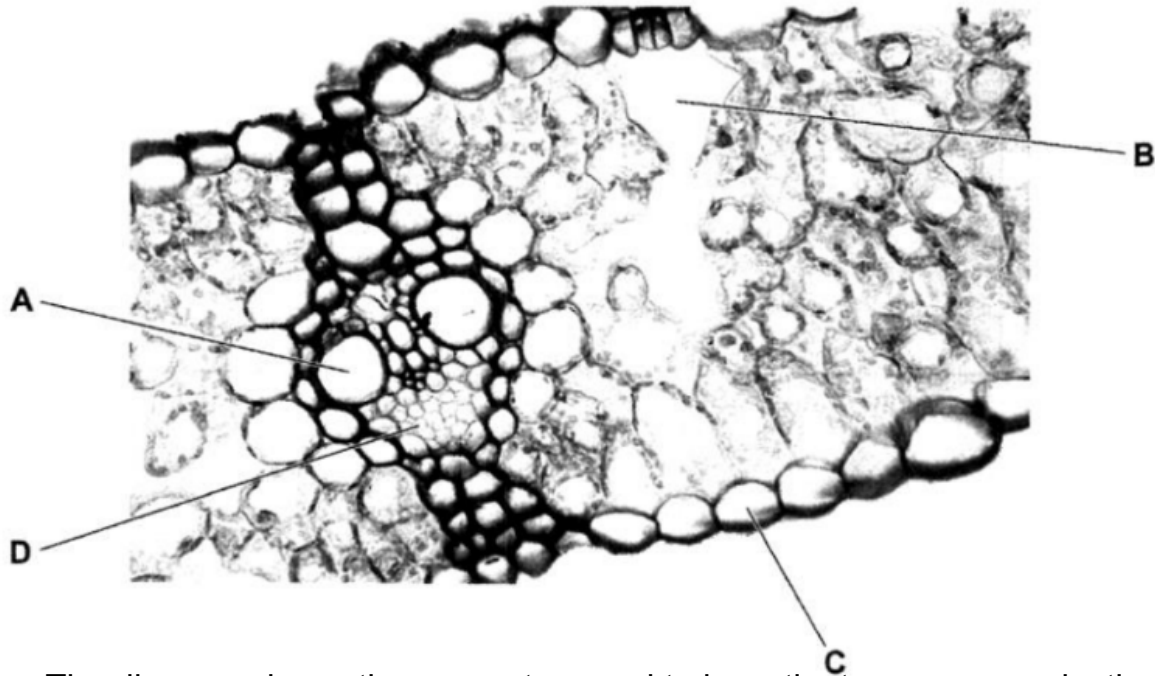


Which statement is correct?

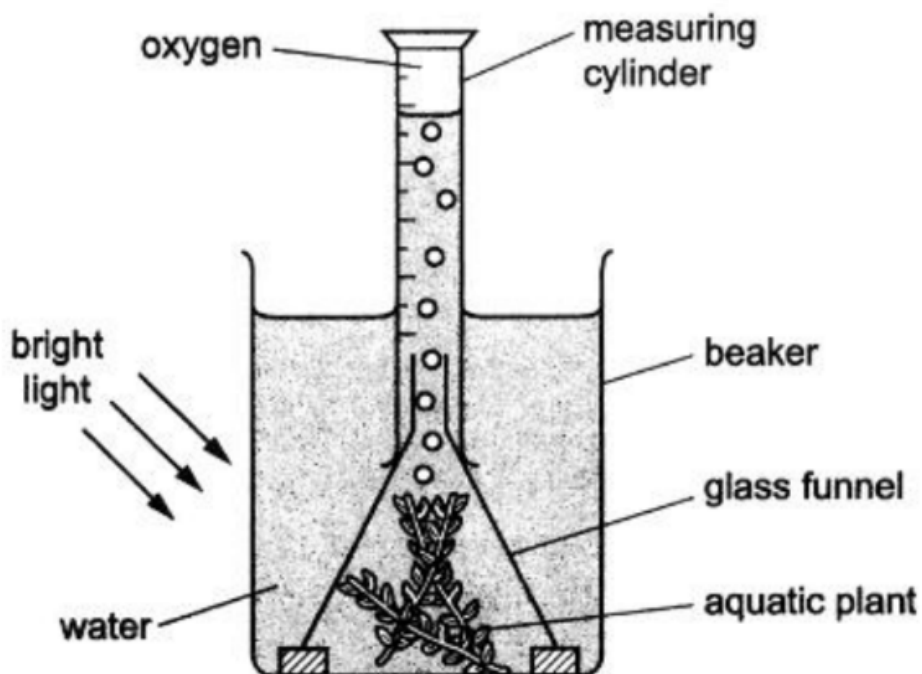
- A At low light intensities carbon dioxide is the limiting factor.
 - B At high light intensities carbon dioxide is the limiting factor.
 - C When the carbon dioxide concentration is high, there is no limiting factor.
 - D When the carbon dioxide concentration is low, the plants cannot photosynthesise.
- 12 What process occurs as a result of transpiration pull?
- A accumulation of water in the intercellular air spaces of the leaves
 - B loss of water vapour through the stomata of the leaves
 - C transport of water and dissolved mineral salts up the xylem
 - D transport of sucrose and amino acids in the phloem

- 13 The diagram shows an image of a cross section of a leaf, as seen through a light microscope.

Which letter shows the part that is responsible for the transport of water?



- 14 The diagram shows the apparatus used to investigate oxygen production from an aquatic plant.



The experiment was repeated several times to calculate the average volume of oxygen produced.

Which two factors must be kept constant in each repeat experiment?

- A** the size of aquatic plant and the time exposed to the light
- B** the size of aquatic plant and the volume of oxygen in the measuring cylinder
- C** the size of beaker and the size of the funnel
- D** the volume of water in the beaker and the height of the measuring cylinder

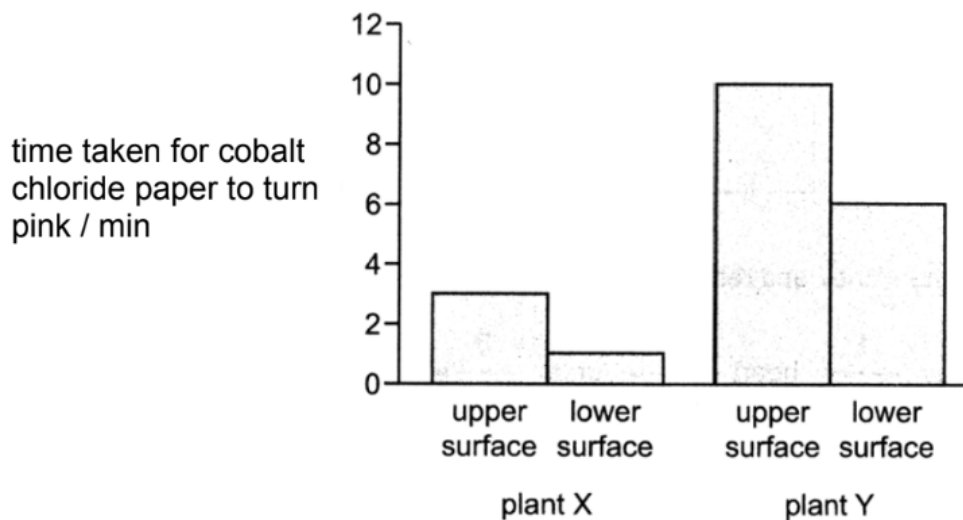
15 Many plants store food substances in their roots.

Which statement describes how food substances enters the roots?

- A** Food substances are absorbed through the root hairs by diffusion.
- B** Food substances are absorbed through the root hairs by active transport.
- C** Food substances are translocated by the phloem to the roots.
- D** Food substances are translocated by the xylem to the roots.

16 Cobalt chloride paper is blue when dry and turns pink when wet. Blue cobalt chloride paper is fastened to the upper and lower surfaces of a leaf on plant X and Y.

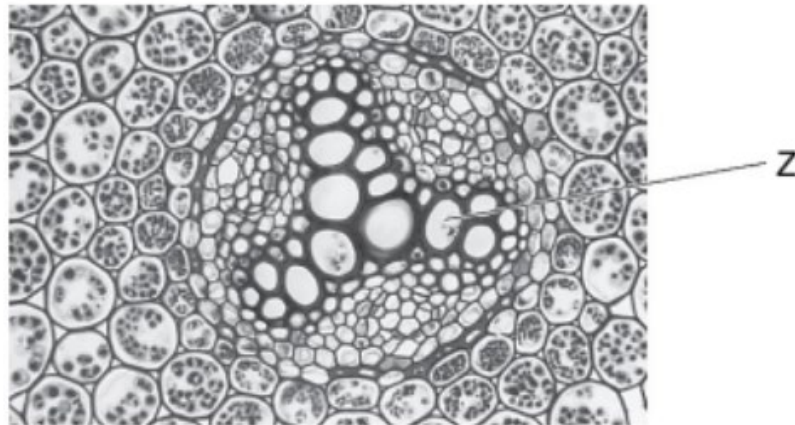
The bar chart shows the time taken for cobalt chloride paper to turn pink.



Which statement can explain the results from the bar chart?

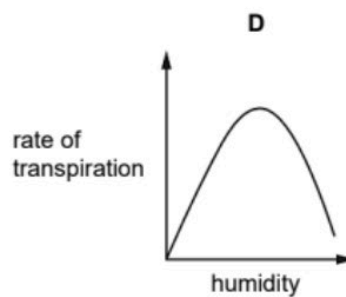
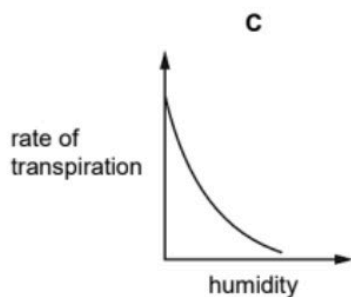
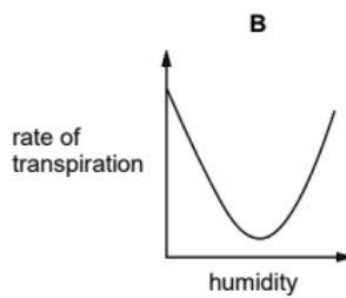
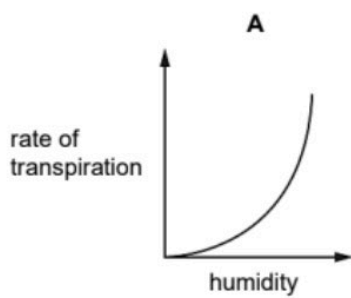
- A** Plant Y has a higher rate of transpiration than Plant X.
- B** Plant Y has more stomata than plant X.
- C** Surface of leaf on plant Y has hairs.
- D** There are more stomata on the upper surface than the lower surface.

- 17 The photomicrograph shows a cross-section through the root of a buttercup plant.



What is the main function of the tissue labelled Z?

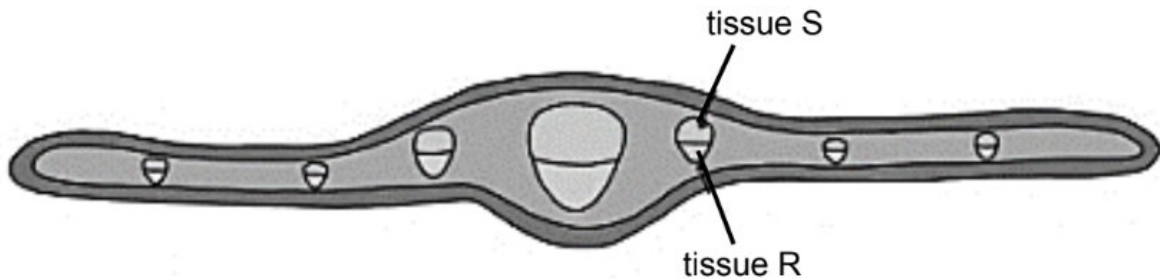
- A photosynthesis
 - B respiration
 - C transport of sugars
 - D transport of water
- 18 Which graph shows the effect of increasing humidity on the rate of transpiration?



- 19 Which sequence describes the pathway of water as it moves from the soil, through a plant?
- A root cortex cells → root hair cells → mesophyll cells → xylem → stomata
 - B root cortex cells → root hair cells → xylem → mesophyll cells → stomata
 - C root hair cells → root cortex cells → xylem → mesophyll cells → stomata
 - D root hair cells → xylem → root cortex cells → mesophyll cells → stomata

20 A herbaceous plant, growing in a nutrient solution, is placed in a well-lit container. Humid air is passed through the container.

The diagram shows a section through a part of the plant.

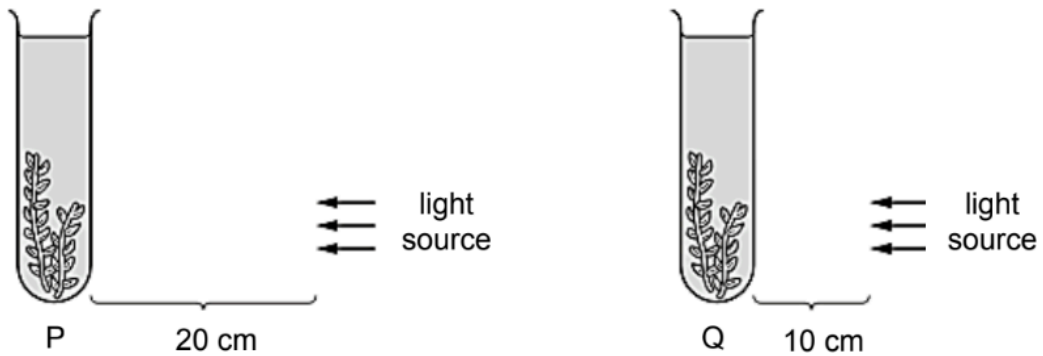


The speeds of movement of the fluids in tissues R and S are measured. The humid air is then replaced by dry air and the speeds of movement of the fluids are measured again.

Which effect does the change to dry air have on the measurements?

	tissue R	tissue S
A	greatly increased downward movement	greatly increased upward movement
B	greatly increased upward movement	little change
C	little change	greatly increased downward movement
D	little change	greatly increased upward movement

- 21 The diagram shows an experiment investigating the effect of light intensity on an aquatic plant.

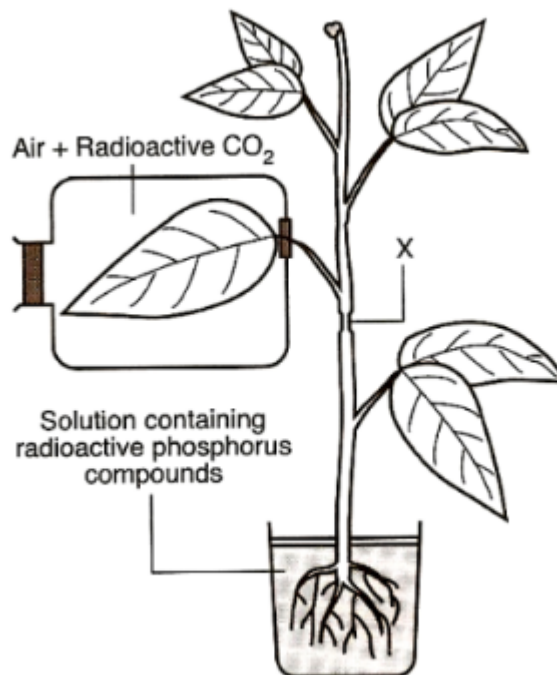


Photosynthesis occurred in both test-tube P and test-tube Q. Both test-tubes were kept at the same temperature. The number of bubbles produced in test-tube P was 12 bubbles per minute.

What is the most likely number of bubbles produced in one minute in test-tube Q?

- A 0
 - B 3
 - C 12
 - D 48
- 22 An experiment was designed to study the movement of materials in a photosynthetic plant with the phloem removed at the level marked X and with the xylem left intact.

After several hours, the relative amounts of radioactive carbon and phosphorus compounds in different parts of the plant were determined.



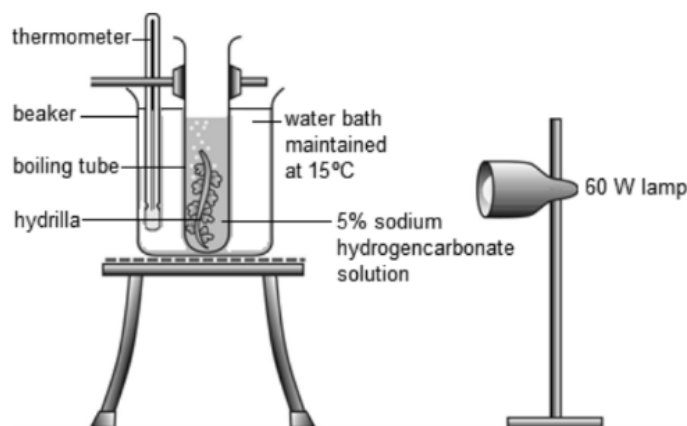
The following statements were made regarding the results of the experiments:

I	Radioactive carbon compounds were detected in the root tissues.
II	Transport of radioactive carbon compounds occurred in both directions of the stem.
III	Radioactive phosphorus compounds were transported up the stem in the xylem.
IV	There was a small swelling containing radioactive carbon compounds located in the region above X.

What would be observed at the end of the experiment?

- A** IV only
- B** II and III only
- C** II, III and IV only
- D** All of the above

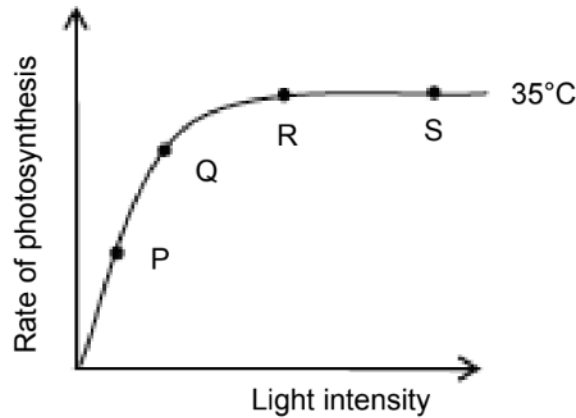
23 The diagram below shows an experimental set-up to investigate the rate of photosynthesis in aquatic submerged plant.



Which of the following would decrease the rate of bubble production?

- A** Using a 80 W lamp.
- B** Increase the temperature of the water bath to 45 oC.
- C** Increase the sodium hydrogencarbonate concentration to 8%.
- D** Reduce distance between the lamp and the beaker.

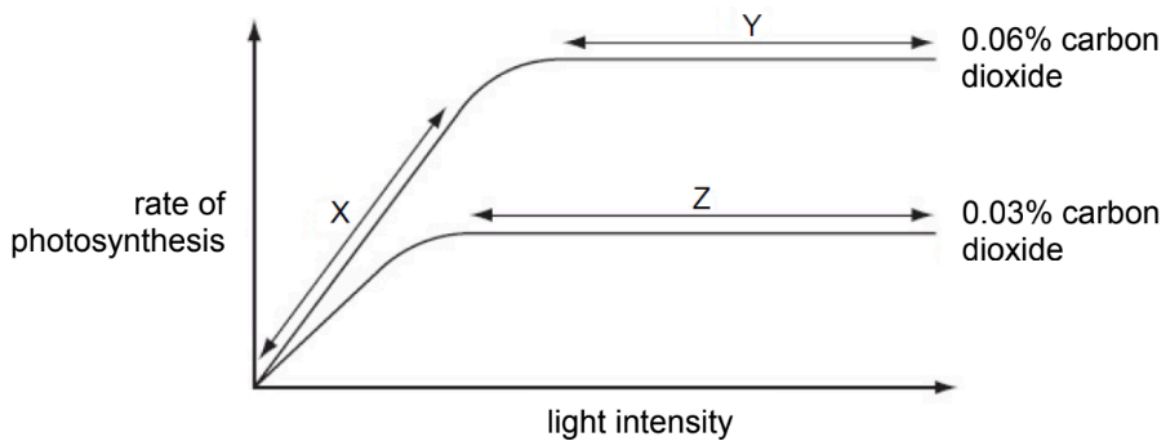
24 The graph shows how the rate of photosynthesis varies with light intensity.



Which is the best conclusion that can be made from the graph?

- A The limiting factor between P and Q is light intensity.
- B The limiting factor between P and Q is temperature.
- C The limiting factor between R and S is light intensity.
- D The limiting factor between R and S is temperature.

25 The graph shows the rate of photosynthesis of a plant at increasing light intensities at two carbon dioxide concentrations. The temperature is kept constant.



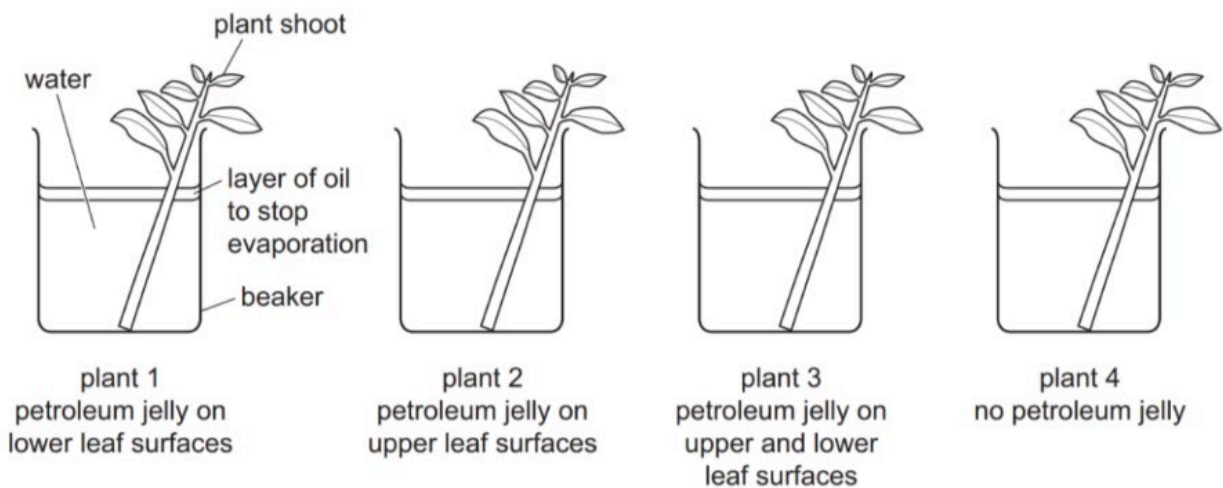
What are the limiting factors at X, Y and Z?

	X	Y	Z
A	CO ₂ concentration	light intensity	CO ₂ concentration
B	CO ₂ concentration	light intensity	light intensity
C	light intensity	CO ₂ concentration	CO ₂ concentration
D	light intensity	CO ₂ concentration	light intensity

26 Which row shows the correct description of translocation occurring in the presence of sunlight?

	source of carbohydrate	type of carbohydrate translocated	tissue involved
A	leaves	glucose	phloem
B	leaves	sucrose	phloem
C	roots	glucose	xylem
D	roots	sucrose	xylem

27 The diagram shows four plant shoots in the same environmental conditions. Waterproof petroleum jelly was applied to selected leaf surfaces. Each beaker, with its plant shoot and water, was weighed at the start of the experiment and after 24 hours. After 24 hours, the percentage loss in mass was calculated for each plant shoot.



Which row shows the possible results of this experiment?

	percentage loss in mass after 24 hours			
	plant 1	plant 2	plant 3	plant 4
A	3	5	13	15
B	3	15	6	12
C	5	12	3	16
D	15	5	12	3

28 Which of the processes takes place in a chloroplast?

- 1 carbon dioxide + water \rightarrow glucose + oxygen
- 2 carbon dioxide + water \rightarrow lactic acid + oxygen
- 3 glucose + oxygen \rightarrow carbon dioxide + water
- 4 glucose \rightarrow lactic acid

- A** 1 only
B 1 and 3 only
C 3 and 4 only
D 1, 2 and 3

29 Which set of conditions is most likely to have light intensity as the main limiting factor during photosynthesis?

	light intensity / a.u.	temperature / °C	carbon dioxide concentration / %	oxygen concentration / %
A	5	5	0.01	20.0
B	5	25	0.04	5.0
C	15	25	0.04	20.0
D	15	5	4.00	5.0

30 Which row shows the translocation of carbohydrate in a potato plant growing in bright sunlight?

	source of carbohydrate	type of carbohydrate transported	destination of carbohydrate
A	leaves	glucose	tuber
B	leaves	sucrose	tuber
C	tuber	glucose	leaves
D	tuber	sucrose	leaves

31 Which of the processes is/are involved in the loss of water from the leaves?

- 1 diffusion
- 2 evaporation
- 3 osmosis

- A** 3 only
B 1 and 2
C 2 and 3
D 1, 2 and 3

NUTRITION AND TRANSPORT IN FLOWERING PLANTS STRUCTURED QUESTIONS

- 1 Fig. 6.1 shows the changes in the relative size of the stomatal openings in the leaves of an Angsana tree during a 24-hour period. This is an example of physiological adaptation.

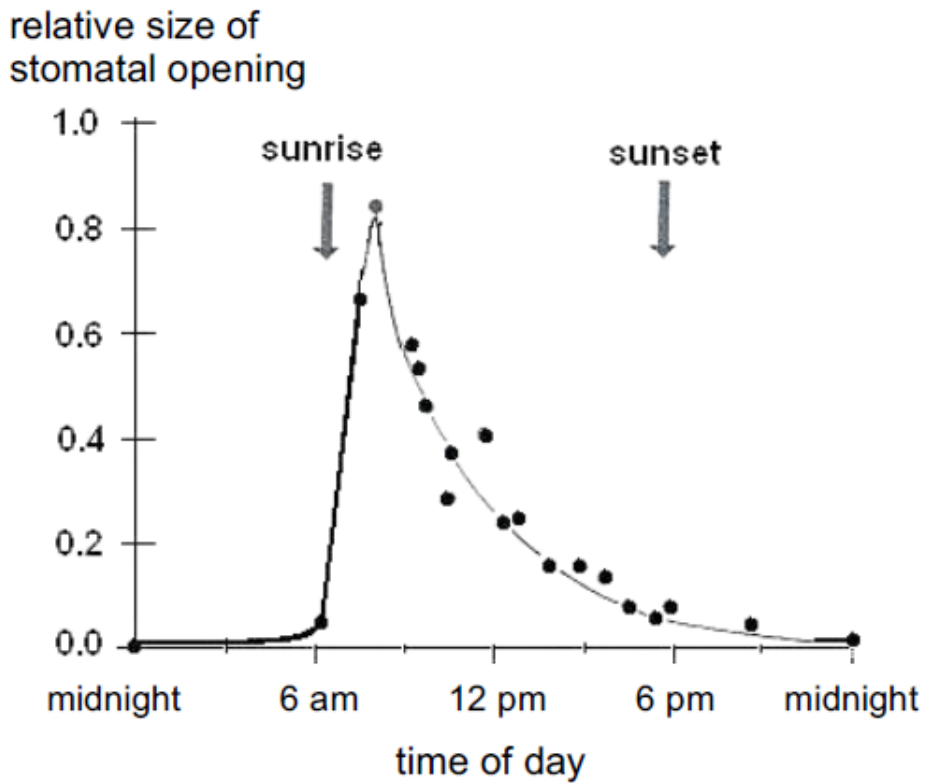


Fig. 6.1

- (a) With reference to Fig. 6.1, describe the changes occurring to the stomata during the period from sunrise to sunset.

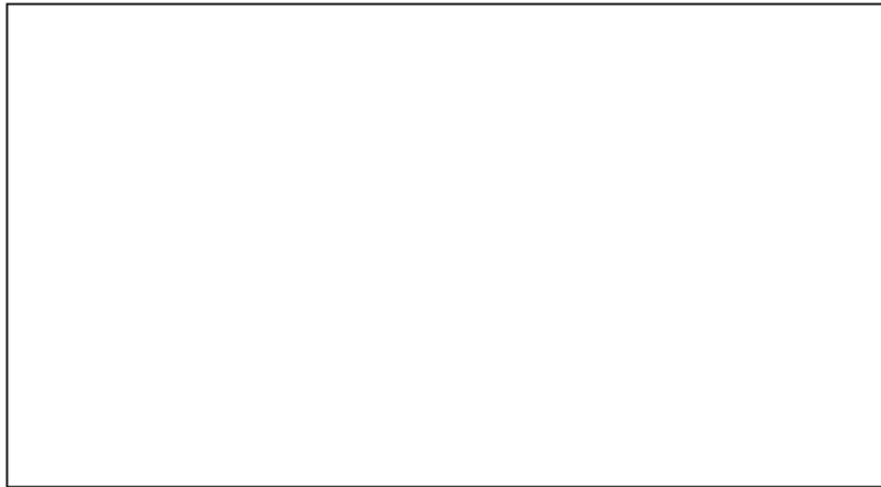
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.....[2]

- (b) In the space below, draw a simple outline of a pair of guard cells seen on the surface view of the lower epidermis of the Angsana leaf as they would appear at 9 am.



[1]

- (c) Explain the significance of changes in relative size of stomatal opening between sunrise and sunset to the Angsana tree's survival.

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[2]

- (d) Suggest and explain how the size of stomatal opening at 12 pm would change if the same Angsana tree experiences a period of heavy rain.

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[2]

[Total: 7]

2 Fig 4.1 shows the cross section of part of a leaf.

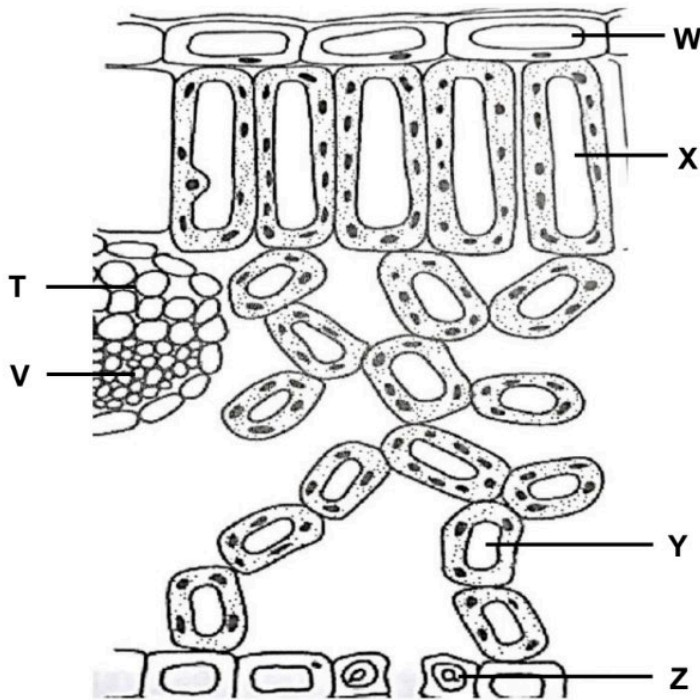


Fig 4.1

- (a) Using the letters in Fig 4.1, identify the structures responsible for
- (i) the highest rate of photosynthesis in the leaf: [1]
 - (ii) the transport of water and mineral salts: [1]

(b) Describe and explain how carbon dioxide enters cell Y.

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[3]

(c) Compare and contrast between cell X and a root hair cell.

.....

[2]

- 3 Fig. 6.1 shows part of a cross-section of the stem of a young sunflower plant.

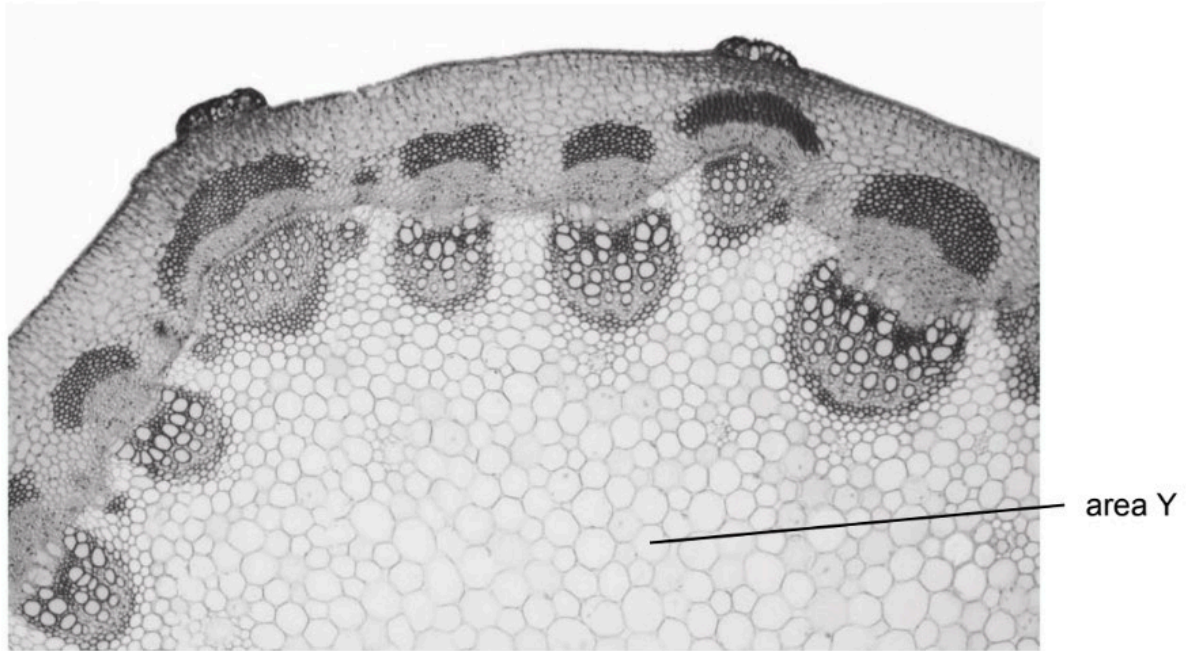


Fig. 6.1

- (a) Draw a circle around one vascular bundle on Fig. 6.1
Label the xylem in the vascular bundle with the letter X. [2]
- (b) Explain how the cells in area Y are able to support the stem so that it stays upright.

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[3]

(c) Researchers used carbon dioxide that contained a traceable source of carbon (^{13}C) to investigate translocation of sucrose from the leaves of bean plants, *Phaseolus vulgaris*.

Fig. 6.2 shows that glucose produced in photosynthesis is converted to sucrose for translocation.

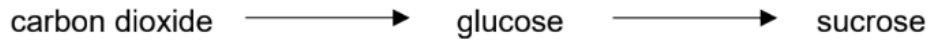
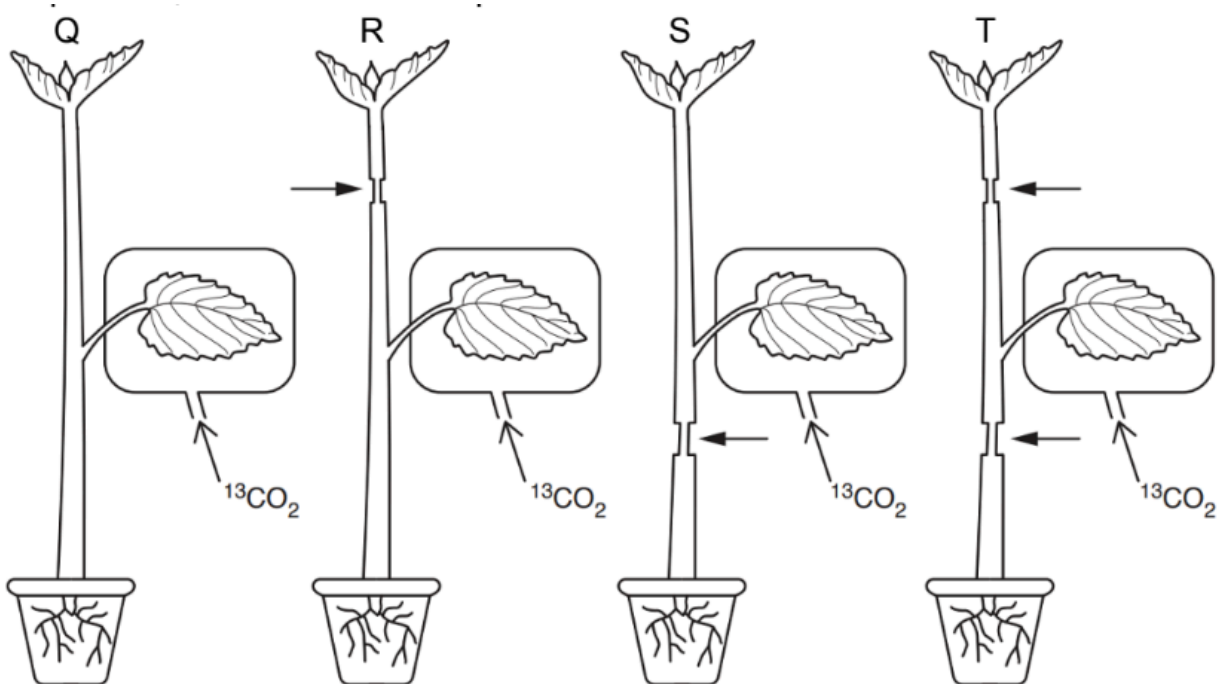


Fig. 6.2

Researchers selected four plants, Q, R, S and T, which had leaves that were of similar sizes. The leaves on the four plants were supplied with $^{13}\text{CO}_2$.

After the leaves had started to make sucrose, the researchers cut away a ring of tissue in different places as shown in Fig. 6.3. The rings of tissue that were removed from plants R, S and T contained phloem.



Key: → the positions on the stems where rings of tissues containing phloem were removed.

Fig. 6.3

4 Fig. 6.1 shows the rate of water uptake and of water loss for a plant over a 24-hour period.

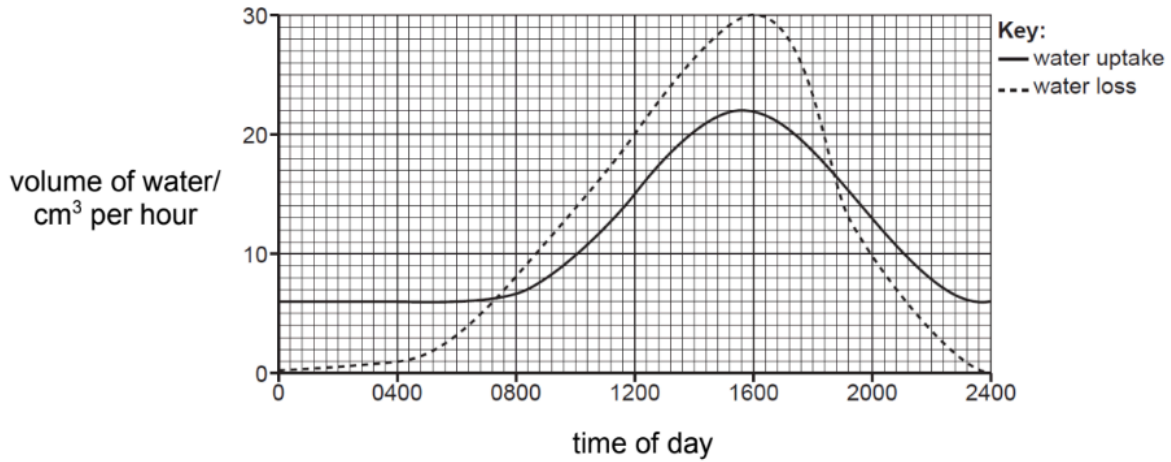


Fig. 6.1

(a) (i) Name the cells through which water is absorbed from the soil.

.....[1]

(ii) Name the cells between which water vapour passes to the atmosphere.

.....[1]

(b) State two uses of water within a plant between midnight and 0400 hours.

1.....

2.....[2]

(c) State two additional uses of water within a plant between 0800 and 1900 hours.

1.....

2.....[2]

(i) State the biological process affected by the chemical.

..... [1]

(ii) Explain why the moss balls did not rise.

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..... [2]

(b) The scientists then investigate how exposure to light affects a moss ball which had been in the dark.

- In Experiment 1, a moss ball is exposed to 12 h of light then 12 h of darkness.
 - In Experiment 2, the moss ball is exposed to continuous light for 24 h.
- Fig. 4.2 shows the results of the experiment.

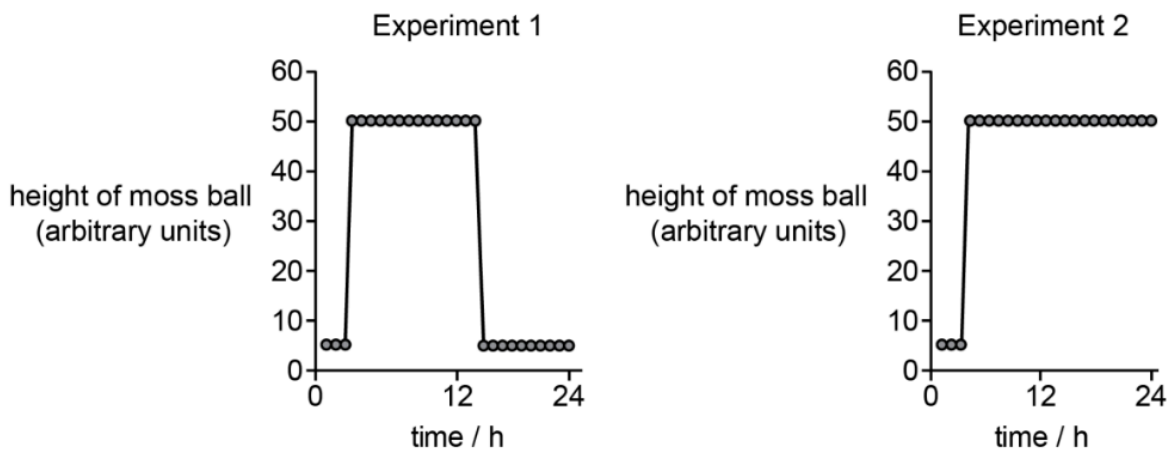


Fig. 4.2

(i) Describe the effect of light on the position of the moss ball in Experiment 1.

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..... [2]

(ii) Suggest an explanation for the differences between the two graphs.

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..... [2]

(c) Temperature is one environmental factor that affects plants. Explain how increasing the temperature from 15 °C to 40 °C can affect plants.

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..... [3]

[Total: 10]

7 Rice, maize and wheat plants are the main carbohydrate source for more than 60% of the human population.

(a) Fig. 8.1 shows the nutritional information of rice.

Nutrition Facts	
Serving Size: 150 g	
Amount Per 100 g	
Calories 121	
	% Daily Values*
Total Fat 0.38g	1%
Saturated Fat 0.09g	0%
Polyunsaturated Fat 0.122g	
Monounsaturated Fat 0.128g	
Cholesterol 0mg	0%
Sodium 126mg	5%
Potassium 32mg	
Total Carbohydrate 25.22g	8%
Dietary Fiber 0.4g	2%
Sugars 0.05g	
Protein 3.54g	

Fig. 8.1

Calculate the mass of carbohydrate in grams per serving of rice. Leave your answer to 2 decimal places.

mass of carbohydrate g [1]..

8 (a) Describe how light energy is converted to chemical energy and stored as carbohydrates in plants.

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..... [4]

(b) Name and explain how two other external factors, other than light intensity, can affect the rate of reaction described in 9(a).

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..... [6]

[Total: 10]

- (b) State the condition that causes wilting, and discuss its advantage and disadvantage for the plant.

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[4]

[Total: 10]

ANSWERS FOR NUTRITION AND TRANSPORT IN FLOWERING PLANTS

MCQ

Q1: D	Q11: B	Q21: D	Q31: D
Q2: C	Q12: C	Q22: C	
Q3: B	Q13: A	Q23: B	
Q4: D	Q14: A	Q24: A	
Q5: B	Q15: C	Q25: C	
Q6: B	Q16: C	Q26: B	
Q7: A	Q17: D	Q27: C	
Q8: A	Q18: C	Q28: A	
Q9: B	Q19: C	Q29: B	
Q10: C	Q20: D	Q30: B	

ANSWERS FOR NUTRITION AND TRANSPORT IN FLOWERING PLANTS
STRUCTURED QUESTIONS

- 1 Fig. 6.1 shows the changes in the relative size of the stomatal openings in the leaves of an Angsana tree during a 24-hour period. This is an example of physiological adaptation.

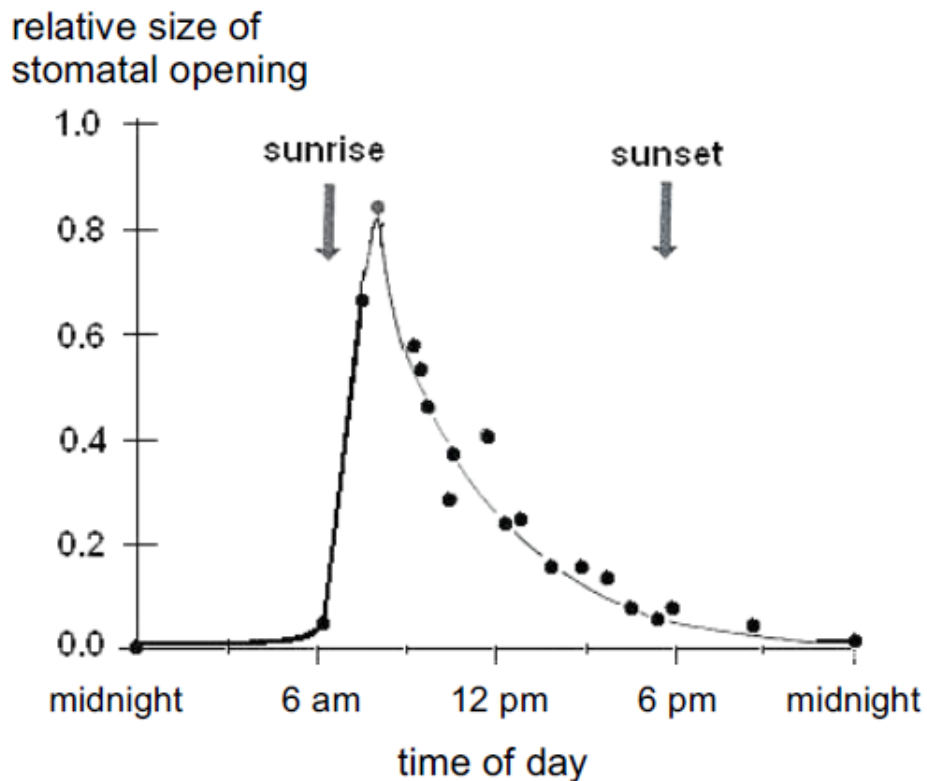


Fig. 6.1

(a) With reference to Fig. 6.1, describe the changes occurring to the stomata during the period from sunrise to sunset.

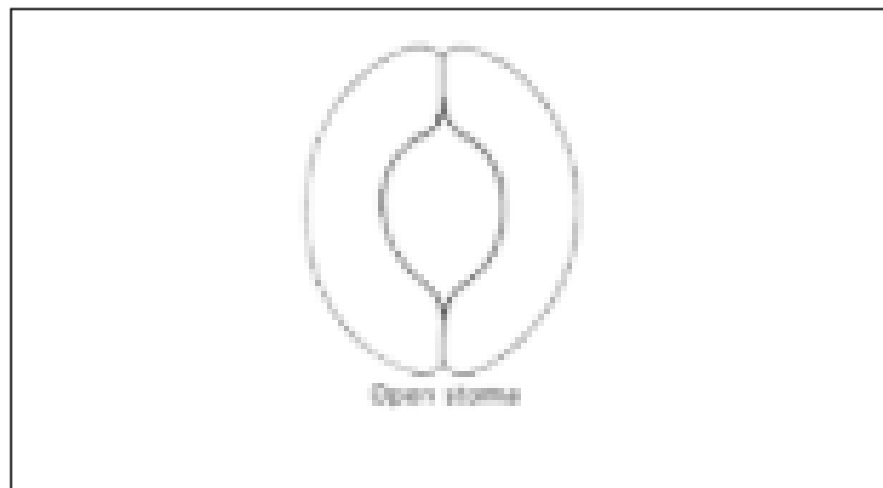
- Opened at 6am/ Sharp increase in stomatal opening

from 6am to 8am [1]

- Maximum opening at 8am and Opening reduced in size from 8am onwards [1]

- Data citation for size of stomatal opening [2]

(b) In the space below, draw a simple outline of a pair of guard cells seen on the surface view of the lower epidermis of the Angsana leaf as they would appear at 9 am.



[1]

(c) Explain the significance of changes in relative size of stomatal opening between sunrise and sunset to the Angsana tree's survival.

- Opened when there is sunlight to allow carbon dioxide to enter for photosynthesis;[1]

- Resultant water loss during transpiration cause closure of stomata to prevent excessive water loss. OR

Stomata closed in the dark to reduce water loss as no photosynthesis can take place. [1] [2]

(d) Suggest and explain how the size of stomatal opening at 12 pm would change if the same Angsana tree experiences a period of heavy rain.

• The stomata will open wider [1] due availability of water [1]

[Reject: answers related to light intensity/humidity rather than water availability] [2]

[Total: 7]

2 Fig 4.1 shows the cross section of part of a leaf.

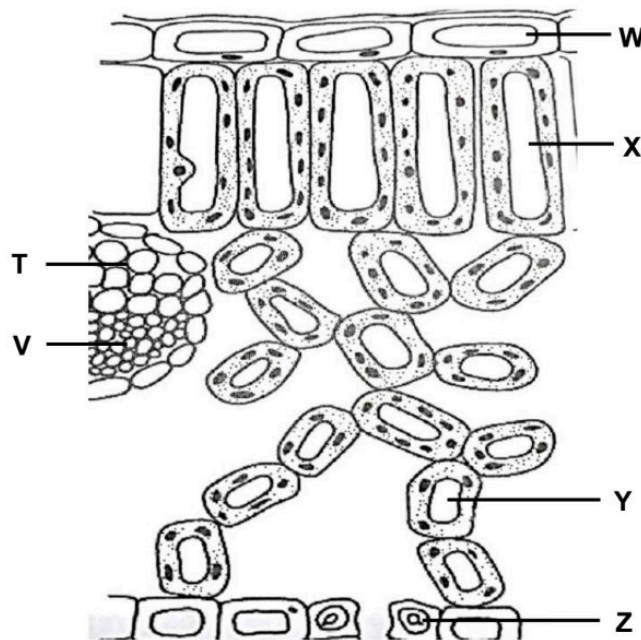


Fig 4.1

(a) Using the letters in Fig 4.1, identify the structures responsible for

(i) the highest rate of photosynthesis in the leaf: X [1]

(ii) the transport of water and mineral salts: I [1]

(b) Describe and explain how carbon dioxide enters cell Y.

Carbon dioxide diffuses into intercellular air spaces through stomata;

Carbon dioxide dissolves into thin film of moisture;

Dissolved carbon dioxide diffuses into spongy mesophyll cells.

No mention of diffusion, dissolving = 0m [3]

(c) Compare and contrast between cell X and a root hair cell.

Both have cell wall/nucleus/mitochondria etc.
 Cell X has chloroplasts, while root hair cells do not.
 Cell X has a regular shape, while root hair cells have long and narrow root hair protruding out.

Minimum 1 similarity or 1 difference. 3 pts – 2m, 2 pts – 1m, 1 pt – 0m.
 All comparisons lumped together – Must fulfil above criteria, and max 1m

[2]

3 Fig. 6.1 shows part of a cross-section of the stem of a young sunflower plant.

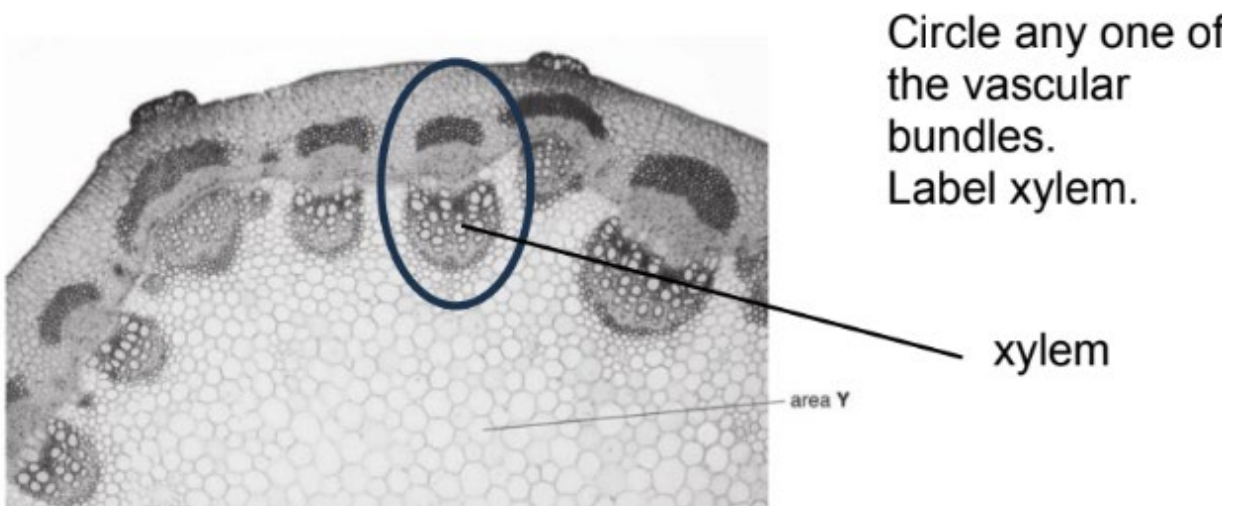


Fig. 6.1

(a) Draw a circle around one vascular bundle on Fig. 6.1
 Label the xylem in the vascular bundle with the letter X. [2]

Circle any one of the vascular bundles.
 Label xylem.

- (b) Explain how the cells in area Y are able to support the stem so that it stays upright.

[1] cell vacuoles / cells have a higher water potential

[2] cells absorbed water by osmosis / down a water potential gradient

[3] causes cells to become turgid / have turgor pressure.

[4] presence of cell wall which is inelastic and prevent the cells from bursting.

Any three points [3]

[3]

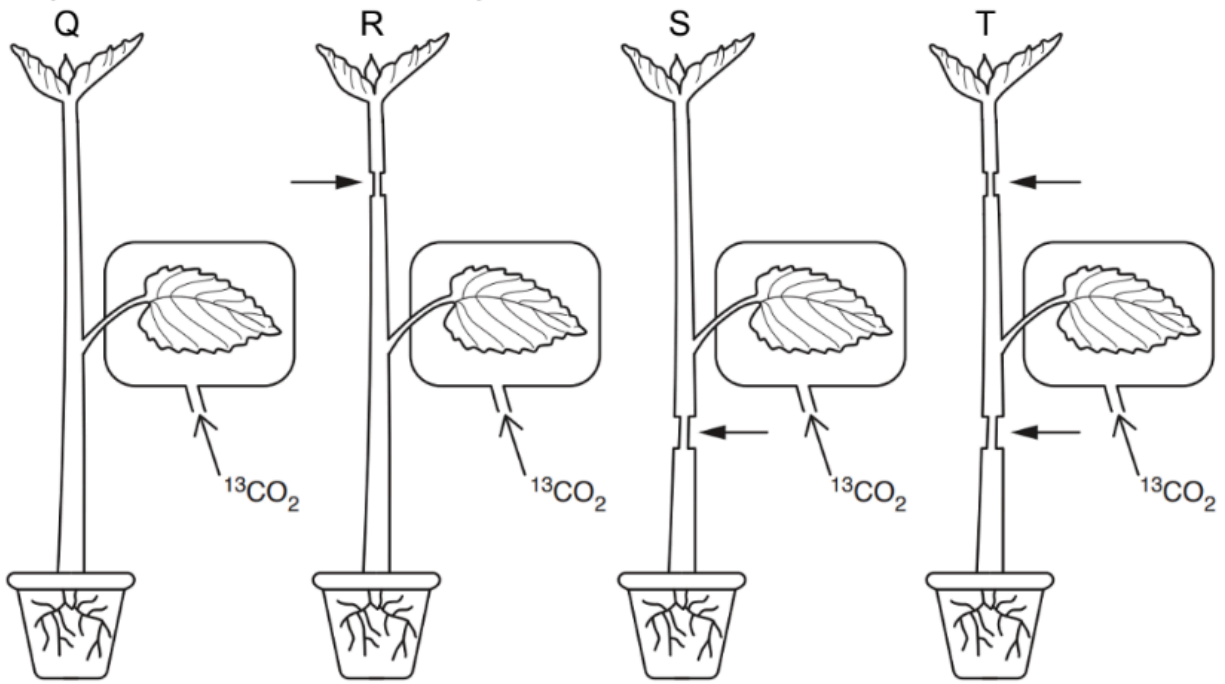
- (c) Researchers used carbon dioxide that contained a traceable source of carbon (^{13}C) to investigate translocation of sucrose from the leaves of bean plants, *Phaseolus vulgaris*.
Fig. 6.2 shows that glucose produced in photosynthesis is converted to sucrose for translocation.

carbon dioxide \longrightarrow glucose \longrightarrow sucrose

Fig. 6.2

Researchers selected four plants, Q, R, S and T, which had leaves that were of similar sizes. The leaves on the four plants were supplied with $^{13}\text{CO}_2$.

After the leaves had started to make sucrose, the researchers cut away a ring of tissue in different places as shown in Fig. 6.3. The rings of tissue that were removed from plants R, S and T contained phloem.



Key: → the positions on the stems where rings of tissues containing phloem were removed.

Fig. 6.3

The quantities of sucrose containing ^{13}C in the shoot tips and in the roots were determined. The results are shown in Table 6.1.

Table 6.1

plant	quantity of sucrose containing ^{13}C /arbitrary units	
	shoot tip	root
Q	3.24	0.94
R	0.00	0.44
S	4.14	0.00
T	0.00	0.00

Describe and explain the effect of removing the phloem on the translocation of sucrose in plants Q, R, S and T.

- [1] Q has sucrose / ^{13}C in shoot and root
- [2] T has no sucrose / ^{13}C in shoot and root
- [3] R has sucrose / ^{13}C in root but not in shoot
- [4] S has sucrose / ^{13}C in shoot but not in root

Any two points

Explain:

- [5] there is no transport of sucrose / ^{13}C where phloem is removed.
- [6] phloem transport sucrose / ^{13}C in both directions; upwards and downwards.
- [7] leaf carry out photosynthesis and produce glucose and convert to sucrose for transport.
- [8] sucrose is then transported to the roots and shoots.

Any three points

[5]

[Total: 10]

- 4 Fig. 6.1 shows the rate of water uptake and of water loss for a plant over a 24-hour period.

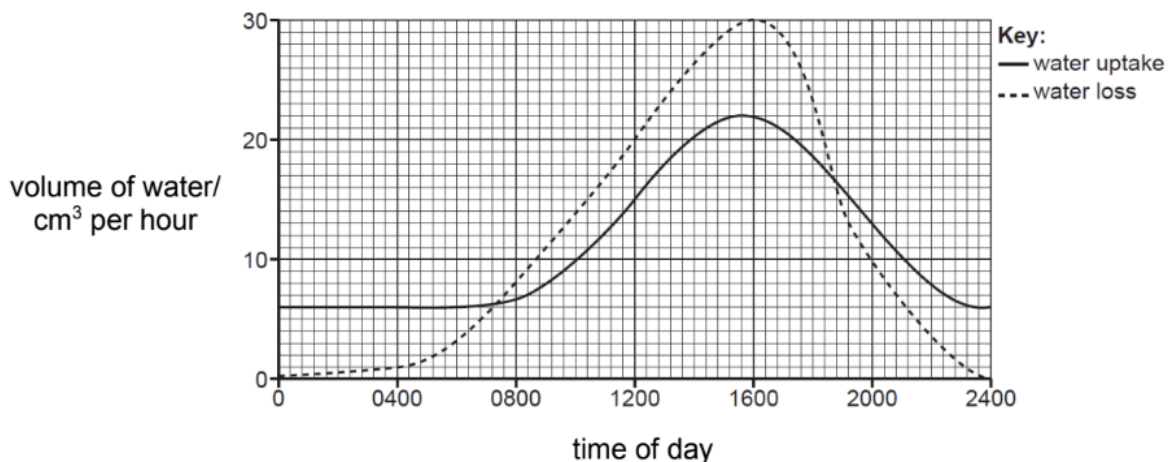


Fig. 6.1

(a) (i) Name the cells through which water is absorbed from the soil.

root hair cell. [1]

(ii) Name the cells between which water vapour passes to the atmosphere.

guard cell (R: stomata, qns asks for cell) [1] [1]

(b) State two uses of water within a plant between midnight and 0400 hours.

solvent for transport (e.g. in xylem and phloem); [1]

maintains turgidity of cells / keep leaf upright [1]

(R: firm) (R: turgidity of specific cells eg guard cells);
medium for enzyme action; [1] [2]

(c) State two additional uses of water within a plant between 0800 and 1900 hours.

photosynthesis; [1]

cooling/ transpiration (A: replace/maintain the thin film of moisture) [1]

Max 2 [2]

(d) Explain what may happen to the plant between 1400 and 1800 hours.

rate of water loss > rate of water intake / rate of transpiration > rate of absorption / overheating; [1]

cells lose turgor/ wilting occurs/ stomata close (R: wither) [1] [2]

[Total: 8]

- 5 (a) Describe how a carbon dioxide molecule in the air can become part of a carbohydrate molecule stored in a leaf of a plant.

Diffuses through the stomata + into the intercellular air spaces;

dissolves in the thin film of moisture lining mesophyll cells;

diffuses into chloroplast of mesophyll cells/ photosynthesis occurs in chloroplast

reacts with water molecule to form glucose;

in the presence of light energy and chlorophyll;
(R: sunlight)

enzymes are involved in the photosynthesis process;

excess glucose is converted into starch and stored in leaf [7]

- (b) Describe how a carbohydrate molecule stored in the leaf of a plant can become a starch molecule stored in the root.

Starch in leaf is broken down into glucose;

Glucose reacts with fructose to form sucrose;

Sucrose is transported/ translocated in phloem to the roots;

Sucrose/ excess glucose is converted into starch to be stored

Max 3 [3]

[Total: 10]

- 6 Marimo moss balls are made up of green algae. They are found in lakes and are known to rise and fall during different times of the day. Fig. 4.1 shows some moss balls in a beaker of water.

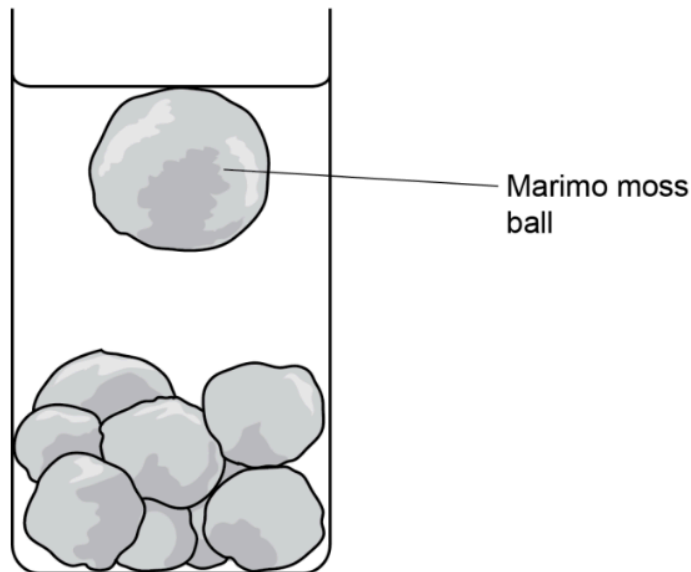


Fig. 4.1

- (a) Scientists predict that the moss balls rise because they are covered in tiny bubbles of oxygen. The scientists test their prediction by using a chemical that stops a biological process in the algae. When the chemical is added to some moss balls, they found that these moss balls did not rise.

- (i) State the biological process affected by the chemical.

Photosynthesis

[1]

- (ii) Explain why the moss balls did not rise.

it stops the process/photosynthesis and no oxygen is produced [1]

algal balls are more dense [1]

[2]

(b) The scientists then investigate how exposure to light affects a moss ball which had been in the dark.

- In Experiment 1, a moss ball is exposed to 12 h of light then 12 h of darkness.
 - In Experiment 2, the moss ball is exposed to continuous light for 24 h.
- Fig. 4.2 shows the results of the experiment.

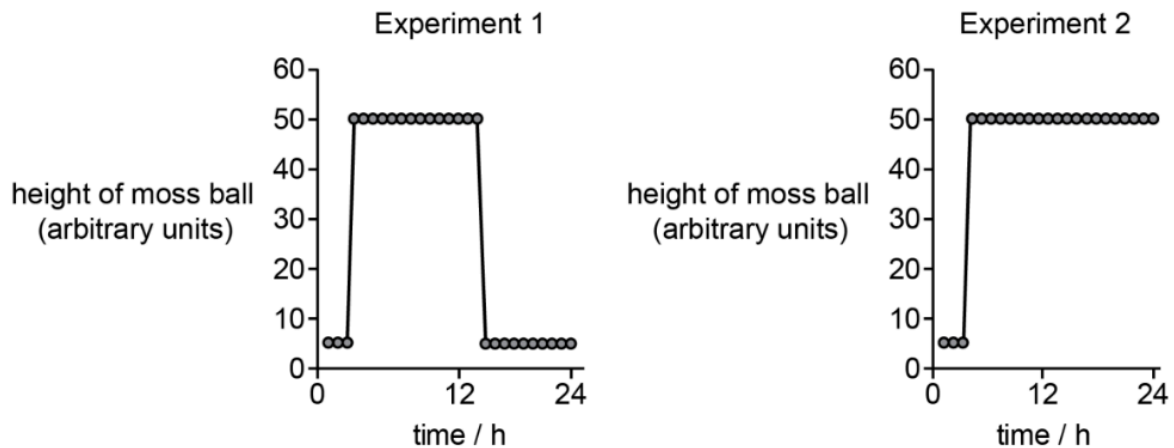


Fig. 4.2

(i) Describe the effect of light on the position of the moss ball in Experiment 1.

With light, sharp increase in height, moss ball floats at highest height of 50 arbitrary units [1]

Aft 12 hours, no light, it sinks to 5 arbitrary units; [2]

(ii) Suggest an explanation for the differences between the two graphs.

In experiment 1, rate of Respiration is more than the rate of photosynthesis using up the oxygen after 12 h [1]

In experiment 2, an increase in duration of light exposure, the higher the rate of photosynthesis /release oxygen which makes the ball float for a longer period of time beyond 12 h. [1] [2]

- (c) Temperature is one environmental factor that affects plants. Explain how increasing the temperature from 15 °C to 40 °C can affect plants.

An increase in temperature to the optimum temperature can increase the rate of photosynthesis [1] as it is an enzyme-catalysed reaction [1]

Beyond the optimum temperature, the rate of photosynthesis can decrease as the enzymes denature [1]

The rate of transpiration increases as the evaporation of water from the spongy mesophyll cells into the intercellular air space and out of the leaf through the stomata increases [1]

Any three

[3]

[Total: 10]

- 7 Rice, maize and wheat plants are the main carbohydrate source for more than 60% of the human population.

- (a) Fig. 8.1 shows the nutritional information of rice.

Nutrition Facts	
Serving Size: 150 g	
Amount Per 100 g	
Calories 121	
	% Daily Values*
Total Fat 0.38g	1%
Saturated Fat 0.09g	0%
Polyunsaturated Fat 0.122g	
Monounsaturated Fat 0.128g	
Cholesterol 0mg	0%
Sodium 126mg	5%
Potassium 32mg	
Total Carbohydrate 25.22g	8%
Dietary Fiber 0.4g	2%
Sugars 0.05g	
Protein 3.54g	

Fig. 8.1

Calculate the mass of carbohydrate in grams per serving of rice. Leave your answer to 2 decimal places.

mass of carbohydrate 37.83 g [1]..

$$25.22 * 150/100 = 37.83 \text{ g}$$

(b) State and describe the process plants like these carry out to produce carbohydrates using materials from the environment.

Any five:

- Photosynthesis ;
- in leaves / green parts of plants / in mesophyll / chloroplasts / using chlorophyll ;
- using light energy ;
- water + soil through the roots/ root hair cells / irrigation from roots ;
- carbon dioxide + air through stomata ;
- produce glucose / C₆H₁₂O₆ ;
- converted to starch ;

[5]

(c) Besides carrying out the process stated in 8(b), discuss the roles these plants play in the carbon cycle in terms of the removal and release of carbon dioxide into the atmosphere.

Any four (note: all explanations must link back to carbon):

- These plants are food source to/ fed on by other organisms, transferring carbon compounds from one trophic level to another
- These plants may eventually be buried underground and subjected to high pressure over time to form fossil fuels, trapping carbon underground
- Combustion of biofuel/these plants (reject coal/natural gas/ fossil fuels) to release carbon dioxide
- These plants are decomposed by microorganisms to release carbon dioxide
- These plants carry out respiration, breaking down nutrients to release carbon dioxide into the atmosphere

Reject: dissolution of carbon dioxide into/out of ocean (not related to rice, maize and wheat)

[4]

[Total: 10]

8 (a) Describe how light energy is converted to chemical energy and stored as carbohydrates in plants.

- Light is absorbed by chlorophyll
- Glucose is made from carbon dioxide and water through the process photosynthesis
- excess glucose is converted into other forms of sugar eg.

Sucrose

- transported to storage organs
- stored as sugars or starch [any 4] [4]

(b) Name and explain how two other external factors, other than light intensity, can affect the rate of reaction described in 9(a).

Temperature [1]

- Photosynthesis is an enzyme-controlled reaction. [1]
- As temperature increases, the rate of reaction will increase [1]
- At high temperature past the optimum temperature, the rate of reaction will decrease as enzymes are denatured [1]

Carbon dioxide concentration [1]

- At low carbon dioxide concentration, the rate of oxygen release is low [1] because less carbon dioxide is available for photosynthesis .
- Under natural conditions, carbon dioxide is an important limiting factor [1] since atmospheric carbon dioxide concentration remains constant at about 0.03% [6]

[Total: 10]

- 9 (a) Describe and explain the cellular adaptations in a leaf that supports photosynthesis.

Upper epidermis is transparent to allow light energy to be captured by palisade layer [1]

Abundance of chloroplasts found in palisade mesophyll cells maximises the capture of sunlight to power photosynthesis. [1]

Regular arrangement allows close packing of palisade cells to maximise light energy captured.

Presence of intercellular airspaces in the spongy mesophyll layer and stomata allow for intake of carbon dioxide. [1]

Presence of thin film of moisture surrounding the spongy mesophyll cells allows carbon dioxide to dissolve and absorbed by these cells. [1]

Presence of vascular bundles allow uptake of water, a reactant in photosynthesis. [1]

Presence of stomata to allow the exchange of gases between the intercellular airspaces and the atmosphere. [1]

Any 5 points for 5m

[5]

(b) Describe the outcome for products of photosynthesis.

Glucose is converted to sucrose before translocating to other parts of the plant **for energy release via respiration.** [1]

Oxygen diffuses from the mesophyll cells to the **atmosphere** through the stomata [1]

Excess glucose is stored as **starch.** [1]

Glucose can also be converted to **plant amino acids /fats.** [1]

Any 3 for 3m, maximum 2m if only outcome of 1 product is described

Teacher's Comments:

Answers for FRQs need to be sequenced and thought through (in terms of question requirement) in order to maximise the marks scored:

Note the suggested answers are generally sequenced by layers, as well as emphasis on how cellular (not organ) adaptations like leaf arrangement) help the leaf to maximise conditions for photosynthesis. [3]

[Total: 8]

10 (a) Describe the movement of water molecules found in soil solution to the atmosphere.

Water molecules enter the **root hair cells** via **osmosis**, and the process repeats until it **reaches the base of the xylem.** [1]

Water molecules are then drawn **up the xylem via transpiration pull.** [1]
Water molecules then **enters the mesophyll cells** in the leaf via **osmosis.** [1]

Water molecules **move out of the mesophyll cells via osmosis** to form the **thin film of moisture.** [1]

The thin film of moisture **evaporates** into the **intercellular air spaces,** [1]
Which then **diffuses into the atmosphere** through the **stomata.** [1] [6]

- (b) State the condition that causes wilting, and discuss its advantage and disadvantage for the plant.

Rate of transpiration greater than rate of absorption of water by the roots. [1]

Reduced surface area exposed to light reduces stomata aperture, hence lower rate of water loss via transpiration. [1]

This also results in **lesser carbon dioxide** available for photosynthesis [1] which **reduces the nutrition available** for the plant. [1]

Teacher's Comments:

Well done; many examples of candidates demonstrating ability to sequence understanding and convey using well-phrased sentences.

This needs to be done for all chapters/questions, not only those that are simpler in understand.

4]

[Total: 10]