

Photosynthesis & Mineral Nutrition

Question Paper

Level	O Level
Subject	Biology
Exam Board	Cambridge International Examinations
Topic	Plant Nutrition
Sub Topic	Photosynthesis & Mineral Nutrition
Booklet	Question Paper 1

Time Allowed: 60 minutes

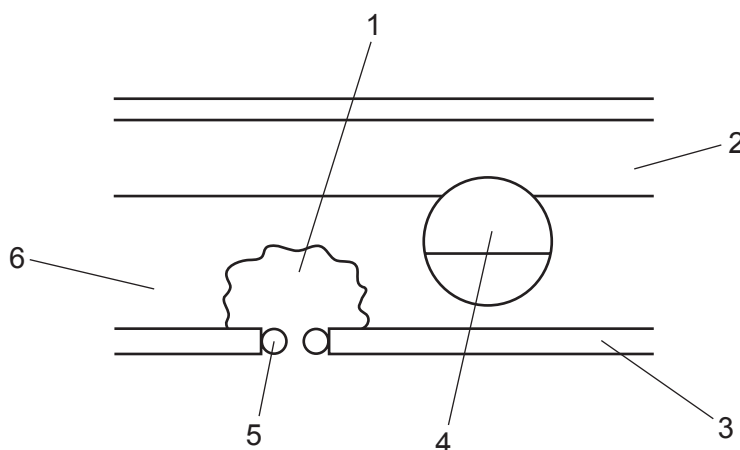
Score: /50

Percentage: /100

1 Which row shows what happens in photosynthesis?

	energy conversion	immediate product of photosynthesis	storage product of photosynthesis
A	chemical energy to light energy	glucose	starch
B	chemical energy to light energy	starch	glucose
C	light energy to chemical energy	glucose	starch
D	light energy to chemical energy	starch	glucose

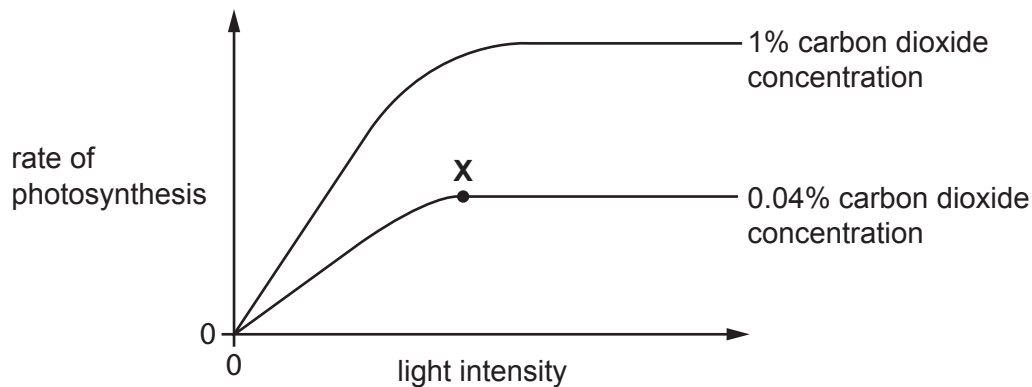
2 The diagram shows a cross-section of a dicotyledonous leaf.



Which labelled parts of the leaf carry out photosynthesis?

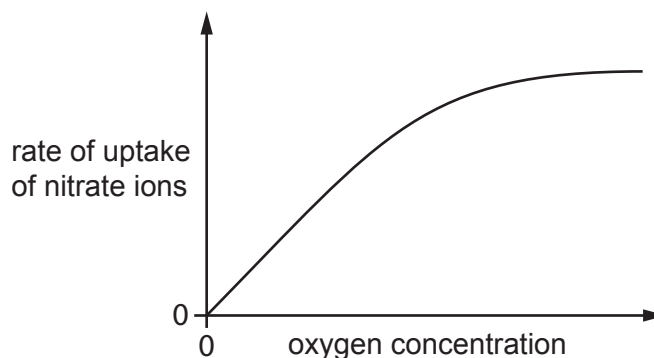
- A** 1, 2 and 3 **B** 1, 3 and 4 **C** 2, 5 and 6 **D** 4, 5 and 6

- 3 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 constant at 20 °C.



Which factor is limiting the rate of photosynthesis at point X?

- A availability of chlorophyll
 - B availability of water
 - C concentration of carbon dioxide
 - D intensity of light
- 4 The graph shows the effect of oxygen concentration on the uptake of nitrate ions from the soil into a root hair cell.



What can be concluded from this information?

- A Nitrate ions enter the root hair cell by active transport.
- B Nitrate ions enter the root hair cell by osmosis.
- C Nitrate ions leave the root hair cell by diffusion.
- D Nitrate ions leave the root hair cell in low oxygen concentrations.

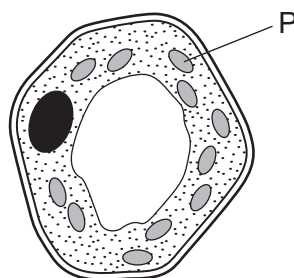
5 During a sunny day, which substance is excreted from a leaf?

- A carbon dioxide
- B nitrogen
- C oxygen
- D sucrose

6 Which process in a developing seedling needs light energy?

- A breakdown of food reserves
- B respiration
- C synthesis of organic material
- D uptake of salts and water

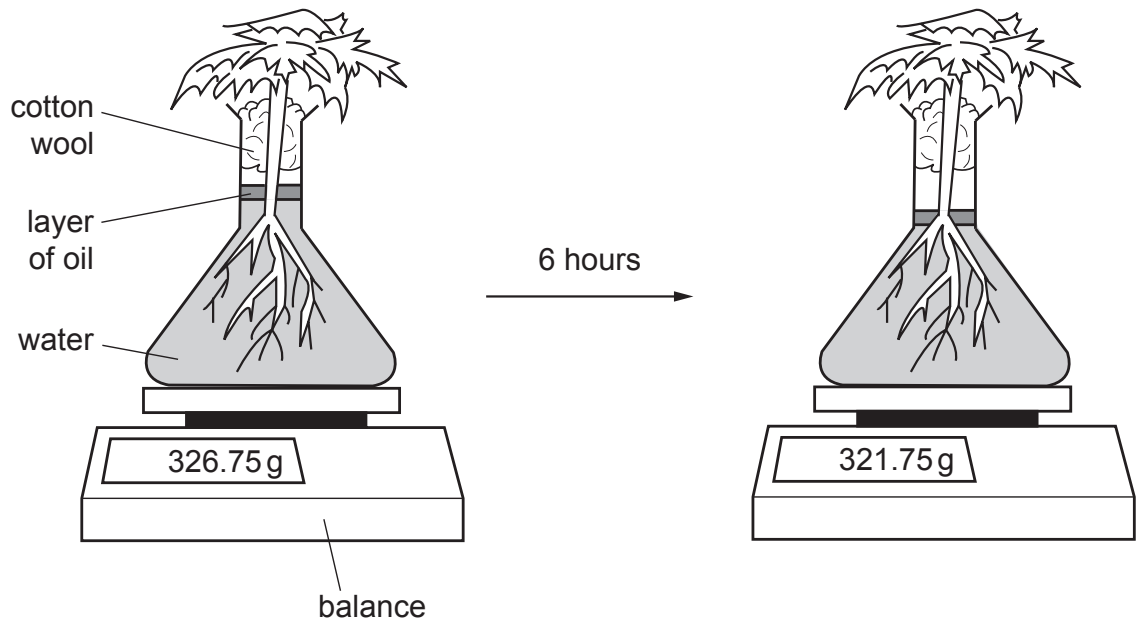
7 The diagram shows a plant cell.



Compared with the rest of the cell, which row describes the concentrations of oxygen and magnesium inside structure P during the daytime?

	oxygen	magnesium
A	high	high
B	high	low
C	low	high
D	low	low

8 The diagrams show a plant in a flask of water. It is left in the light at 16 °C for six hours.

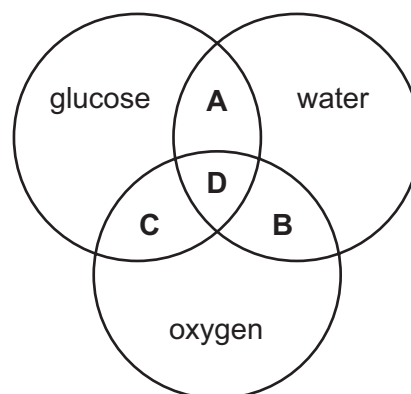


What explains the change in mass after six hours?

- A absorption of water into the root hairs
- B evaporation of water from the flask
- C photosynthesis in the leaves of the plant
- D transpiration from the leaves of the plant

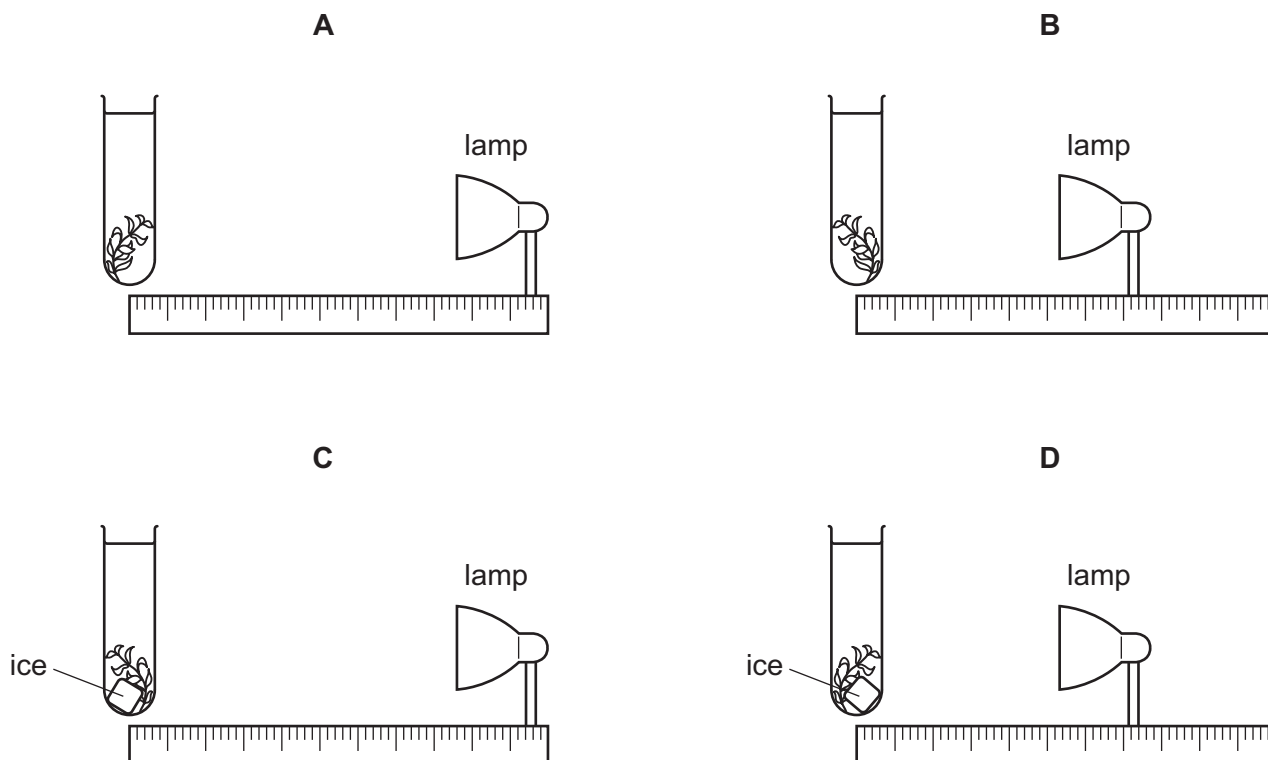
9 The diagram refers to some substances found in plant cells.

Which area of the diagram represents the end products of photosynthesis?



10 The diagrams show an experiment to find the rate of photosynthesis in an aquatic plant in different conditions.

Which plant produces the most bubbles per minute?



11 What are the signs of magnesium deficiency and nitrogen deficiency in leaves of plants?

- 1 purple spots on leaves
- 2 reduced growth of roots
- 3 reduced growth with loss of leaf colour
- 4 yellowing of leaves between the veins

	magnesium deficiency	nitrogen deficiency
A	2	1
B	2	3
C	4	1
D	4	3

12 When carbon dioxide is being used in photosynthesis, what is its diffusion pathway in a leaf after entering a stoma?

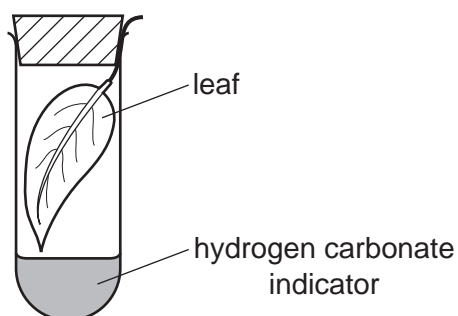
- 1 cell membrane
- 2 cell wall
- 3 chloroplast membrane
- 4 cytoplasm
- 5 intercellular spaces

- A 2 → 1 → 5 → 4 → 3
- B 2 → 5 → 1 → 3 → 4
- C 5 → 1 → 2 → 3 → 4
- D 5 → 2 → 1 → 4 → 3

13 What is the effect of a lack of nitrate ions on plant leaves?

- A all leaves are very dark green
- B leaves lose their yellow colour
- C the leaves wilt
- D young leaves grow very slowly

14 A green leaf is picked at time 07.00 and immediately placed in a sealed test-tube containing hydrogen carbonate indicator solution. The tube is kept near a window for 24 hours. The table shows how the indicator changes in colour.



colour	amount of carbon dioxide compared to average atmospheric concentration
purple	less than normal
red	normal
yellow	more than normal

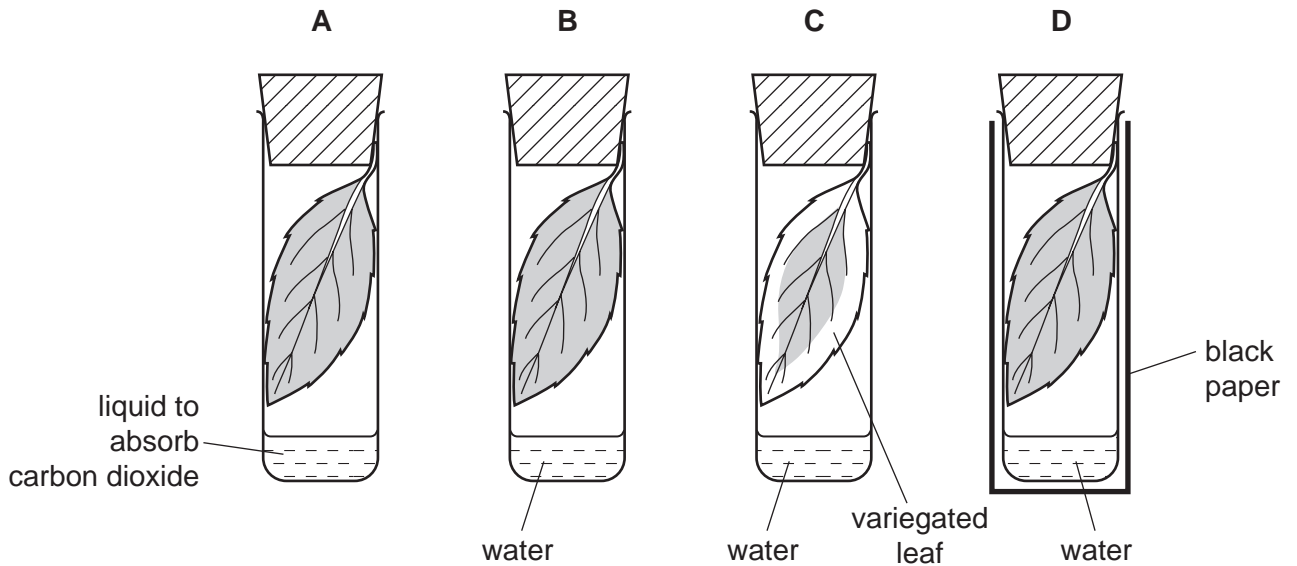
Which colour will the hydrogen carbonate indicator be at times 12.00 and 24.00?

	at 12.00	at 24.00
A	purple	yellow
B	red	purple
C	yellow	purple
D	yellow	red

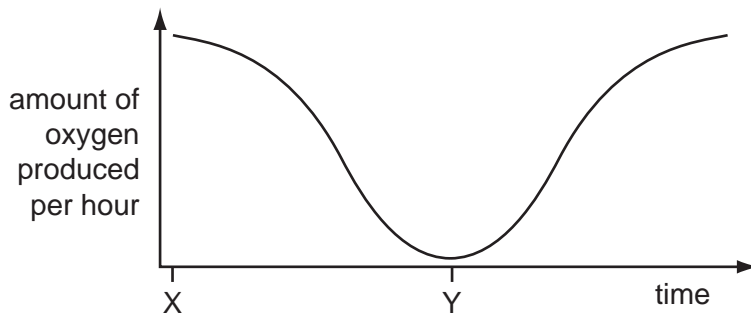
15 In an investigation of photosynthesis, 4 leaves are set up as shown in the diagram.

After 24 hours in the light each leaf is tested for starch.

Which tube is used to investigate whether chlorophyll is needed for photosynthesis?



16 The graph shows the amount of oxygen produced by a green plant, growing outdoors, during a 24-hour period



Which processes are occurring at time X and Y?

	time X		time Y	
	photosynthesis	respiration	photosynthesis	respiration
A	✓	✓	x	✓
B	✓	x	✓	x
C	x	✓	x	✓
D	x	✓	✓	x

key
 ✓ = occurring
 x = not occurring

17 Which signs show that a plant has been grown in soil deficient in magnesium ions?

- A no flowers and poor root growth
- B small leaves and more roots
- C white upper leaves and no flowers
- D yellow stem and yellow leaves

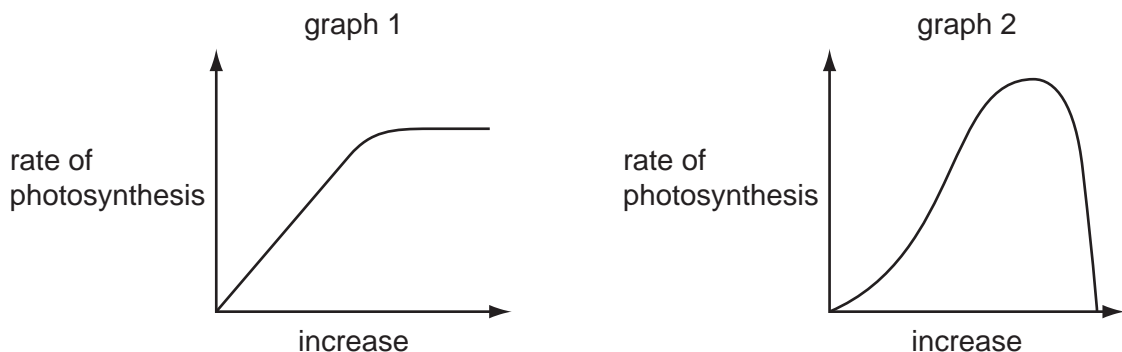
18 What is a function of each of these types of plant cell?

	phloem cells	root hair cells
A	sugar transport	ion uptake
B	sugar transport	transpiration
C	photosynthesis	ion uptake
D	photosynthesis	transpiration

19 In photosynthesis, which substances are used up, which are produced and which are necessary but remain unchanged after the reaction?

	used up	produced	remain
A	carbon dioxide	water	oxygen
B	chlorophyll	carbon dioxide	water
C	oxygen	starch	cellulose
D	water	oxygen	chlorophyll

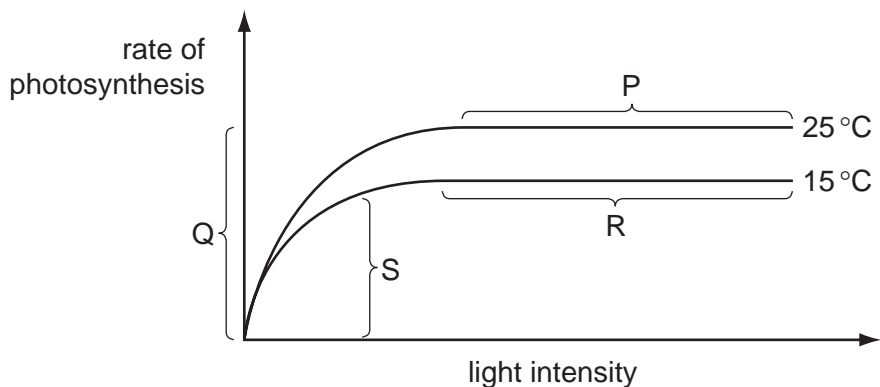
20 The graphs show how two different conditions affect the rate of photosynthesis.



Which conditions are being altered in graphs 1 and 2?

	graph 1	graph 2
A	carbon dioxide concentration	light intensity
B	carbon dioxide concentration	temperature
C	temperature	carbon dioxide
D	temperature	light intensity

21 The graph shows how the rate of photosynthesis varies with light intensity at two different temperatures. Other variables are kept the same.

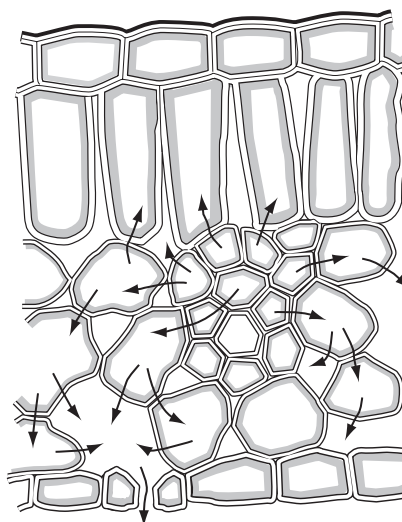


In which sections of the graph is light intensity limiting the rate of photosynthesis?

- A** P and R **B** Q and S **C** R and Q **D** S and P

- 22 If a condition is a limiting factor for photosynthesis, what does this mean?
- A** Changing the condition may either increase or decrease the rate of photosynthesis.
 - B** Changing the condition will only increase the rate of photosynthesis.
 - C** Changing the condition will only decrease the rate of photosynthesis.
 - D** Changing the condition will not affect the rate of photosynthesis.

- 23 The diagram shows a section through a green leaf.

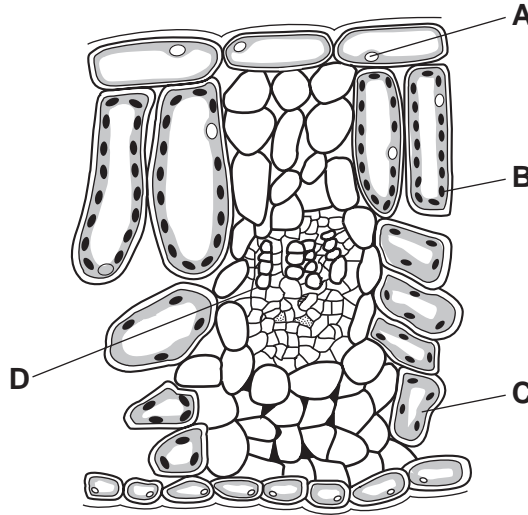


The arrows represent the movement of

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

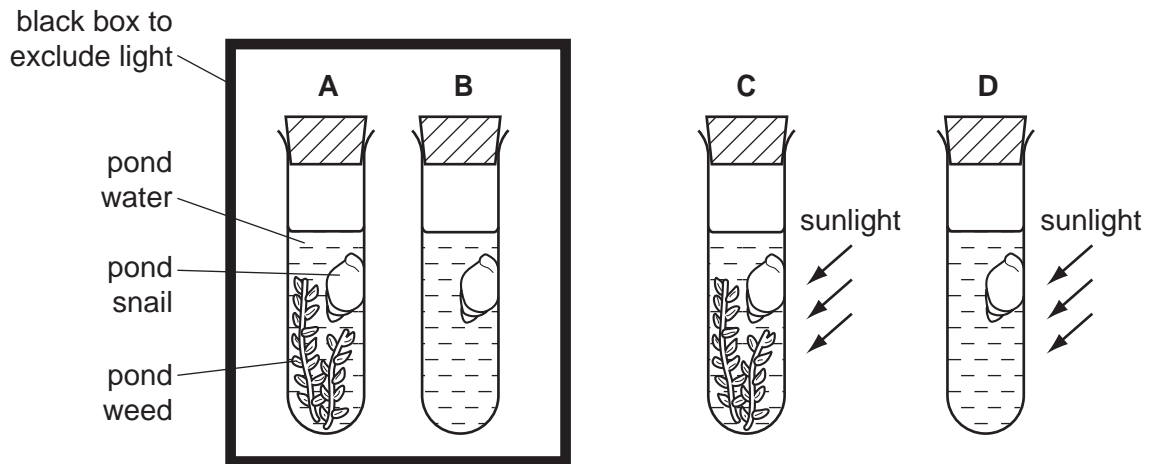
24 The diagram shows cells from a plant leaf.

Which structure contains a high concentration of magnesium?



25 Four test-tubes are set up as shown.

In which test-tube will the concentration of oxygen decrease most rapidly?

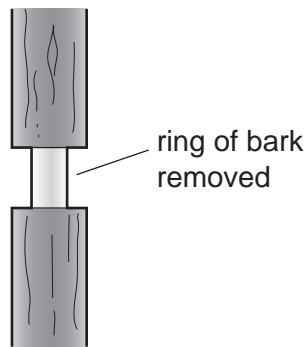


26 The elements, listed, are found in all living organisms.

Which one is **not** obtained by plants from the soil?

- A carbon
- B iron
- C magnesium
- D nitrogen

27 The diagram shows a tree trunk, with a ring of bark, which includes the phloem, removed.



The tree will eventually die because this action cuts off the supply of

- A mineral salts to the leaves.
- B organic nutrients to the roots.
- C oxygen to the roots.
- D water to the leaves.

28 For which processes do plants need either nitrate ions or magnesium ions?

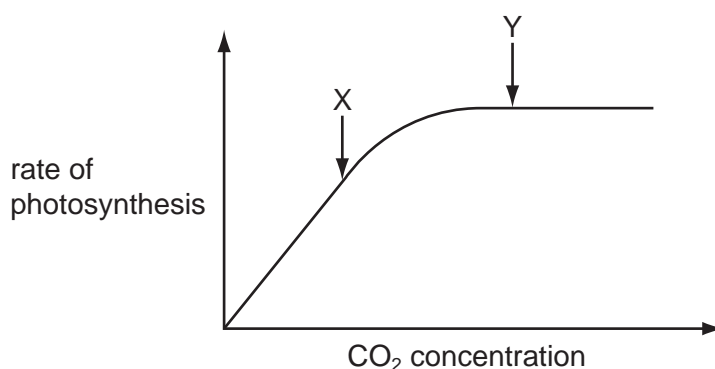
	synthesis of cellulose	synthesis of chlorophyll	synthesis of proteins
A	✓	✓	✓
B	✓	✓	x
C	✓	x	x
D	x	✓	✓

key
 ✓ = nitrate ions or magnesium ions needed
 x = nitrate ions or magnesium ions not needed

29 Magnesium is an essential element for

- A** the formation of cell walls.
- B** the formation of chlorophyll.
- C** the formation of proteins.
- D** the process of cell division.

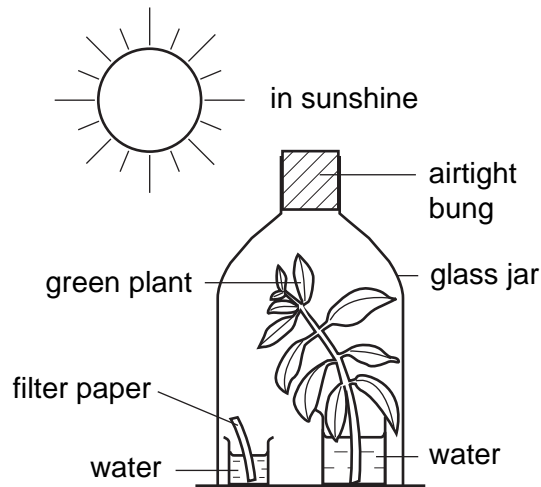
30 The graph shows the effect of carbon dioxide (CO₂) concentration on the rate of photosynthesis.



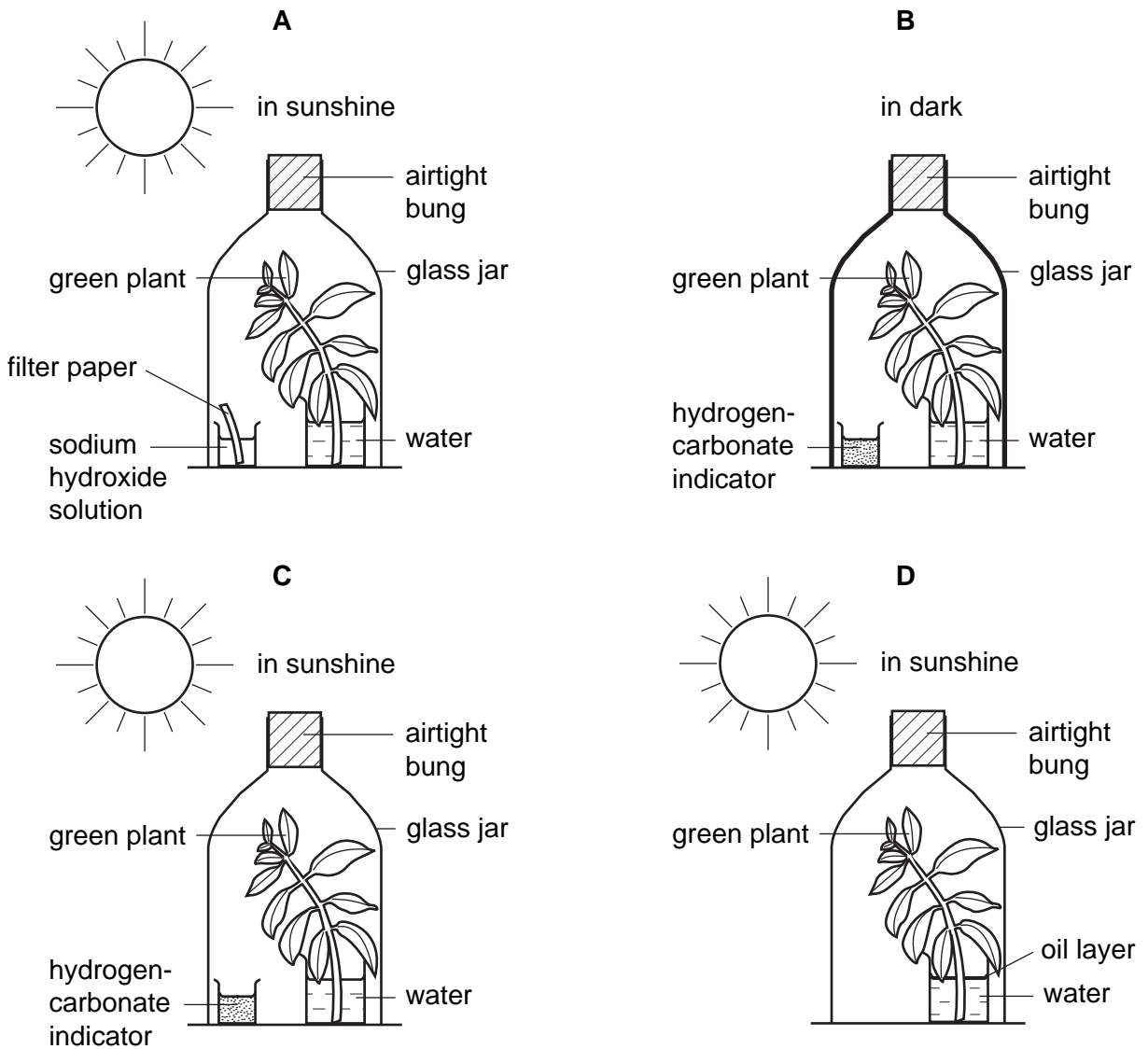
What could be limiting the rate of photosynthesis at points X and Y?

	X	
A	carbon dioxide concentration	carbon dioxide concentration
B	carbon dioxide concentration	light intensity
C	light intensity	carbon dioxide concentration
D	light intensity	light intensity

- 31 The diagram shows a green shoot photosynthesising under a glass jar. This was used as a control experiment in a laboratory investigation.

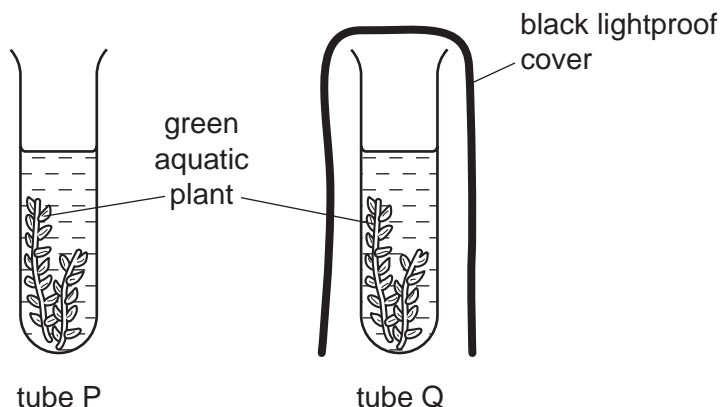


Which diagram shows the other experiment that should be done to investigate the need for carbon dioxide in photosynthesis?



- 32 Two test-tubes, P and Q, were set up each containing a solution of red hydrogen carbonate indicator. Hydrogen carbonate indicator turns yellow when the carbon dioxide concentration increases and turns purple if the carbon dioxide concentration decreases.

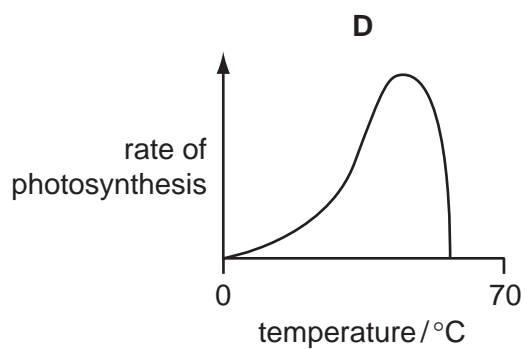
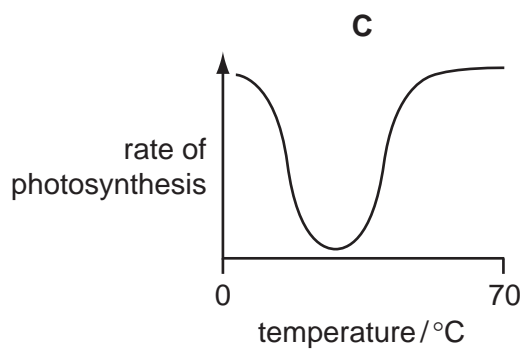
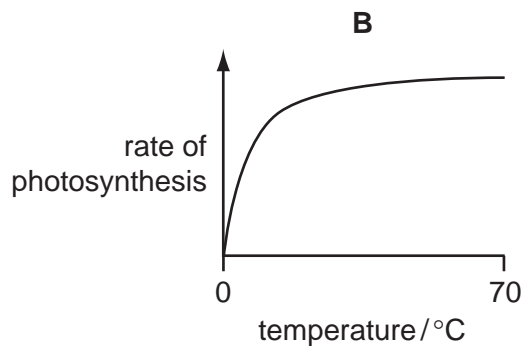
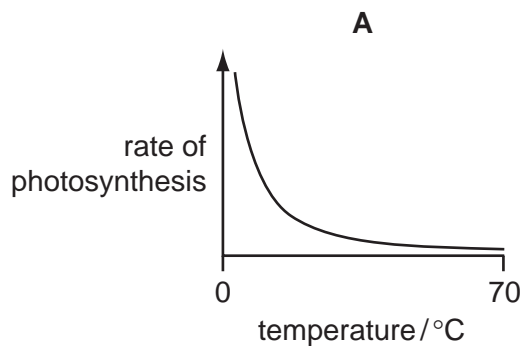
An aquatic plant was placed into tubes P and Q. Tube P was uncovered, tube Q was covered with a black lightproof cover. The tubes were left in a warm room in sunlight for four hours.



What would be the colour of the hydrogen carbonate indicator in the two tubes after four hours?

	tube P	tube Q
A	purple	red
B	purple	yellow
C	red	yellow
D	yellow	red

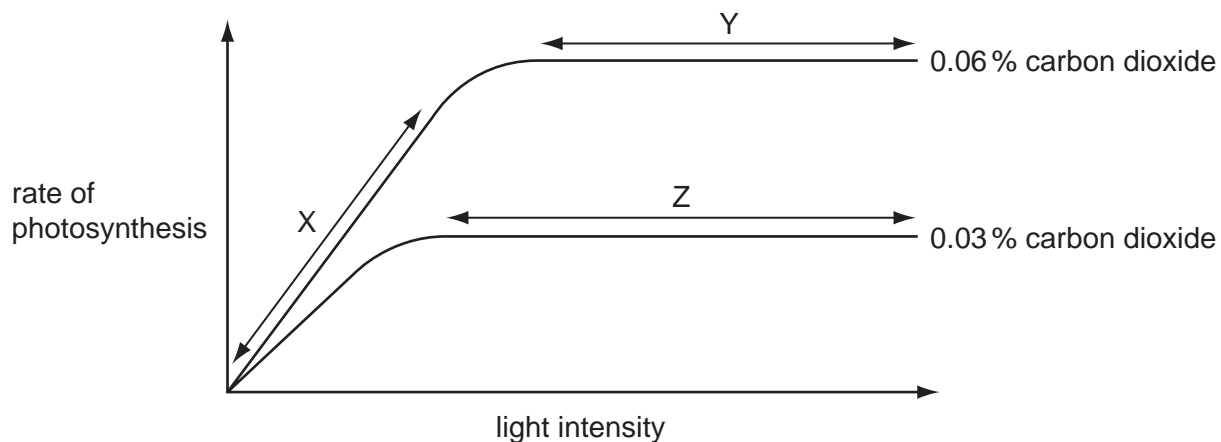
33 Which graph shows the effect of temperature on the rate of photosynthesis?



34 Which signs show that a plant has been grown in a culture solution deficient in magnesium?

- A** purple leaves and poor root growth
- B** small leaves and thin stem
- C** white upper leaves and normal lower leaves
- D** yellow stem and yellow leaves

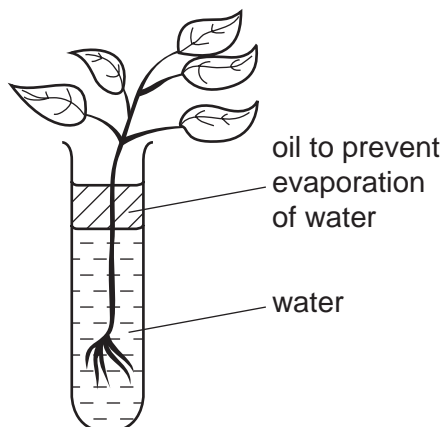
35 The graph shows the rate of photosynthesis of a plant at increasing light intensities at two different carbon dioxide concentrations. The temperature is kept constant.



What may be limiting the rate of photosynthesis at X, Y and Z?

	X	Y	Z
A	carbon dioxide	light intensity	carbon dioxide
B	carbon dioxide	light intensity	light intensity
C	light intensity	carbon dioxide	carbon dioxide
D	light intensity	carbon dioxide	light intensity

36 Five similar plants are placed in test-tubes as shown.



Some of the plants have their leaves coated with grease to reduce transpiration. Each plant is weighed in its test-tube at the start of the experiment and again two days later.

The results are shown in the table.

	mass/g				
	plant 1	plant 2	plant 3	plant 4	plant 5
at the start of experiment	105	121	107	111	119
after two days	103	97	84	110	93

Which plants had their leaves coated with grease?

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

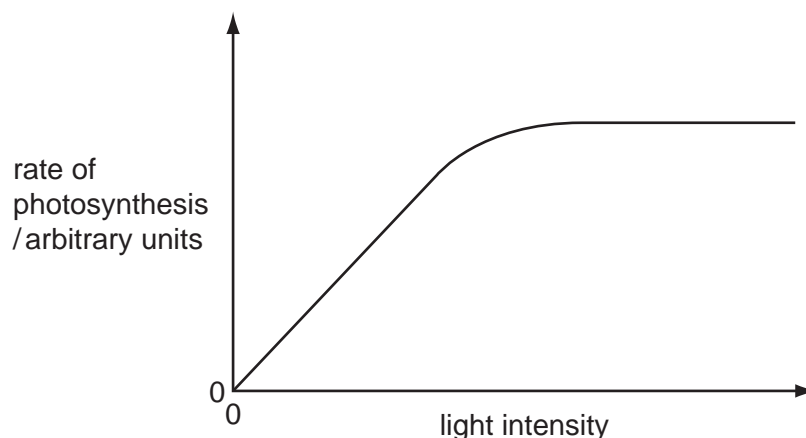
37 Lack of nitrate ions (NO_3^-) in flowering plants causes yellowing of leaves and poor growth whereas lack of magnesium ions (Mg^{2+}) causes yellowing between veins of leaves.

What explains these differences?

	Mg^{2+}		NO_3^-	
	involved in chlorophyll synthesis	involved in protein synthesis	involved in chlorophyll synthesis	involved in protein synthesis
A	✓	x	✓	✓
B	✓	x	✓	x
C	x	✓	x	✓
D	x	✓	x	x

key
 ✓ = true
 x = not true

38 The graph shows the effect of light intensity on the rate of photosynthesis.

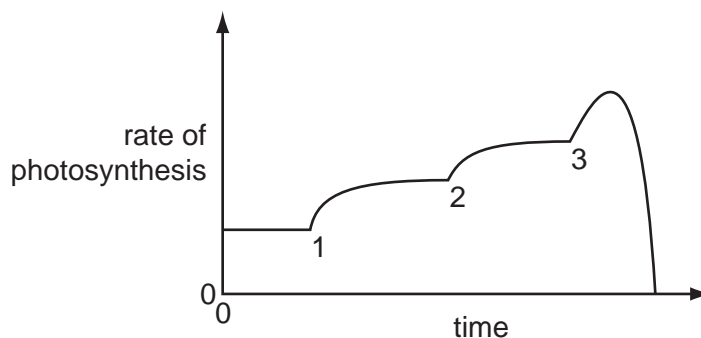


Which statement could explain what is happening at higher light intensities?

- A All the available chloroplasts are fully occupied in light absorption.
- B High light intensities increase the temperature above the optimum for photosynthesis.
- C The chlorophyll in the chloroplasts has been damaged.
- D The products of photosynthesis accumulate and inhibit photosynthesis.

39 Temperature, light intensity and carbon dioxide concentration are three limiting factors in photosynthesis.

In an experiment, each factor is increased in turn. The graph shows the results.



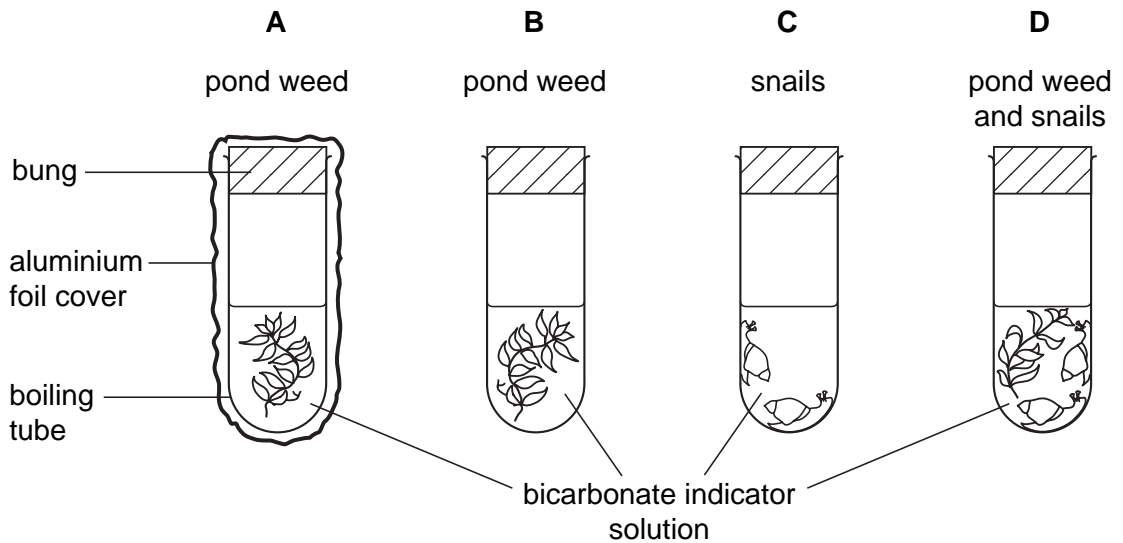
Which numbered points represent when each factor was increased?

	carbon dioxide concentration	light intensity	temperature
A	1	2	3
B	2	3	1
C	3	1	2
D	3	2	1

- 40 Four tubes, **A**, **B**, **C** and **D** are left in sunlight for one hour. The bicarbonate indicator solution in each tube is red at the start of the experiment.

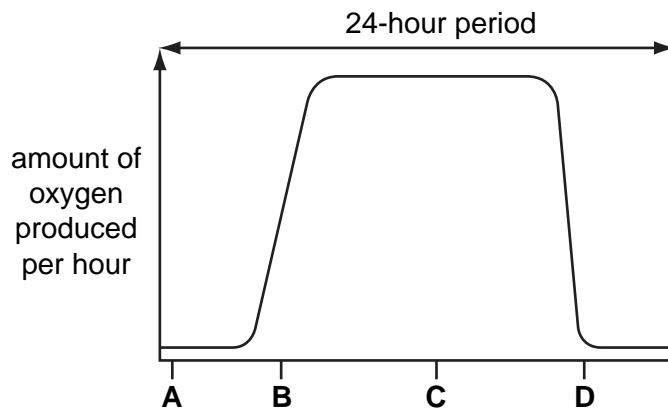
Bicarbonate indicator solution stays red if there is no change in carbon dioxide concentration. The indicator goes yellow if carbon dioxide concentration increases and purple if the carbon dioxide concentration decreases.

In which tube does the colour change to purple?

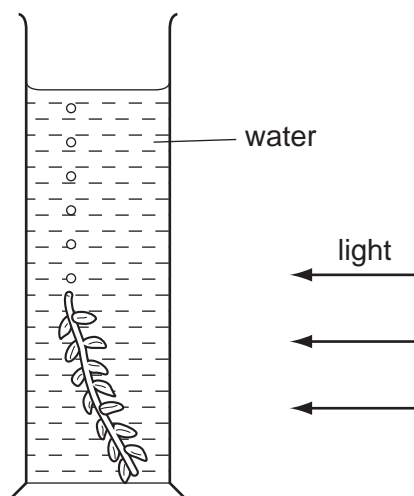


- 41 The graph shows the amount of oxygen produced by a green plant during a 24-hour period.

Which letter represents midnight?



- 42 The waterweed shown in the apparatus is illuminated and is photosynthesising. The rate is measured by bubbles of gas released.

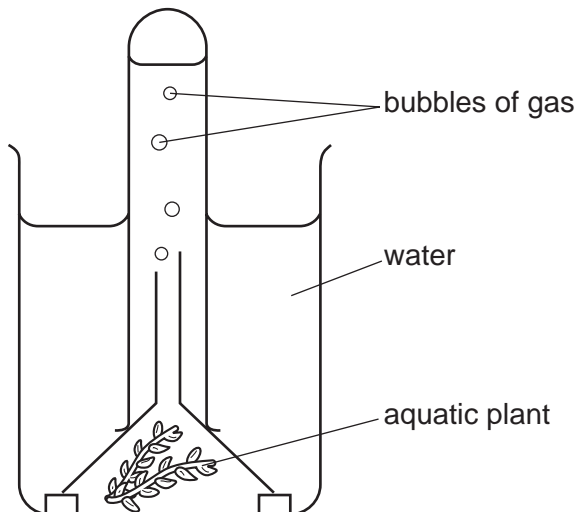


After a few minutes the bubbles cease.

Which factor in the water might be limiting the rate of photosynthesis?

- A carbon dioxide
- B magnesium
- C nitrate
- D oxygen

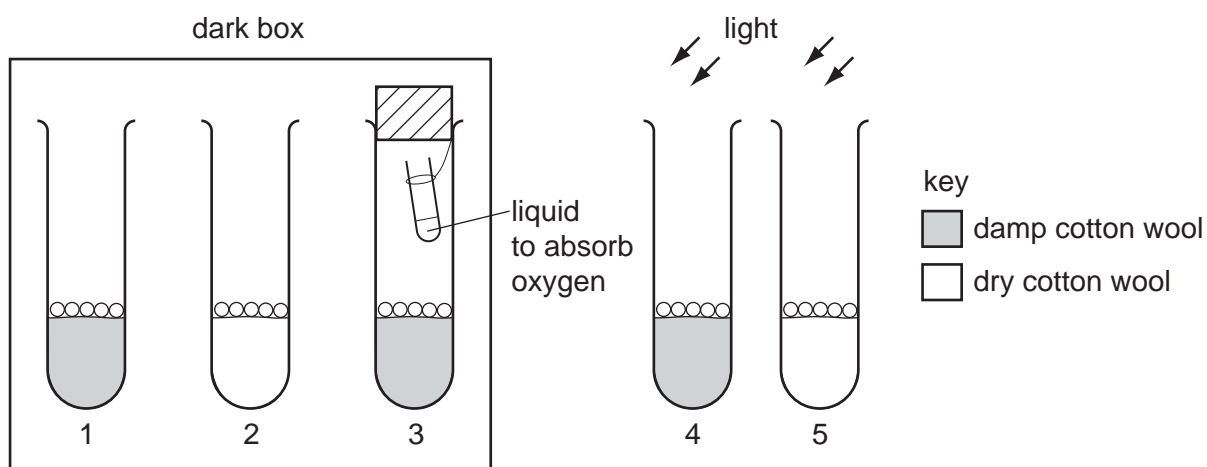
- 43 The diagram shows an experiment to investigate the volume of gas produced by an aquatic plant under different conditions of light intensity and temperature.



Which conditions result in the greatest production of gas by the plant?

	light intensity	temperature/°C
A	high	5
B	low	5
C	high	25
D	low	25

- 44 In the experiment shown, each test tube contains mustard seeds on cotton wool.



Which two test tubes should be compared to discover whether light is needed for germination of these seeds?

- A** 1 and 4 **B** 2 and 4 **C** 3 and 5 **D** 4 and 5

45 Magnesium is an essential element for

- A the formation of cell walls.
- B the formation of chlorophyll.
- C the formation of proteins.
- D the process of cell division.

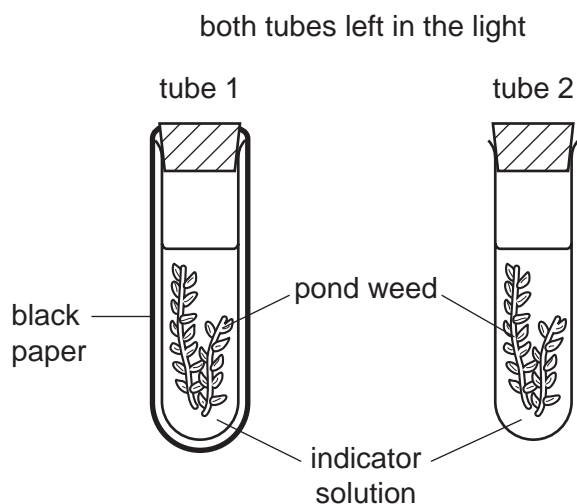
46 An indicator solution shows the following colour changes.

pH 7 : orange

pH below 7 : yellow

pH above 7 : purple

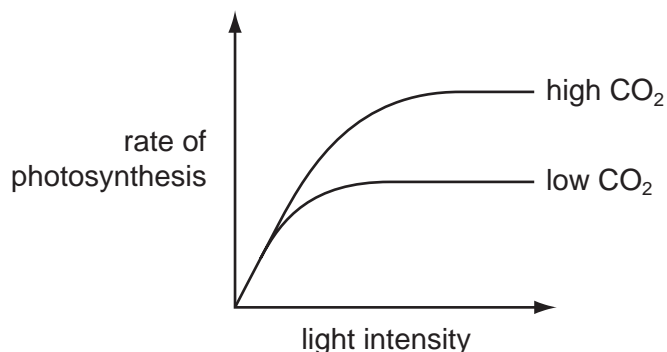
Consider the experiment represented by the diagram below. The indicator was orange in both tubes at the beginning of the experiment.



Which colours would the indicators show after three hours?

	tube 1	tube 2
A	purple	orange
B	orange	yellow
C	yellow	purple
D	yellow	orange

47 The graph shows the effects of carbon dioxide and light intensity on the rate of photosynthesis.



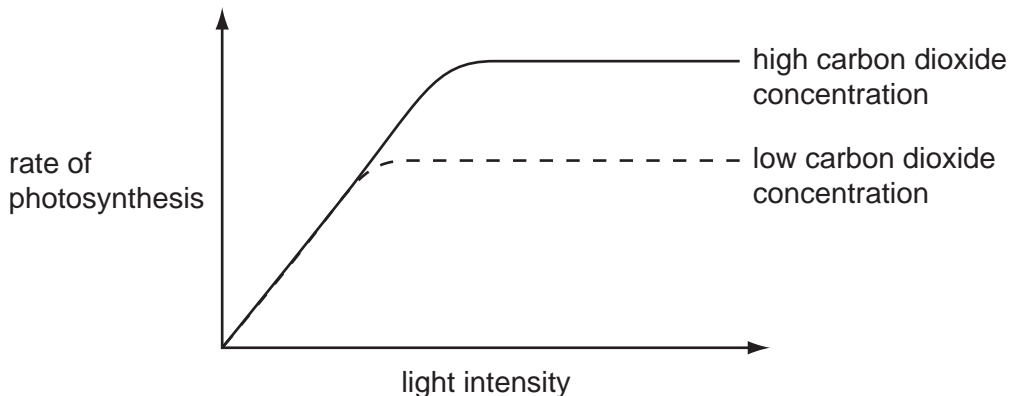
Which statement is supported **only** by evidence from the graph?

- A Carbon dioxide limits the rate of photosynthesis at low light intensities.
- B Light intensity and carbon dioxide both limit the rate of photosynthesis.
- C The rate of photosynthesis is proportional to light intensity.
- D Temperature affects the rate of photosynthesis.

48 When is carbon dioxide absorbed and when is it released by an ecosystem, such as a tropical rainforest?

	daylight	darkness
A	absorbed	absorbed
B	absorbed	released
C	released	absorbed
D	released	released

- 49 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 carbon dioxide concentration is low, the plant cannot photosynthesise.
- 50 The graph shows the amount of oxygen produced by a green plant, growing outdoors, during a 24-hour period

Which letter represents midday?

