

**Biology**  
**PAPER 1**  
**Higher Tier**

Total Marks
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**Friday 10 May 2024 – Morning**

**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.**

**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.**

**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. 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) (i) Which process is involved in the theory of evolution?  
(1 mark)**

- ☐ **A genetic engineering**
- ☐ **B biological control**
- ☐ **C natural selection**
- ☐ **D tissue culture**

**(continued on the next page)**

1(a) continued.

(ii) Figure 1 shows some stages of the theory of evolution.

**FIGURE 1**

overproduction → variation → survival of the fittest

State TWO causes of variation in organisms.  
(2 marks)

1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(continued on the next page)

**1(a) continued.**

**(iii) Disease is an example of a selection pressure.**

**Give ONE other example of a selection pressure that leads to survival of the fittest.  
(1 mark)**

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**(continued on the next page)**

**1 continued.**

- (b) Look at Figure 2 for Question 1(b) in the Diagram Booklet. It shows the location of the Wallace line, an imaginary line Alfred Wallace suggested, based on his research.**

**Wallace found that animals to the west of the line were different from animals to the east of the line.**

- (i) Suggest TWO possible reasons why animals to the west of the Wallace line are different from animals to the east of the Wallace line.  
(2 marks)**

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

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\_\_\_\_\_

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

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**(continued on the next page)**

**1(b) continued.**

- (ii) Give ONE reason why the work of Alfred Wallace encouraged Charles Darwin to publish his theory of evolution.  
(1 mark)**

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

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- 2 (a) Pepsin and trypsin are enzymes that break down proteins.**

**Look at Figure 3 for Question 2(a) in the Diagram Booklet. It shows the results of an investigation into the activity of pepsin and trypsin at different pH levels.**

- (i) Which molecules are produced when a protein is broken down?  
(1 mark)**

- ☐ **A    sugars**
- ☐ **B    amino acids**
- ☐ **C    fatty acids**
- ☐ **D    starches**

**(continued on the next page)**

**2(a) continued.**

**(ii) Describe the trend in the graph for the enzyme pepsin.**

**Use data from the graph to support your answer.**

**(3 marks)**

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**(continued on the next page)**

**2(a) continued.**

**(iii) State the optimum pH for the enzyme trypsin.  
(1 mark)**

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**(iv) Explain why there is no trypsin activity at pH 5.  
(3 marks)**

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**Turn over**

**2(a) continued.**

- (v) Temperature is a variable that should be controlled in this investigation.**

**Give ONE way the temperature could be controlled.**

**(1 mark)**

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

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**3 (a) Malaria is a disease that causes damage to the blood and liver.**

**(i) Which type of pathogen causes malaria?  
(1 mark)**

☐ **A a bacterium**

☐ **B a fungus**

☐ **C a protist**

☐ **D a virus**

**(ii) State how the pathogen that causes malaria is spread.  
(1 mark)**

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**(continued on the next page)**

**3 continued.**

**(b) Measles is a disease caused by a virus.**

**Look at Figure 4 for Question 3(b) in the Diagram Booklet. It shows the number of measles cases reported in England and Wales from 1985 to 2015.**

**Explain ONE conclusion that can be made about the change in the number of measles cases reported from 1985 to 2015.**

**(2 marks)**

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**(continued on the next page)**

**Turn over**

**3 continued.**

**(c) Describe TWO ways the immune system will respond to an infection by a pathogen.  
(2 marks)**

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

**(continued on the next page)**

**3 continued.**

- (d) Beriberi is a disease caused by a lack of vitamin B1 in the diet.**

**Give ONE reason why beriberi is classed as a non-communicable disease.**

**(1 mark)**

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**(Total for Question 3 = 7 marks)**

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- 4 (a) Mendel crossed pea plants that always produced purple flowers with pea plants that always produced white flowers.**

**Look at Figure 5 for Question 4(a) in the Diagram Booklet. The flowers of the offspring were all purple, as shown in Figure 5.**

- (i) Which conclusion can be made about the characteristic for purple flowers?  
(1 mark)**

- ☐ **A the characteristic is recessive**
- ☐ **B the characteristic is dominant**
- ☐ **C the characteristic is a mutation**
- ☐ **D the characteristic is environmental**

**(continued on the next page)**

**4(a) continued.**

- (ii) Mendel used two of the offspring with purple flowers in another cross.**

**The pea plants he obtained from this cross produced purple flowers or white flowers in a ratio of 3 : 1.**

**Calculate the expected number of pea plants with purple flowers, in a sample of 160 pea plants.  
(2 marks)**

**Number of pea plants  
with purple flowers = \_\_\_\_\_**

**(continued on the next page)**

**4(a) continued.**

**(iii) A pea plant producing purple flowers had the genotype  $Aa$ .**

**This pea plant was crossed with a pea plant producing white flowers.**

**Look at the Punnett square for Question 4(a)(iii) in the Diagram Booklet. Complete the Punnett square to show the possible genotypes of the offspring.**

**Show the percentage of pea plants that produce white flowers in your answer.**

**(3 marks)**

**Percentage of pea plants  
that produce white flowers = \_\_\_\_\_ %**

**(continued on the next page)**

**4 continued.**

**(b) Asexual reproduction can be used to produce flowering plants.**

**Give TWO advantages of using asexual reproduction to produce flowering plants.**

**(2 marks)**

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

**(continued on the next page)**

**4 continued.**

**(c) Flower colour is controlled by genes.**

**(i) Which is a definition of a gene?  
(1 mark)**

- ☐ **A a section of a DNA molecule that codes for a protein**
- ☐ **B a section of a chromosome that codes for DNA**
- ☐ **C the entire DNA of an organism**
- ☐ **D a section of a chromosome that coils into a double helix**

**(continued on the next page)**

**4(c) continued.**

- (ii) The two strands of a DNA molecule are linked by complementary bases.**

**Describe how the complementary bases are linked in a DNA molecule.**

**(2 marks)**

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

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**5 (a) A student made a microscope slide of cells taken from the inside of their mouth.**

**(i) The student wore gloves while using a swab to collect cells from their mouth.**

**Give ONE other safety precaution the student should take.**

**(1 mark)**

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**(continued on the next page)**

**5(a) continued.**

- (ii) Look at Figure 6 for Question 5(a)(ii) in the Diagram Booklet. A light microscope was used to obtain an image similar to the one shown in Figure 6.**

**Describe how the student used the light microscope to view these cells at a magnification of  $\times 400$   
(3 marks)**

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**5(a)(ii) continued.**

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**5 continued.**

**(b) The cytoplasm of a cell contains a nucleus.**

**Explain the role of ONE other structure in the cytoplasm of a human cell.  
(2 marks)**

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**5 continued.**

- (c) DNA can be extracted from human cells in a similar way to the method used to extract DNA from fruits.**

**Describe the stages of the method used to extract DNA from cells.**

**(3 marks)**

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**Turn over**

**5 continued.**

- (d) The Human Genome Project sequenced the order of the bases in the human genome.**

**Give TWO other outcomes from the Human Genome Project.**

**(2 marks)**

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

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

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**(Total for Question 5 = 11 marks)**

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- 6 (a) Look at Figure 7 for Question 6(a) in the Diagram Booklet. It shows images of two stone tools.

Scientists think that tool **A** was probably used by **Homo erectus** around 1·6 million years ago.

Tool **B** was probably used by **Homo habilis** around 2 million years ago.

- (i) Give ONE reason, using Figure 7, why scientists think that tool **A** was used by a more recent human ancestor.  
(1 mark)

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**6(a) continued.**

- (ii) Describe how scientists can date stone tools using information from where the tools were discovered.  
(2 marks)**

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**(continued on the next page)**

**6 continued.**

- (b) Differences in fossilised bones indicate structural changes that have occurred during the evolution of humans.**

**Describe TWO structural changes that have occurred during human evolution.  
(2 marks)**

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

**(continued on the next page)**

**6 continued.**

- (c) The migration patterns of humans can be tracked by analysing DNA in mitochondria.**

**Look at Figure 8 for Question 6(c) in the Diagram Booklet. It shows a mitochondrion viewed using an electron microscope.**

- (i) At a magnification of  $\times 62\,000$  this mitochondrion has a length of  $434\text{ mm}$ .**

**Calculate the actual length of this mitochondrion.**

**Give your answer in micrometres ( $\mu\text{m}$ ).  
(3 marks)**

\_\_\_\_\_  $\mu\text{m}$

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**6(c) continued.**

- (ii) Explain why an electron microscope is used to see mitochondria clearly.  
(2 marks)**

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**(Total for Question 6 = 10 marks)**

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- 7 (a) Look at Figure 9 for Question 7(a) in the Diagram Booklet. It shows an aphid.**

**An aphid inserts its mouthpart into plant tissue to feed on plant sap.**

- (i) Aphids can transfer plant viruses from one plant to another.**

**Which term describes the role of the aphid in the transmission of plant viruses?  
(1 mark)**

- ☐ **A the aphid is a vector**
- ☐ **B the aphid is a pathogen**
- ☐ **C the aphid is a protist**
- ☐ **D the aphid is a fungus**

**(continued on the next page)**

**7(a) continued.**

- (ii) Describe the physical barriers of a leaf that the virus gets through when an aphid feeds. (2 marks)**

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**7 continued.**

**(b) The genetic material from the virus is transcribed by the plant cell.**

**(i) Describe how mRNA is produced during transcription.  
(4 marks)**

**Answer space continues on the next page.**

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

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**7(b) continued.**

- (ii) Name the stage of protein synthesis  
after transcription.  
(1 mark)**

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**7 continued.**

- (c) Biological control can be used on aphid populations feeding on crops.**

**Explain the advantages of using biological control on aphid populations.**

**(3 marks)**

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**(Total for Question 7 = 11 marks)**

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- 8 Statins are a type of medicine used to treat cardiovascular disease.**

**Some people taking statins have reported muscle pain as a side effect.**

**Scientists analysed data from double-blind trials to determine if there was a correlation between statin use and muscle pain.**

**In these double-blind trials, neither doctors nor patients knew whether the patient had been given statins or not.**

- (a) (i) Describe the benefits of using double-blind trials.  
(2 marks)**

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**Turn over**



**8(a) continued.**

**(ii) Which stage of the process for testing new medicines could involve a double-blind trial?  
(1 mark)**

- ☐ **A discovery**
- ☐ **B development**
- ☐ **C preclinical**
- ☐ **D clinical**

**(continued on the next page)**

**8 continued.**

**(b) In a study, people were given statins or a placebo.**

**The percentage of people who reported muscle pain was recorded.**

**Look at Figure 10 for Question 8(b) in the Diagram Booklet. It shows the results of this study.**

**(i) In year one, 9 199 people taking statins reported muscle pain.**

**Calculate the total number of people taking statins in this study.**

**Give your answer to 4 significant figures.  
(3 marks)**

**\_\_\_\_\_ people**

**(continued on the next page)**

**8(b) continued.**

- (ii) The scientists concluded that most of the muscle pain reported was not due to the use of statins.**

**Explain, using information from the table in Figure 10, why the scientists made this conclusion.**

**(3 marks)**

**Answer space continues on the next page.**

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**8(b)(ii) continued.**

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**8(b) continued.**

- (iii) The results of the study are reliable because the data was obtained from a large sample of people.**

**Describe TWO factors that should have been considered when selecting people for the study.  
(2 marks)**

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

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\_\_\_\_\_

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

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**(Total for Question 8 = 11 marks)**

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- 9 (a) When one cell goes through the stages of the cell cycle, two cells are produced.**

**Look at Figure 11 for Question 9(a) in the Diagram Booklet. It shows the three stages of the cell cycle.**

- \*(i) Describe the three stages of the cell cycle shown in Figure 11.  
(6 marks)**

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

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**9(a)(i) continued.**

[illegible]

**Turn over**

**9(a)(i) continued.**

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**9(a) continued.**

- (ii) State what happens to the cell cycle in cancerous cells.  
(1 mark)**

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**(continued on the next page)**

**9 continued.**

**(b) The production of more cells contributes to the growth of an animal.**

**(i) Which other process is needed for the growth of an animal?**

**(1 mark)**

- ☐ **A cell elongation**
- ☐ **B differentiation**
- ☐ **C cell wall synthesis**
- ☐ **D transpiration**

**(continued on the next page)**

**9(b) continued.**

- (ii) A parent is concerned that their child is not growing as much as other children.**

**Describe how a doctor might determine if the child is growing as expected.**

**(4 marks)**

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**9(b)(ii) continued.**

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

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**10 Stomach ulcers can be caused by bacteria.**

- (a) (i) Name the bacteria that cause stomach ulcers.  
(1 mark)**

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- (ii) People with a stomach ulcer are treated  
with antibiotics and an alkaline medicine to  
reduce symptoms.**

**Give a reason why the alkaline medicine is used.  
(1 mark)**

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**(continued on the next page)**

**10 continued.**

**(b) Antibiotics are used to treat stomach ulcers.**

**Bacteria have become resistant to some antibiotics.**

**A scientist has an agar plate spread with the bacteria that cause stomach ulcers and discs containing different antibiotics.**

**Describe how the scientist could use these to determine which antibiotic can kill the bacteria.  
(3 marks)**

**Answer space continues on the next page.**

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**Turn over**

**10(b) continued.**

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**(continued on the next page)**

**10 continued.**

- \*(c) A bacteriophage is a type of virus that can infect bacterial cells.**

**Look at Figure 12 for Question 10(c) in the Diagram Booklet. It shows a bacteriophage infecting a bacterial cell.**

**Scientists are investigating if a bacteriophage could be used as an alternative to antibiotics.**

**Describe the lytic lifecycle of a virus and suggest why a bacteriophage could be used as an alternative to antibiotics.**

**(6 marks)**

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**10(c) continued.**

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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

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