

**Paper Reference(s) 4HB1/01**  
**Pearson Edexcel International GCSE (9–1)**

**Human Biology**  
**UNIT: 4HB1**  
**PAPER: 01**

<b>Total Marks</b>
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**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**

**Calculator, ruler**

**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.**

**Show all the steps in any calculations and state the units.**

**Turn over**

## **INFORMATION**

**The total mark for this paper is 90.**

**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.**

## **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.**

**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) Look at the diagram for Question 1(a) in the Diagram Booklet. It shows a human eye.**
- (i) On the next page draw one line from each structure to its correct function.**  
**(3 marks)**

**(continued on the next page)**

1(a)(i) continued.

## STRUCTURE

structure X ●

structure Y ●

structure Z ●

## FUNCTION

● transmits electrical impulses to the brain

● refracts light rays

● protects the eye from pathogens

● detects light rays

● controls the shape of the lens

● controls the size of the pupil

(continued on the next page)

Turn over

**1(a) continued.**

**(ii) Most humans have stereoscopic vision.**

**Which of these statements occurs because of stereoscopic vision?  
(1 mark)**

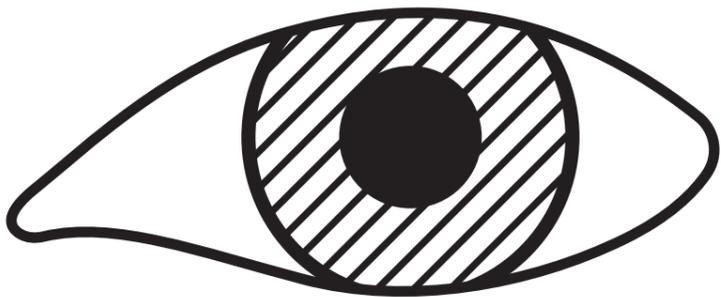
- A being able to judge depth**
- B being able to see in colour**
- C having a wide field of view**
- D to be able to see near and far objects**

**(continued on the next page)**

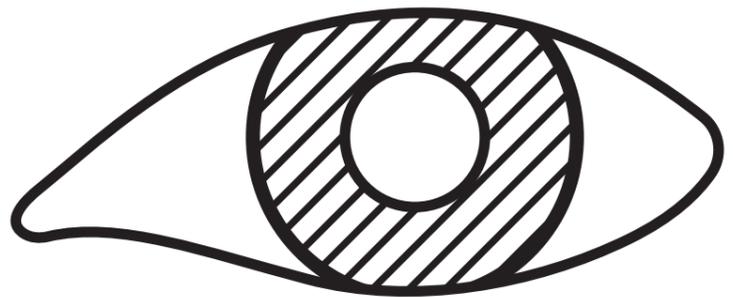
**1 continued.**

**(b) The diagram shows a healthy eye and an eye with a cataract.**

**Healthy eye**



**Eye with cataract**



**(i) Describe the cause of cataracts.  
(2 marks)**

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**(continued on the next page)**

**Turn over**

**1(b) continued.**

**(ii) State one treatment for cataracts.  
(1 mark)**

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**(iii) It is estimated that 39 million  
people in the world are blind.**

**Of these people, 43% are blind  
because of cataracts.**

**Determine the estimated number  
of people who are blind because  
of cataracts.**

**(2 marks)**

**number of people = \_\_\_\_\_**

**1(b) continued.**

**(iv) Some people are blind because of a vitamin deficiency.**

**Name the vitamin that is needed to prevent this type of blindness.  
(1 mark)**

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**(Total for Question 1 = 10 marks)**

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**2 (a) A human sperm cell has a tail, a mid-piece containing organelles and a head with a nucleus.**

**(i) Give the function of the tail.  
(1 mark)**

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**(ii) Which of these, found in the mid-piece, release energy?  
(1 mark)**

**A chromosomes**

**B endoplasmic reticulum**

**C mitochondria**

**D ribosomes**

**(continued on the next page)**

**Turn over**

**2(a) continued.**

**(iii) The process of meiosis is involved in the production of sperm.**

**Explain the importance of meiosis in sperm production.  
(3 marks)**

**Answer lines continue on the next page.**

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**2(a)(iii) continued.**

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**(continued on the next page)**

**2 continued.**

- (b) (i) Look at the diagram for Question 2(b)(i) in the Diagram Booklet. Complete the genetic diagram to show how the sex of a person is determined by the chromosomes in the nucleus of the egg and the nucleus of the sperm.  
(3 marks)**

**(continued on the next page)**

**2(b) continued.**

**(ii) The sperm head has to enter the egg cell so the nuclei can fuse.**

**Describe how the sperm head enters the egg cell.  
(2 marks)**

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**(Total for Question 2 = 10 marks)**

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**3 (a) Look at the diagram for Question 3(a) in the Diagram Booklet. It represents the effect of bile on a large fat droplet.**

**(i) Where is bile produced?  
(1 mark)**

**A gall bladder**

**B liver**

**C small intestine**

**D stomach**

**(continued on the next page)**



**3 continued.**

**(b) Three food tests are used on a solution of food.**

**Look the table for Question 3(b) in the Diagram Booklet. It shows the reagent used and the colour of the food solution after each test.**

**(continued on the next page)**



**3(b) continued.**

**(ii) Saliva is added to a new sample of the food solution and the mixture is kept at 37 °C for 10 minutes.**

**The food tests are then repeated and the solution turns brick red when tested with Benedict's reagent.**

**Explain the effect of saliva on the food solution.  
(3 marks)**

**Answer lines continue on the next page.**

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**3(b)(ii) continued.**

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**(continued on the next page)**

**3 continued.**

**(c) Food is digested as it moves along the alimentary canal.**

**This process is helped by a diet containing fibre.**

**Explain how food is moved along the alimentary canal and how fibre helps this process.  
(5 marks)**

**Answer lines continue on the next 2 pages.**

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**Turn over**



**3(c) continued.**

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**(Total for Question 3 = 15 marks)**

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4 Typhoid is caused by **Salmonella typhi** bacteria.

These bacteria are spread by houseflies.

(a) Look at the image for Question 4 in the Diagram Booklet. It shows **Salmonella typhi**, magnified 60 000 times.

(i) Each bacterium is surrounded by cell structure Y.

Identify cell structure Y.  
(1 mark)

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(continued on the next page)

**4(a) continued.**

**(ii) Bacterium X has a length of 55 mm.**

**Calculate the actual length of the bacterium in micrometres ( $\mu\text{m}$ ).**

**[1 mm = 1000  $\mu\text{m}$ ]  
(2 marks)**

**actual length = \_\_\_\_\_  $\mu\text{m}$**

**(continued on the next page)**

**4 continued.**

**(b) A team of scientists found that the legs of houseflies have hundreds of different species of bacteria on them.**

**(i) Flies in towns and cities carry more bacteria than flies that are found in the countryside.**

**Suggest a reason for this observation.**

**(1 mark)**

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**(continued on the next page)**

**Turn over**

**4(b) continued.**

**(ii) One species of bacterium identified is *Helicobacter pylori* which causes stomach ulcers.**

**Explain how houseflies could increase the transmission of *Helicobacter pylori*.  
(3 marks)**

**Answer lines continue on the next page.**

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**4(b)(ii) continued.**

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**(continued on the next page)**

**4 continued.**

**(c) Look at diagram for Question 4(c) in the Diagram Booklet. It shows the levels of typhoid across the world.**

**(i) Give reasons for the global distribution of typhoid.  
(2 marks)**

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**4(c) continued.**

**(ii) Some strains of bacteria that cause typhoid are resistant to antibiotics.**

**Discuss how resistance to antibiotics develops and the effect this has on the treatment of typhoid.  
(5 marks)**

**Answer lines continue on the next 2 pages.**

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**4(c)(ii) continued.**

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**(Total for Question 4 = 14 marks)**

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**5 (a) A student reads that as people get older their ability to hear high frequency sounds decreases.**

**(i) Describe an investigation a student could do to show if this is correct.  
(3 marks)**

**Answer lines continue on the next page.**

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

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**(ii) Give a reason why hearing loss occurs as people get older.  
(1 mark)**

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**(continued on the next page)**

**Turn over**

**5 continued.**

**(b) Glue ear is a condition that can affect children and causes hearing loss.**

**Look at diagram for Question 5(b) in the Diagram Booklet. Fluid accumulates in the middle ear, as shown in the diagram.**

**As the child grows, the slope of the Eustachian tube increases and the fluid drains.**

**(i) Explain how the fluid in the middle ear causes hearing loss.  
(3 marks)**

**Answer lines continue on the next page.**

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**5(b)(i) continued.**

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**(ii) Explain why children with glue ear get more bacterial ear infections than other children.  
(2 marks)**

**Answer lines continue on the next page.**

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**Turn over**

**5(b)(ii) continued.**

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**(iii) Describe the role of the ear in maintaining a person's balance. (3 marks)**

**Answer lines continue on the next page.**

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**5(b)(iii) continued.**

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**(Total for Question 5 = 12 marks)**

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**6 Yoghurt can be produced by incubating milk with a small amount of live yoghurt.**

**The live yoghurt contains  
Lactobacillus bacteria.**

**Enzymes convert lactose in the milk into lactic acid causing the pH to decrease to around pH 4.4.**

**In an investigation, the change in pH as yoghurt is produced was measured during 20 hours at three different temperatures.**

**Look at the graph for Question 6 in the Diagram Booklet. It shows the results.**

**(continued on the next page)**

**6 continued.**

- (a) (i) Calculate the difference in the time taken to produce yoghurt at 40 °C instead of 20 °C.  
(2 marks)**

**time = \_\_\_\_\_ hours**

**(continued on the next page)**

**Turn over**

**6(a) continued.**

**(ii) Give two variables that need to be controlled in this investigation.  
(2 marks)**

**1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

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**(continued on the next page)**

**6(a) continued.**

**(iii) Describe how this investigation could be improved to find the optimum temperature for the production of yoghurt.  
(2 marks)**

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**(continued on the next page)**

**Turn over**

**6(a) continued.**

**(iv) In some methods to produce yoghurt, the milk is boiled and then cooled before the bacteria are added.**

**Give the reason for boiling and the reason for cooling the milk.  
(2 marks)**

**boiling**

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**cooling**

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**6 continued.**

**(b) When yoghurt reaches a pH of 4.4 the bacteria stop fermenting lactose.**

**Explain why bacteria stop fermenting the lactose at a pH of around 4.4 (2 marks)**

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**(continued on the next page)**

**Turn over**

**6 continued.**

**(c) People who are lactose intolerant can drink lactose-free milk.**

**This can be produced using alginate beads containing lactase.**

**(continued on the next page)**

**6(c) continued.**

**Look at the diagram for Question 6(c) in the Diagram Booklet. It shows the equipment needed.**

- (i) Describe the advantages of using alginate beads containing lactase rather than a solution of lactase. (2 marks)**

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**(continued on the next page)**

**6(c) continued.**

**(ii) The enzyme lactase breaks down lactose into simpler sugars.**

**Explain how the structure of the small intestine allows the absorption of these sugars.  
(3 marks)**

**Answer lines continue on the next page.**

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**6(c)(ii) continued.**

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**(Total for Question 6 = 15 marks)**

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**7 People with polycystic kidney disease have cysts on their kidneys.**

**Cysts are sacs of fluid and they affect the functioning of the kidney.**

**Polycystic kidney disease is caused by a mutation of a gene.**

**(a) Explain how a gene mutation can affect the phenotype of an individual.  
(3 marks)**

**Answer lines continue on the next page.**

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**7(a) continued.**

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**(continued on the next page)**

**7 continued.**

**(b) Polycystic kidney disease can cause kidney failure.**

**Kidney failure can be treated using dialysis or a transplant.**

**(i) Describe the benefits of a transplant rather than dialysis as a treatment for kidney failure.  
(2 marks)**

**Answer lines continue on the next page.**

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**Turn over**

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

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**(continued on the next page)**

**7(b) continued.**

**(ii) In one year in the United Kingdom there were 4733 organ donations.**

**Of these donations, 3233 were kidney donations.**

**Calculate the percentage of organ donations that are kidney donations.**

**(2 marks)**

**percentage = \_\_\_\_\_ %**

**(continued on the next page)**

**Turn over**

**7(b) continued.**

**(iii) The number of kidney donations is much higher than the number of other organ donations such as heart or liver.**

**Give two reasons for the higher number of kidney donations.  
(2 marks)**

**1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

**(continued on the next page)**

**Turn over**

**7 continued.**

**(c) Look at the diagram for Question 7(c) in the Diagram Booklet. It shows a family pedigree. Some of the family have polycystic kidney disease.**

**This disease is caused by a dominant allele that is not sex-linked.**

**(i) Determine the ratio of the females shown in the 3rd generation that are affected with polycystic kidney disease.  
(1 mark)**

**ratio = \_\_\_\_\_**

**7(c) continued.**

**(ii) Explain the possible genotypes and phenotypes for the offspring of individual A and individual B.**

**Look at the genetic diagram for Question 7(c)(ii) in the Diagram Booklet. You should complete the genetic diagram as part of your answer.  
(4 marks)**

**Answer lines continue on the next page.**

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**Turn over**

**7(c)(ii) continued.**

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**(Total for Question 7 = 14 marks)**

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**TOTAL FOR PAPER = 90 MARKS**  
**END OF PAPER**