

**Biology**  
**PAPER 2**  
**Higher Tier**

Total Marks
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**Friday 7 June 2024 – Afternoon**

**Time: 1 hour 45 minutes**

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

<b>Surname</b>					
<b>Other names</b>					
<b>Centre Number</b>					
<b>Candidate Number</b>					

## **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.**

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**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)**

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**(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** \_\_\_\_\_

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**2** \_\_\_\_\_

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**(Total for Question 1 = 7 marks)**

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- 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)**

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- (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** \_\_\_\_\_

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**(continued on the next page)**

**2 continued.**

- (b) (i) When a person donates blood,  $470\text{ cm}^3$  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  $470\text{ cm}^3$  of donated blood.**

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

\_\_\_\_\_  $\text{cm}^3$

**(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** \_\_\_\_\_

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**(Total for Question 2 = 9 marks)**

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**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)**

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**(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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**(continued on the next page)**

**3(a) continued.**

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

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**(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)**

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**(Total for Question 3 = 10 marks)**

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- 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)**

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**4 continued.**

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

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

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**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)**

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**(Total for Question 4 = 11 marks)**

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**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)**

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**5(a)(i) continued.**

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**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** \_\_\_\_\_

\_\_\_\_\_

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**2** \_\_\_\_\_

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**3** \_\_\_\_\_

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**(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)**

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**5 continued.**

**(b) Nitrate fertilisers are used in the garden.**

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

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**(Total for Question 5 = 10 marks)**

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**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 cm<sup>3</sup> 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)**

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**6(a) continued.**

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

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**(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)**

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**6(b) continued.**

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

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**(Total for Question 6 = 8 marks)**

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**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)**

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**7(b)(i) continued.**

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**7(b) continued.**

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

[illegible]

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**Turn over**

**Explain why large leaves are an advantage to the plant.**

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**Turn over**

- 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)
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(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)**

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**(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**

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**9(a) continued.**

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

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**Turn over**

**9(a) continued.**

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

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**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)**

**Answer space continues on the next 2 pages.**

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**9(b) continued.**

[illegible]

**Turn over**

**9(b) continued.**

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**(Total for Question 9 = 12 marks)**

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- 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)
- 
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(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.**

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**10(b)(i) continued.**

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**10 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.**

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**10(b)(ii) continued.**

[illegible]

**Turn over**



**10(b)(ii) continued.**

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**(Total for Question 10 = 11 marks)**

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**TOTAL FOR PAPER = 100 MARKS**  
**END OF PAPER**