Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Monday 09 June 2025

Morning (Time: 1 hour 15 minutes)

Paper reference **4BI1/2B**

Biology

UNIT: 4BI1

PAPER: 2B

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 70.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P78875A

Y:1/1/1/1/1/1/1/

P 7 8 8 7 5 A 0 1 2 4

Pearson

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Rivers – the arteries of the world

Rivers are important supplies of water for drinking, farming, industry, and leisure activities. Like our circulatory system, rivers are essential for transport, and have a homeostatic effect on nature. The biodiversity in rivers is high as they are the habitat for many different species. In many countries rivers are under threat from human impact, particularly the release of untreated sewage.

Flooding can cause untreated sewage to run into rivers from pipelines. Scientists estimated that in England and Wales during 2022, sewage was released into rivers for a total time of 300 000 hours. This sewage came from 1200 different pipelines. Untreated sewage may contain fertilisers, pesticides, pathogenic bacteria, and pharmaceutical drugs.

(Source: © ANDY DAVIES / SCIENCE PHOTO LIBRARY)

The photograph shows sewage being released into a river. The sewage causes the growth of something called 'sewage fungus'. Sewage fungus looks like fungus but is a solid collection of several types of anaerobic bacteria. Sewage fungus is common in rivers that are polluted with untreated sewage or are near to cattle and intensive crop farms. If sewage fungus is found in a river it often indicates that the biodiversity of the river will be low.

Pesticides from agriculture are also released into rivers, and these are frequently transferred through natural food chains. Even pharmaceutical drugs, such as those containing the hormones oestrogen and progesterone, have been found in polluted rivers. These drugs must have been consumed by humans, excreted and then released into the sewage flowing into rivers.

Untreated sewage can also contain pathogenic species of bacteria that then enter rivers. If humans are infected with these bacteria, the large intestine absorbs less water, causing diarrhoea. Some of the bacteria found in sewage are resistant to antibiotics.

Scientists are looking for ways to prevent river pollution. One way is to reduce the risk of pollution from fertilisers and from cattle urine and faeces. Woodchip bioreactors are being trialled in agricultural fields that are near to rivers. These bioreactors are pits filled with woodchips and denitrifying bacteria. Water
30 drains through these bioreactors, which helps to remove nitrates before they reach the rivers. In some countries, efforts are being made to replant forests in areas upstream of rivers to reduce river flooding and the risk of untreated sewage release.

(a) Rivers have a homeostatic effect on nature. This is similar to the role of homeostasis in humans.
State what is meant by the term **homeostasis** (lines 2 and 3).

(1)

.....

.....

(b) Calculate the mean number of hours that each pipeline released sewage into rivers in 2022 (lines 7 and 8).

(1)

mean number = ... hours

(c) (i) Sewage fungus is not a fungus but is made from several different species of bacteria.

Which of these structures are present both in fungi and in bacteria?

(1)

- ☒ **A** cell wall and cytoplasm only
- ☒ **B** cell wall and nucleus only
- ☒ **C** cell wall, cytoplasm and nucleus
- ☒ **D** cytoplasm and nucleus only

(ii) Explain why rivers near to farms may have low biodiversity (lines 13 to 16).

(4)

(d) Oestrogen and progesterone in polluted water lower the levels of FSH and LH in mammals.

(i) State why lower levels of FSH can reduce fertility in mammals.

(1)

(ii) State why lower levels of LH can reduce fertility in mammals.

(1)

(e) (i) Pathogenic bacteria produce poisons that prevent the active transport of salt into the blood vessels surrounding the intestines.

Explain why preventing the transport of salt into the blood vessels will cause more water to be present in faeces (lines 22 to 24).

(2)

(ii) Explain why overuse of antibiotics has led to an increase in antibiotic-resistant bacteria (lines 24 and 25).

(3)

(f) (i) Explain how woodchip bioreactors reduce pollution in rivers (lines 27 to 31).

(2)

(ii) Explain why replanting forests in areas upstream of rivers will reduce flooding (lines 31 to 33).

(2)

(Total for Question 1 = 18 marks)

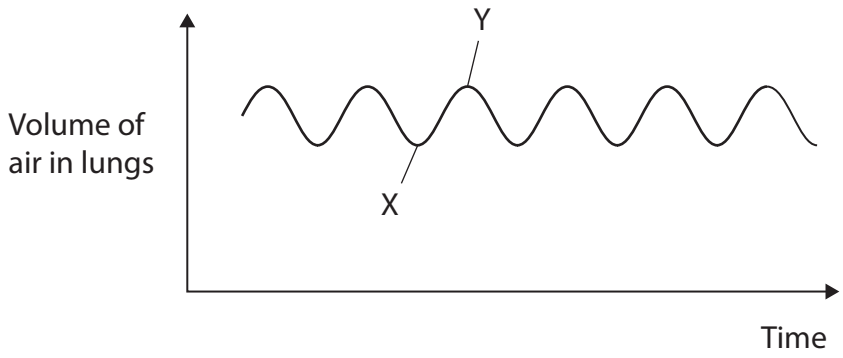
2 The lungs and the kidneys are excretory organs.

(a) (i) Which substances are excreted by the lungs?

(1)

- ☒ **A** carbon dioxide and urea
- ☒ **B** carbon dioxide and water
- ☒ **C** carbon dioxide, urea, and water
- ☒ **D** urea and water

(ii) The graph shows how the volume of air in the lungs changes over time.



Explain the change in volume of air in the lungs from point X to point Y.

(3)

(b) People with a condition called diabetes often have very high blood sugar.

Urine from people with diabetes attracts ants but urine from people without diabetes does not attract ants.

Ants are insects that are attracted to glucose.

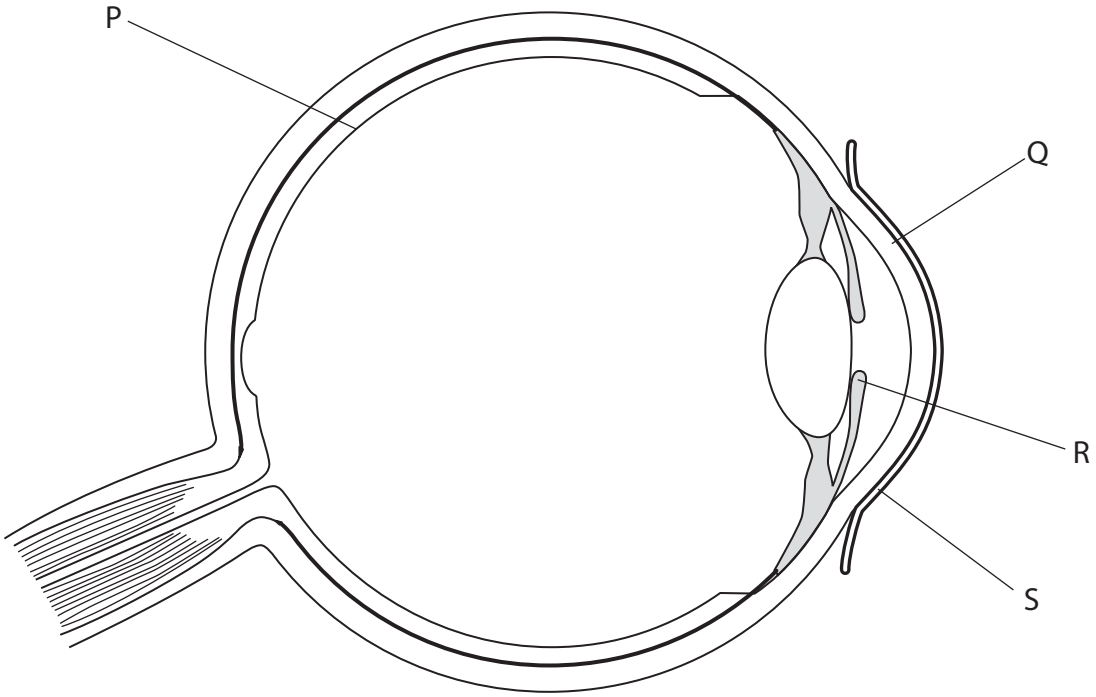
Explain why people with diabetes produce urine that can attract ants.

(3)

(Total for Question 2 = 7 marks)

BLANK PAGE

3 The diagram shows a human eye with some structures labelled.



(a) Which structure is the retina?

(1)

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

(b) A teacher investigates the effect of light intensity on pupil diameter.

This is the teacher's method.

- cover a student's eyes with a mask
- set the light intensity in the room to a low level
- remove the mask and wait 20 seconds
- record an image of the student's pupil and iris with a camera
- measure the diameter of the pupil on the image using a ruler
- repeat two more times at the same light intensity

The teacher repeats the experiment at different light intensities.

The table shows the teacher's results.

Light intensity in arbitrary units	Diameter of pupil in mm			
	test 1	test 2	test 3	mean
1	8.1	8.4	8.2	
2	7.8	7.5	7.4	7.6
3	3.5	3.2	3.6	3.4
4	2.1	2.2	2.2	2.2
5	2.2	2.1	1.9	2.0

(i) Calculate the mean pupil diameter for the light intensity of 1 arbitrary unit.

Give your answer to two significant figures.

(2)

mean pupil diameter ..... mm

(ii) With reference to data in the table, **describe** the effect of increasing light intensity on the diameter of the pupil.

(2)

(iii) **Explain** the effect of increasing light intensity on the diameter of the pupil.

(3)

(iv) State one variable that the teacher should control.

(1)

(v) Explain how the teacher's method ensures that the measurement of the pupil diameters are accurate.

(2)

(Total for Question 3 = 11 marks)

4 The photograph shows Prometea, the first cloned horse.

(Source: © MAURO FERMARIELLO / SCIENCE PHOTO LIBRARY)

Prometea was produced by cloning, using the nucleus of a skin cell from a horse called Stella Cometa.

(a) Complete the passage about cloning by writing a suitable word or words in each blank space.

(5)

A ..... nucleus was taken from a skin cell from Stella Cometa.

This nucleus was inserted into an enucleated ..... that had been taken from a donor horse. An ..... was used to start the type of cell division called ....., eventually producing an embryo. The embryo was then placed into the ..... of the mother.

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(b) Until recently, most cloning has been attempted with farm animals.

The table shows some information about the success rates of cloning different farm animals during a four-year period.

Animal	Number in four-year period		
	embryos made	live births	surviving at least two years
cattle	7500	75	55
sheep	3500	50	15
goat	500	25	5

Some people now want to use cloning to replace their pets. The cost of cloning a pet cat can be as much as 50 000 United States dollars.

Comment on the use of cloning to replace pets.

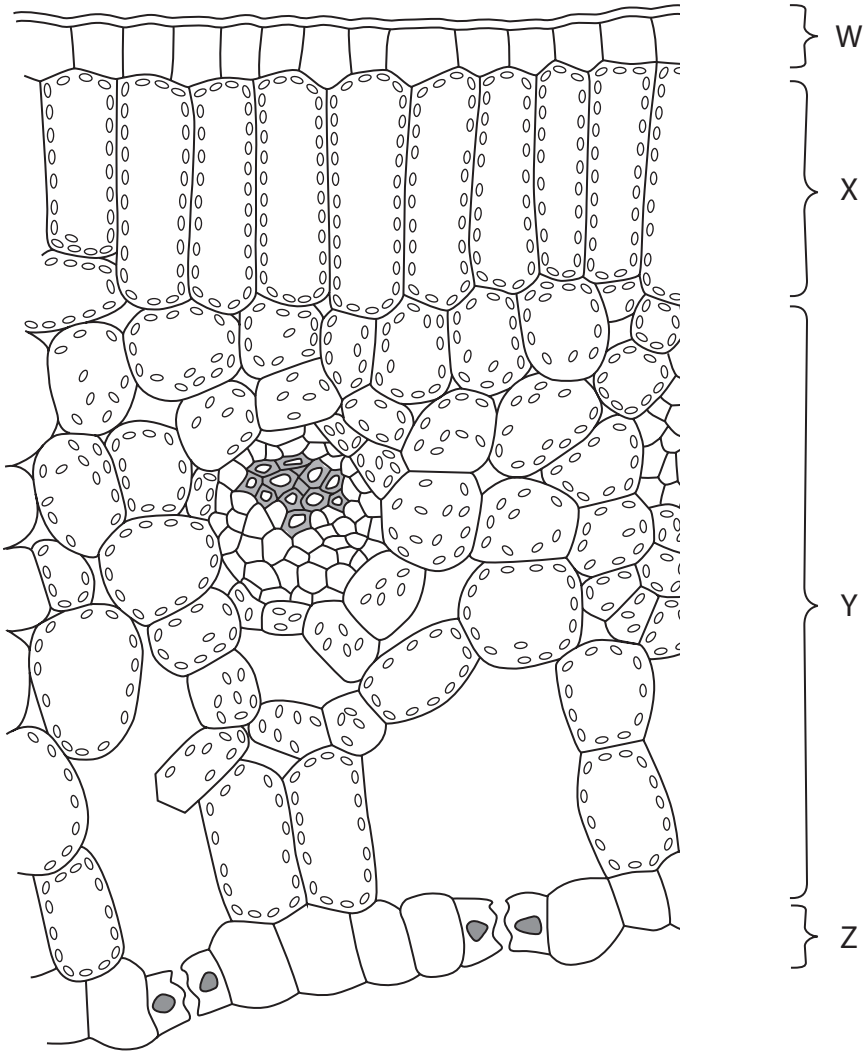
Use the information in the table and your own knowledge about variation to support your answer.

(5)

(Total for Question 4 = 10 marks)

BLANK PAGE

5 The diagram shows a cross section through a plant leaf.

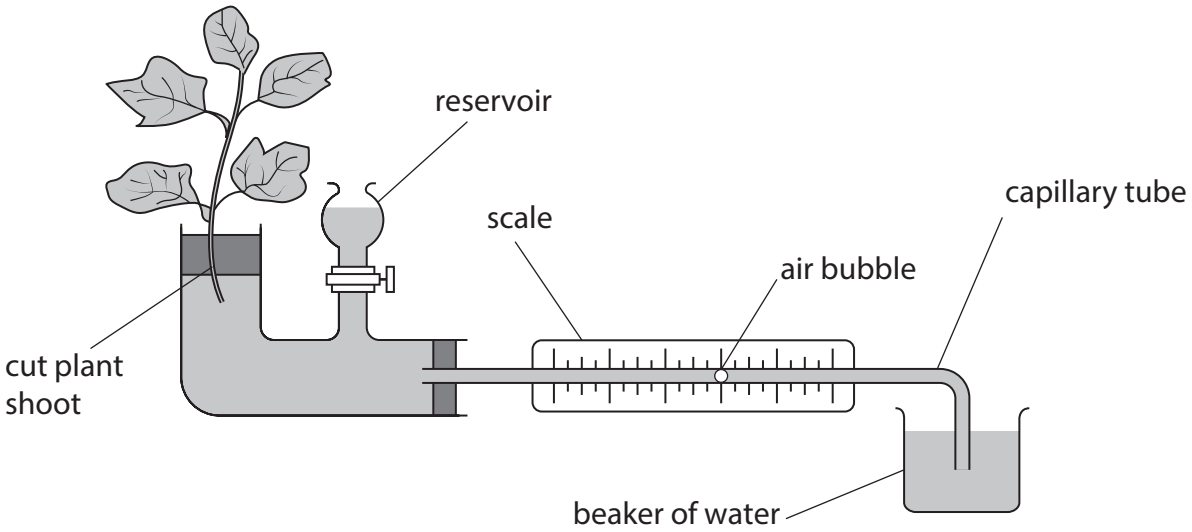


(a) Which area of the leaf contains xylem vessels?

(1)

- ☒ **A** W
- ☒ **B** X
- ☒ **C** Y
- ☒ **D** Z

(b) A student uses this apparatus to measure the water uptake by a cut plant shoot.



(i) The inside of the capillary tube is a cylinder shape.

The air bubble moves a length, l, of 5.2 cm in 5 minutes.

The inside of the capillary tube has a radius, r, of 0.50 mm.

Calculate the rate of water uptake, in mm^3 per minute, by the cut plant shoot.

[volume of cylinder = $\pi r^2 l$]

[π = 3.14]

(2)

rate = ... mm^3 per minute

(ii) Describe how the student can use the apparatus to investigate the effect of changing wind speed on water uptake by the cut plant shoot.

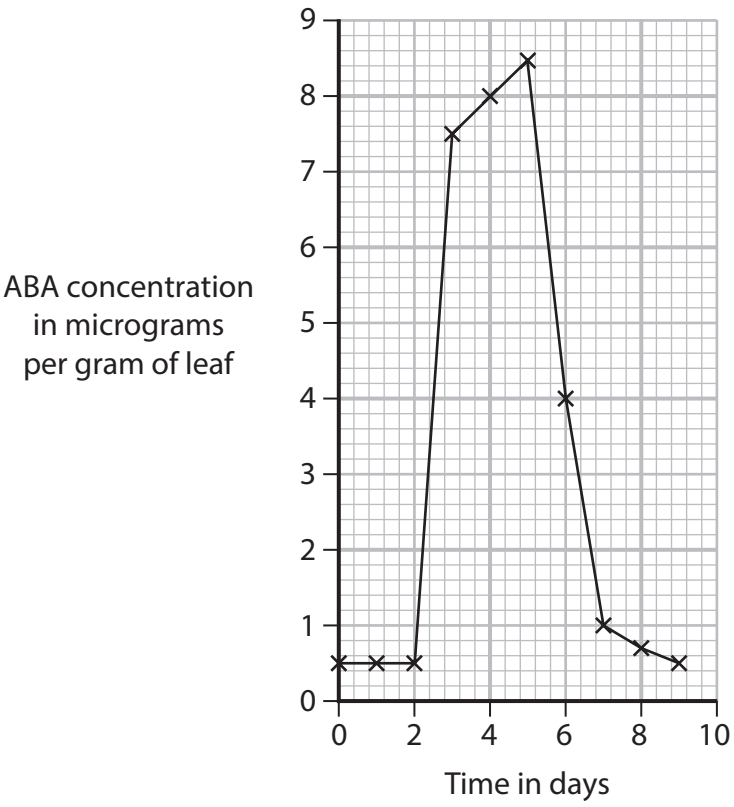
(4)

(c) A scientist investigates how ABA, an auxin-like substance, affects plant growth.

The scientist does not water a plant for 4 days.

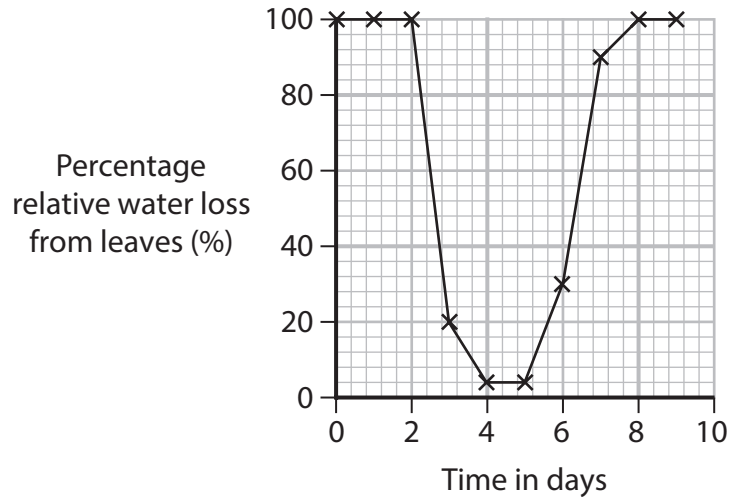
They then water the plant on day 5.

Graph 1 shows the changes in the ABA concentration in the leaves of the plant.



Graph 1

Graph 2 shows the changes in percentage relative water loss from the leaves of the plant.



Graph 2

Comment on the changes in ABA concentration and water loss in the scientist's investigation.

Use information from both graphs in your answer.

(4)

(Total for Question 5 = 11 marks)

6 Apples contain an enzyme called phenol oxidase.

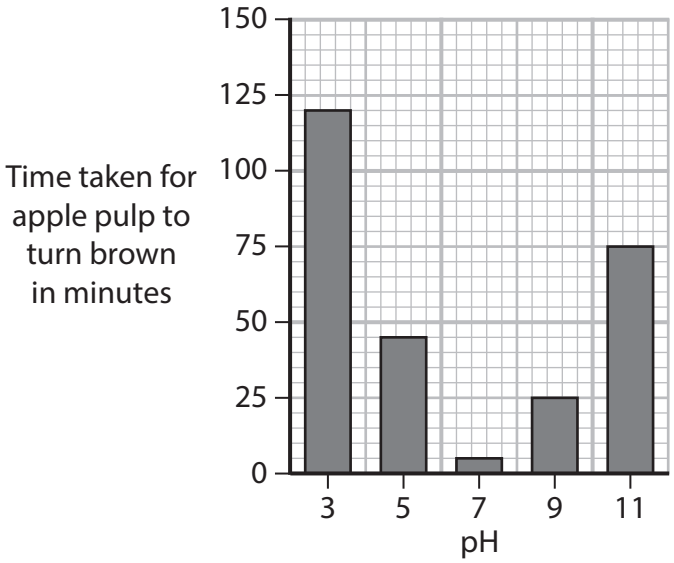
When apple tissue is exposed to oxygen in the air, this enzyme turns the apple tissue brown.

(a) A student uses this method to investigate the effect of pH on the time taken for apple tissue to turn brown.

- mash an apple to produce a pulp
- place 25 g of this pulp into a beaker
- mix a pH 7 buffer with the pulp to maintain the pH
- check the colour of the pulp every five minutes
- record the time when the pulp turns brown

The student repeats this method using pH buffers of 3, 5, 9, and 11.

The graph shows the student's results.



(i) Calculate the percentage increase in time taken for the apple pulp to turn brown at pH 11 compared with the time taken at pH 7.

(2)

percentage increase = ... %

(ii) Explain why the change in pH affects the time taken for the apple pulp to turn brown.

(3)

(iii) Explain how the student could modify this method to give a more accurate measure of the time taken for the apple pulp to turn brown.

(2)

QUESTION 6 CONTINUES ON NEXT PAGE.

(b) A genetically modified (GM) variety of apple has been produced that does not turn brown when exposed to air.

These apples have a gene in their DNA that produces a section of mRNA with a complementary sequence to the mRNA for the phenol oxidase gene.

(i) State two differences between DNA and mRNA.

(2)

1 .....

.....

2 .....

.....

(ii) Explain why these GM apples do not turn brown when the apple tissue is exposed to air.

Use your knowledge of protein synthesis to support your answer.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 70 MARKS

BLANK PAGE

BLANK PAGE