

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.

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.**

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

\_\_\_\_\_

\_\_\_\_\_

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**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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**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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**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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**Turn over**



**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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(continued on the next page)

**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)**

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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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**(continued on the next page)**

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

\_\_\_\_\_

\_\_\_\_\_

**(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.**

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**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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**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.**

[illegible]

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

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