AQA GCSE Biology | 8461

SPECIFICATION POINT 4.4.1.1

Photosynthetic reaction

Past-paper questions

Tier	**Foundation**
Question groups	**36**
Available paper years	**2008–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

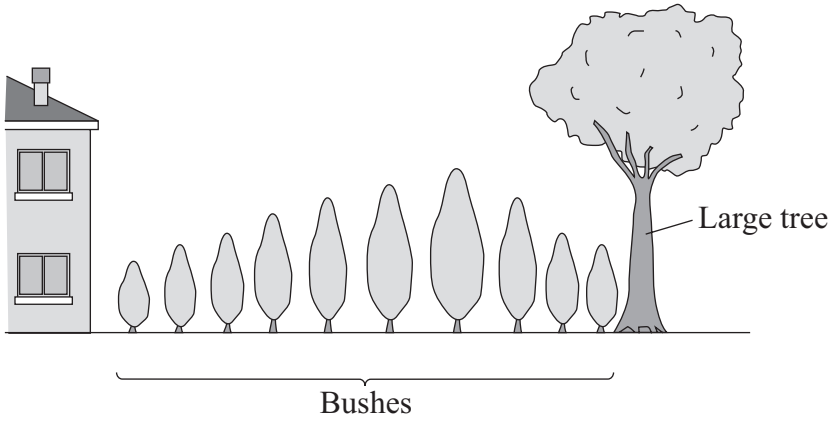
4.4.1.1 Photosynthetic reaction

Question 01

January 2008 | BLY2F | Original Q4 | Legacy

4 The diagram shows bushes in a hedge growing near to a house.

The bushes were the same species and the same age.



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

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

Draw only **two** lines.

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

(2 marks)

(ii) Complete the word equation for photosynthesis.

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

(2 marks)

Question 4 continues on the next page

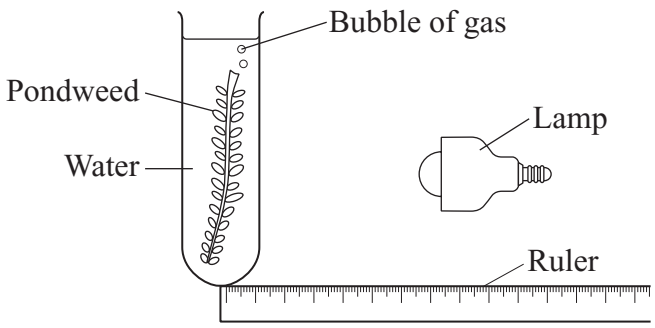
4.4.1.1 Photosynthetic reaction

Question 01 · continued

BLANK

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

She used the apparatus shown in the diagram.



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

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

.....

.....

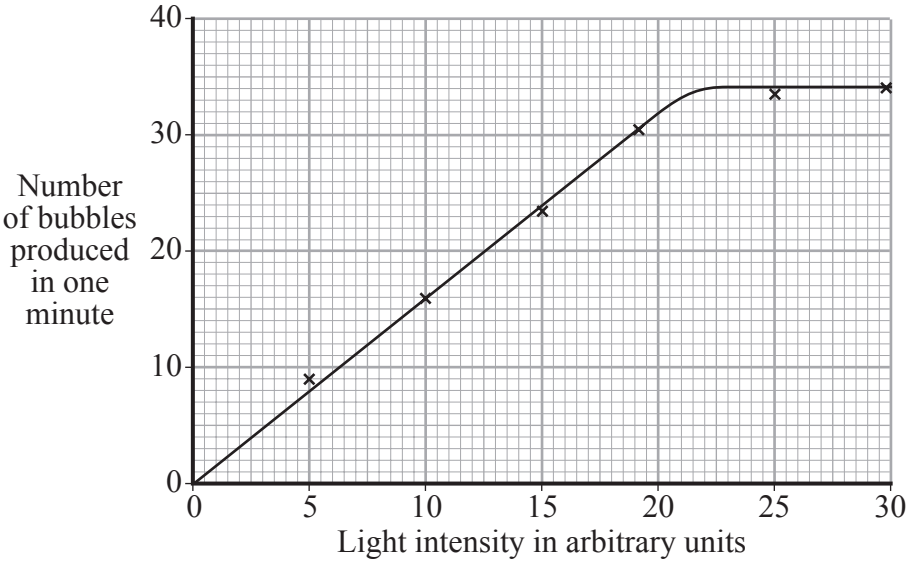
(1 mark)

4.4.1.1 Photosynthetic reaction

Question 01 · continued

BLANK

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



Describe the pattern shown on the graph.

.....

.....

.....

.....

(2 marks)

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

"Increasing the light intensity increases the rate of photosynthesis of the pondweed."

Why was her conclusion incomplete?

.....

.....

(1 mark)

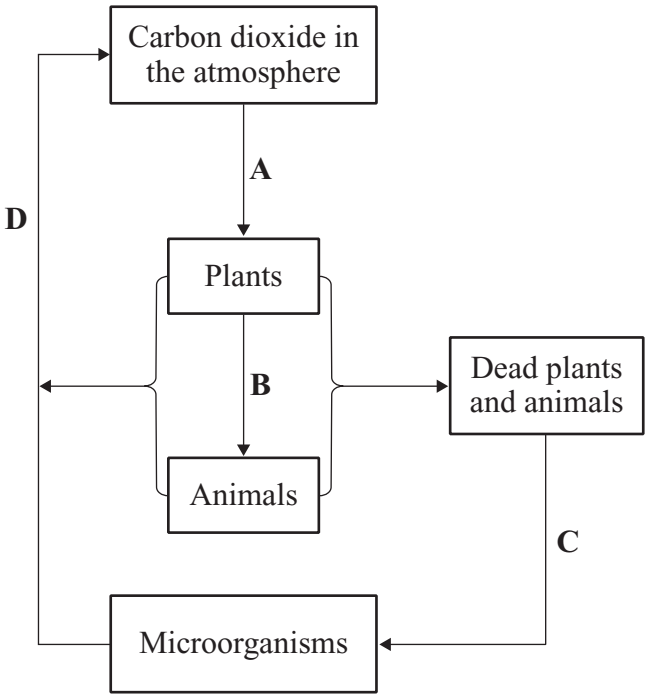
8

4.4.1.1 Photosynthetic reaction

Question 02

January 2008 | BLY2F | Original Q7 | Legacy

7 The diagram shows part of the carbon cycle.



(a) Which letter, **A**, **B**, **C** or **D**, represents:

(i) respiration .....

(1 mark)

(ii) photosynthesis? .....

(1 mark)

4.4.1.1 Photosynthetic reaction

Question 02 · continued

BLANK

(b) Local authorities are encouraging people to recycle vegetable waste by converting it into compost.

Compost is made by mixing the vegetable waste with soil in a large container.

(i) Decay occurs more quickly if the container has holes in the sides.

Explain why.

.....

.....

.....

.....

(2 marks)

(ii) Spreading compost on the soil between plants leads to better growth of the plants.

Explain why.

.....

.....

(1 mark)

5

4.4.1.1 Photosynthetic reaction

Question 03

June 2008 | BLY2F | Original Q2 | Legacy

2 Green plants are able to make their own food.

Complete each sentence by drawing a ring around the correct answer in the box.

2 (a) Green plants make their own food during the process of

diffusion
photosynthesis
respiration

.

(1 mark)

2 (b) This process can be summarised by the equation:

carbon dioxide + water → glucose +

mineral salts
light
oxygen

.

(1 mark)

2 (c) The energy needed for this process is trapped for the plant by

chlorophyll
glucose
light

.

(1 mark)

2 (d) Some of the food made by plants is stored as insoluble

chlorophyll
glucose
starch

.

(1 mark)

4

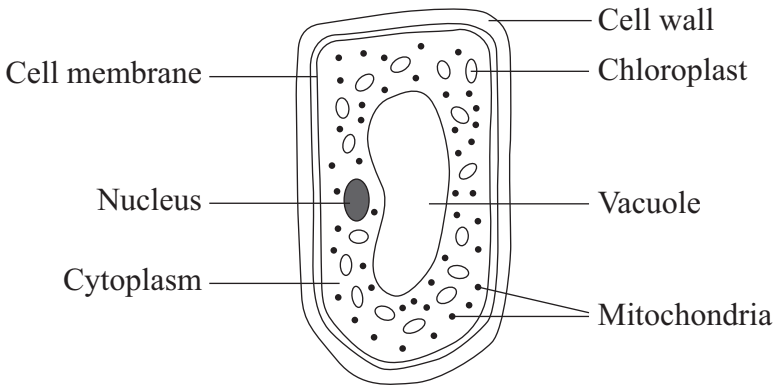
4.4.1.1 Photosynthetic reaction

Question 04

June 2009 | BLY2F | Original Q1 | Legacy

1 **Diagram 1** shows a cell from a leaf.

Diagram 1



1 (a) How is the leaf cell specialised to carry out photosynthesis?

Tick (✓) **one** box.

It has a permanent vacuole. ☐

It has many chloroplasts. ☐

It has cytoplasm. ☐

It has many mitochondria. ☐

(1 mark)

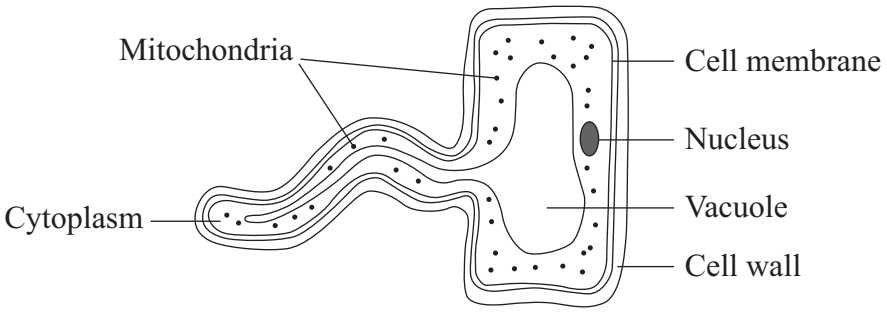
4.4.1.1 Photosynthetic reaction

Question 04 · continued

for mark

1 (b) **Diagram 2** shows another type of plant cell.

Diagram 2



Give **two** ways in which this cell is different from an animal cell.

1.....

.....

2.....

.....

(2 marks)

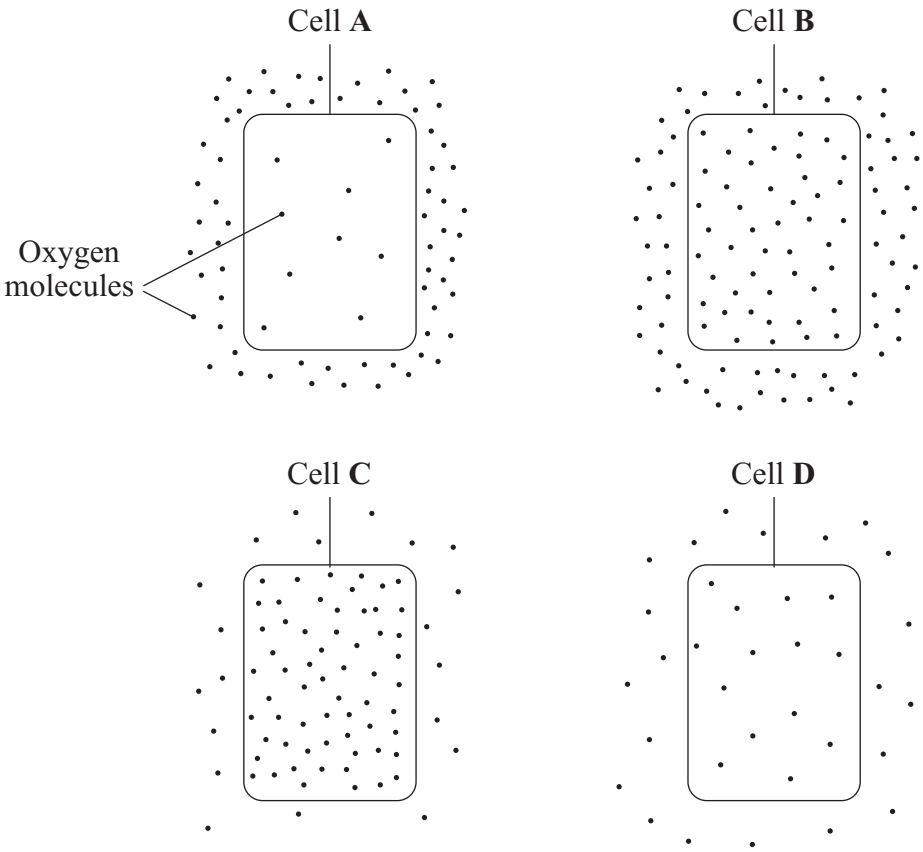
3

4.4.1.1 Photosynthetic reaction

Question 05

June 2009 | BLY2F | Original Q2 | Legacy

2 (a) The diagrams show cells containing and surrounded by oxygen molecules. Oxygen can move into cells or out of cells.



Into which cell, **A**, **B**, **C** or **D**, will oxygen move the fastest?

Write your answer, **A**, **B**, **C** or **D**, in the box.

(1 mark)

4.4.1.1 Photosynthetic reaction

Question 05 · continued

for mark

2 (b) Draw a ring around the correct word to complete each sentence.

2 (b) (i) Oxygen is taken into cells by the process of

diffusion
osmosis
respiration

.

(1 mark)

2 (b) (ii) Cells need oxygen for

breathing
photosynthesis
respiration

.

(1 mark)

2 (b) (iii) The parts of cells that use up the most oxygen are the

membranes
mitochondria
nuclei

.

(1 mark)

2 (b) (iv) Some cells produce oxygen in the process of

diffusion
photosynthesis
respiration

.

(1 mark)

5

4.4.1.1 Photosynthetic reaction

Question 06

June 2009 | BLY2F | Original Q7 | Legacy

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

carbon dioxide + ... (+ light energy) → glucose + ...

(2 marks)

7 (a) (ii) Most of the carbon dioxide that a plant uses during photosynthesis is absorbed from the air.

Give **one** other source of carbon dioxide for a plant.

Draw a ring around your answer.

the soil **respiration in the plant** **osmosis in the plant** **water**

(1 mark)

A student investigated the conditions that plants need for photosynthesis.
The leaves of the plant he used had green and white parts.

Diagram 1 shows how part of one leaf was covered in black (opaque) card.
The plant was placed in a warm, sunny area and was watered well.
Eight hours later the leaf was removed from the plant and was tested for starch.

The results of the test are shown in **Diagram 2**, the shaded parts show where starch was present.

Diagram 1

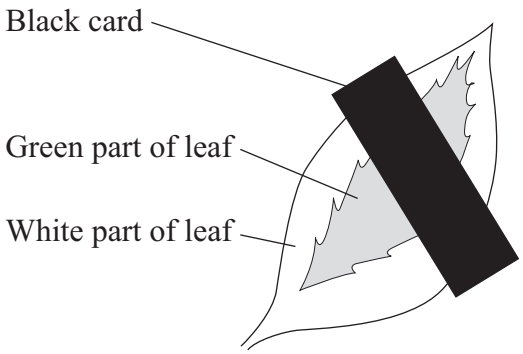
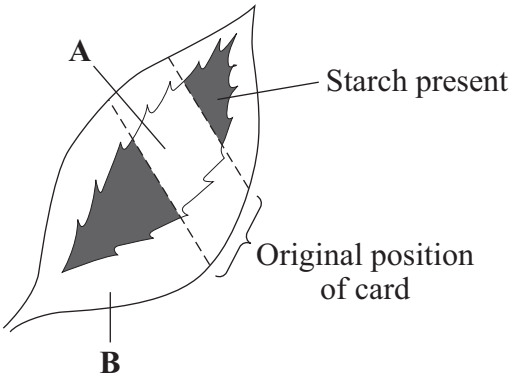


Diagram 2



4.4.1.1 Photosynthetic reaction

Question 06 · continued

for mark

7 (b) Name the **two** independent variables in this investigation.

1 .....

.....

2 .....

.....

(2 marks)

7 (c) Why was no starch found in:

7 (c) (i) the part of the leaf labelled **A**

.....

.....

(1 mark)

7 (c) (ii) the part of the leaf labelled **B**?

.....

.....

(1 mark)

7

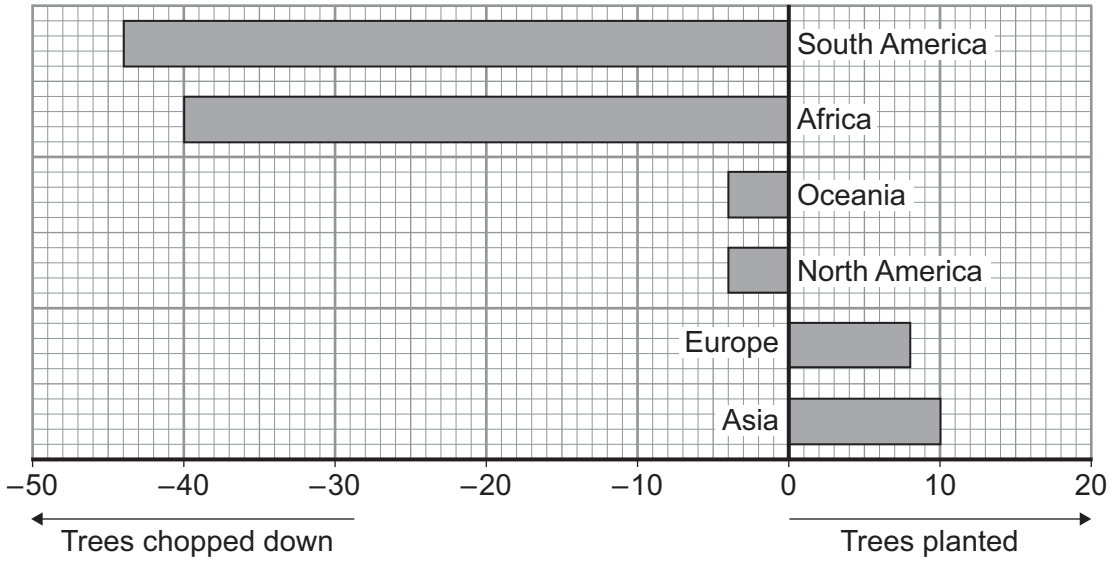
4.4.1.1 Photosynthetic reaction

Question 07

June 2010 | BLY1F | Original Q5 | Legacy

5 In many parts of the world, forests are being chopped down (deforestation) so that the land can be used to grow food crops. In other parts, trees are planted to produce new forests.

The graph shows how the area of forest in each of the continents is changing each year.



Change in area of forest in thousands of km^2 per year

5 (a) (i) What area of forest is being lost in Africa each year?

Area = ... thousand km^2

(1 mark)

5 (a) (ii) Use **Steps 1**, **2** and **3** to calculate the total change to the area of forest each year.

Step 1 Calculate the total area of trees chopped down.

.....

Total area chopped down = ... thousand km^2

Step 2 Calculate the total area of trees planted.

.....

Total area planted = ... thousand km^2

4.4.1.1 Photosynthetic reaction

Question 07 · continued

Step 3 Use your answers from **Steps 1** and **2** to calculate the total change in the area of forest.

.....

Total change in area of forest ..... thousand km^2

(3 marks)

5 (b) Draw a ring around the correct answer to complete each sentence.

5 (b) (i) Large scale deforestation reduces the number of species of

plants only.

animals only.

both animals and plants.

(1 mark)

5 (b) (ii) The remains of the trees are broken down into carbon dioxide by

lichens.

microorganisms.

plants.

(1 mark)

5 (b) (iii) The gas released into the atmosphere when trees are burned is

carbon dioxide.

methane.

oxygen.

(1 mark)

7

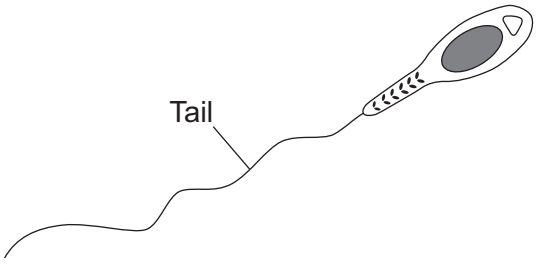
4.4.1.1 Photosynthetic reaction

Question 08

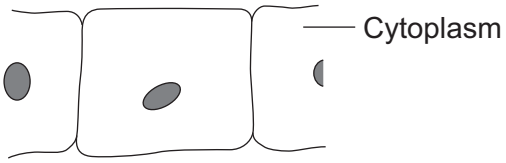
June 2010 | BLY2F | Original Q1 | Legacy

1 The diagrams show four types of cell, **A**, **B**, **C** and **D**.
Two of the cells are plant cells and two are animal cells.

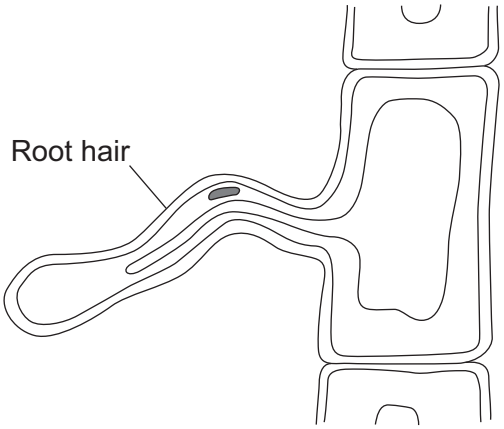
A



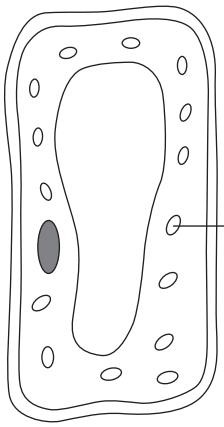
B



C



D



1 (a) (i) Which **two** of the cells are plant cells?

Tick (✓) **one** box.

A and **B** ☐

A and **D** ☐

C and **D** ☐

(1 mark)

4.4.1.1 Photosynthetic reaction

Question 08 · continued

1 (a) (ii) Which part is found **only** in plant cells?

Draw a ring around **one** answer.

cell membrane **cell wall** **nucleus**

(1 mark)

1 (b) (i) Which cell, **A**, **B**, **C** or **D**, is adapted for swimming? ☐

(1 mark)

1 (b) (ii) Which cell, **A**, **B**, **C** or **D**, can produce glucose by photosynthesis? ☐

(1 mark)

1 (c) Cells **A**, **B**, **C** and **D** all use oxygen.

For what process do cells use oxygen?

Draw a ring around **one** answer.

osmosis **photosynthesis** **respiration**

(1 mark)

5

4.4.1.1 Photosynthetic reaction

Question 09

June 2010 | BLY2F | Original Q2 | Legacy

2 This question is about what happens during decay.

Draw a ring around the correct word to complete each sentence.

2 (a) After living things die, they are decayed by

animals.
microorganisms.
plants.

(1 mark)

2 (b) Decay happens faster when there is plenty of oxygen and conditions are

cold.
dry.
moist.

(1 mark)

2 (c) During decay carbon dioxide is produced by

osmosis.
respiration.
photosynthesis.

(1 mark)

2 (d) Decay releases mineral salts into the soil.

These mineral salts are absorbed by plant

leaves.
roots.
stems.

(1 mark)

4

4.4.1.1 Photosynthetic reaction

Question 10

June 2019 | BLY2F | Original Q6 | Legacy

6 This question is about photosynthesis.

6 (a) Plants make glucose during photosynthesis. Some of the glucose is changed into insoluble starch.

What happens to this starch?

Tick (✓) **one** box.

The starch is converted into oxygen. ☐

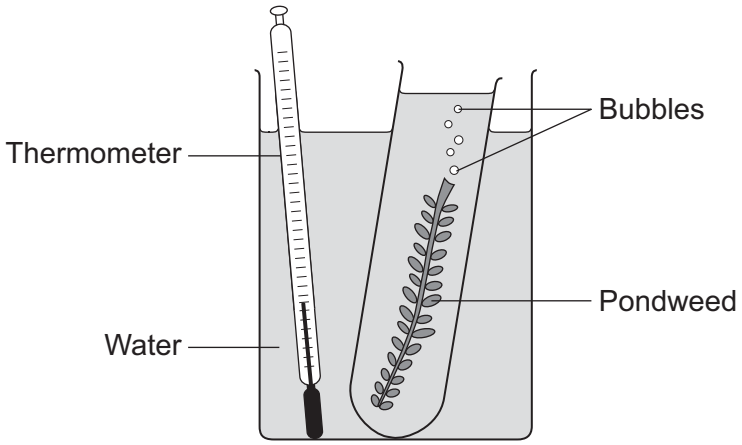
The starch is stored for later use. ☐

The starch is used to make the leaf green. ☐

(1 mark)

6 (b) A student investigated the effect of temperature on the rate of photosynthesis in pondweed.

The diagram shows the way the experiment was set up.



6 (b) (i) The student needed to control some variables to make the investigation fair.

State **two** of these variables.

1 .....

2 .....

(2 marks)

4.4.1.1 Photosynthetic reaction

Question 10 · continued

6 (b) (ii) The bubbles of gas are produced only while photosynthesis is taking place.

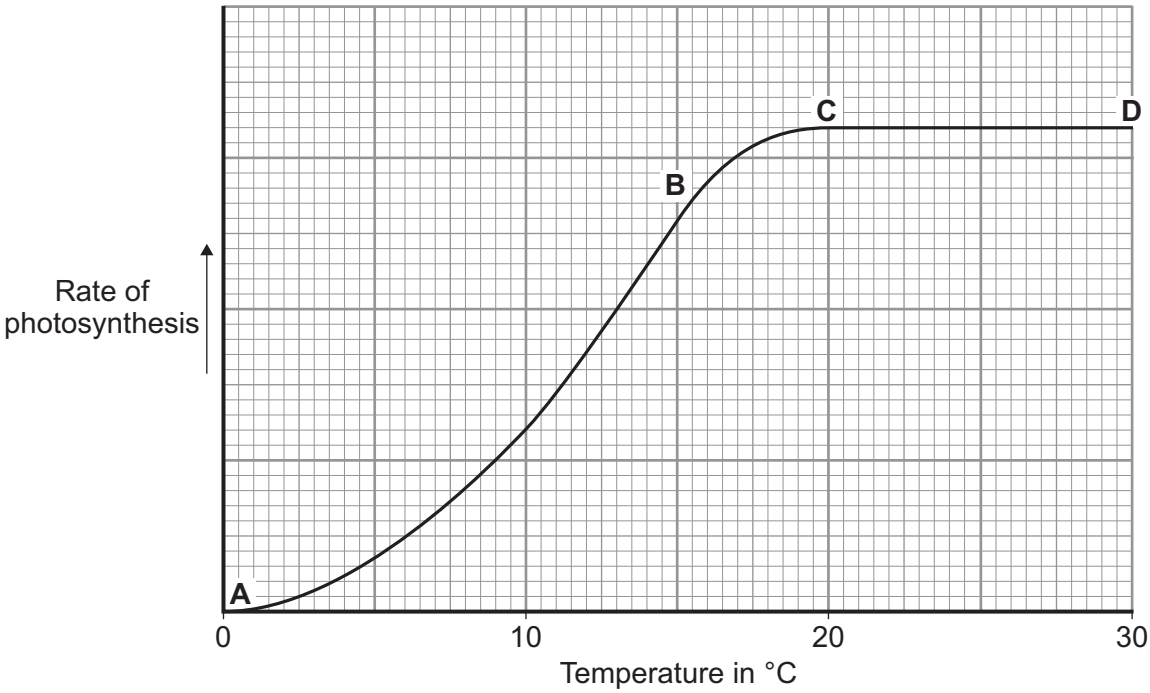
What **two** measurements would the student make to calculate the rate of photosynthesis?

1 .....

2 .....

(2 marks)

6 (c) The graph shows the effect of temperature on the rate of photosynthesis.



6 (c) (i) Name the factor that limits the rate of photosynthesis between the points labelled **A** and **B** on the graph.

.....

(1 mark)

6 (c) (ii) Suggest which factor, carbon dioxide, oxygen or water, might limit the rate of photosynthesis between the points labelled **C** and **D** on the graph.

.....

(1 mark)

7

4.4.1.1 Photosynthetic reaction

Question 11

3 The amount of carbon dioxide in the atmosphere is increasing.

The table shows the estimated mass of carbon dioxide exchanged with the atmosphere in one year.

	Mass of carbon dioxide exchanged with the atmosphere in millions of tonnes	
	Passed out into the atmosphere	**Taken in from the atmosphere**
Plants	30	64
Animals	10	0
Microorganisms	24	0
Combustion	6	0

3 (a) (i) Calculate the total mass of carbon dioxide passed out into the atmosphere in one year.

Show clearly how you work out your answer.

.....

.....

Answer ..... million tonnes
(2 marks)

3 (a) (ii) Calculate the increase in the mass of carbon dioxide in the atmosphere in one year.

You should use your answer to part (a)(i) in your calculation.

Show clearly how you work out your answer.

.....

.....

Answer ..... million tonnes
(2 marks)

4.4.1.1 Photosynthetic reaction

Question 11 · continued

3 (b) Draw a ring around the correct answer to complete the sentence.

Plants use carbon dioxide in the process of

- decomposition.
- photosynthesis.
- respiration.

(1 mark)

5

Turn over for the next question

4.4.1.1 Photosynthetic reaction

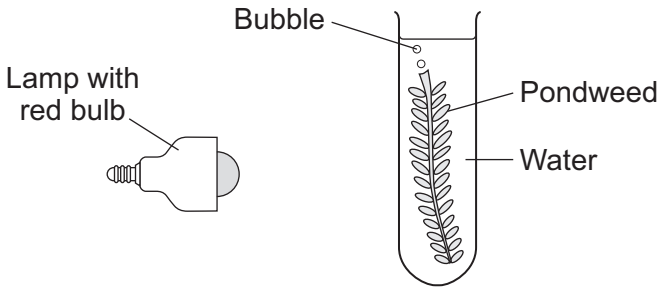
Question 12

7 A group of pupils investigated the way in which the colour of light affects photosynthesis.

The pupils:

- put a piece of pondweed into a test tube of water
- shone light from a lamp with a red light bulb onto the pondweed
- counted the bubbles of gas produced by the pondweed every minute for three minutes.

The diagram shows the experiment.



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

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

.....

(1 mark)

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

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

.....

(1 mark)

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

Why?

.....

.....

(1 mark)

4.4.1.1 Photosynthetic reaction

Question 12 · continued

7 (b) The table shows the pupils' results.

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

Algae are tiny organisms that photosynthesise.
In natural light algae grow very quickly on the sides of a fish tank.
The algae make it difficult to see the fish.

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

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

Draw a ring around **one** answer.

red **yellow** **green** **blue**

(1 mark)

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

.....

.....

.....

.....

(2 marks)

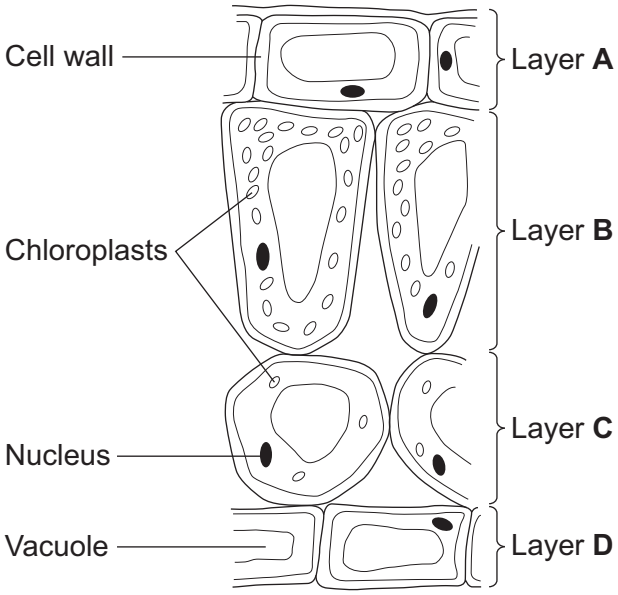
6

4.4.1.1 Photosynthetic reaction

Question 13

1 Leaves are made from layers of cells.

The diagram shows a section through part of a leaf.



1 (a) (i) Which word in the table describes layer **A**?

Tick (✓) **one** box.

Layer A	Tick (✓)
Tissue	
Organ	
Cell	

(1 mark)

1 (a) (ii) Which word describes a whole leaf?

Draw a ring around **one** answer.

organ **tissue** **organism**

(1 mark)

4.4.1.1 Photosynthetic reaction

Question 13 · continued

1 (b) (i) Which **two** layers of cells, **A**, **B**, **C** and **D**, can photosynthesise?

Use information from the diagram to help you.

Tick (✓) **two** boxes.

Layer **A** ☐

Layer **B** ☐

Layer **C** ☐

Layer **D** ☐

(2 marks)

1 (b) (ii) Give **one** reason for your answer.

.....

.....

(1 mark)

1 (c) List **X** gives the names of two parts of a cell.
List **Y** gives information about parts of a cell.

Draw **one** line between each part of the cell in list **X** and information about it in list **Y**.

List X Part of a cell	List Y Information
Vacuole	Controls the passage of substances into the cell
Nucleus	Contains the cell sap
	Controls the activities of the whole cell

(2 marks)

7

4.4.1.1 Photosynthetic reaction

Question 14

June 2012 | BL1FP | Original Q3 | Legacy

3 Green plants are found at the start of all food chains.

3 (a) Complete the sentences.

3 (a) (i) The source of energy for green plants is radiation from the ..... .

(1 mark)

3 (a) (ii) Green plants absorb some of the light energy that reaches them for a process called ..... .

(1 mark)

3 (b) Draw a ring around the correct answer to complete each sentence.

3 (b) (i) This process transfers light energy into

- chemical
- sound
- electrical

energy.

(1 mark)

3 (b) (ii) The process uses the gas

- carbon dioxide.
- oxygen.
- water.

(1 mark)

3 (b) (iii) The process produces carbon-containing compounds called

- carbohydrates.
- minerals.
- salts.

(1 mark)

4.4.1.1 Photosynthetic reaction

Question 14 · continued

3 (c) The amount of living material (biomass) at each stage in a food chain is less than at the previous stage.

The diagram shows a food chain.

oak tree → **caterpillar** → **blue-tit** → **hawk**

Give **two** ways in which biomass is lost in this food chain.

Tick (✓) **two** boxes.

As carbon dioxide from the caterpillar ☐

As food eaten by the hawk ☐

As oxygen from the oak tree ☐

As faeces (droppings) from the blue-tit ☐

(2 marks)

7

4.4.1.1 Photosynthetic reaction

Question 15

June 2012 | BL2FP | Original Q6 | Legacy

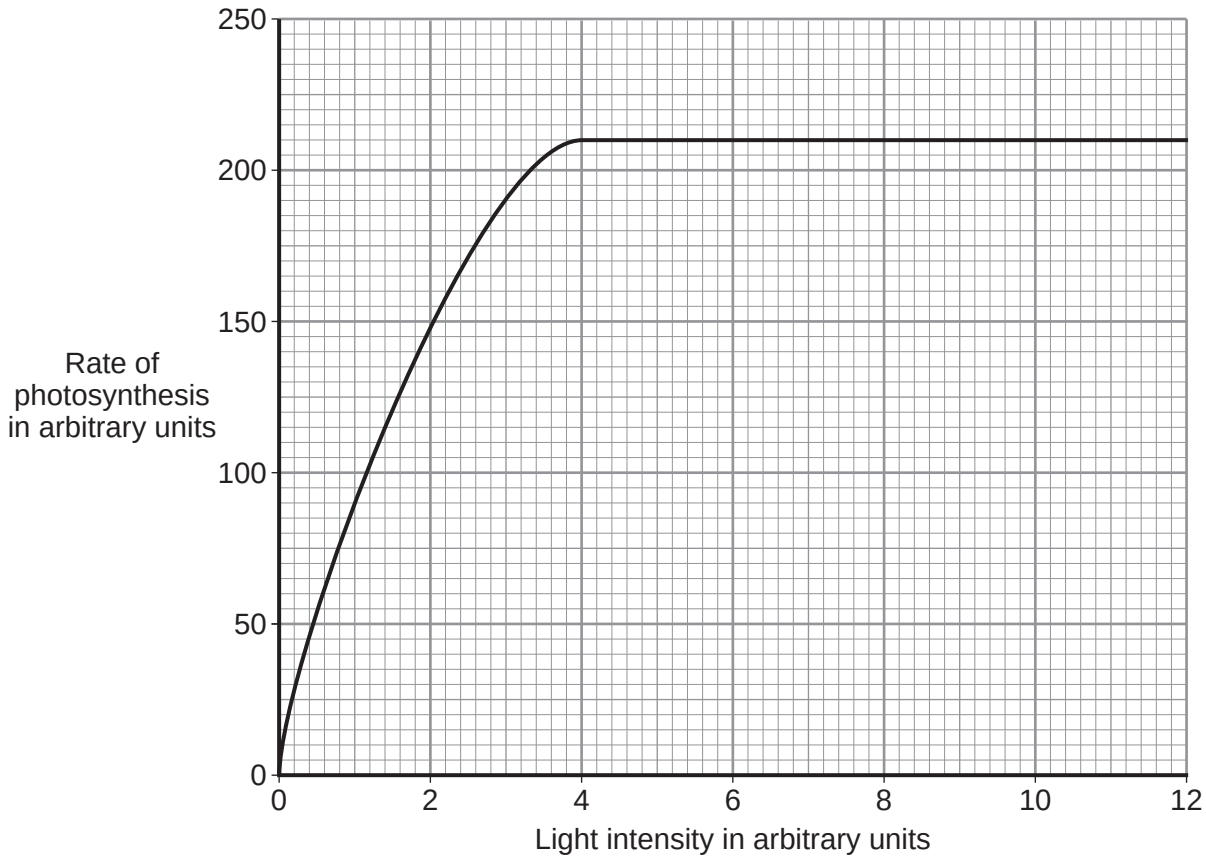
6 (a) Complete the equation for photosynthesis.

Carbon dioxide + ... $\xrightarrow{\text{light energy}}$ ..... + oxygen

(2 marks)

6 (b) A farmer grew tomato plants in a greenhouse.

The graph shows the effect of light intensity on the rate of photosynthesis in the tomato plants growing in the greenhouse.



6 (b) (i) At which light intensity was light a limiting factor for photosynthesis?

Tick (✓) **one** box.

1 arbitrary unit ☐

4 arbitrary units ☐

10 arbitrary units ☐

(1 mark)

4.4.1.1 Photosynthetic reaction

Question 15 · continued

6 (b) (ii) What was the highest rate of photosynthesis?

..... arbitrary units

(1 mark)

6 (b) (iii) The farmer wants to increase the rate of photosynthesis in his tomato plants.

Apart from light intensity, name **one** factor that the farmer could change to increase the rate of photosynthesis in his tomato plants.

.....

(1 mark)

5

Turn over for the next question

4.4.1.1 Photosynthetic reaction

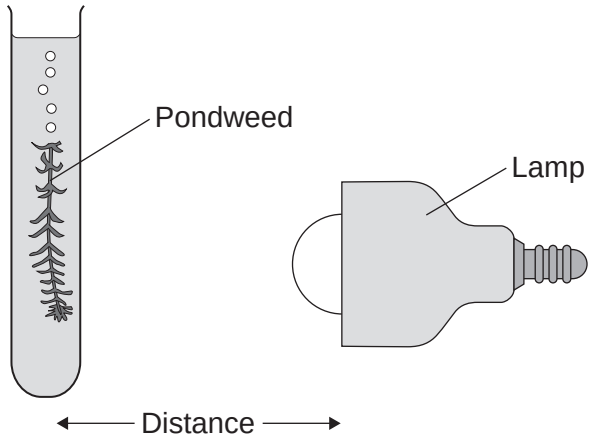
Question 16

January 2013 | BL2FP | Original Q7 | Legacy

7 Some students investigated the effect of light intensity on the rate of photosynthesis.

They used the apparatus shown in **Diagram 1**.

Diagram 1



The students:

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

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

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

.....

.....

(1 mark)

4.4.1.1 Photosynthetic reaction

Question 16 · continued

7 (b) The table shows the students' results.

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

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

What evidence is there for this in the table?

.....

.....

(1 mark)

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

.....

(1 mark)

Question 7 continues on the next page

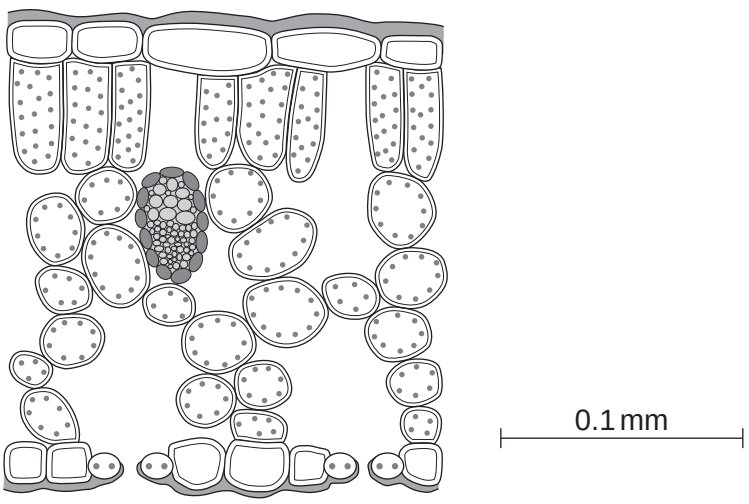
4.4.1.1 Photosynthetic reaction

Question 16 · continued

7 (c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Diagram 2 shows a section through a plant leaf.

Diagram 2



Describe the structure of the leaf and the functions of the tissues in the leaf.

You should use the names of the tissues in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

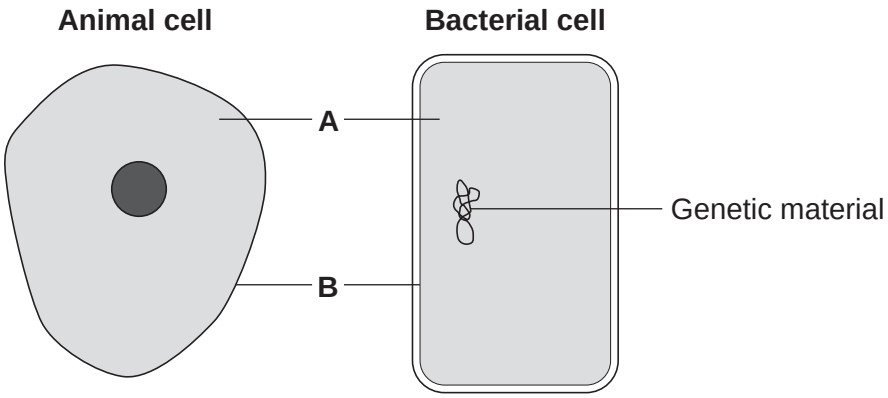
.....

4.4.1.1 Photosynthetic reaction

Question 17

June 2013 | BL2FP | Original Q1 | Legacy

1 The diagrams show an animal cell and a bacterial cell.



1 (a) (i) Structures **A** and **B** are found in both the animal cell and the bacterial cell.

Use words from the box to name structures **A** and **B**.

cell membrane	**chloroplast**	**cytoplasm**	**vacuole**

A .....

B .....

(2 marks)

1 (a) (ii) Both cells contain genetic material.

Name the structure in the animal cell that contains genetic material.

.....

(1 mark)

4.4.1.1 Photosynthetic reaction

Question 17 · continued

1 (b) **List A** gives three structures found in animal cells.

List B gives four functions of cell structures.

Draw **one** line from each structure in **List A** to its correct function in **List B**.

List A – Structure	List B – Function
Cell membrane	Controls what substances enter the cell
Mitochondrion	Photosynthesis
Ribosome	Protein synthesis
	Respiration

(3 marks)

6

4.4.1.1 Photosynthetic reaction

Question 18

June 2013 | BL2FP | Original Q6 | Legacy

6 (a) Use words from the box to complete the equation for aerobic respiration.

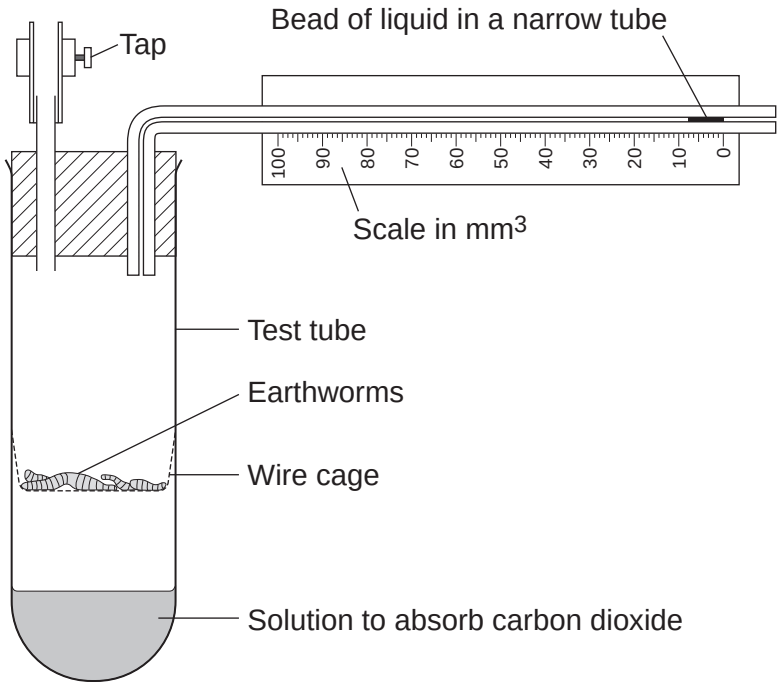
alcohol	**glucose**	**lactic acid**	**water**

..... + oxygen ⟶ carbon dioxide + ... (+ energy)

(2 marks)

6 (b) Some students investigated the effect of temperature on the rate of aerobic respiration in earthworms.

The diagram shows the apparatus the students used.
When the tap is closed, the bead of liquid moves to the left as the earthworms take in oxygen.



The students put the test tube into a water bath at 20 °C for 10 minutes.
They left the tap open during this time.

4.4.1.1 Photosynthetic reaction

Question 18 · continued

Why did the students put the test tube in the water bath at 20 °C for 10 minutes?

Tick (✓) **one** box.

Because the air contains more oxygen at 20°C. ☐

Because the air contains less carbon dioxide at 20°C. ☐

So the earthworms' body temperature would change to 20°C. ☐

(1 mark)

Question 6 continues on the next page

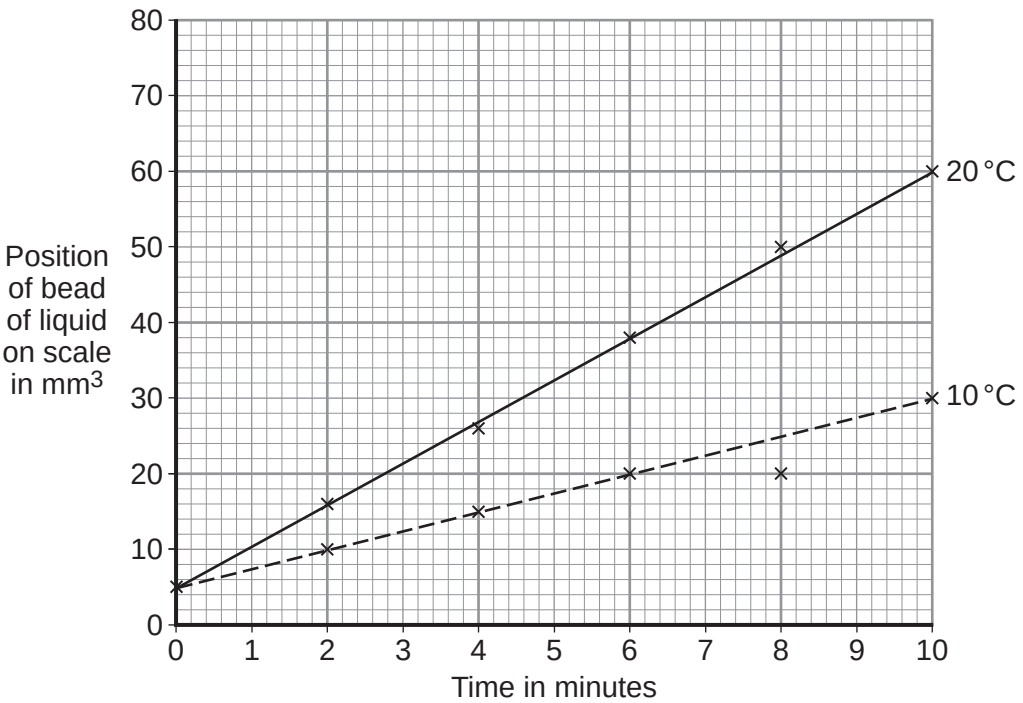
4.4.1.1 Photosynthetic reaction

Question 18 · continued June 2013 | BL2FP | Original Q6 | Legacy

6 (c) The students then:

- closed the tap
- started a stopwatch
- recorded the position of the bead of liquid every 2 minutes for 10 minutes
- repeated the experiment at 10 °C.

The graph shows the students' results.



6 (c) (i) How much oxygen did the earthworms take in during the 10 minutes at 20 °C?

Use information from the graph to work out your answer.

.....

.....

.....

Volume of oxygen taken in = ... mm^3

(2 marks)

4.4.1.1 Photosynthetic reaction

Question 18 · continued

6 (c) (ii) The earthworms took in this volume of oxygen in 10 minutes.

Use your answer from part **(c)(i)** to calculate how much oxygen the earthworms took in each minute.

.....

.....

Volume of oxygen taken in = ... mm^3 per minute

(1 mark)

6 (c) (iii) The earthworms took in less oxygen each minute at 10 °C than they took in at 20 °C.

Explain why.

.....

.....

.....

.....

(2 marks)

6 (d) When drawing the line on the graph for the experiment at 10 °C, the students ignored the reading at 8 minutes.

6 (d) (i) Suggest why they ignored the reading at 8 minutes.

.....

.....

(1 mark)

6 (d) (ii) One student suggested they should repeat the experiment twice more at each temperature.

How would repeating the experiment improve the investigation?

.....

.....

(1 mark)

10

4.4.1.1 Photosynthetic reaction

Question 19

June 2014 | BL2FP | Original Q6 | Legacy

6 (a) A student carried out the following investigation using a plant with variegated leaves.
A variegated leaf has green and white stripes.

The student:

- left the plant in the dark for 3 days to remove the starch
- fixed two pieces of card to a leaf on the plant
- left the plant in the light for 2 days
- removed the leaf from the plant
- tested the leaf for starch.

Figure 9 shows how the two pieces of card were attached to the leaf.

Figure 9

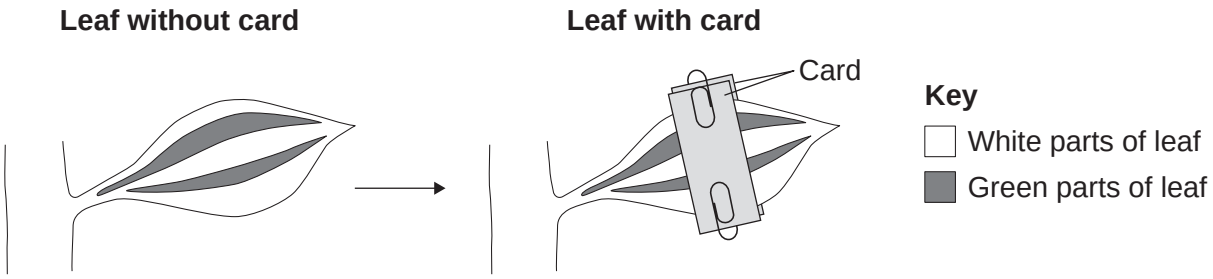
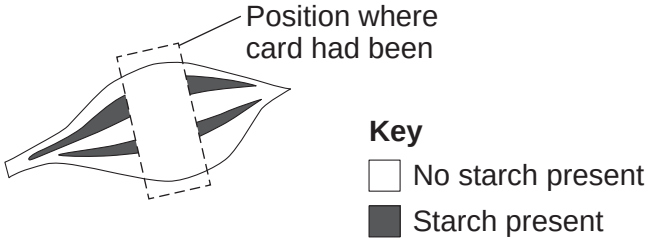


Figure 10 shows the same leaf after 2 days in the light.
The leaf has been tested for starch.

Figure 10



Give **two** conclusions from this investigation.

Tick (✓) **two** boxes.

[2 marks]

- Carbon dioxide is needed for photosynthesis. ☐
- Chlorophyll is needed for photosynthesis. ☐
- Light is needed for photosynthesis. ☐
- Water is needed for photosynthesis. ☐

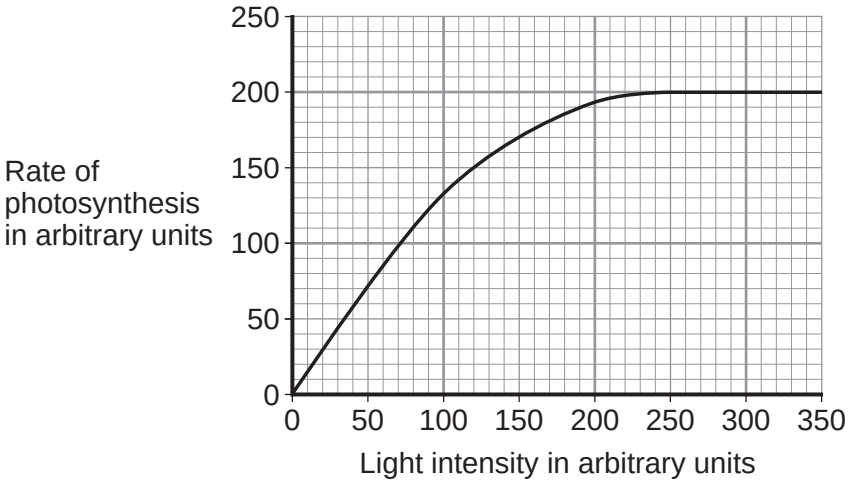
4.4.1.1 Photosynthetic reaction

Question 19 · continued

6 (b) Scientists investigated the effect of light intensity on the rate of photosynthesis.

Figure 11 shows the scientists' results.

Figure 11



Describe the effect of increasing light intensity on the rate of photosynthesis.
You should include numbers from **Figure 11** in your description.

[3 marks]

.....

.....

.....

.....

.....

.....

6 (c) At a light intensity of 250 arbitrary units, light is **not** a limiting factor of photosynthesis.

6 (c) (i) What is the evidence for this in **Figure 11**?

[1 mark]

.....

.....

6 (c) (ii) Give **two** factors that could be limiting the rate of photosynthesis at a light intensity of 250 arbitrary units.

[2 marks]

1 .....

2 .....

8

4.4.1.1 Photosynthetic reaction

Question 20

June 2015 | BL2FP | Original Q4 | Legacy

4 Photosynthesis uses carbon dioxide to make glucose.

4 (a) (i) Complete the equation for photosynthesis.

[2 marks]

carbon dioxide + ... $\xrightarrow{\text{energy}}$ glucose + ...

4 (a) (ii) What type of energy does a plant use in photosynthesis?

[1 mark]

.....

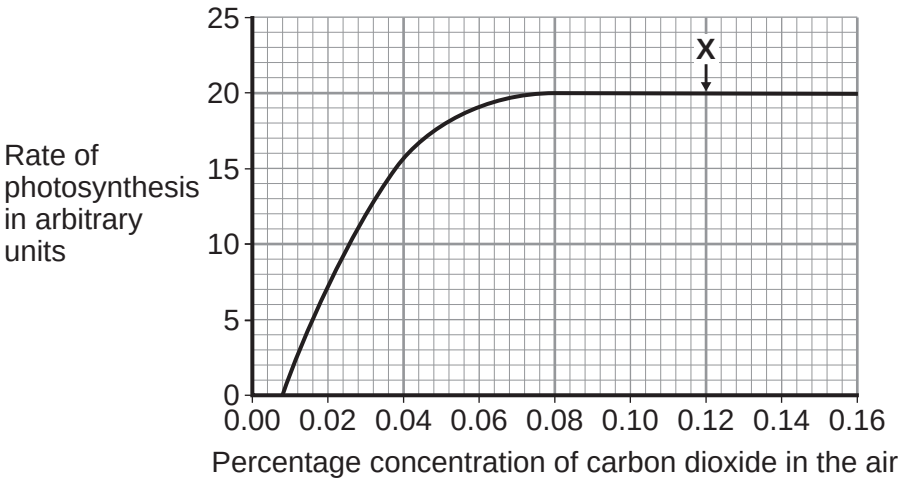
4 (a) (iii) Which part of a plant cell absorbs the energy needed for photosynthesis?

[1 mark]

.....

4 (b) **Figure 3** shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in tomato plants at 20 °C.

Figure 3



4 (b) (i) What is the maximum rate of photosynthesis of the tomato plants shown in **Figure 3**?

[1 mark]

..... arbitrary units

4 (b) (ii) At point **X** on **Figure 3**, carbon dioxide is **not** a limiting factor of photosynthesis.

Suggest **one** factor that is limiting the rate of photosynthesis at point **X**.

[1 mark]

.....

4.4.1.1 Photosynthetic reaction

Question 20 · continued

4 (c) A farmer plans to grow tomatoes in a large greenhouse.

The concentration of carbon dioxide in the atmosphere is 0.04%.
The farmer adds carbon dioxide to the greenhouse so that its concentration is 0.08%.

4 (c) (i) Why does the farmer use 0.08% carbon dioxide?

[1 mark]

Tick (✓) **one** box.

- To increase the rate of growth of the tomato plants ☐
- To increase the rate of respiration of the tomato plants ☐
- To increase water uptake by the tomato plants ☐

4 (c) (ii) Why does the farmer **not** use a concentration of carbon dioxide higher than 0.08%?

[2 marks]

Tick (✓) **two** boxes.

- Because it would cost more money than using 0.08% ☐
- Because it would decrease the temperature of the greenhouse ☐
- Because it would not increase the rate of photosynthesis of the tomato plants any further ☐
- Because it would increase water loss from the tomato plants ☐

9

4.4.1.1 Photosynthetic reaction

Question 21

June 2015 | BL3FP | Original Q2 | Legacy

2 The human population is increasing and more household waste is being produced.

2 (a) Give **one** way in which an increase in household waste affects our environment.

[1 mark]

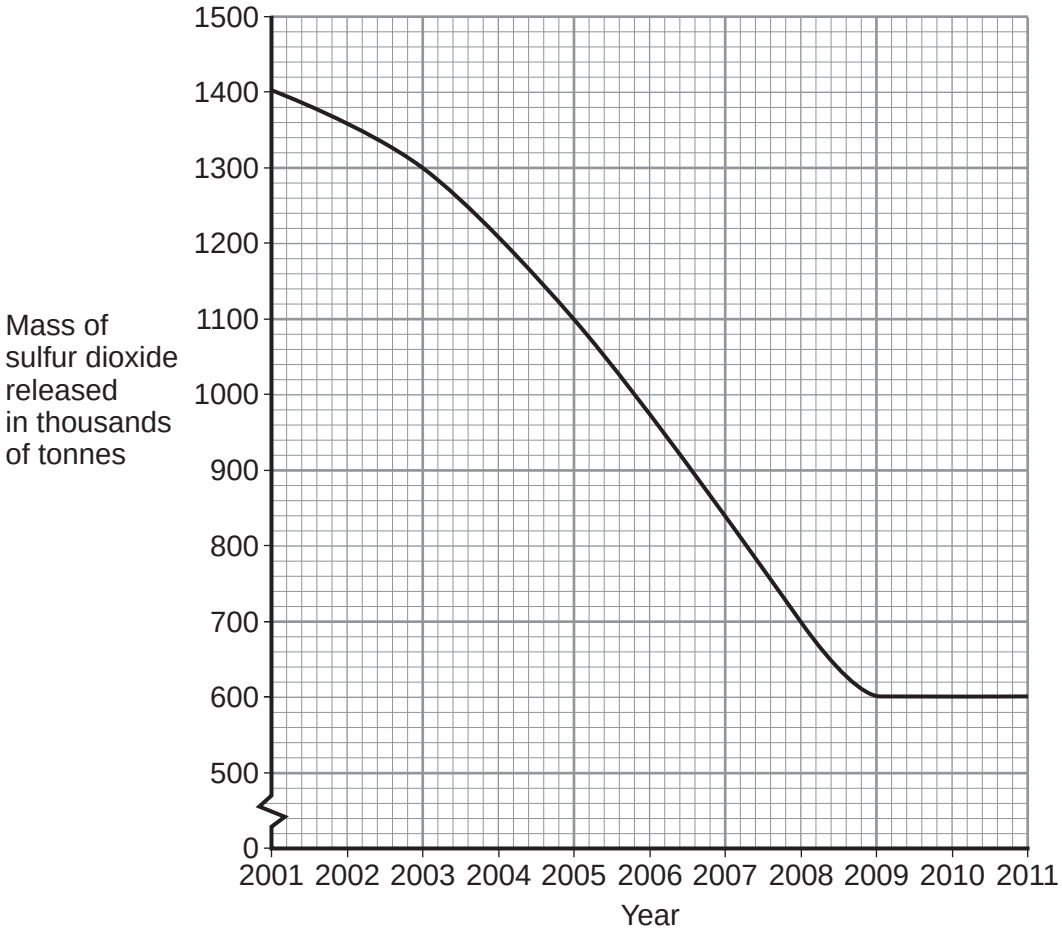
.....

.....

2 (b) The release of sulfur dioxide affects our environment.

Figure 2 shows how the mass of sulfur dioxide released in the UK has changed from 2001 to 2011.

Figure 2



2 (b) (i) Describe the pattern shown in **Figure 2**.

[2 marks]

.....

.....

.....

.....

4.4.1.1 Photosynthetic reaction

Question 21 · continued

2 (b) (ii) In 2001, 1400 thousand tonnes of sulfur dioxide were released.

By which year had the amount of sulfur dioxide released reduced to half of this amount?

[2 marks]

.....

.....

.....

Year = ...

2 (b) (iii) Give **one** problem caused when sulfur dioxide gas is in the air.

[1 mark]

.....

.....

2 (c) Carbon dioxide is another gas that affects the environment.

Which **two** of the following help to reduce the levels of carbon dioxide in the atmosphere by storing carbon dioxide?

[2 marks]

Tick (✓) **two** boxes.

Animals respiring ☐

Carbon dioxide being absorbed in oceans and lakes ☐

Photosynthesis by trees ☐

The production of biogas ☐

8

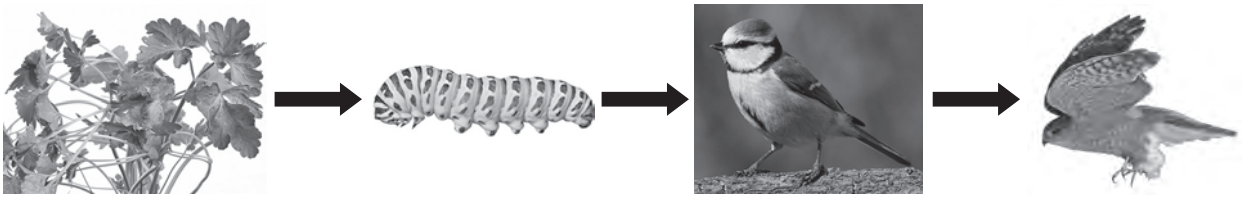
4.4.1.1 Photosynthetic reaction

Question 22

June 2016 | BL1FP | Original Q3 | Legacy

3 **Figure 3** shows how energy and biomass pass along a food chain.

Figure 3



Parsley → Swallowtail caterpillar → Blue tit → Hawk

3 (a) The parsley shown in **Figure 3** carries out photosynthesis.

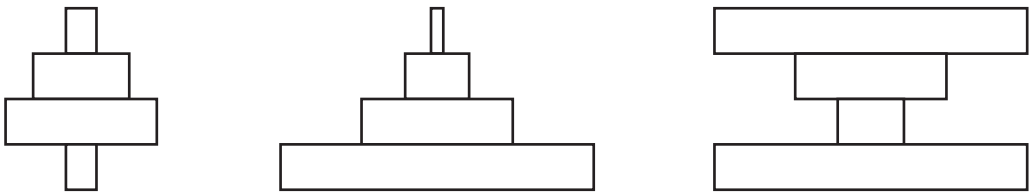
Why is photosynthesis important in the food chain?

[2 marks]

3 (b) Which diagram shows the pyramid of biomass for the food chain in **Figure 3**?

[1 mark]

Tick (✓) **one** box.

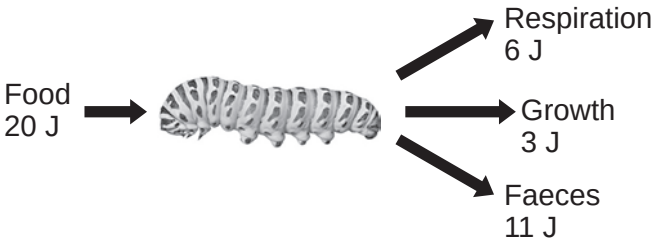


4.4.1.1 Photosynthetic reaction

Question 22 · continued

3 (c) **Figure 4** shows the ways a swallowtail caterpillar transfers 20 J of energy from food.

Figure 4



What percentage of the energy in the caterpillar's food is used for growth?

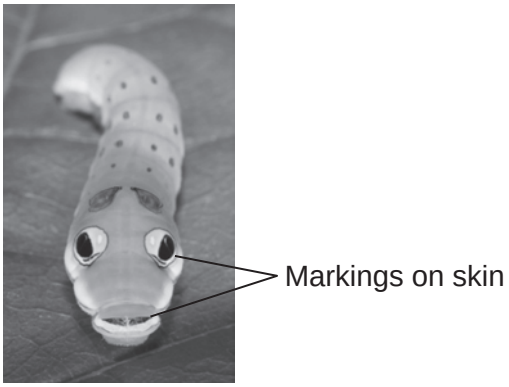
[2 marks]

Percentage = _____

3 (d) The organisms in the food chain are adapted for survival.

3 (d) (i) **Figure 5** shows a swallowtail caterpillar seen from the back.

Figure 5



Suggest how the swallowtail caterpillar shown in **Figure 5** is adapted to reduce the chance of being eaten by blue tits.

[2 marks]

4.4.1.1 Photosynthetic reaction

Question 22 · continued

3 (d) (ii) **Figure 6** shows a hawk.

Figure 6



Suggest **two** ways that the hawk is adapted to catch and kill blue tits.

[2 marks]

1 _____

_____

2 _____

_____

9

4.4.1.1 Photosynthetic reaction

Question 23

June 2016 | BL2FP | Original Q8 | Legacy

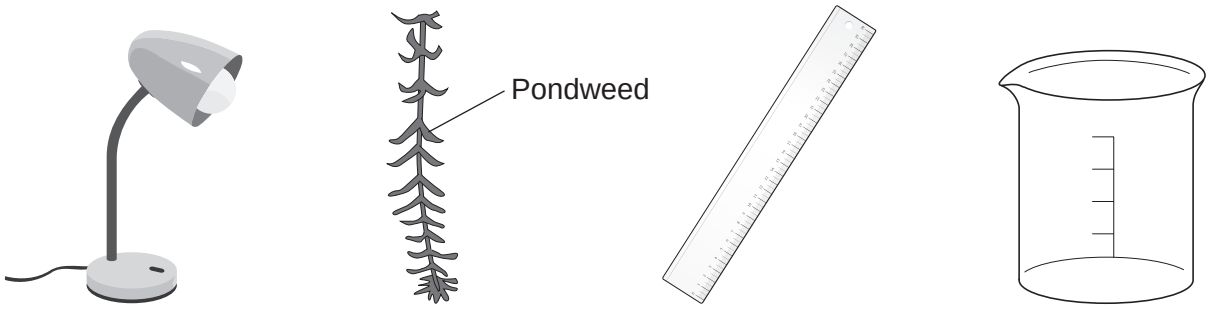
8 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Light intensity, carbon dioxide concentration and temperature are three factors that affect the rate of photosynthesis.

How would you investigate the effect of **light intensity** on the rate of photosynthesis?

Figure 9 shows some of the apparatus you might use.

Figure 9



Not to scale

You should include details of:

- how you would set up the apparatus and the materials you would use
- the measurements you would make
- how you could make this a fair test.

[6 marks]

4.4.1.1 Photosynthetic reaction

Question 24

June 2017 | BL2FP | Original Q1 | Legacy

1 Green plants make their own food.

1 (a) (i) What is the name of the process that plants use to make food?

[1 mark]

Draw a ring around the correct answer.

digestion **growth** **photosynthesis** **respiration**

1 (a) (ii) Plants need energy to make food.

Where does this energy come from?

[1 mark]

Draw a ring around the correct answer.

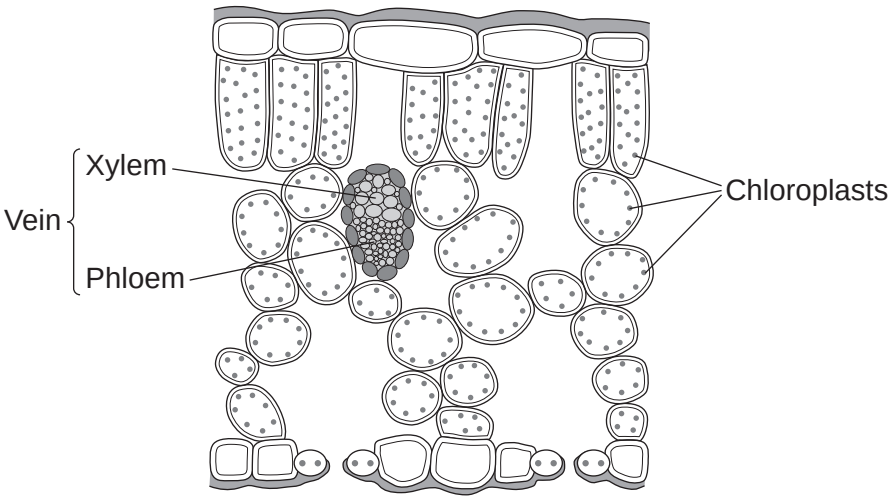
light **oxygen** **soil** **water**

1 (b) In plants, most of the food is made by the leaves.

Figure 1 shows a section through a plant leaf.

In the leaf, many of the cells contain chloroplasts.

Figure 1



1 (b) (i) Chloroplasts contain a green substance.

Name this green substance.

[1 mark]

_____

4.4.1.1 Photosynthetic reaction

Question 24 · continued

1 (b) (ii) How does this green substance help chloroplasts to make food?

[1 mark]

_____

_____

1 (b) (iii) What is the function of the vein shown in **Figure 1**?

[1 mark]

_____

_____

1 (b) (iv) Plants make glucose.

Name **two** substances a plant must take in to make glucose.

[2 marks]

1 _____

2 _____

7

4.4.1.1 Photosynthetic reaction

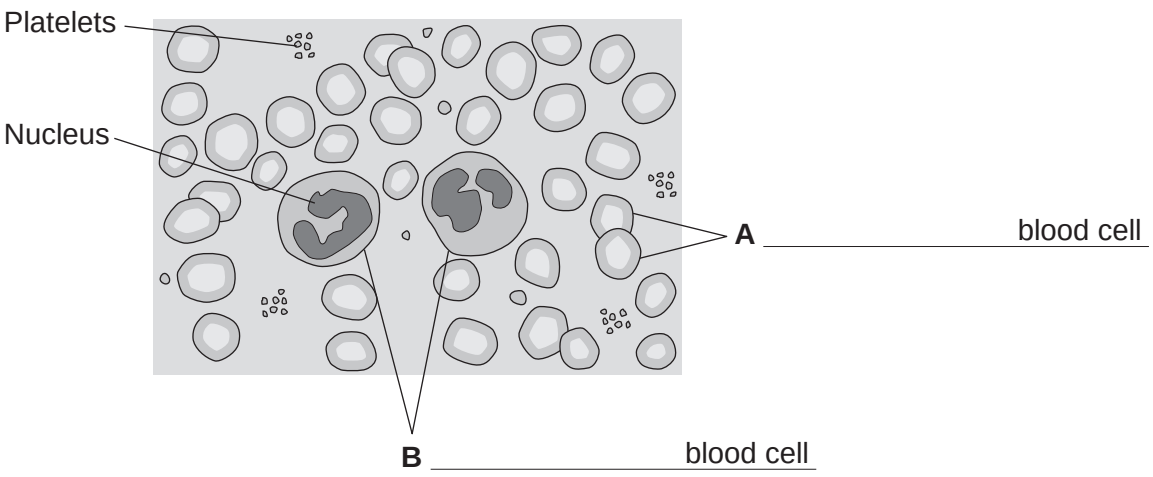
Question 25

June 2017 | BL3FP | Original Q3 | Legacy

3 Blood is a tissue.

Figure 4 is a diagram of the parts of the blood.

Figure 4



3 (a) **A** and **B** are different types of blood cell.

Label cells **A** and **B** in **Figure 4**.

[2 marks]

3 (b) A man has a bad cut on his arm that continues to bleed.

The man goes to hospital and has a blood test.

Table 1 shows the results of the man's blood test.

Table 1

Blood test results

Test	Normal range	Result	Healthy	Abnormal
Platelets	140 – 400	98		✓
Cholesterol	112 – 328	297	✓	
Iron	12 – 300	120	✓	

4.4.1.1 Photosynthetic reaction

Question 25 · continued

3 (b) (i) Use information from **Table 1** and your own knowledge to explain why the man's cut does not stop bleeding.

[2 marks]

_____

_____

_____

_____

_____

3 (b) (ii) The doctor gives the man a blood transfusion.

Suggest why the blood needs to be the same blood group as the man.

[1 mark]

Tick (✓) **one** box.

So the donor is not harmed ☐

To prevent rejection of the new blood cells ☐

To reduce the number of blood cells ☐

To suppress the immune system ☐

3 (c) Blood plasma carries substances around the body.

Use the correct answers from the box to complete the sentences.

[3 marks]

bladder	**carbon dioxide**	**kidneys**	**lungs**
oxygen	**small intestine**	**starch**	

Blood plasma carries _____ from the organs to the lungs.

Blood plasma carries the soluble products of digestion from the _____ to other organs.

Blood plasma carries urea from the liver to the _____ to be removed.

8

4.4.1.1 Photosynthetic reaction

Question 26

0 2 Plants are made up of cells, tissues and organs.

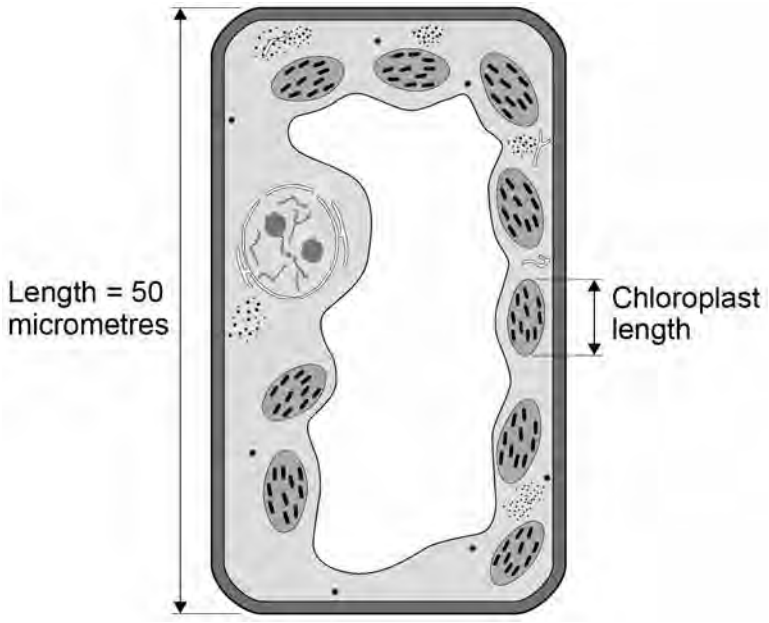
0 2 . 1 Draw **one** line from each level of organisation to the correct plant part.

[2 marks]

Level of organisation	Plant part
	Leaf
Organ	Root hair
	Spongy mesophyll
Tissue	Vacuole
	Xylem cell

Figure 3 shows a plant cell drawn to scale.

Figure 3



4.4.1.1 Photosynthetic reaction

Question 26 · continued

0 2 . 2 Where in a plant would the cell in **Figure 3** be found?

[1 mark]

Tick **one** box.

- Epidermis ☐
- Palisade mesophyll ☐
- Phloem ☐
- Xylem ☐

0 2 . 3 Calculate the length of the chloroplast labelled in **Figure 3**.

[2 marks]

Length = _____ micrometres

0 2 . 4 Cells in plant roots do **not** photosynthesise.

Give **one** reason why.

[1 mark]

4.4.1.1 Photosynthetic reaction

Question 26 · continued

0 2 . 5 As a plant grows, new root hair cells are formed from unspecialised cells.

How does an unspecialised cell become a new root hair cell?

[1 mark]

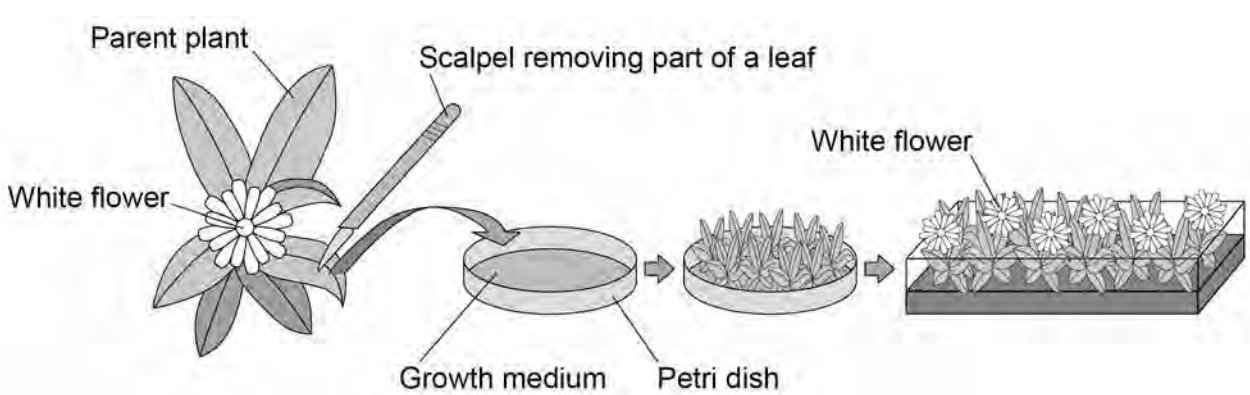
Tick **one** box.

- Differentiation ☐
- Metabolism ☐
- Transpiration ☐
- Transport ☐

Scientists can clone plants using tissue culture.

Figure 4 shows the process of tissue culture.

Figure 4



4.4.1.1 Photosynthetic reaction

Question 26 · continued

0 2 . 6 Why might scientists want to clone plants?

[1 mark]

Tick **one** box.

- To create new species of plants. ☐
- To introduce variation into plants. ☐
- To protect endangered plants from extinction. ☐
- To reduce disease resistance in plants. ☐

0 2 . 7 What is the advantage of cloning plants using tissue culture?

[1 mark]

Tick **one** box.

- No special equipment is needed. ☐
- Plants can be produced quickly. ☐
- The flowers are all different colours. ☐
- The offspring are all genetically different. ☐

0 2 . 8 The growth medium in **Figure 4** helps the plants to grow.

Name **one** substance in the growth medium.

[1 mark]

_____

_____

10

4.4.1.1 Photosynthetic reaction

Question 27

June 2019 | 8461/1F | Original Q3

0 3 This question is about leaves.

0 3 . 1 Complete the sentences.

Choose answers from the box.

[3 marks]

epidermis	**phloem**	**palisade mesophyll**
waxy cuticle	**xylem**	

The layer of cells lining the upper surface and lower surface of a leaf is the _____.

The part of the leaf where most photosynthesis occurs is the _____.

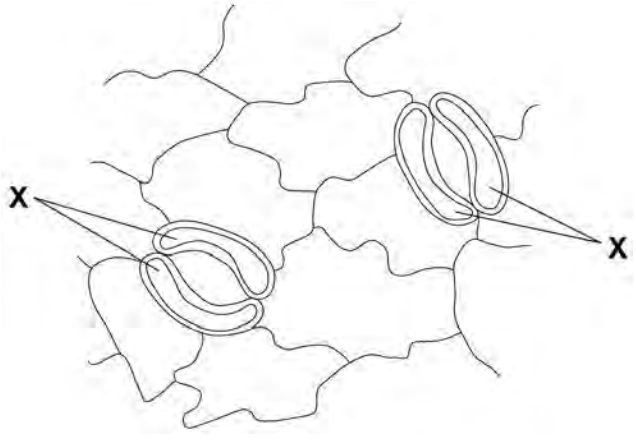
Water is transported to the leaf in the _____.

Water is lost through small openings on the lower surface of plant leaves.

These small openings are called stomata.

Figure 5 shows two stomata on the lower surface of a leaf.

Figure 5



4.4.1.1 Photosynthetic reaction

Question 27 · continued

0 3 . 2 The cells labelled **X** control the width of the stomata.

What are the cells labelled **X**?

[1 mark]

Tick (✓) **one** box.

- Guard cells ☐
- Mesophyll cells ☐
- Root hair cells ☐
- Stem cells ☐

0 3 . 3 What is the function of the stomata?

[1 mark]

Tick (✓) **one** box.

- To allow light into the leaf ☐
- To let carbon dioxide into the leaf ☐
- To let sugars out of the leaf ☐
- To protect the leaf from pathogens ☐

0 3 . 4 How is water lost from a leaf?

[1 mark]

Tick (✓) **one** box.

- By evaporation ☐
- By respiration ☐
- By translocation ☐

4.4.1.1 Photosynthetic reaction

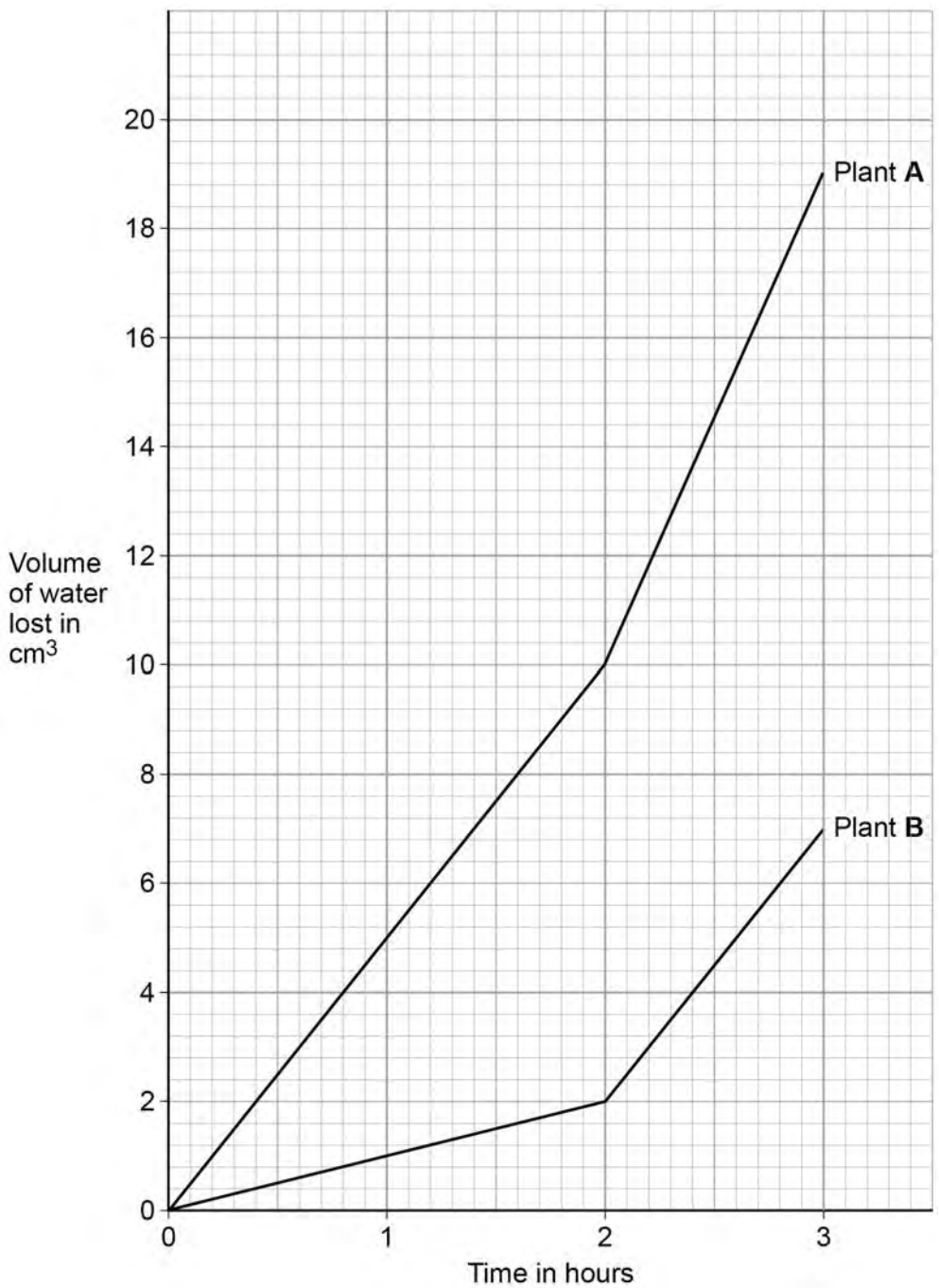
Question 27 · continued

A student investigated the volume of water lost from two plants.

The plants were different species.

Figure 6 shows the student's results.

Figure 6



4.4.1.1 Photosynthetic reaction

Question 27 · continued

0 3 . 5 Calculate the difference in the volume of water lost by plant **A** compared to plant **B** in the first hour.

[2 marks]

Difference in volume = _____ cm^3

0 3 . 6 What could cause plant **A** to lose water at a faster rate than plant **B**?

[1 mark]

Tick (✓) **one** box.

Plant **A** has fewer stomata per leaf. ☐

Plant **A** is smaller. ☐

Plant **A** has more leaves. ☐

Plant **A** has smaller leaves. ☐

0 3 . 7 After the first 2 hours, both plants were moved to a new room.

Suggest **one** reason why both plants lost water at a faster rate in the new room.

[1 mark]

Question 3 continues on the next page

4.4.1.1 Photosynthetic reaction

Question 27 · continued

0 3 . 8 Some plants have adaptations to stop them from being eaten by animals.

Figure 7 shows part of a holly plant.

Figure 7



Describe **one** way the holly plant is adapted to stop it being eaten by animals.

[1 mark]

11

4.4.1.1 Photosynthetic reaction

Question 28

June 2019 | 8461/1F | Original Q9

0 9 This question is about photosynthesis.

0 9 . 1 Complete the word equation for photosynthesis:

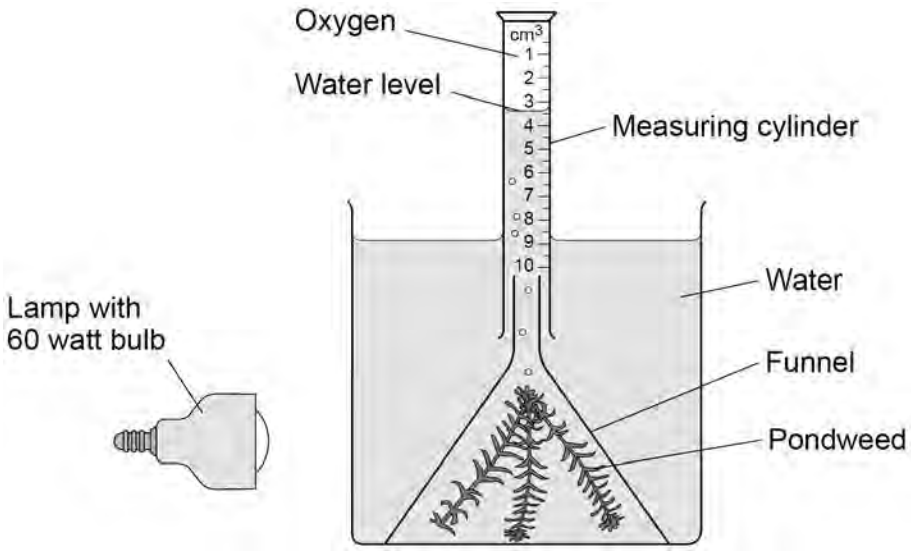
[2 marks]

_____ + _____ ⟶ _____ + oxygen

A student investigated photosynthesis using pondweed.

Figure 14 shows the apparatus the student used.

Figure 14



This is the method used.

1. Set up the apparatus as shown in **Figure 14**.
2. Switch on the lamp.
3. After 20 minutes, record the volume of oxygen collected in the measuring cylinder.
4. Repeat steps 1–3 using bulbs of different power output.

4.4.1.1 Photosynthetic reaction

Question 28 · continued

0 9 . 2 What was the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

- Power output of bulb ☐
- Rate of photosynthesis ☐
- Time to collect oxygen ☐
- Volume of oxygen collected ☐

0 9 . 3 Suggest **two** ways the method could be improved so the results would be more valid.

[2 marks]

1 _____

_____

2 _____

_____

Question 9 continues on the next page

4.4.1.1 Photosynthetic reaction

Question 28 · continued

Table 9 shows the student's results.

Table 9

Power output of bulb in watts	Volume of oxygen collected in 20 minutes in cm^3	Rate of photosynthesis in cm^3/hour
60	0.5	1.5
100	0.8	2.4
150	1.1	**X**
200	1.2	3.6
250	1.2	3.6

0 9 . 4 Calculate value **X** in **Table 9**.

[1 mark]

X = _____ cm^3/hour

4.4.1.1 Photosynthetic reaction

Question 28 · continued

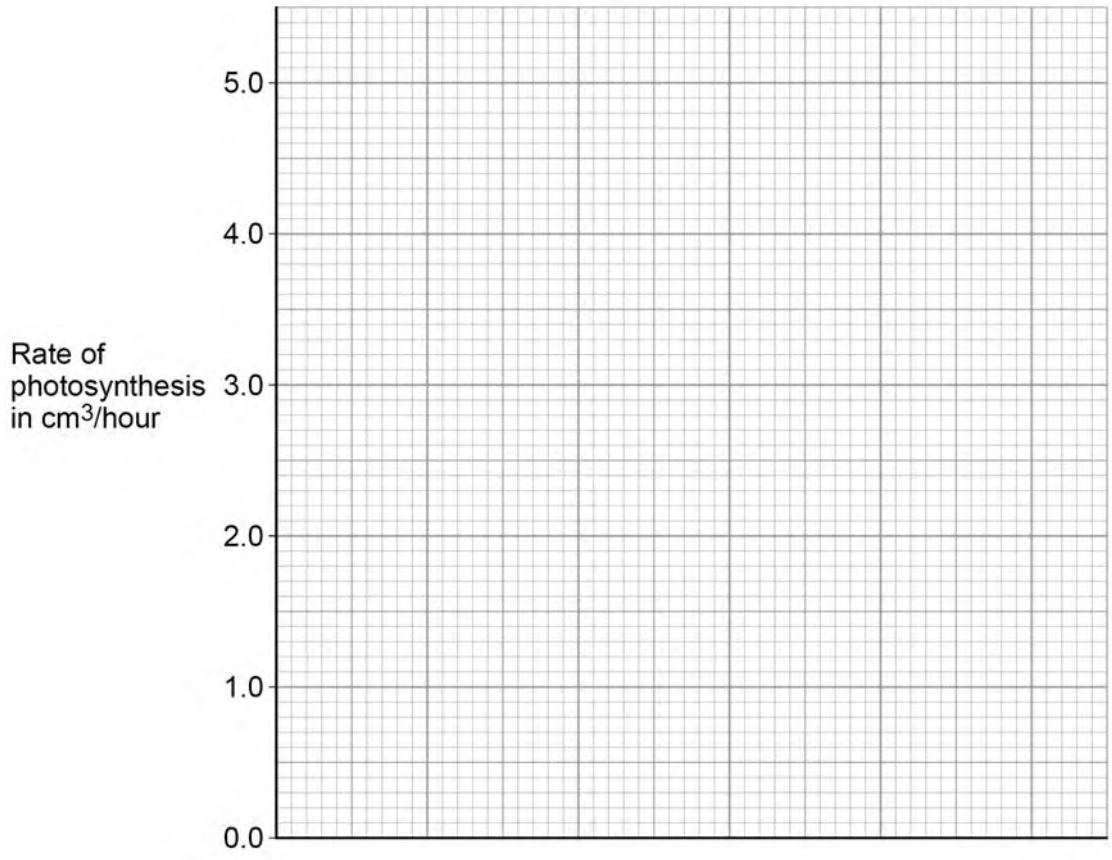
0 9 . 5 Complete **Figure 15**.

[4 marks]

You should:

- label the x-axis
- use a suitable scale
- plot the data from **Table 9** and your answer to Question **09.4**
- draw a line of best fit.

Figure 15



0 9 . 6 Determine the expected rate of photosynthesis with a bulb of power output 75 watts.

Use **Figure 15**.

[1 mark]

Rate of photosynthesis at 75 watts = _____ cm^3/hour

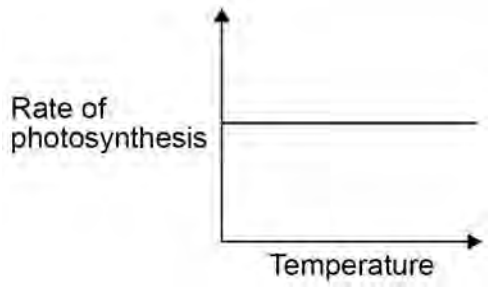
4.4.1.1 Photosynthetic reaction

Question 28 · continued

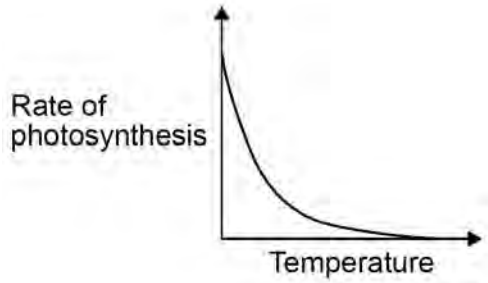
0 9 . 7 Which graph shows the effect of temperature on the rate of photosynthesis?

[1 mark]

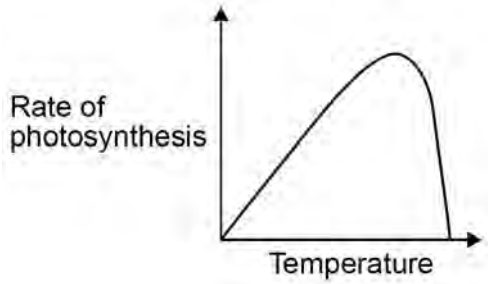
Tick (✓) **one** box.



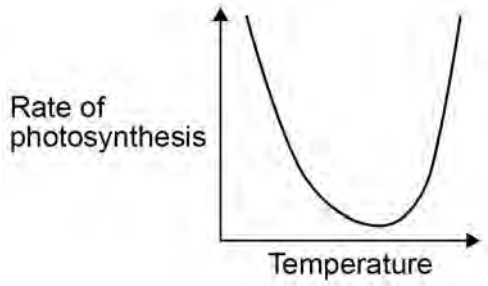
☐



☐



☐



☐

12

4.4.1.1 Photosynthetic reaction

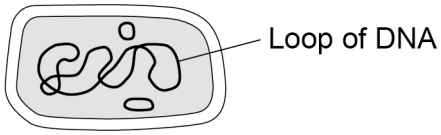
Question 29

November 2020 | 8461/1F | Original Q1

0 1 This question is about cells.

0 1 . 1 **Figure 1** shows a cell.

Figure 1



What type of cell is shown in **Figure 1**?

[1 mark]

Tick (✓) **one** box.

Animal ☐

Bacterium ☐

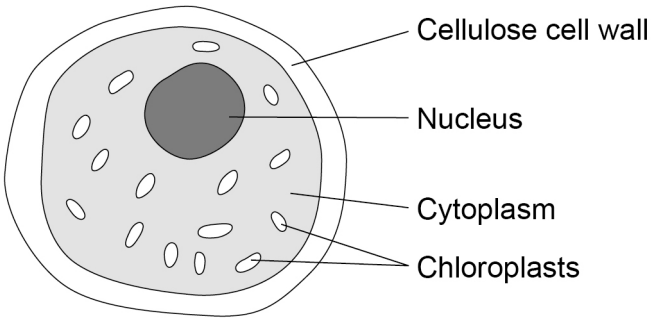
Plant ☐

4.4.1.1 Photosynthetic reaction

Question 29 · continued

Figure 2 shows an algal cell.

Figure 2



0 1 . 2 What is the function of the cell wall?

[1 mark]

Tick (✓) **one** box.

- To contain the genetic material ☐
- To stop the chloroplasts leaking out ☐
- To strengthen the cell ☐

0 1 . 3 The algal cell is green.

Which part of the algal cell makes it green in colour?

[1 mark]

Tick (✓) **one** box.

- Cellulose ☐
- Chloroplast ☐
- Cytoplasm ☐
- Nucleus ☐

4.4.1.1 Photosynthetic reaction

Question 29 · continued

0 1 . 4 Cells contain sub-cellular structures.

Draw **one** line from each structure to its function.

[3 marks]

Structure	Function
	Controls transport of substances into the cell
Cell membrane	Where energy is released
Mitochondria	Where glucose is made
Ribosomes	Where photosynthesis takes place
	Where proteins are made

4.4.1.1 Photosynthetic reaction

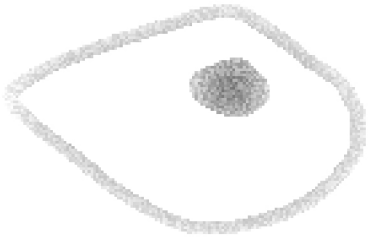
Question 29 · continued

A student prepared a microscope slide of cheek cells.

The student looked at one cell using a microscope.

Figure 3 shows the image the student saw.

Figure 3



0 1 . 5 What should the student do to get a clear image?

[1 mark]

Tick (✓) **one** box.

Adjust the focus knob ☐

Make the light dimmer ☐

Put water on the slide ☐

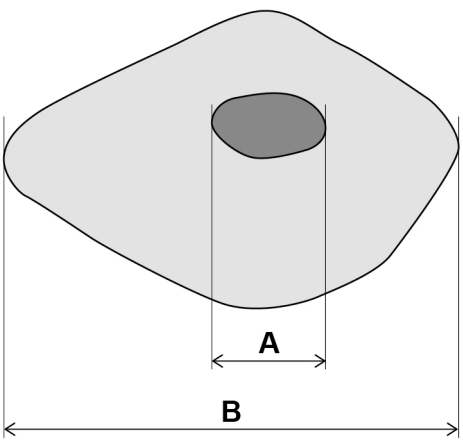
Question 1 continues on the next page

Question 29 · continued

The student then obtained a clear image.

Figure 4 shows the clear image.

Figure 4



0 1 . 6 Measure the length of the nucleus (**A**) and the length of the cell (**B**) in millimetres (mm).

[2 marks]

A = _____ mm

B = _____ mm

0 1 . 7 How many times longer is the cell (**B**) than the nucleus (**A**)?

[1 mark]

_____

Number of times longer = _____

4.4.1.1 Photosynthetic reaction

Question 29 · continued

0 1 . 8 The student looked at another cell.

The image width of the cell was 40 mm

The real width of the cell was 0.1 mm

Calculate the magnification of the cell.

[2 marks]

Use the equation:

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

Magnification = ×

12

Turn over for the next question

4.4.1.1 Photosynthetic reaction

Question 30

November 2020 | 8461/1F | Original Q7

0 7 This question is about photosynthesis.

0 7 . 1 Complete the word equation for photosynthesis.

[2 marks]

_____ + _____ → _____ + oxygen

0 7 . 2 Describe how energy for the photosynthesis reaction is gained by plants.

[2 marks]

Students investigated the effect of temperature on the rate of photosynthesis.

The students shone light from a lamp onto pondweed and measured the volume of oxygen produced per hour.

Table 3 shows the results.

Table 3

Temperature in °C	Rate of photosynthesis in cm^3/hour			
	Test 1	Test 2	Test 3	Mean
20	18.5	19.3	19.5	**X**
25	32.6	34.1	32.9	33.2
30	41.9	45.2	44.9	44.0
35	38.6	39.8	44.0	40.8
40	23.1	20.5	22.4	22.0
45	1.9	14.2	2.2	2.1

4.4.1.1 Photosynthetic reaction

Question 30 · continued

0 7 . 3 Calculate mean value **X**.

[2 marks]

X = _____ cm^3/hour

The students identified one anomalous result in **Table 3**.

0 7 . 4 Draw a ring around the anomalous result in **Table 3**.

[1 mark]

0 7 . 5 Suggest **one** possible cause of the anomalous result.

[1 mark]

0 7 . 6 How did the students deal with the anomalous result?

[1 mark]

0 7 . 7 Give **one** factor the students should have kept constant in this investigation.

[1 mark]

4.4.1.1 Photosynthetic reaction

Question 30 · continued

Table 3 is repeated below.

Table 3

Temperature in °C	Rate of photosynthesis in cm^3/hour			
	Test 1	Test 2	Test 3	Mean
20	18.5	19.3	19.5	**X**
25	32.6	34.1	32.9	33.2
30	41.9	45.2	44.9	44.0
35	38.6	39.8	44.0	40.8
40	23.1	20.5	22.4	22.0
45	1.9	14.2	2.2	2.1

0 7 . 8 Why did the rate of photosynthesis decrease from 35 °C to 45 °C?

[1 mark]

4.4.1.1 Photosynthetic reaction

Question 30 · continued

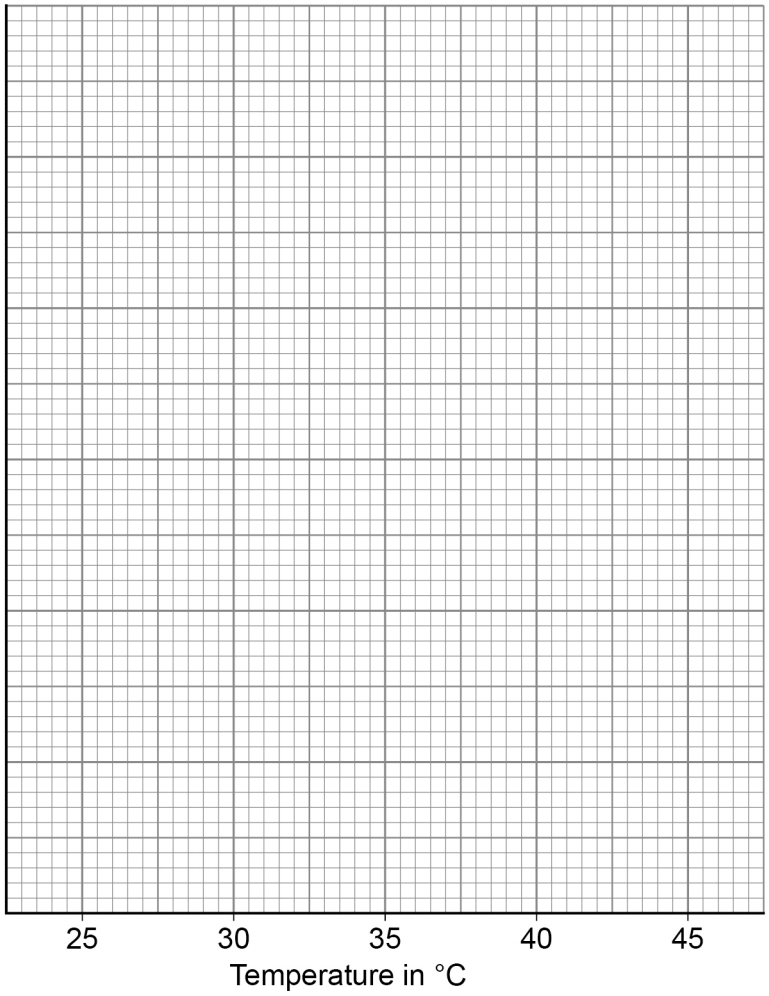
0 7 . 9 Complete **Figure 10** using data from **Table 3**.

You should:

- label the y-axis
- use a suitable scale for the y-axis
- plot the mean data from **Table 3** for temperatures from 25 °C to 45 °C
- draw a line of best fit.

[5 marks]

Figure 10



16

4.4.1.1 Photosynthetic reaction

Question 31

November 2021 | 8461/1F | Original Q2

0 2 Viruses cause disease.

0 2 . 1 What name is given to microorganisms that cause disease?

[1 mark]

Tick (✓) **one** box.

- Pathogens ☐
- Predators ☐
- Prokaryotes ☐

0 2 . 2 How do viruses cause the symptoms of disease?

[1 mark]

Tick (✓) **one** box.

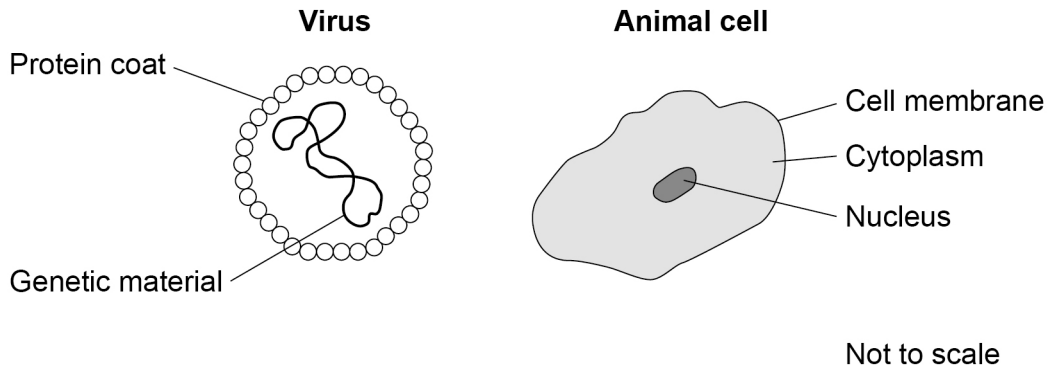
- Viruses engulf white blood cells, destroying them. ☐
- Viruses produce antibodies that damage tissues. ☐
- Viruses reproduce inside cells, damaging them. ☐

4.4.1.1 Photosynthetic reaction

Question 31 · continued

Figure 4 shows a virus and an animal cell.

Figure 4



0 2 . 3 Suggest **one** reason why viruses are **not** classed as cells.

[1 mark]

A vaccine can protect humans from a viral disease.

0 2 . 4 What does the vaccine contain?

[1 mark]

Tick (✓) **one** box.

- A toxic form of a virus ☐
- A weakened form of a virus ☐
- An active form of a virus ☐

Question 2 continues on the next page

4.4.1.1 Photosynthetic reaction

Question 31 · continued

In some cases, a first vaccination needs to be followed by a second vaccination some time later.

0 2 . 5 Which graph shows how the concentration of antibodies in a person's blood changes after the first and second vaccinations?

[1 mark]

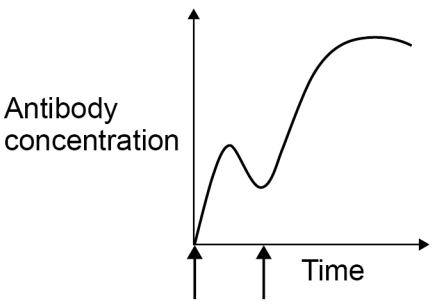
Tick (✓) **one** box.

Key

↑ Vaccination given

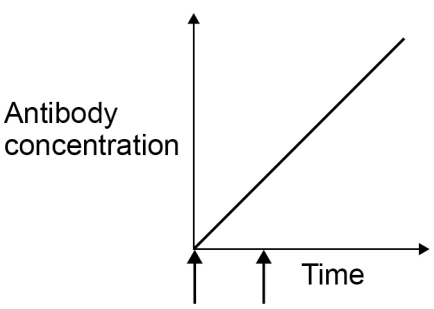
Antibody concentration

Time ☐



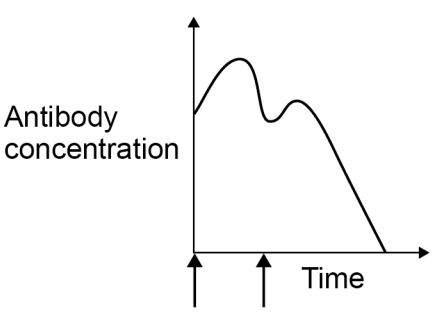
Antibody concentration

Time ☐



Antibody concentration

Time ☐



4.4.1.1 Photosynthetic reaction

Question 31 · continued

Tobacco mosaic virus (TMV) causes disease in plants.

TMV affects the rate of photosynthesis in plants.

0 2 . 6 Which part of a plant shows discolouration caused by TMV?

[1 mark]

Tick (✓) **one** box.

Flower ☐

Leaf ☐

Root ☐

Question 2 continues on the next page

4.4.1.1 Photosynthetic reaction

Question 31 · continued

Table 1 shows the rate of photosynthesis in four different tobacco plants.

Table 1

Tobacco plant	Level of TMV infection in plant	Rate of photosynthesis in arbitrary units
A	None	15
B	Mild	13
C	Medium	7
D	High	3

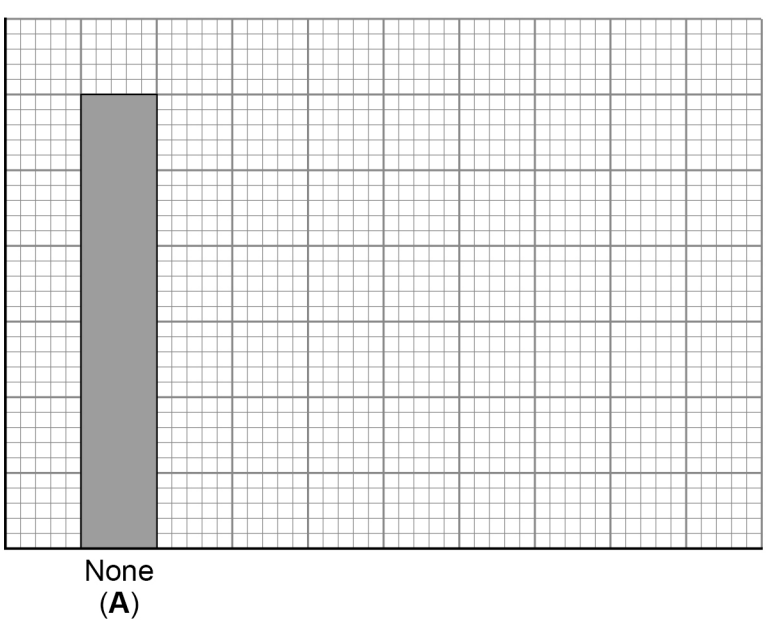
0 2 . 7 Complete **Figure 5**.

You should:

- label the y-axis
- add the correct scale to the y-axis
- plot the data from **Table 1**
- label each bar.

[5 marks]

Figure 5



4.4.1.1 Photosynthetic reaction

Question 31 · continued

0 2 . 8 What conclusion can be made from the data in **Table 1**?

[1 mark]

0 2 . 9 Explain why a high level of TMV infection reduces growth in a plant.

[2 marks]

14

Turn over for the next question

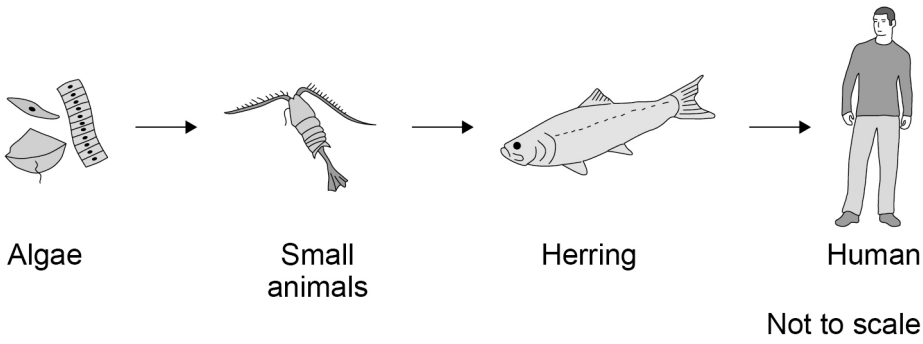
4.4.1.1 Photosynthetic reaction

Question 32

0 3 People eat fish caught in the North Sea.

Figure 4 shows a food chain.

Figure 4



0 3 . 1 The algae make glucose by photosynthesis.

Which **two** substances do the algae need for photosynthesis?

[2 marks]

Tick (✓) **two** boxes.

- Carbon dioxide ☐
- Nitrogen ☐
- Oxygen ☐
- Starch ☐
- Water ☐

4.4.1.1 Photosynthetic reaction

Question 32 · continued

0 3 . 2 What is the source of energy for photosynthesis?

[1 mark]

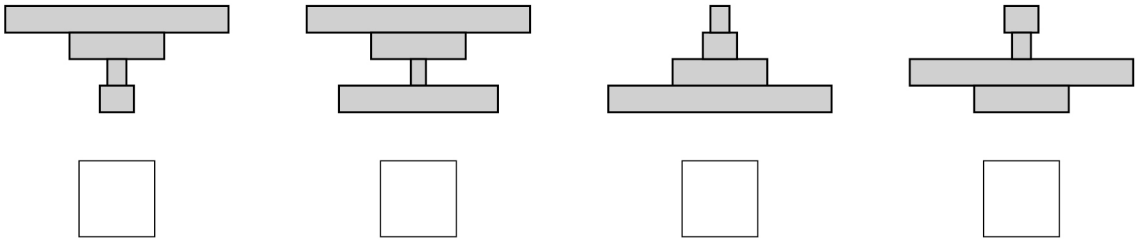
Tick (✓) **one** box.

- Light ☐
- Mineral ions ☐
- Protein ☐
- Water ☐

0 3 . 3 Which pyramid of biomass is correct for the food chain shown in **Figure 4**?

[1 mark]

Tick (✓) **one** box.



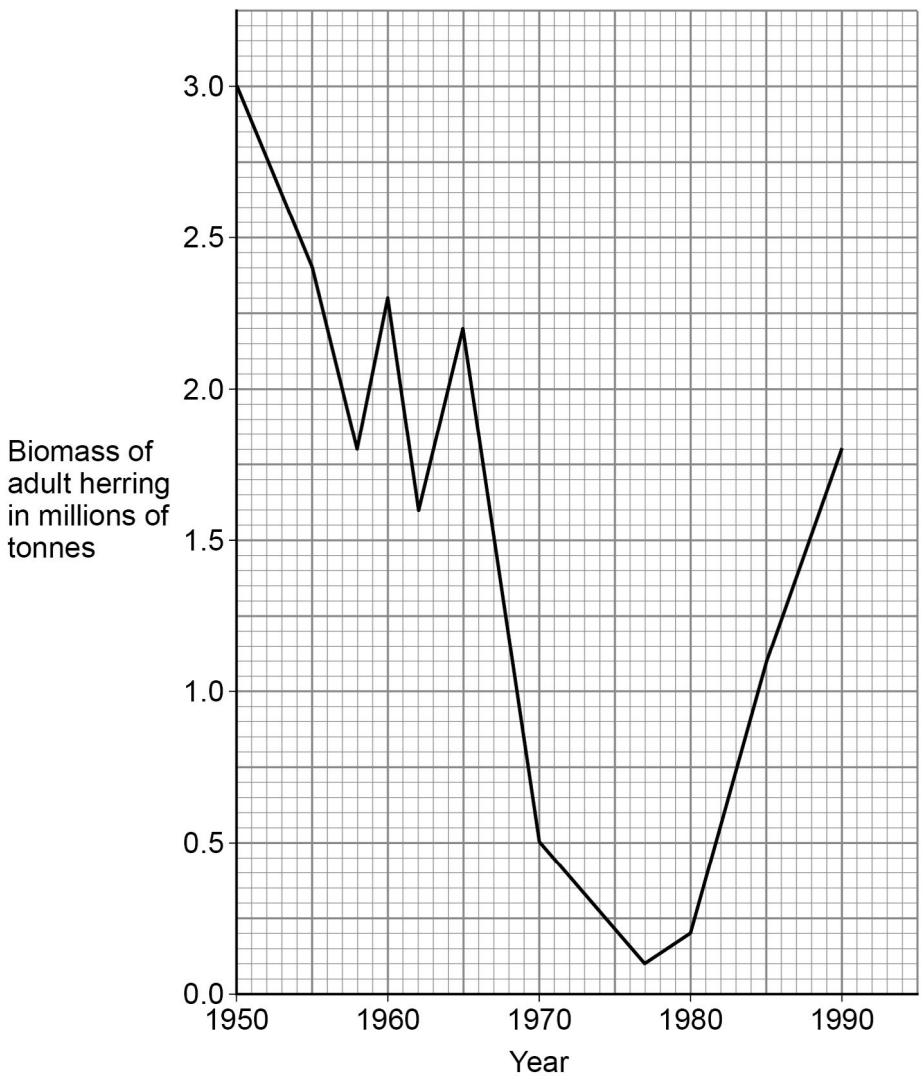
Question 3 continues on the next page

4.4.1.1 Photosynthetic reaction

Question 32 · continued

Figure 5 shows the biomass of adult herring in the North Sea between 1950 and 1990.

Figure 5



4.4.1.1 Photosynthetic reaction

0 3 . 4 Too many herring were caught in the 1960s.

Calculate the percentage decrease in the biomass of adult herring between 1960 and 1970.

Use the equation:

$$\text{percentage decrease} = \frac{(\text{biomass in 1960} - \text{biomass in 1970})}{\text{biomass in 1960}} \times 100$$

Give your answer to the nearest whole number.

[4 marks]

Percentage decrease = _____ %

From 1977, laws were introduced to help conserve herring.

0 3 . 5 Describe the change in biomass of adult herring from 1977 to 1990.

Use data from **Figure 5** in your answer.

[2 marks]

Question 3 continues on the next page

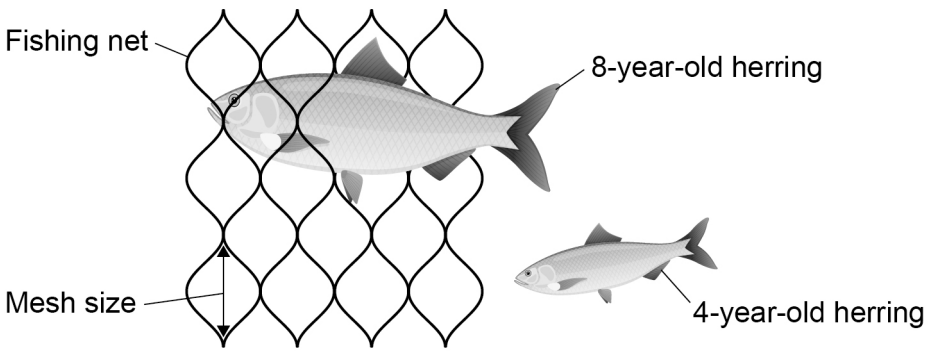
4.4.1.1 Photosynthetic reaction

Question 32 · continued

0 3 . 6 One of the laws was to control mesh size of fishing nets.

Figure 6 shows a fishing net with a legal mesh size.

Figure 6



Herring can live for up to 12 years.

Herring start to reproduce when they are 3 to 4 years old.

Explain how the control of mesh size of fishing nets has helped to conserve stocks of herring.

[2 marks]

12

4.4.1.1 Photosynthetic reaction

Question 33

June 2022 | 8461/1F | Original Q3

0 3 A scientist investigated the rate of photosynthesis of one type of tomato plant.

The tomato plants were grown in a greenhouse.

Table 2 shows the results.

Table 2

Percentage (%) concentration of carbon dioxide in the air	Rate of photosynthesis in arbitrary units
0.00	0
0.02	5
0.04	16
0.06	19
0.08	20
0.10	20
0.12	20

0 3 . 1 Give **two** control variables the scientist should have used in the investigation.

[2 marks]

1 _____

2 _____

0 3 . 2 Which range of carbon dioxide concentrations caused the rate of photosynthesis to change the most?

[1 mark]

Tick (✓) **one** box.

From 0.00% to 0.02% ☐

From 0.02% to 0.04% ☐

From 0.04% to 0.06% ☐

From 0.06% to 0.08% ☐

4.4.1.1 Photosynthetic reaction

Question 33 · continued

0 3 . 3 How could the scientist have improved the validity of the results?

[1 mark]

Tick (✓) **one** box.

Repeat each reading three times and calculate a mean. ☐

Use concentrations of carbon dioxide above 0.12%. ☐

Use different tomato plants for each concentration. ☐

0 3 . 4 Explain the change in the rate of photosynthesis when the concentration of carbon dioxide increased between 0.00% to 0.08%.

[2 marks]

0 3 . 5 A farmer decided **not** to use a concentration of carbon dioxide higher than 0.08% to grow tomato plants.

Suggest **two** reasons for the farmer's decision.

Use information from **Table 2** and your own knowledge.

[2 marks]

1

2

8

4.4.1.1 Photosynthetic reaction

Question 34

June 2022 | 8461/1F | Original Q5

0 5 . 1 Plants take up water from the soil through their roots.

Some of the water is used for photosynthesis.

Complete the word equation for photosynthesis.

Choose answers from the box.

[2 marks]

fat	**glucose**	**nitrogen**	**oxygen**	**protein**

carbon dioxide + water → _____ + _____

0 5 . 2 Water and dissolved substances are transported through a plant.

Complete the sentences.

Choose answers from the box.

[3 marks]

epidermis	**guard cells**	**palisade cells**
phloem	**stomata**	**xylem**

Water moves from the roots to the leaves in the _____.

Water is lost from leaves through pores called _____.

Dissolved sugars are transported in the _____.

Question 5 continues on the next page

4.4.1.1 Photosynthetic reaction

Question 34 · continued

Table 3 shows the rate of transpiration in four different plant species.

Table 3

Plant species	Rate of transpiration in arbitrary units
A	310
B	254
C	87
D	192

0 5 . 3 Calculate how many times greater the rate of transpiration of species **A** is than the rate of transpiration of species **B**.

Give your answer to 2 significant figures.

[3 marks]

Number of times greater (2 significant figures) = _____

4.4.1.1 Photosynthetic reaction

Question 34 · continued

0 5 . 4 Which factor could cause species **A** to have a higher rate of transpiration than species **B**?

[1 mark]

Tick (✓) **one** box.

Each flower of species **A** has more petals. ☐

Each leaf of species **A** has more stomata. ☐

Each plant of species **A** has shorter roots. ☐

0 5 . 5 Which environmental change would cause an increase in the rate of transpiration?

[1 mark]

Tick (✓) **one** box.

Decreased light intensity ☐

Decreased wind speed ☐

Increased humidity ☐

Increased temperature ☐

0 5 . 6 Which plant species in **Table 3** is most likely to live in a dry desert?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Question 5 continues on the next page

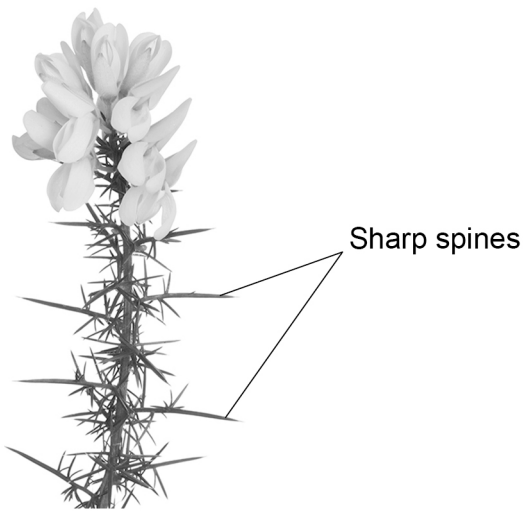
4.4.1.1 Photosynthetic reaction

Question 34 · continued

0 5 . 7 Some plants have adaptations that help them survive.

Figure 6 shows part of a gorse plant.

Figure 6



How will the sharp spines help the gorse plant survive?

[1 mark]

4.4.1.1 Photosynthetic reaction

Question 34 · continued

0 5 . 8 Animals also have adaptations to help them survive.

Figure 7 shows two insects.

Figure 7



Hornet **Hornet Moth**

Hornets are insects that sting other animals and cause pain.

Hornet moths do **not** sting other animals.

Explain why animals avoid eating the **hornet moth**.

[2 marks]

14

4.4.1.1 Photosynthetic reaction

Question 35

June 2023 | 8461/1F | Original Q3

0 3 Photosynthesis produces oxygen.

0 3 . 1 Complete the word equation for photosynthesis.

Choose answers from the box.

[3 marks]

carbon dioxide	**fat**	**glucose**
nitrogen	**protein**	**water**

_____ + _____ → _____ + oxygen

0 3 . 2 Explain how oxygen is used in cells.

[2 marks]

4.4.1.1 Photosynthetic reaction

Question 35 · continued

A student investigated the effect of light from different coloured light bulbs on photosynthesis.

The student:

- used pondweed in a beaker of water
- used different coloured light bulbs in a lamp
- counted the number of bubbles of oxygen the pondweed produced in 2 minutes for each colour of light bulb.

0 3 . 3 Give **one** hazard the student would need to consider when using the apparatus in this investigation.

Give the risk the hazard would cause.

[2 marks]

Hazard _____

_____

Risk _____

_____

0 3 . 4 The student needed to keep the temperature of the water in the beaker the same throughout the investigation.

Describe how the student could keep the temperature of the water the same.

[1 mark]

_____

_____

0 3 . 5 The beaker of water contained the pondweed.

Explain why the temperature of the water in the beaker needed to be kept the same throughout the investigation.

[2 marks]

_____

_____

_____

_____

4.4.1.1 Photosynthetic reaction

Question 35 · continued

Table 3 shows the results.

Table 3

Colour of light bulb	Number of bubbles of oxygen produced in 2 minutes
Blue	46
Green	8
Red	38
Yellow	29

0 3 . 6 Which colour of light caused the highest rate of photosynthesis in the pondweed?

[1 mark]

Tick (✓) **one** box.

- Blue ☐
- Green ☐
- Red ☐
- Yellow ☐

0 3 . 7 What is the best way to display the data in **Table 3**?

[1 mark]

Tick (✓) **one** box.

- Bar graph ☐
- Line graph ☐
- Scatter graph ☐

4.4.1.1 Photosynthetic reaction

Question 35 · continued

0 3 . 8 The student wanted to measure the **volume** of oxygen the pondweed produced in 2 minutes.

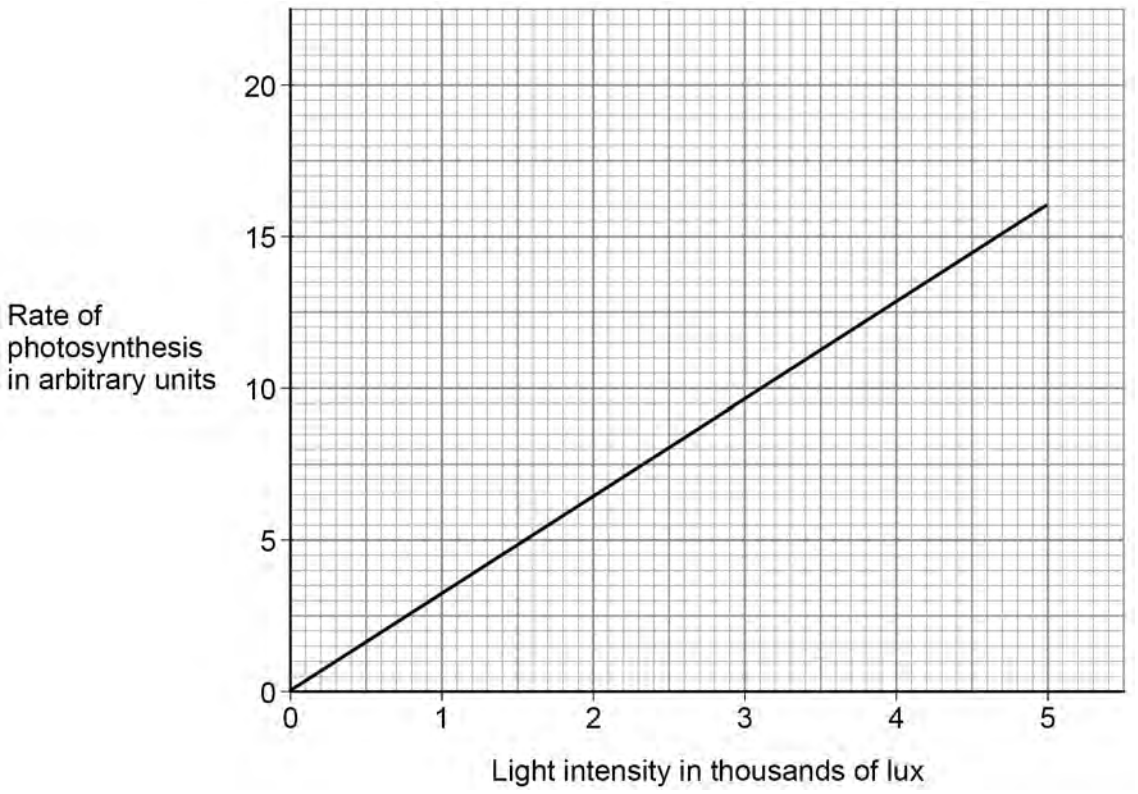
Name **one** piece of apparatus the student could use to measure the volume of oxygen.

[1 mark]

0 3 . 9 Another student investigated the effect of light intensity on the rate of photosynthesis.

Figure 1 shows the results.

Figure 1



Describe what **Figure 1** shows about the relationship between light intensity and the rate of photosynthesis.

[2 marks]

15

4.4.1.1 Photosynthetic reaction

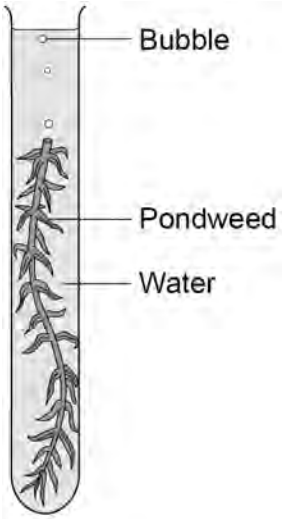
Question 36

June 2025 | 8461/1F | Original Q2

0 2 A student investigated the effect of temperature on the rate of photosynthesis in pondweed.

Figure 2 shows how the student set up the apparatus.

Figure 2



This is the method used.

1. Prepare six tubes of pondweed as shown in **Figure 2**.
2. Place one tube into each of six water baths set at different temperatures.
3. Wait two minutes.
4. Measure the time taken for each piece of pondweed to release 10 bubbles.

0 2 . 1 What is the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Length of pondweed ☐

Temperature of pondweed ☐

Volume of water ☐

Question 2 continues on the next page

4.4.1.1 Photosynthetic reaction

Question 36 · continued

Table 2 shows the results.

Table 2

Temperature in °C	Time taken for pondweed to release 10 bubbles in seconds
10	84
20	43
30	27
40	25
50	33
60	77

0 2 . 2 Complete the sentences.

Choose answers from the box.

[2 marks]

cellulose	**chlorophyll**	**nitrogen**	**oxygen**	**water**

Photosynthesis by the pondweed releases bubbles of _____.

The green substance needed for photosynthesis is called _____.

0 2 . 3 Describe the effect of increasing temperature on the time taken for the pondweed to release 10 bubbles.

[2 marks]

_____

_____

_____

_____

4.4.1.1 Photosynthetic reaction

Question 36 · continued

0 2 . 4 Calculate the rate of photosynthesis at **50 °C**.

Use the equation:

$$\text{rate of photosynthesis in bubbles per second} = \frac{10}{\text{time taken to release 10 bubbles in seconds}}$$

Use **Table 2**.

Give your answer to 1 decimal place.

[3 marks]

Rate of photosynthesis (1 decimal place) = _____ bubbles per second

0 2 . 5 Which temperature had the fastest rate of photosynthesis?

[1 mark]

Tick (✓) **one** box.

- 20 °C ☐
- 30 °C ☐
- 40 °C ☐
- 50 °C ☐

Question 2 continues on the next page

4.4.1.1 Photosynthetic reaction

Question 36 · continued

Table 2 is repeated below.

Table 2

Temperature in °C	Time taken for pondweed to release 10 bubbles in seconds
10	84
20	43
30	27
40	25
50	33
60	77

0 2 . 6 The student repeated the investigation at 80 °C.

What would be the time taken for the pondweed to release 10 bubbles at 80 °C?

[1 mark]

Tick (✓) **one** box.

Less than 77 seconds ☐

Exactly 77 seconds ☐

More than 77 seconds ☐

4.4.1.1 Photosynthetic reaction

Question 36 · continued

0 2 . 7 Which **two** factors could affect the rate of photosynthesis in this investigation?

[2 marks]

Tick (✓) **two** boxes.

- Concentration of carbon dioxide ☐
- Light intensity ☐
- Size of boiling tube ☐
- Size of bubbles ☐
- Type of stopwatch ☐

12

Turn over for the next question