

Biology
PAPER 2
Higher Tier

Total Marks

Friday 7 June 2024 – Afternoon

Time: 1 hour 45 minutes

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

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Ruler, calculator

YOU WILL BE GIVEN

Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

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

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.

There may be spare copies of some diagrams.

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) Banting and Best were the first scientists to use the hormone insulin for the treatment of diabetes.**

They extracted insulin from the body organs of animals.

- (i) Which body organ produces insulin?
(1 mark)**

- ☐ **A liver**
- ☐ **B heart**
- ☐ **C kidney**
- ☐ **D pancreas**

(continued on the next page)

1(a) continued.

**(ii) How does insulin travel to its target organ?
(1 mark)**

- ☐ **A by diffusion along neurones**
- ☐ **B dissolved in blood plasma**
- ☐ **C attached to red blood cells**
- ☐ **D by osmosis in white blood cells**

(continued on the next page)

1 continued.

(b) Tasting urine was one of the first ways doctors tested for diabetes.

If the urine tasted sweet, the patient may have diabetes.

Describe the chemical test we now use to test for glucose in urine.

(3 marks)

(continued on the next page)

Turn over

1 continued.

- (c) A scientist wanted to compare the glucose concentration in two urine samples.**

State TWO variables that need to be controlled for the comparison to be valid.

(2 marks)

1 _____

2 _____

(Total for Question 1 = 7 marks)

- 2 A centrifuge can be used to separate the different parts of human blood.**

Look at Figure 1 for Question 2 in the Diagram Booklet. It shows blood separated into different parts.

- (a) (i) Name part X.
(1 mark)**

- (ii) Which substance, needed for cellular respiration, is carried by red blood cells?
(1 mark)**

- ☐ **A carbon dioxide**
- ☐ **B urea**
- ☐ **C amino acids**
- ☐ **D oxygen**

(continued on the next page)

2(a) continued.

**(iii) Name TWO types of white blood cell.
(2 marks)**

1 _____

2 _____

(continued on the next page)

2 continued.

- (b) (i) When a person donates blood, 470 cm^3 of blood is removed from their body.**

Red blood cells make up 44% by volume of the blood.

Calculate the volume of red blood cells in 470 cm^3 of donated blood.

**Give your answer to the nearest whole number.
(3 marks)**

_____ cm^3

(continued on the next page)

Turn over

2(b) continued.

- (ii) Before donating blood, a person has a small blood sample taken to check that the blood is healthy.**

State TWO precautions a doctor should take when collecting this sample.

(2 marks)

1 _____

2 _____

(Total for Question 2 = 9 marks)

3 (a) Look at Figure 2 for Question 3(a) in the Diagram Booklet. It shows a root hair cell from a plant.

**(i) Name the part labelled X.
(1 mark)**

**(ii) State ONE way that the structure of the root hair cell increases the volume of substances it absorbs.
(1 mark)**

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3(a) continued.

**(iii) Explain why root hair cells do not
contain chloroplasts.
(3 marks)**

(continued on the next page)

3 continued.

(b) A student studied the water plant *Elodea*.

The student used a light microscope to observe the cells of the plant in tap water and in a 10% salt solution.

Look at Figure 3 for Question 3(b) in the Diagram Booklet. It shows *Elodea* cells in tap water and in a 10% salt solution.

- (i) Describe TWO ways that the *Elodea* cells in the 10% salt solution are different from the *Elodea* cells in tap water.**
(2 marks)

1 _____

2 _____

(continued on the next page)

Turn over

3(b) continued.

- (ii) Explain why placing the *Elodea* cells in the 10% salt solution causes the changes seen in Figure 3.
(3 marks)**

(Total for Question 3 = 10 marks)

- 4 A student investigated the decomposition of two different types of leaf.

The student placed 200 grams of holly leaves in a net bag.

The student placed 200 grams of oak leaves in another net bag.

The bags were left in a classroom.

The mass of the leaves in each bag was recorded every 10 days for 50 days.

- (a) State TWO variables that would need to be controlled in this investigation.
(2 marks)

1 _____

2 _____

(continued on the next page)

4 continued.

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

- (i) Calculate the rate of decomposition of holly leaves from 0 to 50 days.
(2 marks)**

_____ grams per day

(continued on the next page)

Turn over

4(b) continued.

- (ii) Compare the trends shown in the data for holly leaves and oak leaves.
(2 marks)**

(continued on the next page)

4 continued.

- (c) Explain why it is important for the environment that dead leaves are decomposed.
(2 marks)**

- (d) Name ONE type of organism that decomposes leaves.
(1 mark)**

(continued on the next page)

Turn over

4 continued.

(e) Leaves are eaten by snails.

1 600 grams of leaves and 10 snails were kept in a container for one month.

A scientist measured the mass of the leaves and the mass of the snails at the start and end of one month.

Look at Figure 5 for Question 4(e) in the Diagram Booklet. It shows the results.

Explain why the change in mass of the leaves is not the same as the change in mass of the snails.

(2 marks)

(Total for Question 4 = 11 marks)

5 (a) A scientist decided to study the variety of living organisms in a garden.

(i) The scientist wanted to use a random sampling technique.

Devise a plan the scientist could use to randomly sample the number of plant species in the garden.

(3 marks)

Answer space continues on the next page.

5(a)(i) continued.

(continued on the next page)

5(a) continued.

- (ii) The scientist also measured abiotic factors in the garden.**

The pH of the soil was measured using a pH meter.

Describe how THREE other abiotic factors could be measured in the garden.

(3 marks)

1 _____

2 _____

3 _____

(continued on the next page)

Turn over

5(a) continued.

(iii) Mistletoe is a parasite that grows on some trees.

Look at Figure 6 for Question 5(a)(iii) in the Diagram Booklet. It shows a tree with mistletoe growing on it.

Describe the feeding relationship between the mistletoe and the tree.

(2 marks)

(continued on the next page)

5 continued.

(b) Nitrate fertilisers are used in the garden.

**Explain why nitrate fertilisers are used in gardens.
(2 marks)**

(Total for Question 5 = 10 marks)

6 A student investigated the effect of glucose concentration on the rate of anaerobic respiration in yeast.

(a) The student used five concentrations of glucose: 5 %, 10 %, 15 %, 20 % and 25 %.

A teaspoon of dried yeast was added to 20 cm³ of the 5 % glucose concentration in a measuring cylinder.

A drop of washing up liquid was added and the mixture was stirred.

A reaction occurred and bubbles collected as foam on the surface of the mixture.

The height of the foam was measured after five minutes.

This method was repeated for each concentration of glucose.

**(i) Describe how to set up a control for this investigation.
(2 marks)**

Answer space continues on the next page.

6(a) continued.

- (ii) State how the scientist could improve this investigation to increase the rate of the reaction.
(1 mark)**

(continued on the next page)

6 continued.

(b) Look at Figure 7 for Question 6(b) in the Diagram Booklet. It shows the results of this investigation.

(i) The student thought one of the results was anomalous.

**Explain which of these results is anomalous.
(2 marks)**

(continued on the next page)

6(b) continued.

- (ii) Explain why the height of the foam was greatest for the 25 % glucose concentration. (3 marks)**

(Total for Question 6 = 8 marks)

7 A farmer wants to make sunflower seeds germinate faster.

**(a) Which is the best hormone for the farmer to use?
(1 mark)**

- ☐ **A adrenalin**
- ☐ **B auxin**
- ☐ **C thyroxine**
- ☐ **D gibberellin**

(b) The sunflower plants grew and flowered.

The farmer noticed that the flowers faced a different direction at different times of the day.

Look at Figure 8 for Question 7(b) in the Diagram Booklet. It shows a sunflower at different times of the day.

This movement is an example of phototropism.

(continued on the next page)

7(b) continued.

- (i) This movement of the flower was in response to the light.**

Explain how the sunflower changed direction throughout the day.

(4 marks)

Answer space continues on the next page.

7(b)(i) continued.

(continued on the next page)

7(b) continued.

**(ii) Explain how water moves through the stem of the sunflower plant to the leaves.
(3 marks)**

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Turn over

Explain why large leaves are an advantage to the plant.
(3 marks)

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(Total for Question 7 = 11 marks)

- 8 (a) Look at Figure 9 for Question 8(a) in the Diagram Booklet. It shows a human heart.
- (i) Draw arrows on Figure 9 to show the direction of blood flow through the left side of the heart.
(2 marks)
- (ii) Name the main blood vessel that carries deoxygenated blood into the heart.
(1 mark)
-
-

(continued on the next page)

8 continued.

(b) Look at Figure 10 for Question 8(b) in the Diagram Booklet. It shows the heart rate and stroke volume of a person when at rest and when doing exercise.

(i) Calculate the difference in cardiac output when at rest and when doing exercise.

Give your answer to 3 significant figures and include units in your answer.

(4 marks)

answer _____

(continued on the next page)

Turn over

8(b) continued.

**(ii) Explain why the cardiac output needs to increase during exercise.
(4 marks)**

[illegible]

(Total for Question 8 = 11 marks)

Turn over

9 (a) The female contraceptive pill contains hormones to prevent pregnancy.

**(i) Which hormones are in the female combined contraceptive pill?
(1 mark)**

- ☐ **A FSH and oestrogen**
- ☐ **B oestrogen and progesterone**
- ☐ **C progesterone and LH**
- ☐ **D LH and FSH**

(continued on the next page)

9(a) continued.

- (ii) Explain how the hormones in contraceptive pills prevent ovulation.
(3 marks)**

(continued on the next page)

Turn over

9(a) continued.

- (iii) Explain how a barrier method of contraception prevents pregnancy.
(2 marks)**

(continued on the next page)

9 continued.

***(b) Hormones can be used as part of assisted reproductive technology.**

Explain how assisted reproductive technology (ART) can be used to increase the chances of a woman becoming pregnant.

(6 marks)

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9(b) continued.

[illegible]

Turn over

9(b) continued.

(Total for Question 9 = 12 marks)

- 10 (a) Look at Figure 11 for Question 10(a) in the Diagram Booklet. It shows the location of the liver and kidneys in the human body.
- (i) The liver breaks down substances in the body to form waste products.

Which row of the table is correct?
(1 mark)

	substances broken down	waste products
<input type="checkbox"/> A	amino acids	urea
<input type="checkbox"/> B	amino acids	enzymes
<input type="checkbox"/> C	urea	enzymes
<input type="checkbox"/> D	urea	amino acids

- (ii) State how the waste products travel from the liver to the kidneys.
(1 mark)

(continued on the next page)

10 continued.

- (b) A scientist investigated the effect of a high-protein, low-carbohydrate diet on a person's body.**

The scientist measured the concentration of substances found in the urine of a person on this diet (person A) and in the urine of a person not on this diet (person B).

Look at Figure 12 for Question 10(b) in the Diagram Booklet. It shows the results.

- (i) Evaluate the results shown in Figure 12.
(3 marks)**

Answer space continues on the next page.

10(b)(i) continued.

(continued on the next page)

10(b) continued.

- *(ii) Explain how a nephron ensures that there is no protein and no glucose in the urine of person A.
(6 marks)**

Answer space continues on the next 2 pages.

10(b)(ii) continued.

[illegible]

Turn over

10(b)(ii) continued.

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS
END OF PAPER