AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.7.3.3

Land use

Past-paper questions

Tier	**Higher**
Question groups	**20**
Available paper years	**2018–2025**

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.

4.7.3.3 Land use

Question 01

June 2018 | 8464/B/1H | Original Q3

0 3 This question is about photosynthesis.

0 3 . 1 What is the correct balanced equation for photosynthesis?

[1 mark]

Tick **one** box.

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ ☐

$O_2 + H_2O \rightarrow C_6H_{12}O_6 + CO_2$ ☐

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ ☐

$6O_2 + 6CO_2 \rightarrow 6H_2O + C_6H_{12}O_6$ ☐

0 3 . 2 What type of reaction is photosynthesis?

[1 mark]

Tick **one** box.

Aerobic ☐

Endothermic ☐

Exothermic ☐

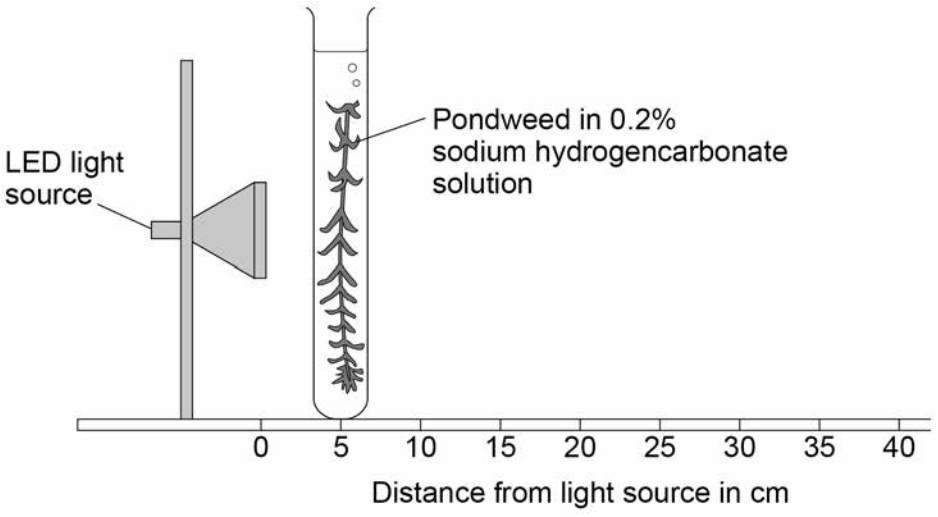
Oxidation ☐

Question 01 · continued

A student investigated the effect of light intensity on the rate of photosynthesis.

Figure 5 shows the apparatus used.

Figure 5



Sodium hydrogencarbonate solution releases carbon dioxide gas for the pondweed.

This is the method used.

1. Place the pondweed at 5 cm from the light source.
2. Measure the rate of photosynthesis by counting the number of bubbles produced in 1 minute.
3. Repeat with the pondweed at 10 cm and at 20 cm from the light source.

0 3 . 3 Counting the number of bubbles produced in 1 minute is **not** an accurate way to measure the rate of photosynthesis.

Suggest **two** ways the method could be improved to measure the rate of photosynthesis more accurately.

[2 marks]

1 _____

_____

2 _____

_____

Question 3 continues on the next page

4.7.3.3 Land use

Question 01 · continued

0 3 . 4 The LED light source does **not** get hot.

Explain why it is important that the pondweed remains at a constant temperature.

[2 marks]

0 3 . 5 Light intensity can be calculated using the inverse square law:

$$I \propto \frac{1}{d^2}$$

Where I is light intensity and d is the distance of the pondweed from the light source.

The student placed the pondweed at 5, 10 and 20 cm from the light source.

Explain how light intensity changes as the distance of the pondweed from the light source is doubled.

You **must** include calculations in your answer.

[3 marks]

Question 01 · continued

0 3 . 6 The student's results are shown in **Table 1**

Table 1

Distance of the pondweed from the light source in cm	Number of bubbles produced in 1 minute
5	129
10	31
20	8

Predict how many bubbles of gas would be produced in 1 minute if the pondweed was placed 40 cm from the light source.

Give a reason for your prediction.

[2 marks]

0 3 . 7 Describe how the student could change the method to investigate the effect of carbon dioxide concentration on the rate of photosynthesis.

You should include:

- how to change the independent variable
- **two** control variables.

Use **Figure 5** on page 9 to help you answer this question.

[3 marks]

14

4.7.3.3 Land use

Question 02

0 4 A student investigated the effect of different concentrations of sugar solution on pieces of carrot.

This is the method used.

1. Weigh five pieces of carrot.
2. Place each piece into a different tube.
3. Into each tube add 20 cm^3 of water or one of the sugar solutions as shown in **Figure 6**
4. Leave the apparatus for 2 hours.
5. Remove the carrot and dry each piece on paper towel.
6. Reweigh each piece.
7. Calculate the percentage (%) change in mass of each piece.

Figure 6 shows how the investigation was set up.

Figure 6

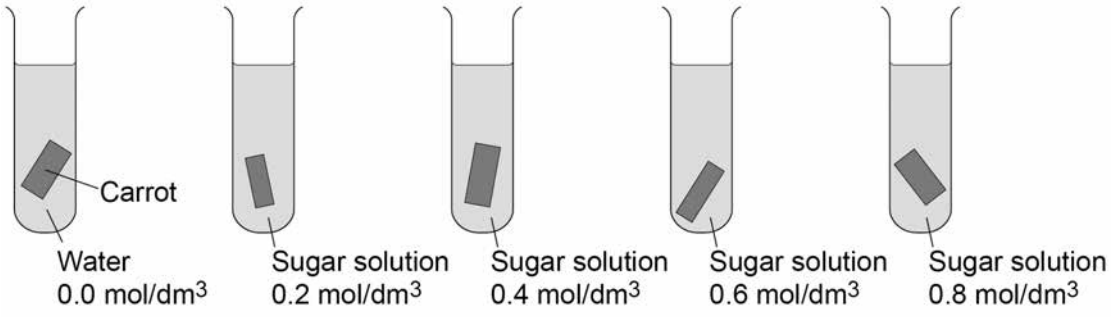


Table 2 shows the results.

Table 2

Concentration of sugar solution in mol/dm^3	Percentage (%) change in mass
0.0	+24
0.2	+12
0.4	+1
0.6	–8
0.8	–15

0 4 . 1 Suggest why the student calculated the percentage (%) change in mass of each piece of carrot.

[1 mark]

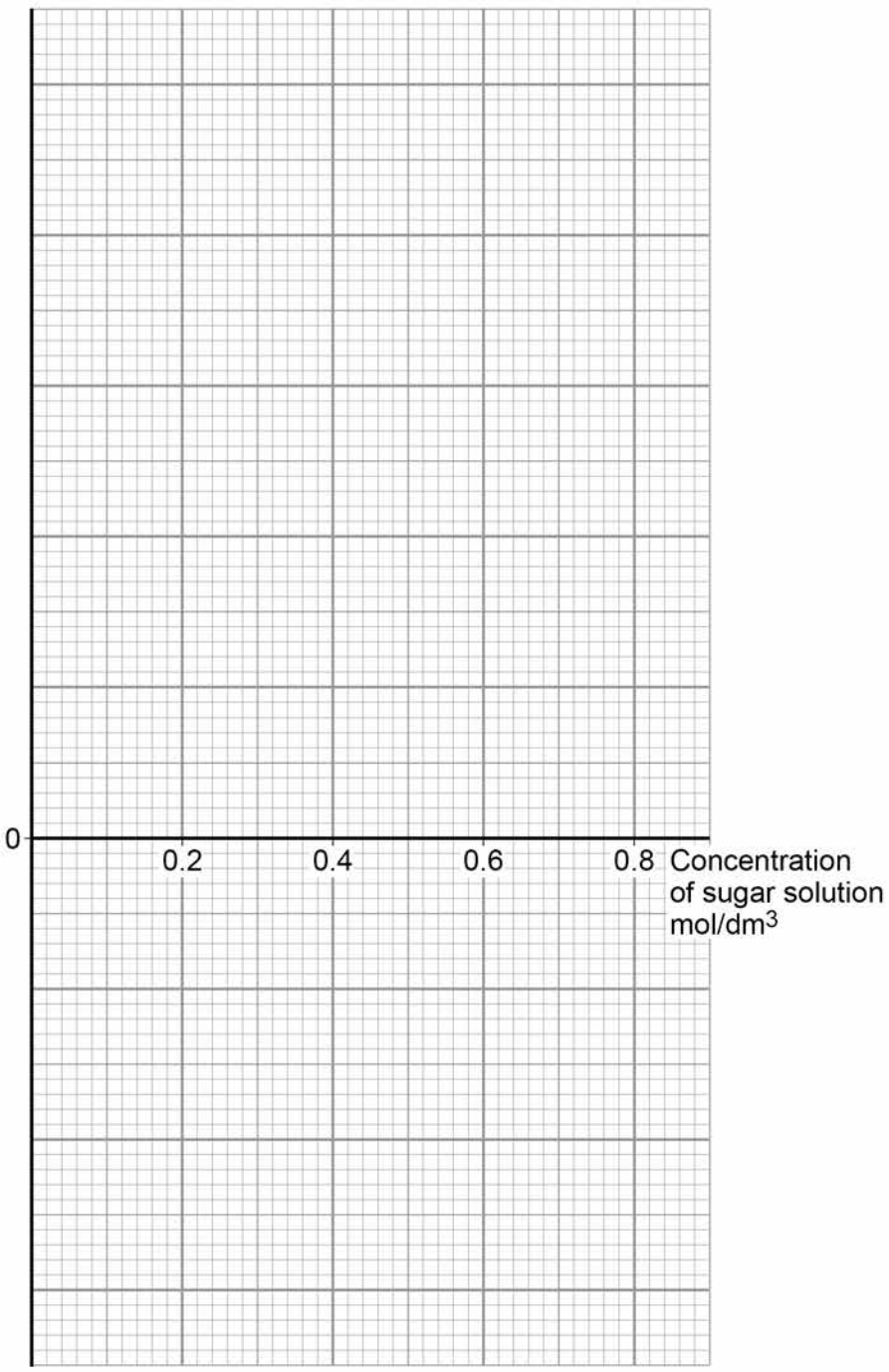
Question 02 · continued

0 4 . 2 Complete **Figure 7** using the results in **Table 2**

- Choose a suitable scale and label for the y-axis.
- Plot the results.
- Draw a line of best fit.

[4 marks]

Figure 7



Question 4 continues on the next page

4.7.3.3 Land use

0 4 . 3 Estimate the concentration of sugar solution inside the carrot cells.

Use your completed graph on **Figure 7**

[1 mark]

Concentration = _____ mol/dm^3

0 4 . 4 Explain why the mass of the carrot in the 0.6 mol/dm^3 sugar solution changed.

[4 marks]

0 4 . 5 The student repeated the investigation using boiled pieces of carrot.

The pieces of carrot did **not** change in mass.

Suggest why.

[1 mark]

11

4.7.3.3 Land use

Question 03

June 2018 | 8464/B/2H | Original Q1

0 1 Many biotic and abiotic factors can affect the growth of plants.

0 1 . 1 Are the factors in **Table 1** biotic or abiotic?

[2 marks]

Tick **one** box for each factor.

Table 1

Factor	Biotic	Abiotic
Diseases		
Herbivores		
Temperature		
Water		

Two students investigated the effect of light intensity on the distribution of small plants.

The plants are growing under a tree in a park.

The students made the following hypothesis:

'As you move outwards from a tree there will be more plant growth.'

0 1 . 2 Explain why the students thought their hypothesis would be correct.

[3 marks]

4.7.3.3 Land use

Question 03 · continued

0 1 . 3 The students used two pieces of equipment.

Give the scientific name of each piece of equipment.

[2 marks]

A square frame measuring 0.5 m × 0.5 m _____

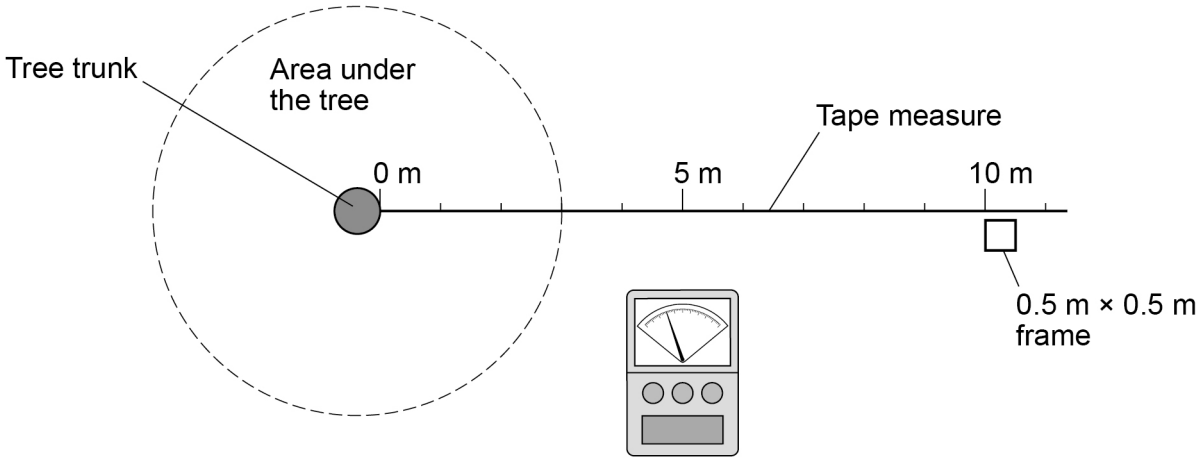
An electronic device to measure light intensity _____

This is the method used.

1. Fix one end of a tape measure at the base of the tree.
2. Fix the other end of the tape measure 11 metres from the tree.
3. At 0 metres put the square frame on the ground.
4. Identify all the plant species growing inside the frame.
5. Estimate and record the percentage cover of each plant species.
6. Measure the light intensity inside the frame.
7. Put the square frame on the ground every 2 metres along the tape to 10 metres.
8. Repeat steps 4 – 6 in every frame.

Figure 1 shows the equipment in this investigation.

Figure 1



0 1 . 4 Calculate the total area sampled.

[1 mark]

_____

_____

Total area sampled = _____ m^2

Question 03 · continued

0 1 . 5 The whole investigation was done as quickly as possible on the same day.

Suggest **one** reason why.

[1 mark]

0 1 . 6 Give **one** way the investigation could be improved.

[1 mark]

Table 2 shows the results.

Table 2

	Distance from tree in metres					
	0	**2**	**4**	**6**	**8**	**10**
Percentage cover of grass	15	50	35	16	15	15
Percentage cover of plantain	0	5	10	40	25	30
Percentage cover of daisy	0	0	0	4	20	10
Percentage cover of clover	1	10	25	40	40	45
Total percentage cover of plants	16	65	70	100	100	100
Light intensity in arbitrary units	37	59	150	175	>200	>200

0 1 . 7 Which plant species in **Table 2** will only grow at high light intensity?

[1 mark]

4.7.3.3 Land use

Question 03 · continued

0 1 . 8 What conclusion can be made about the relationship between light intensity and the total percentage cover of plants?

Use data from **Table 2** in your answer.

[2 marks]

0 1 . 9 Light intensity might **not** be the cause of this pattern of plant distribution.

Suggest **one** different factor that may cause these results.

Give **one** reason for your answer.

[2 marks]

Factor

Reason

15

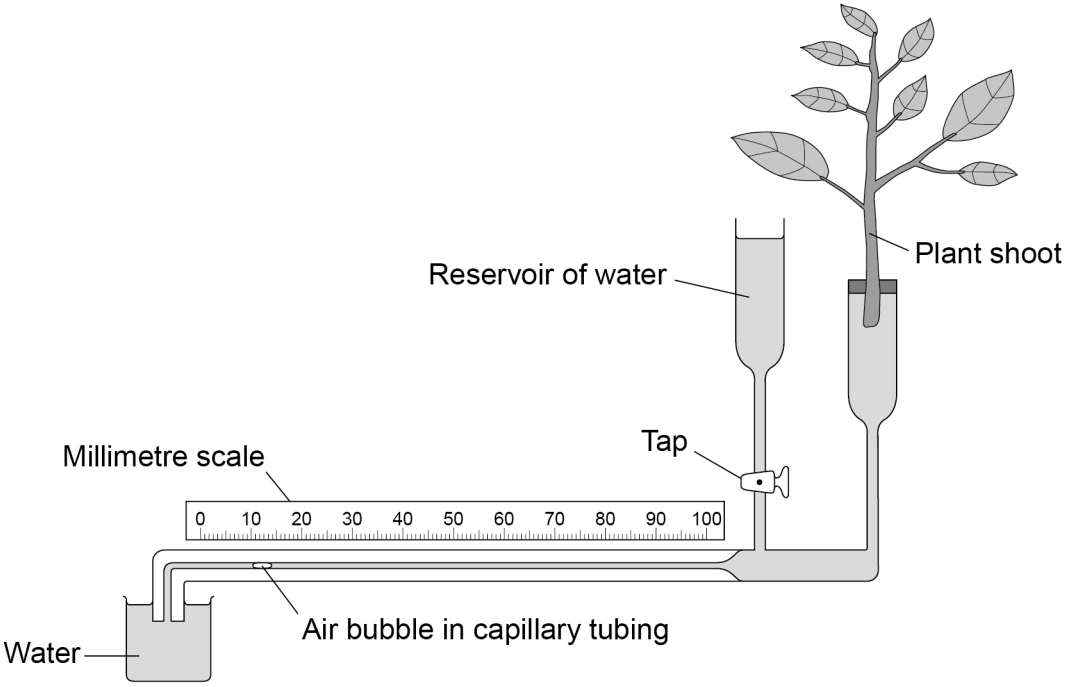
4.7.3.3 Land use

Question 04

0 3 A student used a potometer to investigate the rate of water uptake in a plant shoot.

Figure 3 shows a potometer.

Figure 3



As the shoot takes in water the air bubble moves.

The rate of water uptake is the distance the air bubble moves in a given time.

This is the method used.

1. Place the potometer in moist air at 25 °C
2. Position the air bubble at 0 mm in the capillary tube.
3. Record the position of the air bubble in the capillary tube every minute for 5 minutes.
4. Repeat steps 2 and 3 with the potometer in different conditions.

Table 3 shows the conditions used.

Table 3

Investigation	Conditions
A	Moist air at 25 °C
B	Dry air at 15 °C
C	Dry air at 25 °C

0 3 . 1 After investigation **A** the air bubble had moved part way along the capillary tube.

Suggest how the student moved the air bubble back to 0 mm for the start of investigation **B**.

[1 mark]

0 3 . 2 Capillary tubing is very narrow.

Explain why narrow tubing was used.

[2 marks]

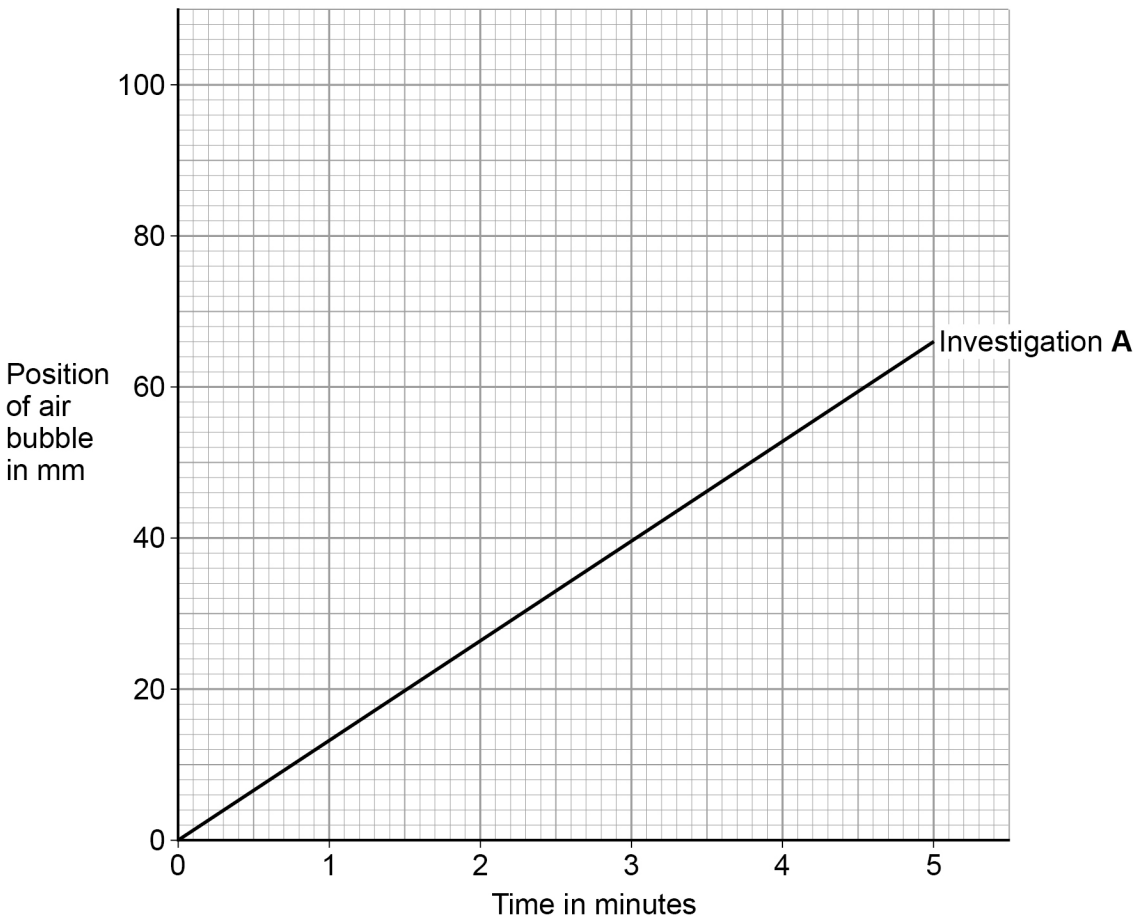
Question 3 continues on the next page

4.7.3.3 Land use

Question 04 · continued

Figure 4 shows the results for investigation **A**.

Figure 4



0 3 . 3 The cross-sectional area of the capillary tube was 0.8 mm^2

Calculate the rate of water uptake for investigation **A** in mm^3/min

[3 marks]

Rate = _____ mm^3/min

4.7.3.3 Land use

Question 04 · continued

0 3 . 4 **Table 4** shows the results from investigation **B**.

Table 4

Time in minutes	Position of air bubble in mm
0	0
1	6
2	16
3	22
4	30
5	42

Plot the data from **Table 4** on **Figure 4**.

You should:

- draw a line of best fit
- label the line **B**.

[3 marks]

0 3 . 5 Investigation **C** was carried out in dry air at 25 °C

Draw a line on **Figure 4** to show the results you would expect for investigation **C**.

Label the line **C**.

[1 mark]

0 3 . 6 The investigations were carried out in daylight.

The air bubble would **not** move if the investigations were done in the dark.

Explain why.

[3 marks]

4.7.3.3 Land use

Question 05

June 2019 | 8464/B/2H | Original Q1

0 1 Some students investigated the effect of drinking caffeine on reaction time.

They used a drink containing 32.25 mg of caffeine per 100 cm^3

This is the method used.

1. Divide the students into four groups, **A**, **B**, **C** and **D**.
2. Measure and record the reaction time of each student using the ruler-drop test.
3. Students in:
   - group **A** drink 200 cm^3 of water
   - group **B** drink 200 cm^3 of the caffeine drink
   - group **C** drink 400 cm^3 of the caffeine drink
   - group **D** drink 600 cm^3 of the caffeine drink.
4. Repeat step 2 after 15 minutes.

0 1 . 1 Describe how to do the ruler-drop test.

[3 marks]

Question 1 continues on the next page

Question 05 · continued

0 1 . 2 **Table 1** shows the mass of caffeine taken in by each student.

Table 1

Group	Mass of caffeine in mg
A	0
B	64.5
C	129.0
D	**X**

Calculate value **X**.

[1 mark]

X = _____ mg

0 1 . 3 Why did group **A** drink water instead of the caffeine drink?

[1 mark]

4.7.3.3 Land use

Question 05 · continued

Table 2 was used to convert the results of the ruler-drop test into reaction times.

Table 2

Distance in cm	Reaction time in s	Distance in cm	Reaction time in s
2	0.064	28	0.239
4	0.090	30	0.247
6	0.111	32	0.256
8	0.128	34	0.263
10	0.143	36	0.271
12	0.156	38	0.278
14	0.169	40	0.286
16	0.181	42	0.293
18	0.192	44	0.300
20	0.202	46	0.306
22	0.212	48	0.313
24	0.221	50	0.319
26	0.230	52	0.326

0 1 . 4 Estimate the reaction time for a student who recorded a distance of 23 cm

[1 mark]

Reaction time = _____ s

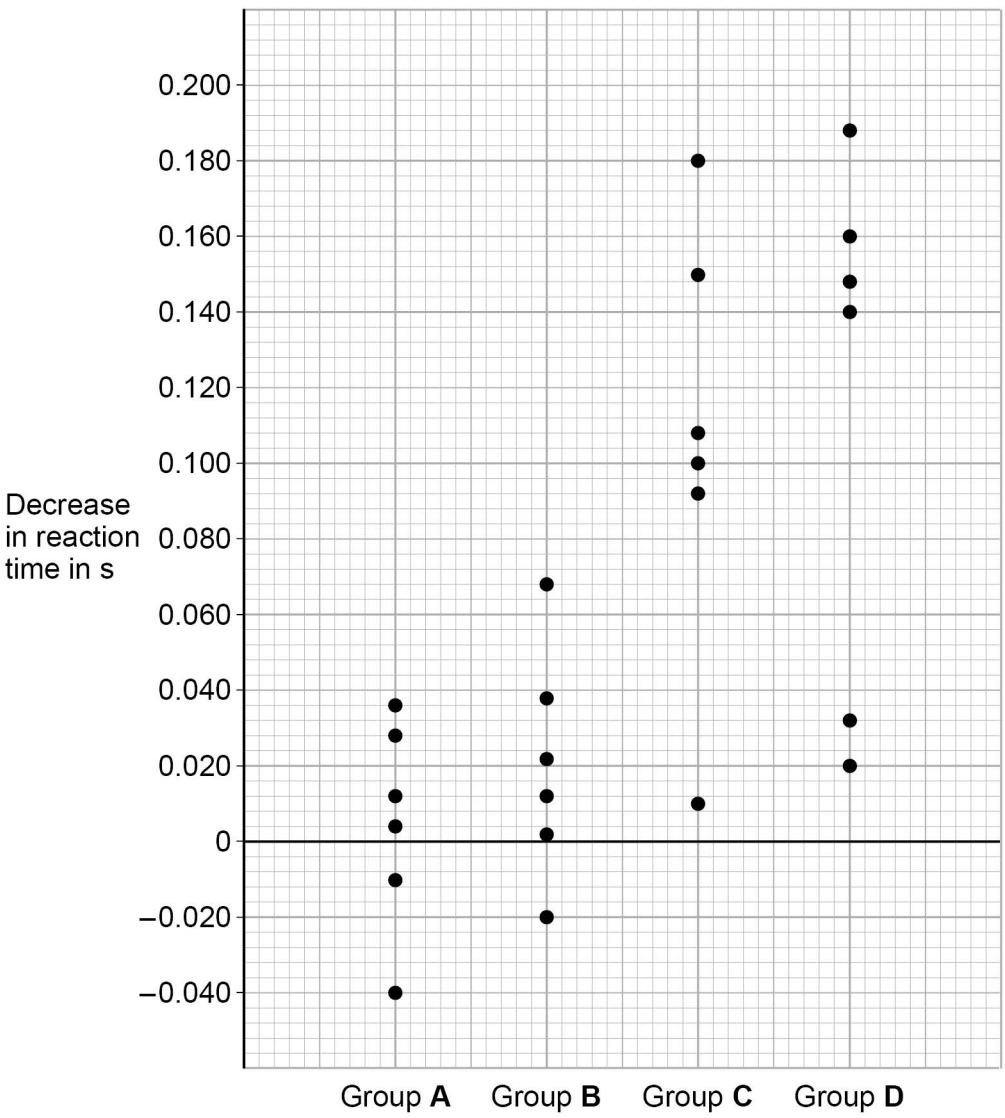
Question 1 continues on the next page

Question 05 · continued

Students calculated the decrease in their reaction time after the drink compared with before the drink.

Figure 1 shows the results for each student.

Figure 1



0 1 . 5 Describe the effect of the mass of caffeine taken in on the decrease in reaction time.

[1 mark]

4.7.3.3 Land use

Question 05 · continued

0 1 . 6 For three students the decrease in reaction time was negative.

Give the reason why the value was negative.

[1 mark]

0 1 . 7 What is the range of results for group **C**?

[1 mark]

0 1 . 8 Suggest **two** variables that should have been controlled in this investigation.

[2 marks]

1

2

0 1 . 9 Explain why the ruler-drop test does **not** involve a reflex action.

[2 marks]

13

4.7.3.3 Land use

Question 06

June 2019 | 8464/B/2H | Original Q5

0 5 Some students estimated the population of daisies in a school field.

This is the method used.

1. Find a place where some daisies are growing.
2. Put the quadrat down.
3. Count and record the number of daisies in the quadrat.
4. Repeat steps 1–3 at four different places in the field.
5. Calculate the mean number of daisies per quadrat.
6. Use the data to estimate the total number of daisies in the field.

0 5 . 1 Which **two** improvements would increase the validity of this method?

[2 marks]

Tick (✓) **two** boxes.

- Do not put any quadrats near trees. ☐
- Repeat for another ten quadrats. ☐
- Use a long tape measure. ☐
- Use a random method to place the quadrats. ☐
- Use the same person to place all the quadrats. ☐

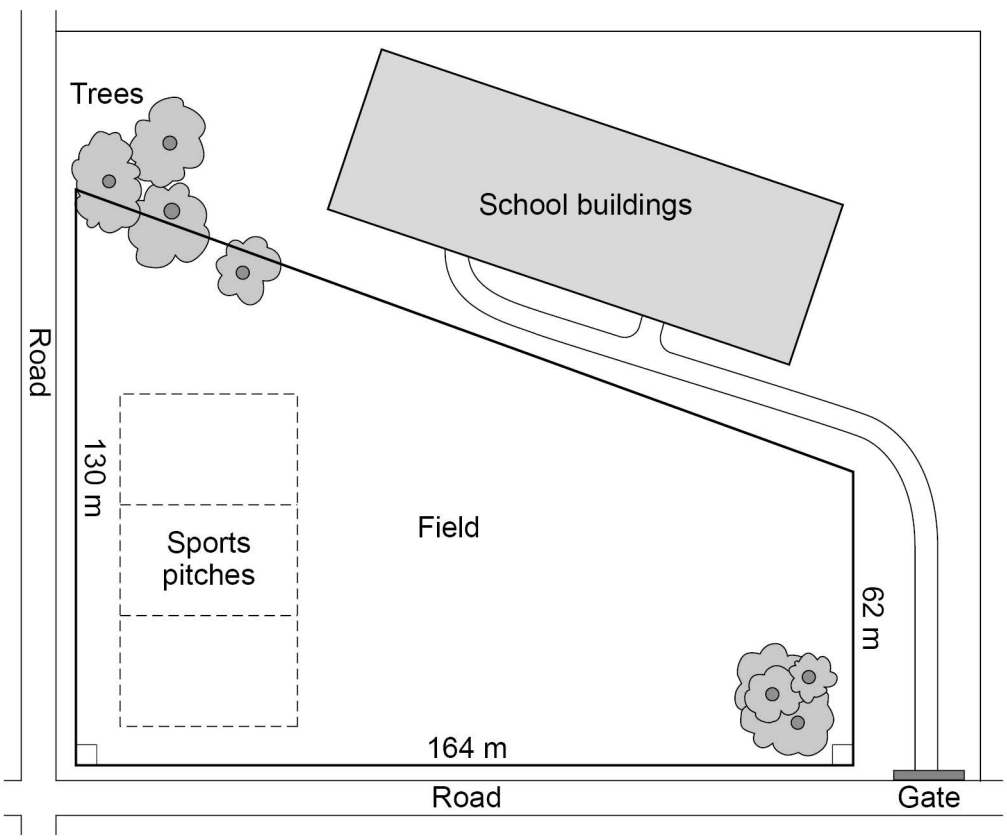
Question 5 continues on the next page

0 5 . 2 With an improved method the students calculated the mean number of daisy plants to be 7.65 per quadrat.

The students used a quadrat measuring 50 cm × 50 cm

Figure 3 shows the school site and the dimensions of the school field.

Figure 3



4.7.3.3 Land use

Question 06 · continued

Calculate the population of daisy plants on the school field.

Give your answer in standard form to 2 significant figures.

[5 marks]

Population of daisy plants = _____

Question 5 continues on the next page

4.7.3.3 Land use

Question 06 · continued

0 5 . 3 The students noticed a very uneven distribution of daisy plants in the field.

Explain how different biotic factors **and** abiotic factors could have caused an uneven distribution of daisy plants.

Use **Figure 3** on page 20.

[6 marks]

13

4.7.3.3 Land use

Question 07

November 2020 | 8464/B/1H | Original Q1

0 1 A student investigated the effect of different concentrations of sugar solution on pieces of potato.

This is the method used.

1. Cut five pieces of potato.

2. Record the starting mass of each piece of potato.

3. Place each piece of potato in a different concentration of sugar solution.

4. After 24 hours remove the pieces of potato from the solutions.

5. Record the final mass of each piece of potato.

6. Calculate the change in mass for each piece of potato.

0 1 . 1 What is the independent variable?

[1 mark]

Tick (✓) **one** box.

- Change in mass of the pieces of potato ☐
- Concentration of the sugar solution ☐
- Length of time the pieces of potato are in the solution ☐
- Starting mass of the pieces of potato ☐

Question 1 continues on the next page

Question 07 · continued

Table 1 shows the results.

Table 1

Concentration of sugar solution in mol/dm^3	Mass of potato at start in grams	Mass of potato after 24 hours in grams	Change in mass in grams
0.0	7.94	10.14	2.20
0.1	7.95	9.10	1.15
0.2	7.96	8.21	0.25
0.3	7.93	7.53	–0.40
0.4	7.93	7.18	–0.75
0.5	7.95	7.00	–0.95

0 1 . 2 Explain why the potato in 0.0 mol/dm^3 sugar solution increased in mass.

[2 marks]

Question 07 · continued

0 1 . 3 Complete **Figure 1**.

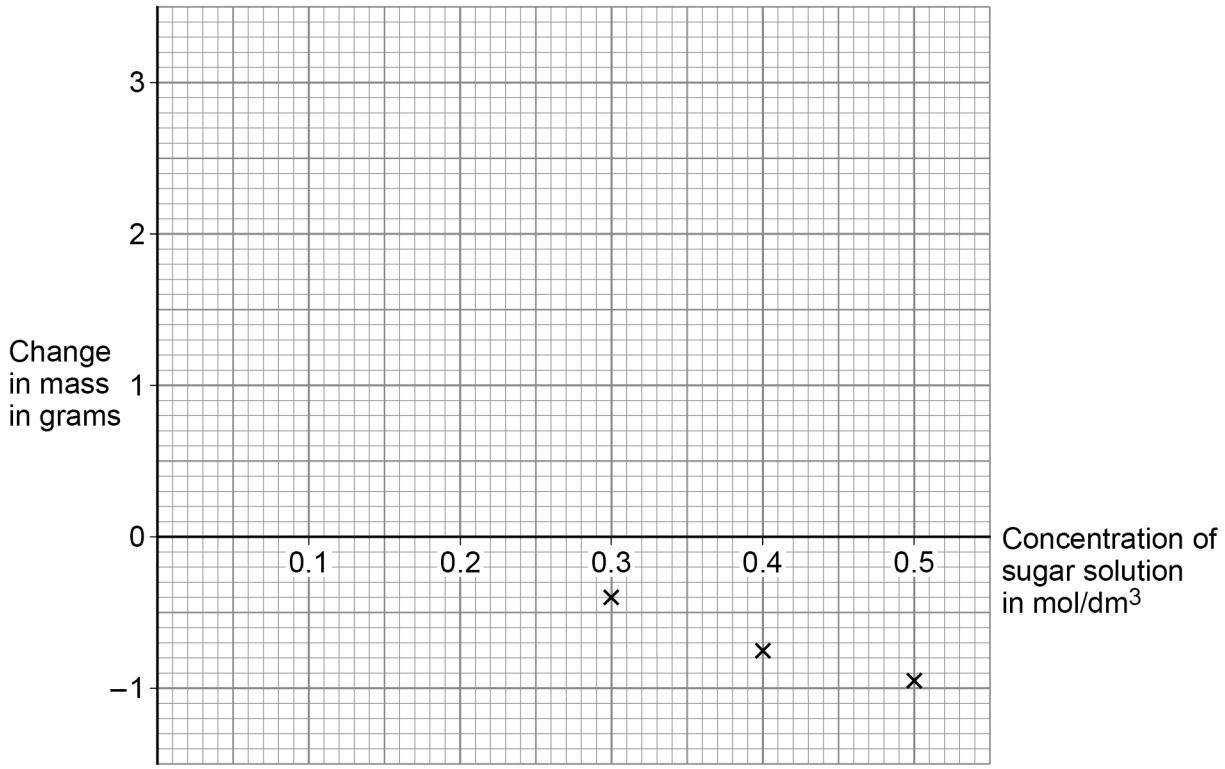
Some of the results have been plotted for you.

You should:

- plot the data from **Table 1**
- draw a line of best fit through all the points.

[2 marks]

Figure 1



0 1 . 4 The mass of a piece of potato does **not** change when:

concentration of solution inside cells = concentration of solution outside cells

Determine the concentration of sugar solution inside the potato cells.

Use **Figure 1**.

[1 mark]

Concentration = _____ mol/dm^3

Table 1 is repeated below.

Table 1

Concentration of sugar solution in mol/dm^3	Mass of potato at start in grams	Mass of potato after 24 hours in grams	Change in mass in grams
0.0	7.94	10.14	2.20
0.1	7.95	9.10	1.15
0.2	7.96	8.21	0.25
0.3	7.93	7.53	–0.40
0.4	7.93	7.18	–0.75
0.5	7.95	7.00	–0.95

0 1 . 5 Calculate the percentage change in mass for the potato in 0.2 mol/dm^3 sugar solution.

Use **Table 1**.

Use the equation:

$$\text{percentage change in mass} = \frac{\text{change in mass}}{\text{mass of potato at start}} \times 100$$

Give your answer to 3 significant figures.

[3 marks]

Percentage change in mass (3 significant figures) = _____ %

9

4.7.3.3 Land use

Question 08

November 2020 | 8464/B/1H | Original Q2

0 2 Starch is digested to form sugar molecules in the digestive system.

0 2 . 1 What is the name of the enzyme that digests starch?

[1 mark]

_____

0 2 . 2 Where are most food molecules absorbed?

[1 mark]

Tick (✓) **one** box.

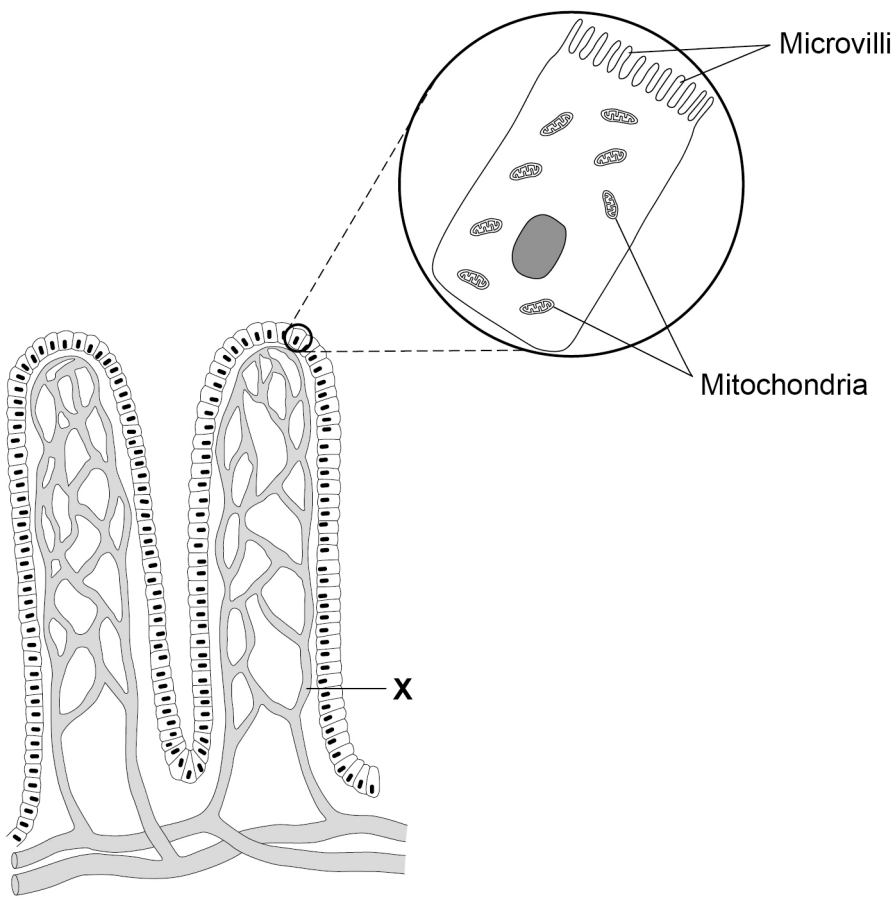
- Large intestine ☐
- Liver ☐
- Small intestine ☐
- Stomach ☐

Question 2 continues on the next page

Figure 2 shows two villi.

Figure 2 also shows one cell on the surface of a villus as seen using an electron microscope.

Figure 2



0 2 . 3 Give **one** advantage of using an electron microscope compared with using a light microscope.

[1 mark]

0 2 . 4 What type of blood vessel is labelled **X**?

[1 mark]

Tick (✓) **one** box.

Artery ☐

Capillary ☐

Vein ☐

0 2 . 5 The real length of one villus is 0.8 mm

Calculate the image length if the villus is viewed at a magnification of ×20

Use the equation:

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

[3 marks]

Image length = _____ mm

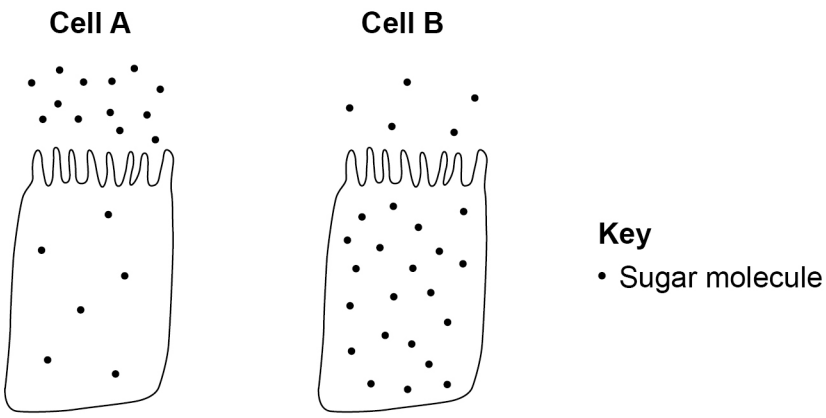
Question 2 continues on the next page

Question 08 · continued

Figure 3 shows two cells from the surface of a villus.

There are sugar molecules inside and next to each cell.

Figure 3



0 2 . 6 Name the process by which sugar moves into cell **A**.

[1 mark]

0 2 . 7 Name the process by which sugar moves into cell **B**.

[1 mark]

0 2 . 8 Give **one** use of sugar in the body.

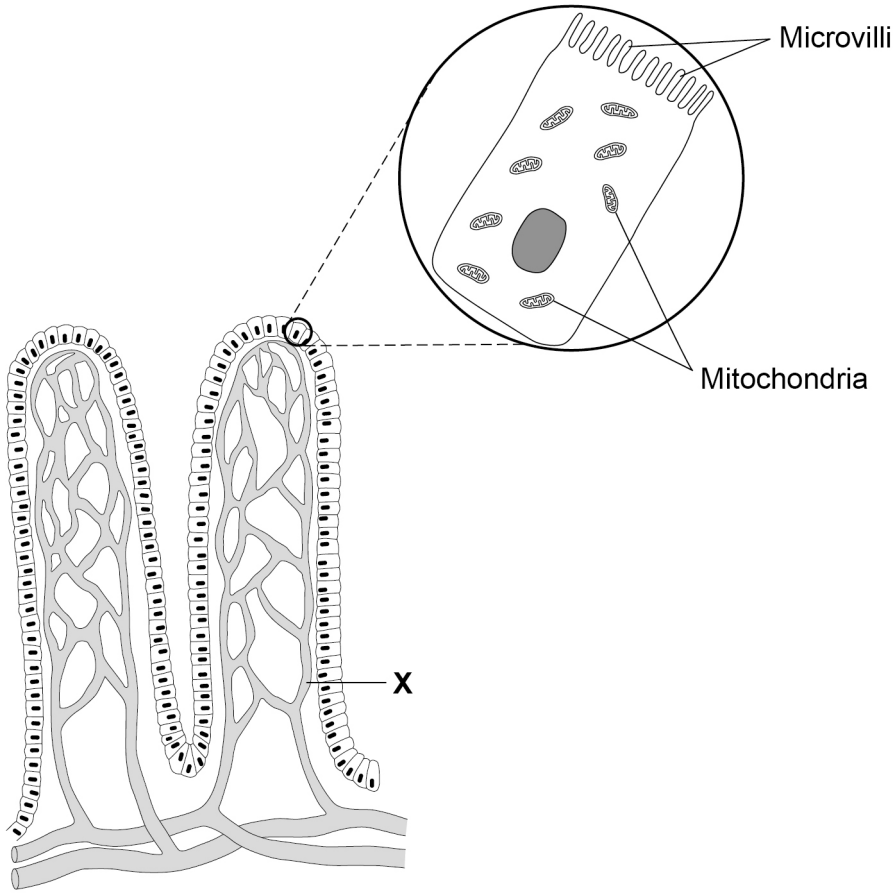
[1 mark]

4.7.3.3 Land use

Question 08 · continued

0 2 . 9 **Figure 2** is repeated below.

Figure 2



Explain how villi are adapted for efficient absorption of sugar molecules.

[4 marks]

14

4.7.3.3 Land use

Question 09

November 2020 | 8464/B/2H | Original Q3

0 3 There is a need to grow enough food for all the people in the world.

Growing enough food affects habitats and biodiversity.

0 3 . 1 What is meant by the term biodiversity?

[1 mark]

Peat bogs are being destroyed because peat is used by humans.

Destroying peat bogs also reduces biodiversity.

0 3 . 2 Give **one** use of peat taken from peat bogs.

[1 mark]

0 3 . 3 Explain why the use of peat is harmful to the environment.

Do **not** refer to biodiversity in your answer.

[2 marks]

4.7.3.3 Land use

Question 09 · continued

0 3 . 4 Intensive farming, where a single crop is grown on a large area of land year after year, is more cost effective for farmers.

It is efficient to use fertilisers and to burn the waste so the land is ready to use the next year.

Planting a single crop reduces biodiversity.

Suggest **two** ways that this type of farming can damage the environment.

Do **not** refer to biodiversity in your answer.

[2 marks]

1 _____

_____

2 _____

_____

0 3 . 5 Most of the world's production of antibiotics is used in farming.

Antibiotics are given to animals to prevent the spread of disease.

Explain how the widespread use of antibiotics in farming is a threat to human life.

[4 marks]

_____

_____

_____

_____

_____

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_____

10

4.7.3.3 Land use

Question 10

November 2021 | 8464/B/1H | Original Q1

0 1 Plants absorb light for photosynthesis.

0 1 . 1 Which is the equation for photosynthesis?

[1 mark]

Tick (✓) **one** box.

$C_6H_{12}O_6 + 6\,O_2 \rightarrow 6\,CO_2 + 6\,H_2O$ ☐

$6\,CO_2 + 6\,H_2O \rightarrow C_6H_{12}O_6 + 6\,O_2$ ☐

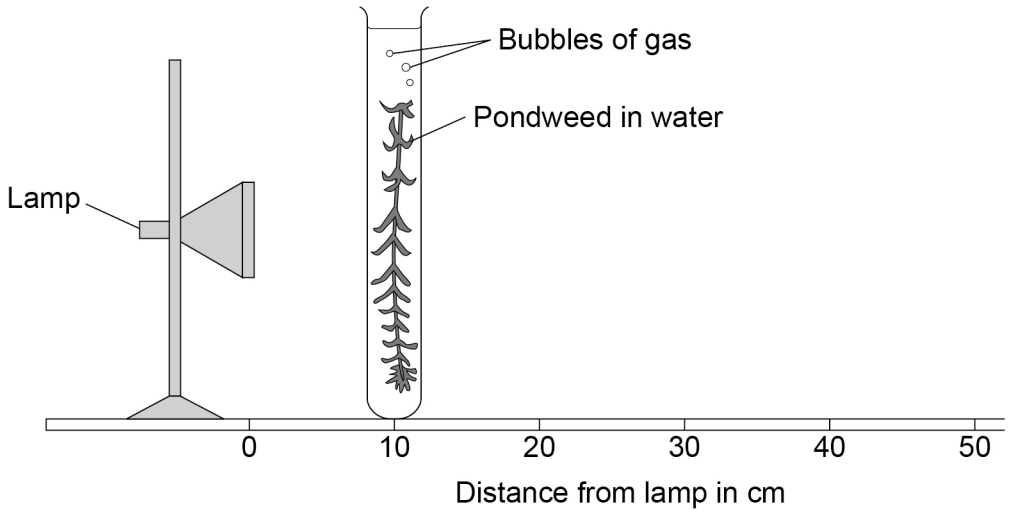
$6\,H_2O + 6\,O_2 \rightarrow C_6H_{12}O_6 + 6\,CO_2$ ☐

$6\,O_2 + 6\,CO_2 \rightarrow C_6H_{12}O_6 + 6\,H_2O$ ☐

A student investigated the effect of light intensity on the rate of photosynthesis.

Figure 1 shows the apparatus.

Figure 1



Question 10 · continued

This is the method used.

1. Set up the apparatus as shown in **Figure 1**.
2. Place the pondweed 10 cm away from the lamp.
3. Switch on the lamp.
4. Record the number of bubbles of gas produced in 5 minutes.
5. Repeat steps 2 to 4 with the pondweed at different distances from the lamp.

0 1 . 2 What was the independent variable in this investigation?

[1 mark]

Tick (✓) **one** box.

- Distance of the pondweed from the lamp ☐
- Length of the piece of pondweed ☐
- Number of bubbles of gas produced ☐
- Time taken to collect the gas ☐

Question 1 continues on the next page

Question 10 · continued

The lamp gets warm when it is on. This causes the temperature of the water to increase.

0 1 . 3 Explain how an increase in temperature would affect the results of this investigation.

[2 marks]

0 1 . 4 Suggest **one** way the investigation could be improved so the temperature of the water does **not** increase.

[1 mark]

0 1 . 5 Suggest **two** improvements to the investigation so the results would be more valid.

Do **not** refer to controlling the temperature of the water.

[2 marks]

1

2

Table 1 shows the results.

Table 1

Distance of pondweed from the lamp in cm	Number of bubbles of gas produced in 5 minutes
10	120
20	56
30	31
40	16
50	10

0 1 . 6 Calculate the rate of photosynthesis when the pondweed was 40 cm from the lamp.

Give the rate of photosynthesis as the number of bubbles of gas produced per minute.

[1 mark]

Rate = _____ bubbles of gas produced per minute

0 1 . 7 Give **one** conclusion that can be made from **Table 1**.

[1 mark]

4.7.3.3 Land use

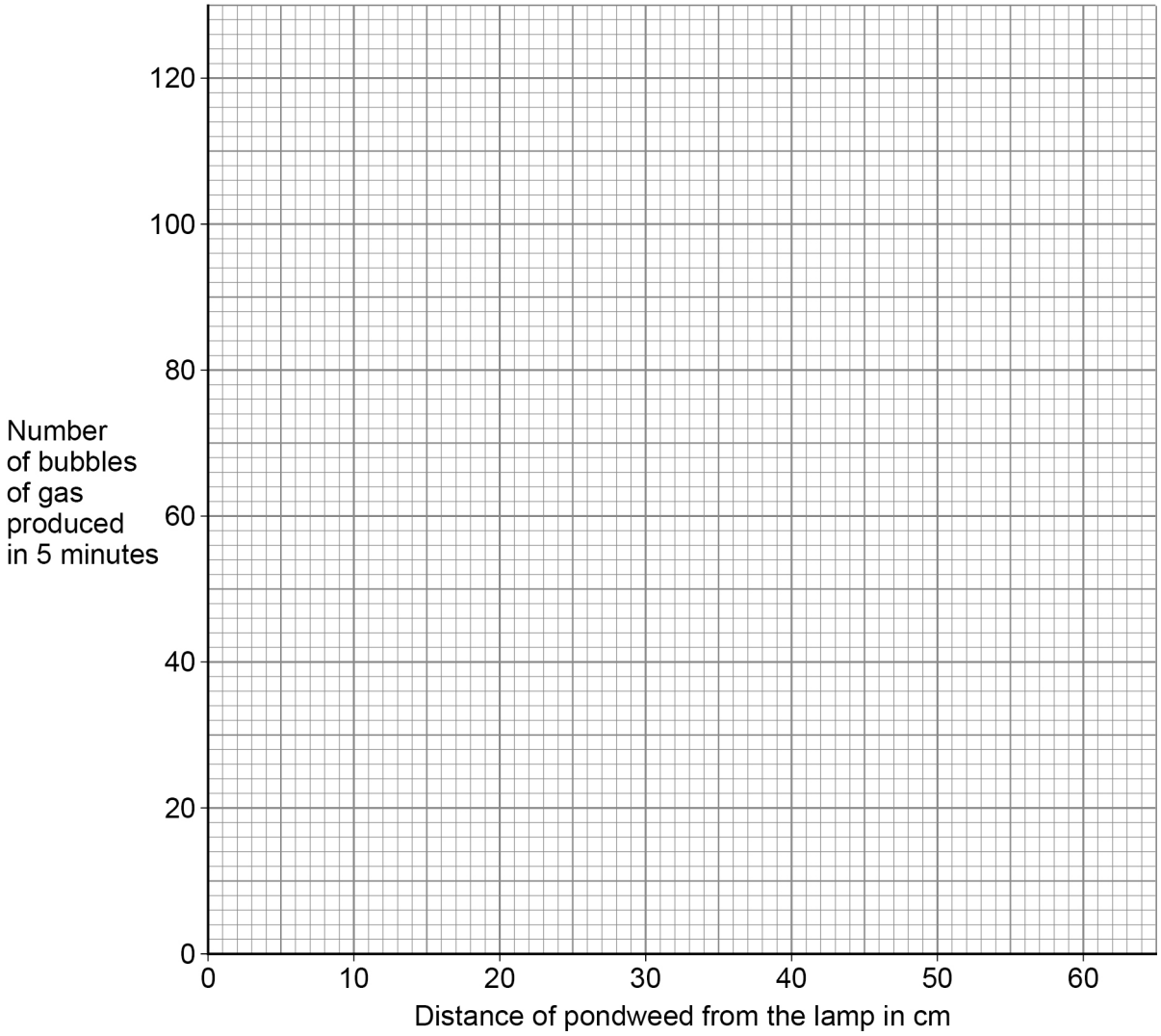
Question 10 · continued

0 1 . 8 Plot the data from **Table 1** on **Figure 2**.

Draw a line of best fit.

[3 marks]

Figure 2



0 1 . 9 Predict the number of bubbles that would be produced in 5 minutes if the pondweed was 60 cm from the lamp.

Use **Figure 2**.

[1 mark]

Number of bubbles produced in 5 minutes = _____

13

4.7.3.3 Land use

Question 11

November 2021 | 8464/B/1H | Original Q3

0 3 Fermentation in yeast is used in the manufacture of bread and alcoholic drinks.

The equation for fermentation is:

glucose → ethanol + carbon dioxide

0 3 . 1 Fermentation is an exothermic reaction.

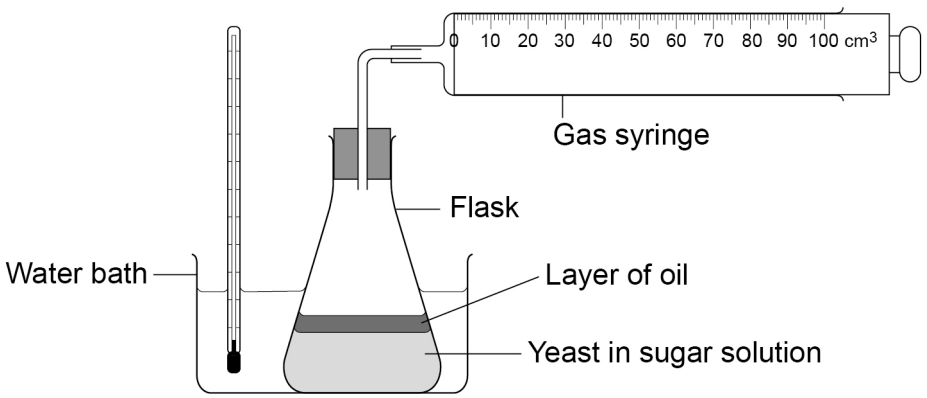
What does exothermic mean?

[1 mark]

A student investigated the effect of temperature on fermentation in yeast.

Figure 3 shows the apparatus.

Figure 3



Question 11 · continued

This is the method used.

1. Mix yeast with sugar solution in a flask.
2. Pour a layer of oil over the surface of the mixture.
3. Put the flask in a water bath at 2 °C and leave for 20 minutes.
4. Attach a gas syringe.
5. Record the volume of gas collected every 5 minutes for 30 minutes.
6. After 30 minutes move the flask to a water bath at 35 °C.
7. Continue to record the volume of gas collected every 5 minutes.

0 3 . 2 Suggest why a layer of oil was needed on the surface of the mixture.

[1 mark]

0 3 . 3 Suggest why the mixture was left for 20 minutes before the gas syringe was attached.

[1 mark]

Question 3 continues on the next page

Question 11 · continued

Steps 1 to 4 of the method were repeated at 35 °C.

The volume of gas collected was recorded every 5 minutes for 45 minutes.

Table 2 shows the results for both flasks for the first 30 minutes.

Table 3 shows the results for the last 15 minutes, when both flasks were at 35 °C.

Table 2

Time in minutes	Volume of gas collected in cm^3	
	Flask at 2 °C	Flask at 35 °C
0	0	0
5	0	26
10	0	52
15	0	78
20	0	98
25	0	108
30	0	115

Table 3

Time in minutes	Volume of gas collected in cm^3	
	Flask at 2 °C moved to 35 °C	Flask kept at 35 °C
35	2	120
40	7	123
45	22	124

4.7.3.3 Land use

Question 11 · continued

0 3 . 4 Explain the results from 0 minutes to 45 minutes for the flask that was at 2 °C and was then moved to 35 °C.

Use **Table 2** and **Table 3**.

[3 marks]

0 3 . 5 Explain the results from 0 minutes to 45 minutes for the flask kept at 35 °C.

Use **Table 2** and **Table 3**.

[4 marks]

10

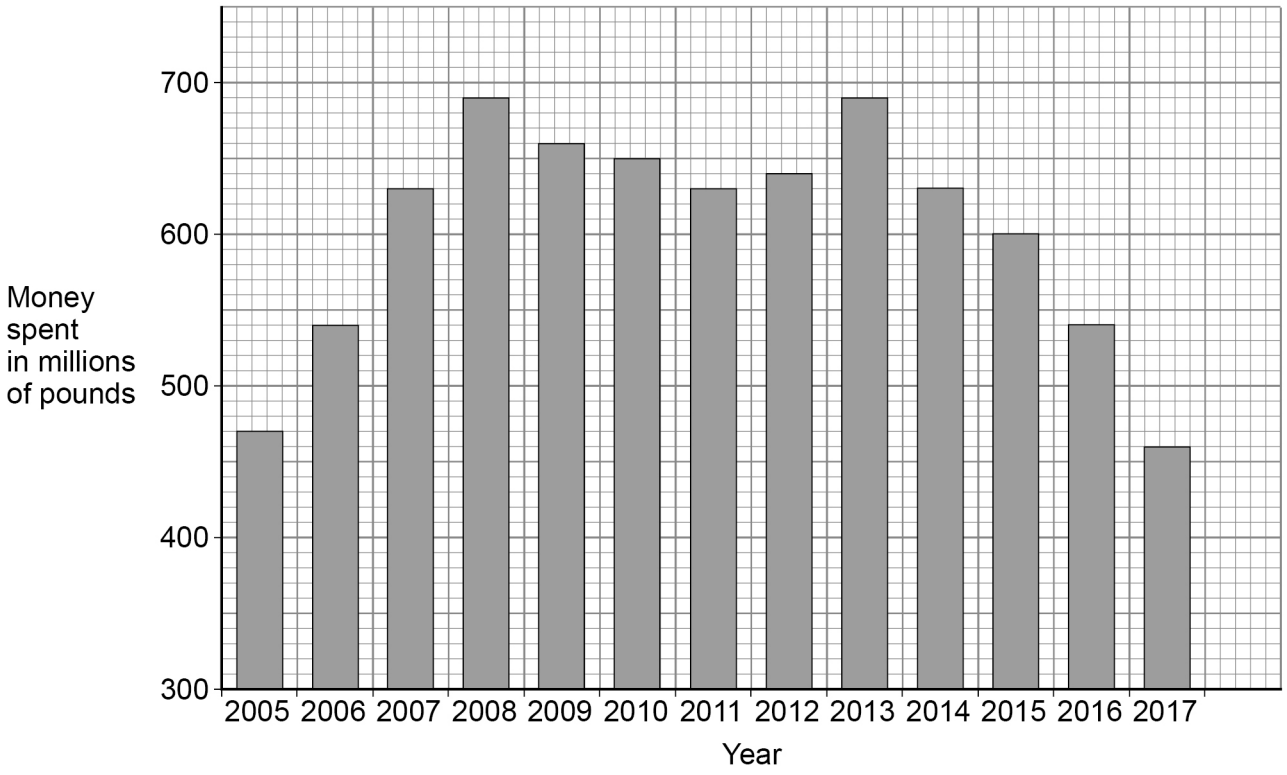
4.7.3.3 Land use

Question 12

November 2021 | 8464/B/2H | Original Q2

0 2 **Figure 2** shows the money spent on conserving biodiversity in the UK by the government.

Figure 2



0 2 . 1 Describe the trends in the money spent on conserving biodiversity from 2005 to 2011.

Use data from **Figure 2** in your answer.

[2 marks]

4.7.3.3 Land use

Question 12 · continued

0 2 . 2 Calculate the percentage decrease in the money spent on conserving biodiversity from 2013 to 2017.

Use the equation:

$$\text{percentage decrease} = \frac{\text{change in money spent from 2013 to 2017}}{\text{money spent in 2013}} \times 100$$

Give your answer to 2 significant figures.

[3 marks]

Percentage decrease (2 significant figures) = _____ %

0 2 . 3 Conservation of peat bogs can help maintain biodiversity.

Give **two** uses of peat taken from peat bogs.

[2 marks]

1 _____

2 _____

Question 2 continues on the next page

4.7.3.3 Land use

Question 12 · continued

0 2 . 4 Describe **two** ways to **increase** biodiversity in the UK.

Do **not** refer to money spent or to peat in your answer.

[2 marks]

1 _____

_____

2 _____

_____

9

4.7.3.3 Land use

Question 13

November 2021 | 8464/B/2H | Original Q5

0 5 Caffeine is a drug that decreases reaction time.

A group of sixteen students investigated the effect of caffeine on reaction time.

The students were all 15-year-old girls.

The group was divided into 8 pairs of students.

This is the method used.

1. Student **A** starts two stopwatches at the same time.
2. Student **A** then gives one of the stopwatches to Student **B**.
3. Student **A** says "stop" at the same time as stopping her stopwatch. Student **B** stops her stopwatch as quickly as possible after Student **A** says "stop".
4. The difference in time shown on the two stopwatches is recorded. This is the reaction time of Student **B**.
5. Student **B** drinks a caffeinated drink.
6. The students wait 15 minutes and then repeat steps 1 to 4.

0 5 . 1 Suggest **one** control variable the students should have used in the investigation.

Do **not** refer to age or sex in your answer.

[1 mark]

4.7.3.3 Land use

Question 13 · continued

0 5 . 2 Suggest **two** sources of random error when using this method to measure a person's reaction time.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Question 5 continues on the next page

Table 1 shows the results.

Table 1

Student pair	Decrease in reaction time after drinking the caffeinated drink in seconds
1	0.039
2	0.021
3	0.027
4	0.041
5	0.022
6	0.036
7	0.024
8	0.097

0 5 . 3 Why can a mode **not** be determined for the data in **Table 1**?

[1 mark]

0 5 . 4 The students decided the result from pair **8** was anomalous.

The students calculated that the mean decrease in reaction time was 0.030 seconds.

Describe how the students calculated the mean decrease in reaction time.

[1 mark]

4.7.3.3 Land use

Question 13 · continued

0 5 . 5 Caffeine causes the release of adrenaline.

Adrenaline affects heart rate.

Explain how the effect of adrenaline on heart rate might cause reaction time to decrease.

[4 marks]

Question 5 continues on the next page

Question 13 · continued

Adenosine is a different chemical made by the body.

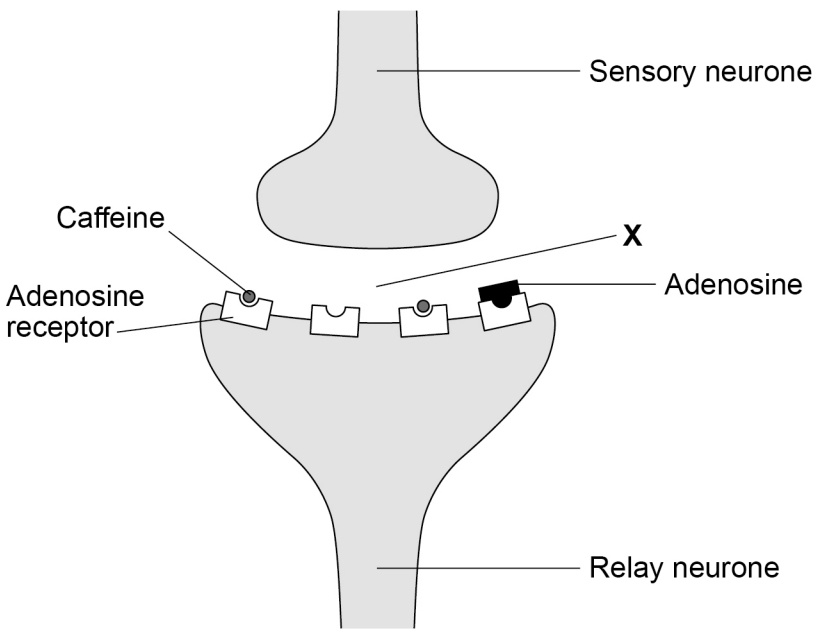
Adenosine binds to receptors on relay neurones.

Adenosine decreases the number of impulses in relay neurones.

Figure 5 shows how caffeine binds to adenosine receptors on a relay neurone.

When caffeine binds to adenosine receptors it blocks the receptor so adenosine cannot bind.

Figure 5



0 5 . 6 Label **X** shows the gap between the sensory neurone and the relay neurone.

What is the name of the gap labelled **X**?

[1 mark]

4.7.3.3 Land use

Question 13 · continued

0 5 . 7 Suggest why reaction time decreases when caffeine binds to adenosine receptors.

[2 marks]

12

Turn over for the next question

4.7.3.3 Land use

Question 14

June 2022 | 8464/B/1H | Original Q5

0 5 This question is about tumours.

0 5 . 1 Describe the similarities and differences between benign tumours and malignant tumours.

[4 marks]

Question 5 continues on the next page

4.7.3.3 Land use

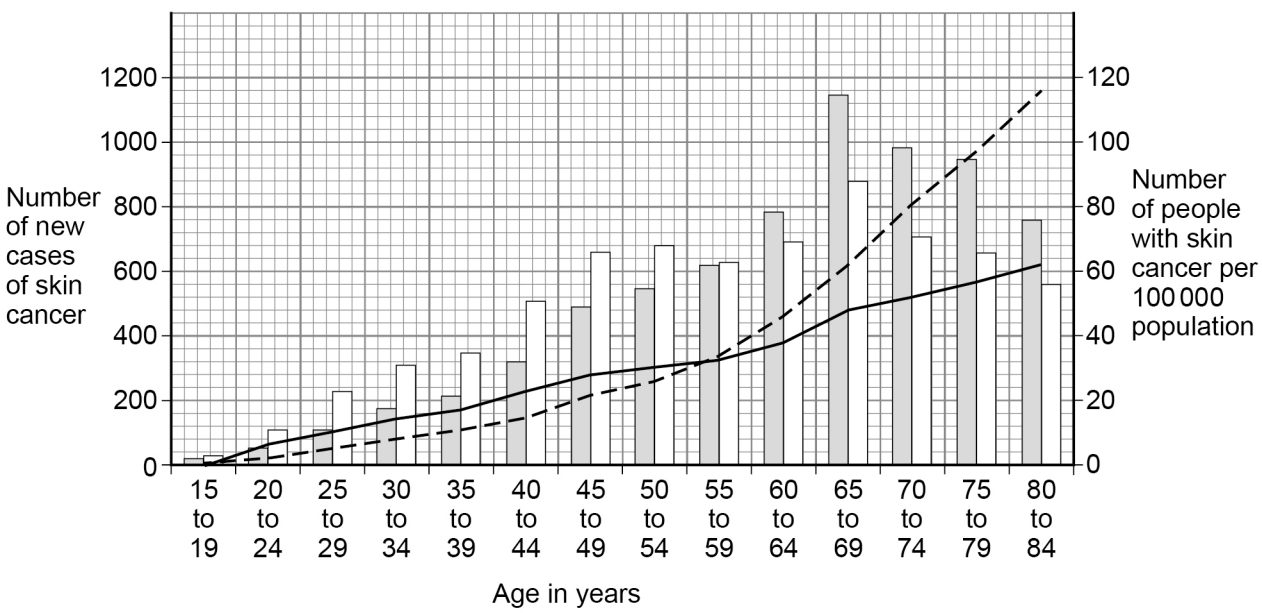
Question 14 · continued

Figure 10 shows data about skin cancer in males and females for different age groups in the UK.

It shows:

- the number of new cases of skin cancer in 1 year
- the number of people with skin cancer per 100 000 population in 1 year.

Figure 10



Key

New male cases

New female cases

Number of males with skin cancer per 100 000

Number of females with skin cancer per 100 000

4.7.3.3 Land use

Question 14 · continued

0 5 . 2 There are no new cases of skin cancer diagnosed in people younger than 15 years of age.

Explain why.

[2 marks]

0 5 . 3 Give **two** conclusions about the number of **new cases** of skin cancer.

Use **Figure 10**.

[2 marks]

1

2

0 5 . 4 The data for the number of people with skin cancer is given per 100 000 population.

Suggest why the data is **not** given as the total number of people.

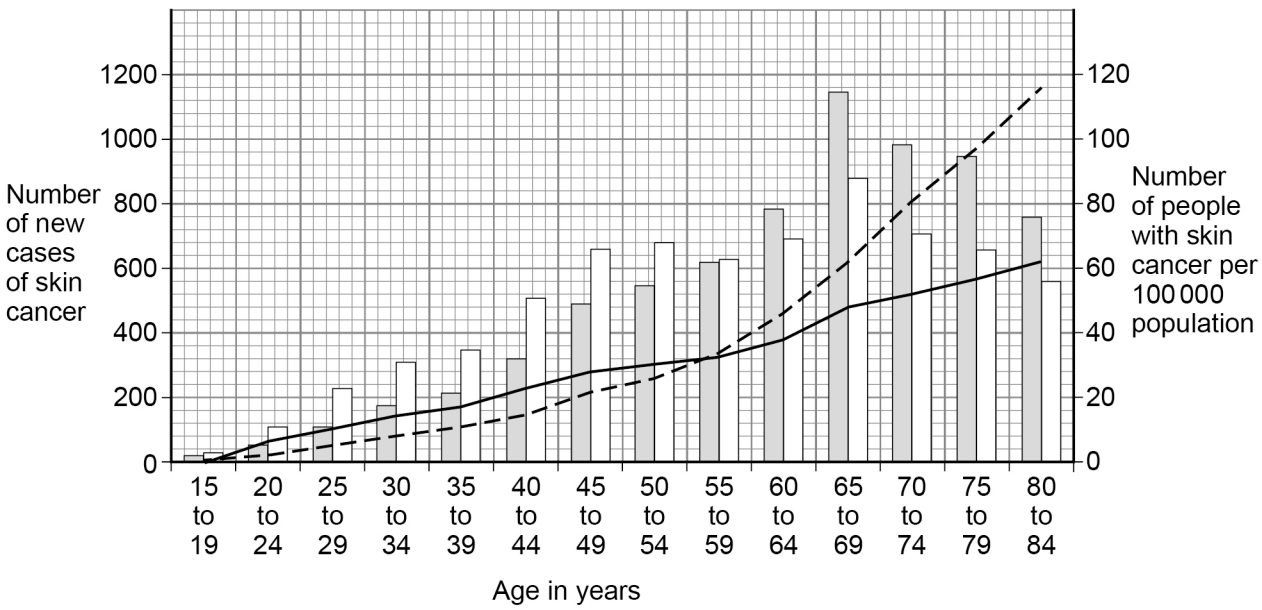
[1 mark]

Question 5 continues on the next page

4.7.3.3 Land use

Figure 10 is repeated below.

Figure 10



Key

- New male cases
- New female cases
- – – – Number of males with skin cancer per 100 000
- —— Number of females with skin cancer per 100 000

0 5 . 5 Describe **two** trends shown in **Figure 10**.

Use **only** the data for the number of people with skin cancer per 100 000 population.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

4.7.3.3 Land use

Question 14 · continued

0 5 . 6 The estimated population of males aged 80 to 84 years was 694 000

Calculate the number of males aged 80 to 84 years with skin cancer in that year.

Use **Figure 10**.

Give your answer to 3 significant figures.

[3 marks]

Number of males with skin cancer (3 significant figures) = _____

14

Turn over for the next question

4.7.3.3 Land use

Question 15

June 2022 | 8464/B/2H | Original Q4

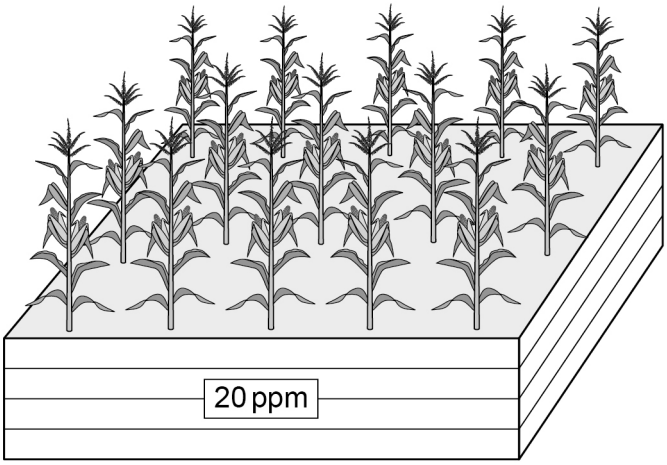
0 4 Scientists investigated the effect of soil nitrate ion concentration on the yield of corn.

This is the method used.

1. Corn plants were grown in a large box of soil.
2. The soil nitrate ion concentration in the box was kept at 0 parts per million (ppm).
3. All the corn from each plant in the box was removed and weighed.
4. The mean mass of corn per plant was calculated.
5. Steps 1 to 4 were repeated for boxes containing soil with different concentrations of nitrate ions.

Figure 2 shows the corn plants in the box with a 20 ppm soil nitrate ion concentration.

Figure 2



0 4 . 1 Give **two** variables the scientists should have controlled in this investigation.

[2 marks]

1 _____

_____

2 _____

_____

4.7.3.3 Land use

The scientists carried out a valid investigation.

Table 1 shows the scientists' results.

Table 1

Soil nitrate ion concentration in ppm	Mean mass of corn per plant in grams
0	122
10	190
20	256
30	268
40	240
50	184

4.7.3.3 Land use

Question 15 · continued

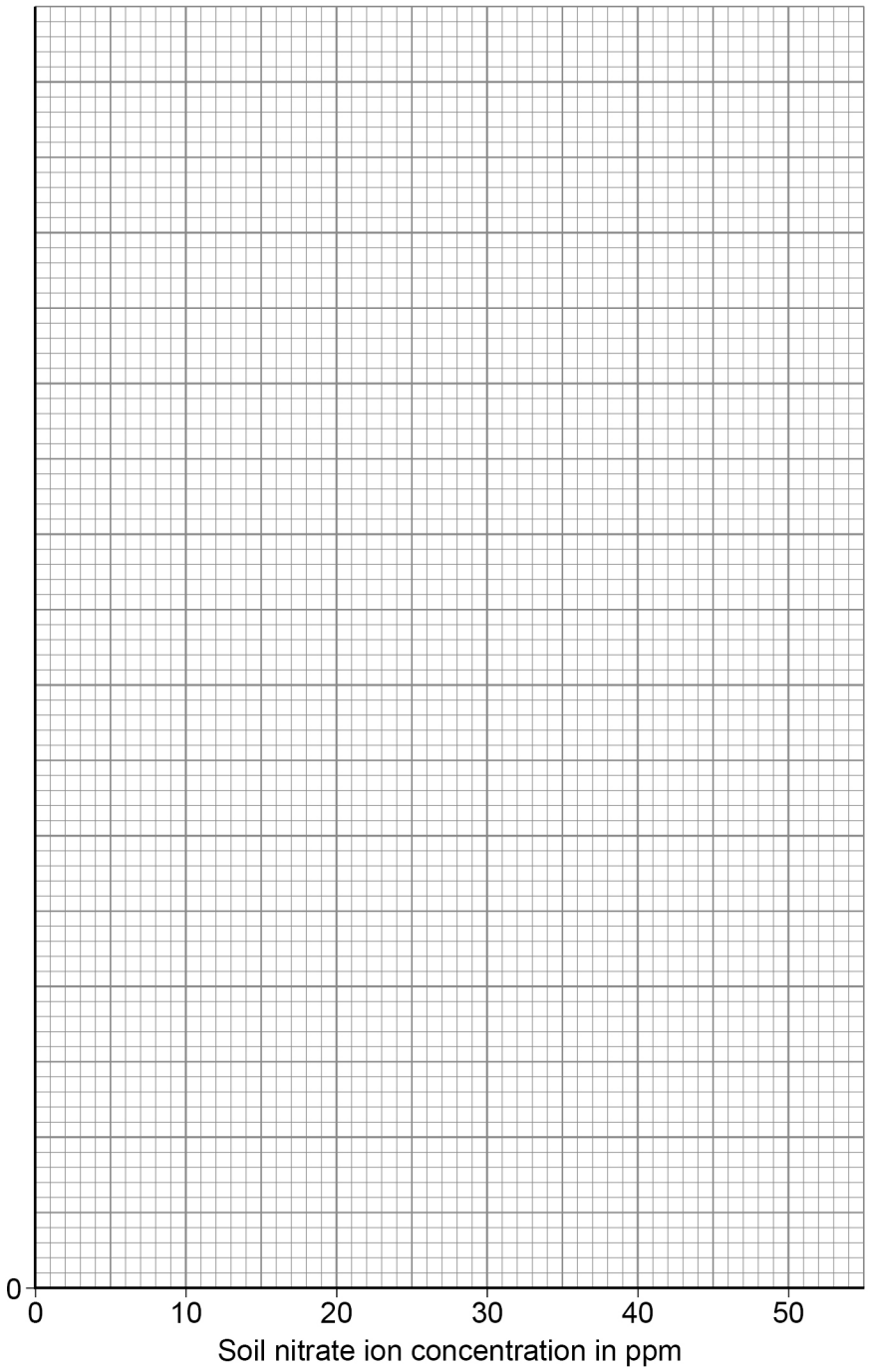
0 4 . 2 Complete **Figure 3**.

You should:

- label the *y*-axis
- use a suitable scale for the *y*-axis
- plot the data from **Table 1**
- draw a line of best fit.

[4 marks]

Figure 3



4.7.3.3 Land use

Question 15 · continued

Table 1 is repeated below.

Table 1

Soil nitrate ion concentration in ppm	Mean mass of corn per plant in grams
0	122
10	190
20	256
30	268
40	240
50	184

0 4 . 3 Describe the relationship between soil nitrate ion concentration and the mean mass of corn per plant.

Use data from **Table 1** in your answer.

[2 marks]

4.7.3.3 Land use

Question 15 · continued

0 4 . 4 Farmers add nitrate fertiliser to fields where they grow corn.

Nitrate fertilisers are expensive.

Evaluate the economic and environmental implications of adding fertiliser to soil in nitrate ion concentrations ranging from 0 to 50 ppm

[4 marks]

12

4.7.3.3 Land use

Question 16

June 2023 | 8464/B/1H | Original Q6

0 6 Amylase is an enzyme that digests starch in the digestive system.

0 6 . 1 Explain why starch has to be digested.

[2 marks]

Question 6 continues on the next page

Question 16 · continued

A student used a colorimeter to investigate the rate of starch digestion.

A colorimeter measures the percentage of light passing through a liquid.

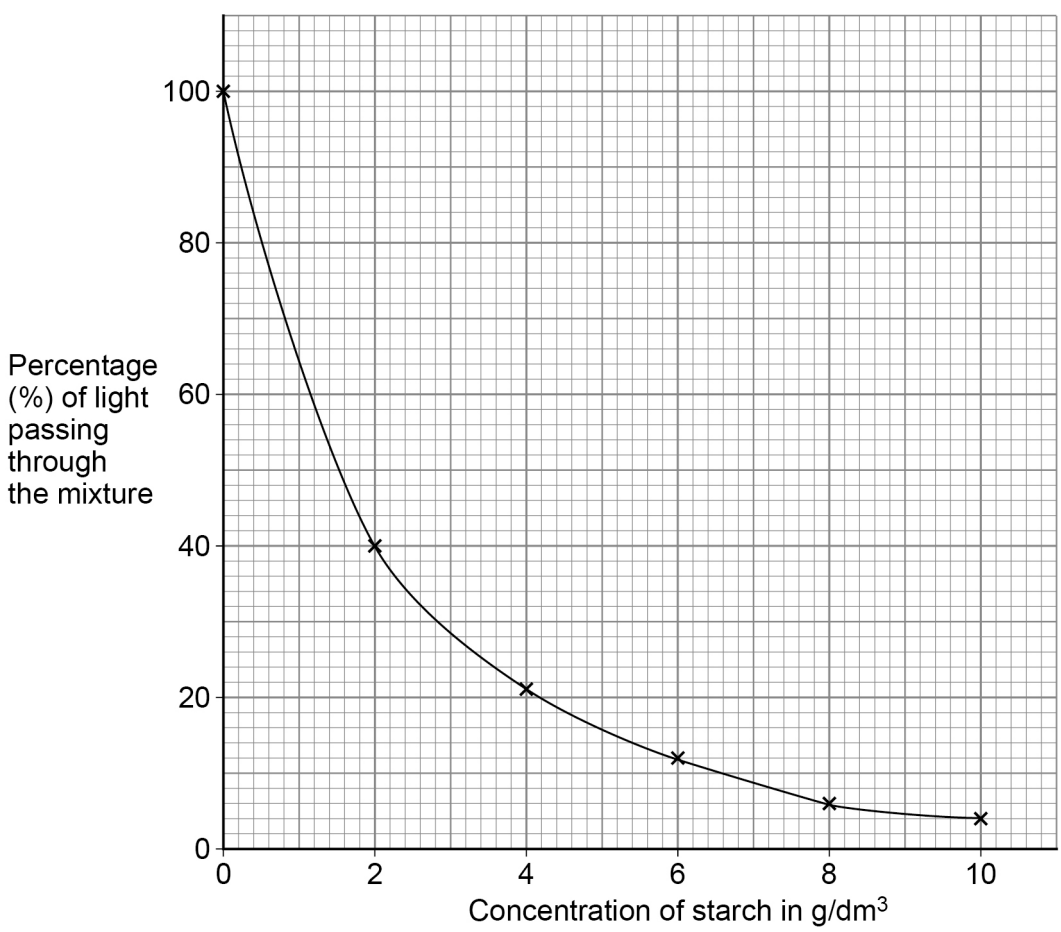
The darker the colour of the liquid, the less light passes through.

The student:

- mixed 1 cm^3 of starch suspension with 10 cm^3 of iodine solution
- measured the percentage of light passing through the mixture
- repeated with different concentrations of starch suspension.

Figure 7 shows the results.

Figure 7



4.7.3.3 Land use

Question 16 · continued

0 6 . 2 Suggest what liquid was used for the test with 0 g/dm^3 starch concentration.

[1 mark]

0 6 . 3 Explain the change in the percentage of light passing through the different concentrations of starch suspension in iodine solution.

Use **Figure 7**.

[3 marks]

Question 6 continues on page 21

Question 16 · continued

The student then investigated the rate of starch digestion using amylase.

This is the method used.

1. Put 10 cm^3 of starch suspension into a test tube.
2. Put 5 cm^3 of amylase solution into a separate test tube.
3. Put both test tubes into a water bath at 37 °C for 10 minutes.
4. Mix the contents of both test tubes together in a beaker.
5. Put the beaker into the water bath.
6. Remove 1 cm^3 of the mixture and add it to 10 cm^3 of iodine solution.
7. Measure the percentage of light passing through the liquid.
8. Repeat steps 6 and 7 every minute for 5 minutes.

0 6 . 4 The starch suspension and the amylase solution were kept in the water bath for 10 minutes before being mixed together.

Give the reason why.

[1 mark]

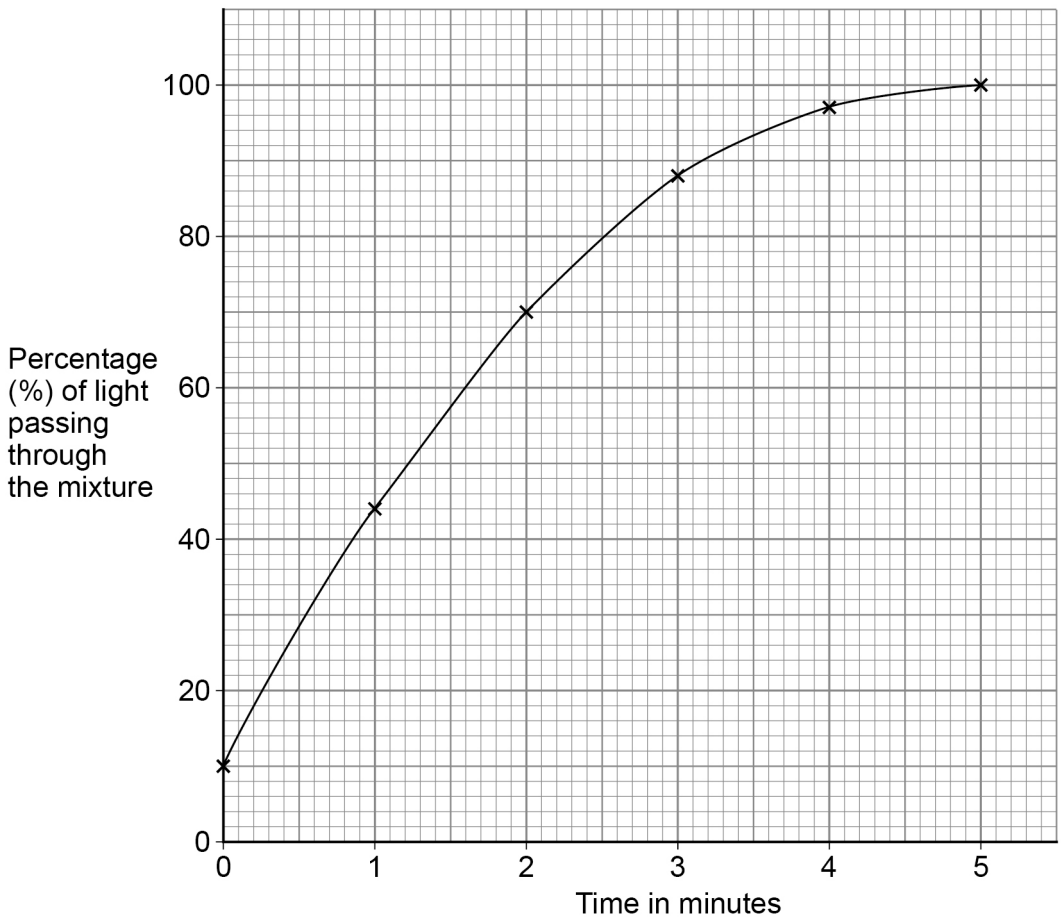
Question 6 continues on the next page

4.7.3.3 Land use

Question 16 · continued

Figure 8 shows the results.

Figure 8



4.7.3.3 Land use

Question 16 · continued

0 6 . 5 The concentration of starch at 3 minutes was 0.3 g/dm^3.

Calculate the mean rate of starch digestion for the first 3 minutes.

Use **Figure 7** on page 18 and **Figure 8** on page 22.

[4 marks]

Mean rate = _____ g/dm^3 per minute

0 6 . 6 The investigation was carried out at pH 7

Explain how the results would be different if the investigation was carried out at pH 1

Use **Figure 8**.

[3 marks]

14

4.7.3.3 Land use

Question 17

June 2024 | 8464/B/2H | Original Q6

0 6 Hormones are released from endocrine glands.

0 6 . 1 Which gland releases hormones to control other glands?

[1 mark]

Tick (✓) **one** box.

- Adrenal ☐
- Pituitary ☐
- Thyroid ☐

4.7.3.3 Land use

Question 17 · continued

Several hormones can affect blood glucose concentration.

0 6 . 2 Adrenaline can increase blood glucose concentration.

What is **one** other effect of adrenaline?

[1 mark]

Tick (✓) **one** box.

- Decreased breathing rate ☐
- Decreased metabolic rate ☐
- Increased blood flow to muscles ☐
- Increased FSH production ☐

0 6 . 3 Cells in the pancreas detect changes in blood glucose concentration.

What type of cell in the body detects changes?

[1 mark]

_____

Question 6 continues on the next page

4.7.3.3 Land use

Question 17 · continued

Scientists investigated whether blood glucose concentration affects reaction time.

The reaction times of ten people with Type 1 diabetes were measured.

This is the method used.

1. Tell one person to drink a glucose solution.
2. Monitor the person's blood glucose concentration.
3. Record the person's reaction time when the person's blood glucose concentration is:
   - 16 mmol/dm^3
   - 6 mmol/dm^3
   - 3 mmol/dm^3
4. Repeat steps 1 to 3 for the nine other people.

0 6 . 4 People with Type 1 diabetes were selected for the investigation instead of people who did **not** have diabetes.

Explain why.

[2 marks]

0 6 . 5 Control variables between the different people in the investigation included:

- age
- sex
- food and drink consumed before and during the test.

Suggest **two other** control variables that should be used in the investigation.

[2 marks]

1 _____

_____

2 _____

_____

0 6 . 6 It was important for the scientists to monitor the health of each person during the investigation.

Suggest **one** reason why.

[1 mark]

_____

_____

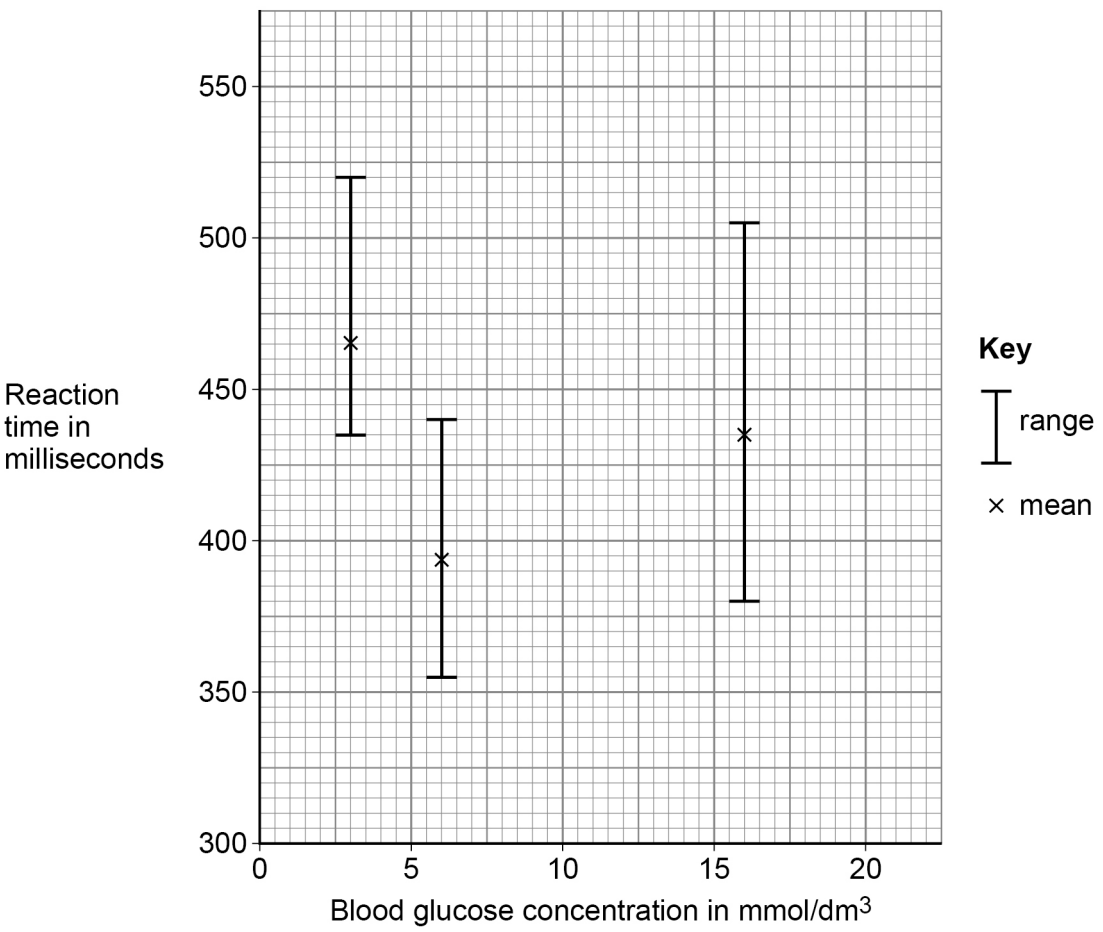
Question 6 continues on the next page

4.7.3.3 Land use

Question 17 · continued

Figure 6 shows the results.

Figure 6



0 6 . 7 People who do **not** have diabetes usually have a blood glucose concentration in the range of 4.0 mmol/dm^3 to 7.8 mmol/dm^3.

Describe how the results in **Figure 6** show the importance of homeostasis.

[2 marks]

4.7.3.3 Land use

Question 17 · continued

0 6 . 8 Describe how blood glucose concentration is maintained within narrow limits in people who do **not** have diabetes.

[5 marks]

0 6 . 9 The scientists gave the hypothesis:

‘Optimum blood glucose concentration increases the production of chemicals that diffuse across synapses.’

Describe how an increase in the chemicals could decrease reaction time.

[2 marks]

17

4.7.3.3 Land use

Question 18

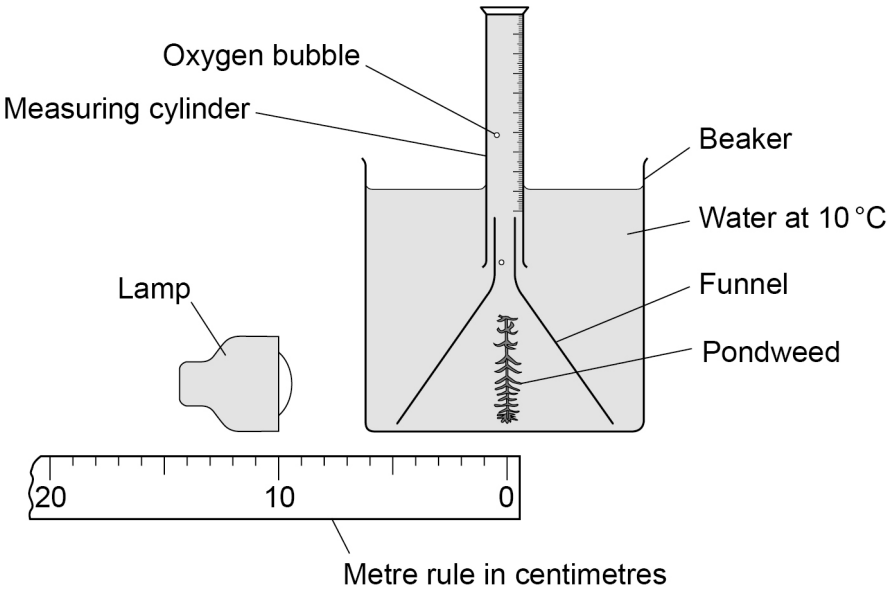
June 2025 | 8464/B/1H | Original Q3

0 3 Photosynthesis is important for plant growth.

A student used pondweed to investigate the rate of photosynthesis.

Figure 3 shows the apparatus used.

Figure 3



This is the method used.

1. Set up the apparatus as shown in **Figure 3**.
2. Switch on the lamp.
3. After 2 hours, record the volume of oxygen collected in the measuring cylinder.
4. Repeat steps 1 to 3 a further five times, increasing the distance between the lamp and the pondweed each time.
5. Calculate the rate of oxygen production for each distance.

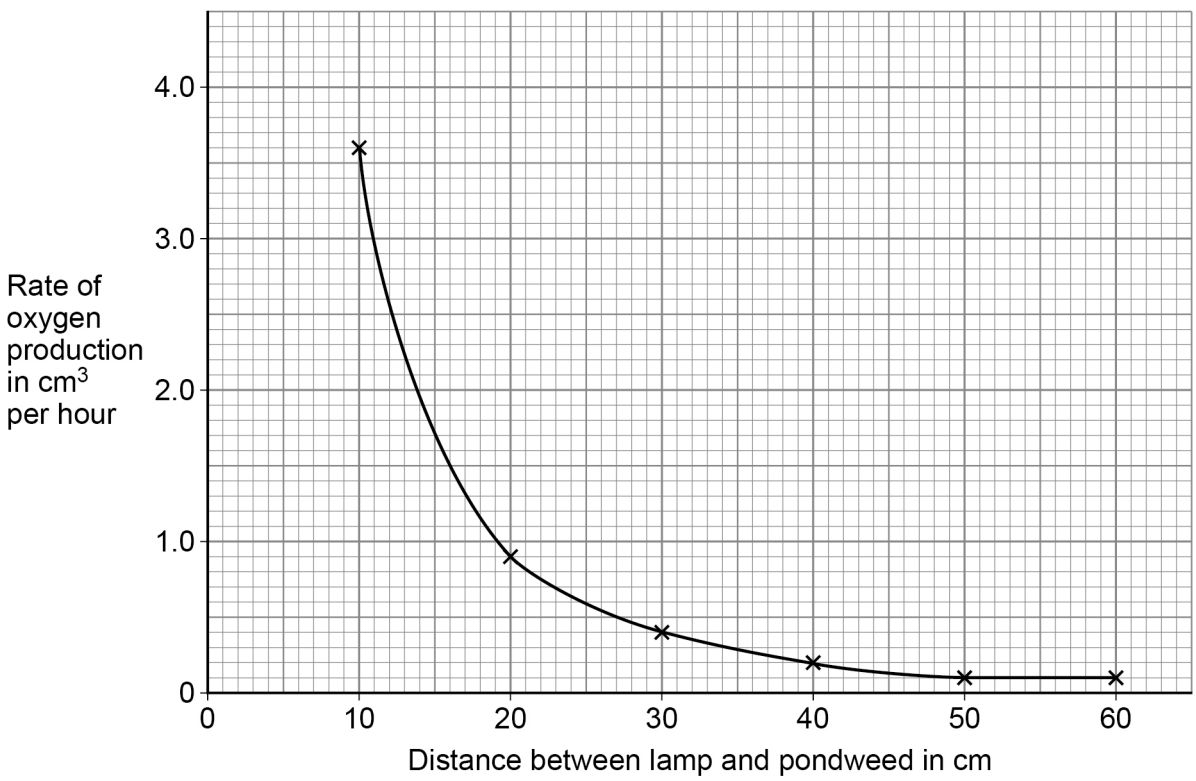
Question 3 continues on the next page

4.7.3.3 Land use

Question 18 · continued

Figure 4 shows the results.

Figure 4



0 3 . 1 Which measuring cylinder should the student have used to give the most accurate results?

[1 mark]

Tick (✓) **one** box.

- 10 cm^3 measuring cylinder with intervals of 0.1 ± 0.01 cm^3 ☐
- 10 cm^3 measuring cylinder with intervals of 0.2 ± 0.01 cm^3 ☐
- 20 cm^3 measuring cylinder with intervals of 0.1 ± 0.02 cm^3 ☐
- 20 cm^3 measuring cylinder with intervals of 0.2 ± 0.02 cm^3 ☐

0 3 . 2 Light intensity can be calculated using the inverse square law.

The equation shows the inverse square law.

$$\text{light intensity} \propto \frac{1}{(\text{distance from light source})^2}$$

Explain how light intensity changed as the distance of the pondweed from the light source was doubled.

Include calculations in your answer.

Use data from **Figure 4**.

[3 marks]

Question 3 continues on the next page

4.7.3.3 Land use

Question 18 · continued

The student did the investigation at 10 °C.

The student repeated the investigation at 20 °C and again at 80 °C.

0 3 . 3 Explain how repeating the investigation at **20 °C** would affect the results.

[3 marks]

0 3 . 4 Explain how repeating the investigation at **80 °C** would affect the results.

[2 marks]

9

4.7.3.3 Land use

Question 19

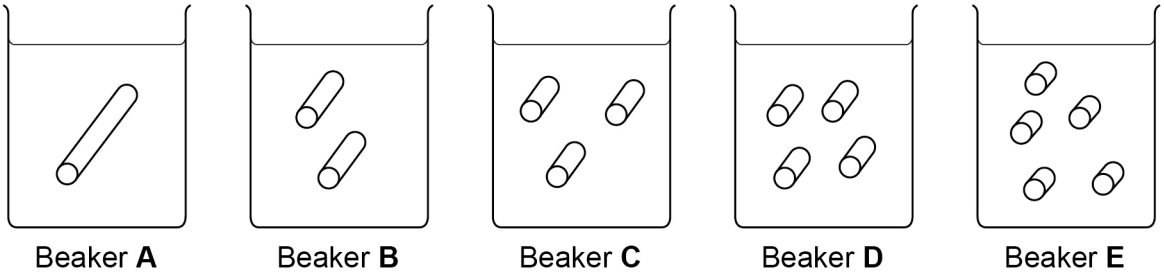
June 2025 | 8464/B/1H | Original Q4

0 4 A student investigated the effect of surface area on the mass of potato pieces placed in water.

This is the method used.

1. Cut 5 cylinders from one potato. Cut each cylinder to a length of 3 cm.
2. Cut 4 of the cylinders into different numbers of pieces.
3. Dry each piece of potato on a paper towel.
4. Record the mass of each group of potato pieces.
5. Put each group of potato pieces into different beakers containing distilled water as shown in **Figure 5**.
6. After 30 minutes remove and dry each group of potato pieces.
7. Record the mass of each group of potato pieces.
8. Calculate the percentage increase in mass for each group of potato pieces.

Figure 5



Question 4 continues on the next page

Question 19 · continued

Table 1 shows the results.

Table 1

Beaker	Total surface area of potato pieces in cm^2	Percentage (%) increase in mass
A	7.4	4.4
B	8.1	4.9
C	8.9	5.3
D	9.7	5.5
E	10.5	5.6

0 4 . 1 Why is it more valid to calculate the **percentage increase** in mass rather than using the increase in mass?

[1 mark]

0 4 . 2 Describe the relationship between total surface area and percentage increase in mass.

Use **Table 1**.

[2 marks]

4.7.3.3 Land use

Question 19 · continued

0 4 . 3 Explain why the potato pieces increased in mass.

[2 marks]

0 4 . 4 The student repeated the investigation.

The potato pieces were in the beakers of distilled water for 24 hours.

Explain what results would be expected after leaving the investigation set up for 24 hours.

[3 marks]

Question 4 continues on the next page

0 4 . 5 The method used is repeated below.

1. Cut 5 cylinders from one potato. Cut each cylinder to a length of 3 cm.
2. Cut 4 of the cylinders into different numbers of pieces.
3. Dry each piece of potato on a paper towel.
4. Record the mass of each group of potato pieces.
5. Put each group of potato pieces into different beakers containing distilled water as shown in **Figure 5** on page 13.
6. After 30 minutes, remove and dry each group of potato pieces.
7. Record the mass of each group of potato pieces.
8. Calculate the percentage increase in mass for each group of potato pieces.

A different student wanted to investigate the effect of salt concentration on potato tissue.

Describe how the student could change the method to investigate the effect of salt concentration on potato tissue.

[2 marks]

10

4.7.3.3 Land use

Question 20

June 2025 | 8464/B/2H | Original Q4

0 4 Farmers can increase crop yield by controlling the conditions the plants grow in.

0 4 . 1 Maize is a crop plant.

A variety of maize has been genetically modified (GM) to be resistant to a herbicide.

Explain how growing GM herbicide-resistant maize can produce a larger yield than growing non-GM maize.

[4 marks]

Extra space

0 4 . 2 Explain how growing a GM herbicide-resistant crop can **decrease** the biodiversity of animals.

[2 marks]

Question 4 continues on the next page

Question 20 · continued

Bees are a type of insect.

The number of insects near a crop can be increased by planting hedgerows.

0 4 . 3 Increasing the number of bees **and** other insects increases crop yield.

Suggest **two** reasons why increasing the number of insects can increase crop yield.

[2 marks]

1 _____

_____

2 _____

_____

0 4 . 4 Hedgerows provide habitats for insects.

Give **one** reason why increasing hedgerow habitats increases insect numbers.

[1 mark]

_____

_____

0 4 . 5 Some farmland contains areas of peat.

When peat is dug up:

- the oxygen levels in the peat increase
- the peat decays quickly.

Explain why increasing the level of oxygen in peat contributes to climate change.

[2 marks]

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