Paper Reference(s) 1BI0/2H
Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Total Marks

Biology
PAPER 2
Higher Tier

Time: 1 hour 45 minutes

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

Y69321A

Pearson

YOU MUST HAVE

Calculator, ruler

YOU WILL BE GIVEN

Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided in this Question Paper – there may be more space than you need.

Calculators may be used.

Any diagrams may NOT be accurately drawn, unless otherwise indicated.

You must show all your working out with your answer clearly identified at the end of your solution.

INFORMATION

The total mark for this paper is 100.

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

In questions marked with an ASTERISK (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

ADVICE

Read each question carefully before you start to answer it.

Try to answer every question.

Check your answers if you have time at the end.

Answer ALL questions. Write your answers in the spaces provided.

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 (a) Bloodworms in a pond indicate that the water is polluted.

(i) Which species also indicates that the water is polluted?
(1 mark)

☐ **A fertiliser**

☐ **B lichen**

☐ **C stonefly**

☐ **D sludgeworm**

(continued on the next page)

1 continued.

(ii) Bloodworms have a high level of haemoglobin in their blood.

Give a reason why this helps them survive in polluted water. (1 mark)

(continued on the next page)

1 continued.

(iii) Carbon dioxide diffuses from the body of the bloodworm into the water.

Give TWO factors that affect the rate of diffusion.
(2 marks)

1 _____

_____

_____

2 _____

_____

_____

(continued on the next page)

1 continued.

(b) Look at Figure 1 for Question 1(b) in the Diagram Booklet. It shows part of a diseased rose plant from a garden.

Explain what Figure 1 indicates about the air quality in the garden.
(2 marks)

(Total for Question 1 = 6 marks)

2 (a) Look at Figure 2 for Question 2(a) in the Diagram Booklet. It shows xylem and phloem from the stem of a plant.

(i) Living cells in phloem use energy to transport sucrose.

Which organelles release energy in living cells?
(1 mark)

☐ A vacuoles

☐ B mitochondria

☐ C nuclei

☐ D ribosomes

(continued on the next page)

2 continued.

(ii) Describe TWO features of the structure of xylem vessels that can be seen in Figure 2.
(2 marks)

1 _____

_____

_____

2 _____

_____

_____

(continued on the next page)

2 continued.

(b) A scientist investigated how the flow of air affected the rate of transpiration in a plant.

A fan was used to change the flow of air.

The volume of water taken up by the plant was measured.

Look at Figure 3 for Question 2(b) in the Diagram Booklet. It shows the results of this investigation.

(i) Explain why switching on the fan caused a change in the volume of water taken up by the plant.
(3 marks)

(continued on the next page)

2 continued.

(ii) Give ONE reason why the volume of water taken up by the plant was also measured when the fan was not switched on.
(1 mark)

(continued on the next page)

2 continued.

(iii) Calculate the rate of water uptake from 8 minutes to 10 minutes when the fan was switched on. (2 marks)

Use the equation

$$\text{rate of water uptake} = \frac{\text{volume of water taken up}}{\text{time taken}}$$

(continue your answer on the next page)

2 continued.

_____ mm^3 per minute

(Total for Question 2 = 9 marks)

3 (a) Look at Figure 4 for Question 3(a) in the Diagram Booklet. It shows a cross-section of an artery and a vein.

(i) Explain ONE difference between the artery wall and the vein wall shown in Figure 4.
(2 marks)

(continued on the next page)

3 continued.

(ii) Name ONE structure that is found in veins but not found in arteries. (1 mark)

_____

_____

(continued on the next page)

3 continued.

(b) A human body has 5 dm^3 of blood.

At rest 20% of the blood travels to the muscles.

During exercise 60% of the blood travels to the muscles.

(i) Calculate the volume of blood travelling to the muscles during exercise.
(2 marks)

_____ dm^3

3 continued.

(ii) Explain ONE reason why there is an increase in blood flow to muscles during exercise.
(2 marks)

(Total for Question 3 = 7 marks)

4 A student investigated the width of leaves on nettle plants growing in two areas next to a woodland: area A and area B.

The woodland caused area A to be in the shade.

The student measured the maximum width of leaves on five plants from each area.

The student always measured one leaf from the fourth pair of leaves.

Look at Figure 5 for Question 4(a) in the Diagram Booklet. It shows a nettle plant.

(continued on the next page)

4 continued.

(a) Give ONE reason why the student always measured a leaf from the fourth pair of leaves.
(1 mark)

(continued on the next page)

4 continued.

(b) Look at Figure 6 for Question 4(b) in the Diagram Booklet. It shows the results.

(i) Why did the student NOT include the circled width when calculating the mean for area B?
(1 mark)

☐ A it has not been measured in millimetres

☐ B it is an anomalous result

☐ C it is a repeat result

☐ D it is the mode value

(continued on the next page)

4 continued.

(ii) Explain the difference in the mean width of leaves in the shade and those in the sunlight. (2 marks)

(continued on the next page)

4 continued.

(c) The student also studied some of the animals in areas A and B.

The student saw caterpillars eating the leaves of some nettles.

The student also saw a toad eating a large beetle.

Large beetles eat ladybirds.

Ladybirds eat caterpillars.

(continued on the next page)

4 continued.

(i) Give the food chain for these feeding relationships.
(3 marks)

(continued on the next page)

4 continued.

(ii) Frogs also eat large beetles.

Look at Figure 7 for Question 4(c)(ii) in the Diagram Booklet. It shows the energy transferred between these animals.

Calculate the percentage efficiency of energy transfer from the large beetles to the frog.
(2 marks)

_____%

(continued on the next page)

4 continued.

(iii) Give TWO reasons why only some of the energy in the biomass of the large beetles is transferred to the biomass of the frog.
(2 marks)

1 _____

_____

_____

2 _____

_____

_____

(Total for Question 4 = 11 marks)

5 (a) Bacteria in the root nodules of a leguminous plant provide the plant with nitrogen compounds.

The leguminous plant provides the bacteria with sugars.

(i) Which term describes the relationship between this leguminous plant and the bacteria?
(1 mark)

☐ A parasitism

☐ B indigenous

☐ C biodiversity

☐ D mutualism

(continued on the next page)

5 continued.

(ii) The width of this root nodule is 7·5 mm.

Give the width in μm.
(1 mark)

_____ μm

(continued on the next page)

5 continued.

(b) Look at Figure 9 for Question 5(b) in the Diagram Booklet. It shows part of the nitrogen cycle.

(i) Identify the types of microorganism involved in process X and process Y.
(2 marks)

X _____

_____

Y _____

_____

(continued on the next page)

5 continued.

(ii) Explain how crop rotation increases nitrate levels in the soil.
(3 marks)

(continued on the next page)

5 continued.

(iii) Explain why increased nitrate levels in the soil improve crop yield.
(2 marks)

(Total for Question 5 = 9 marks)

6 (a) The combined contraceptive pill contains artificial versions of oestrogen and progesterone.

(i) Explain how the combined contraceptive pill prevents pregnancy.
(2 marks)

(continued on the next page)

6 continued.

(ii) When taken correctly, the combined pill can be over 99% effective.

Taking the combined pill can lead to weight gain.

Give ONE other disadvantage of using the combined pill as the only method of contraception.
(1 mark)

(continued on the next page)

6 continued.

(b) Excessive weight gain and obesity increase the likelihood of developing type 2 diabetes.

Explain the effect of type 2 diabetes on the body.
(3 marks)

(continued on the next page)

6 continued.

(c) A woman had unexplained weight loss and fatigue.
She had blood tests to investigate the cause of these symptoms.

Look at Figure 10 for Question 6(c) in the Diagram Booklet. It shows the results.

Comment on the results of these blood tests and the possible causes of the woman's weight loss and fatigue.
(4 marks)

(continued on the next page)

6 continued.

(Total for Question 6 = 10 marks)

7 (a) A gardener read information on a gardening society website about how to use a compost bin.

Look at Figure 11 for Question 7(a) in the Diagram Booklet. It shows the compost bin and some of the instructions.

(i) Give ONE reason why the gardener thought the gardening society website was a good source of information.
(1 mark)

(continued on the next page)

7 continued.

(ii) Give reasons why soil is added to the compost bin and why the contents are turned to add air. (2 marks)

(continued on the next page)

7 continued.

(iii) The gardener noticed the compost bin became warm a few days after vegetation was added.

Why did the contents of the compost bin become warm? (1 mark)

☐ A respiration occurred and this is an endothermic reaction

☐ B respiration occurred and this is an exothermic reaction

☐ C photosynthesis occurred and this is an endothermic reaction

☐ D photosynthesis occurred and this is an exothermic reaction

(continued on the next page)

7 continued.

(iv) The mass of the contents of the compost bin at the start was 40 kg.

After 60 days the mass of the contents was 32 kg.

Which is the rate of decay? (1 mark)

☐ A 1·8 kg per day

☐ B 0·66 kg per day

☐ C 0·53 kg per day

☐ D 0·13 kg per day

(continued on the next page)

7 continued.

*(b) Explain the uses of auxins, gibberellins and ethene in the commercial production of plants and fruits.
(6 marks)

(continued on the next page)

7 continued.

(continued on the next page)

7 continued.

(Total for Question 7 = 11 marks)

8 The effect of different types of exercise on the heart rate of an athlete was investigated.

The athlete counted the number of beats in 10 seconds at the carotid artery pulse point by placing her index and middle finger on the side of her neck in the soft hollow beside the windpipe.

This measurement was used to calculate the heart rate.

The athlete exercised for 20 minutes.

The heart rate was recorded every 5 minutes during each type of exercise.

(continued on the next page)

8 continued.

(a) (i) State how the heart rate was calculated using this method. (1 mark)

(continued on the next page)

8 continued.

(ii) Give TWO ways of improving the method used to obtain the data needed to calculate the heart rate. (2 marks)

1 _____

_____

_____

2 _____

_____

_____

(continued on the next page)

8 continued.

Look at Figure 13 for Question 8(a)(iii) in the Diagram Booklet. It shows the results of this investigation.

(iii) Comment on the difference in the heart rates during these types of exercise.
(3 marks)

(continued on the next page)

8 continued.

(b) Exercise increases adrenalin levels.

(i) State which endocrine gland secretes adrenalin.
(1 mark)

(continued on the next page)

8 continued.

(ii) Explain the effect of adrenalin on liver cells during exercise.
(3 marks)

(continued on the next page)

8 continued.

(c) After high intensity exercise, the pH of muscles can decrease from pH 7·0 to pH 6·3

Explain this change in pH.
(2 marks)

(Total for Question 8 = 12 marks)

9 (a) Scientists use a technique called mark and recapture to estimate animal populations in a habitat.

A sample of the population is captured and a harmless mark is added to each animal.

These animals are released and after a period of time the population is sampled again.

This second sample includes some recaptured animals that have marks on them.

(continued on the next page)

9 continued.

The population can be estimated using this equation

$$\text{population size} = \frac{\text{number marked in the first sample} \times \text{size of the second sample}}{\text{number recaptured in the second sample}}$$

A scientist used this technique to determine the change in the population size of snails in a pond from March to July.

Look at Figure 14 for Question 9(a) in the Diagram Booklet. It shows the results.

(continued on the next page)

9 continued.

(i) Using data from Figure 14, calculate the difference in the population size from March to July.
(3 marks)

Difference in the population size

9 continued.

(ii) State TWO factors the scientist should control when sampling the habitat in March and July. (2 marks)

1 _____

_____

_____

2 _____

_____

_____

(continued on the next page)

9 continued.

(b) This pond is affected by eutrophication.

Explain ONE possible cause of eutrophication.
(2 marks)

(continued on the next page)

9 continued.

*(c) Reforestation has a beneficial effect on air composition and biodiversity.

Animal conservation projects can also have a beneficial effect on biodiversity.

Explain the beneficial effects of reforestation and animal conservation projects.
(6 marks)

(continued on the next page)

9 continued.

(continued on the next page)

9 continued.

(Total for Question 9 = 13 marks)

10 (a) When training, an athlete noticed some types of T-shirts became wetter and heavier due to sweating.

This athlete has three T-shirts, each made of a different material.

Devise a method this athlete could use to find the best T-shirt for training.
(3 marks)

(continued on the next page)

10 continued.

(continued on the next page)

10 continued.

(b) Athletes often eat a high protein diet.

(i) Which is the test and result for a food containing protein?
(1 mark)

☐ A Benedict's reagent is used and the solution turns brick red

☐ B Benedict's reagent is used and the solution stays blue

☐ C biuret solution is used and the solution stays blue

☐ D biuret solution is used and the solution turns purple

(continued on the next page)

10 continued.

(ii) Digested protein is absorbed in the small intestine by diffusion.

Look at Figure 15 for Question 10(b)(ii) in the Diagram Booklet. It shows part of the small intestine.

Using Figure 15 and Fick's law, explain the effect of the villi on the rate of diffusion.
(3 marks)

(continued on the next page)

10 continued.

(iii) Digested protein enters the blood as amino acids.

State which component of the blood transports amino acids. (1 mark)

(continued on the next page)

10 continued.

(c) Explain how high levels of amino acids in the blood cause a high concentration of urea in urine. (4 marks)

(continued on the next page)

10 continued.

(Total for Question 10 = 12 marks)

TOTAL FOR PAPER = 100 MARKS
END OF PAPER