



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)

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

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

overproduction → variation → survival of the fittest

Figure 1

State **two** causes of variation in organisms.

(2)

1 .....

2 .....

(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)

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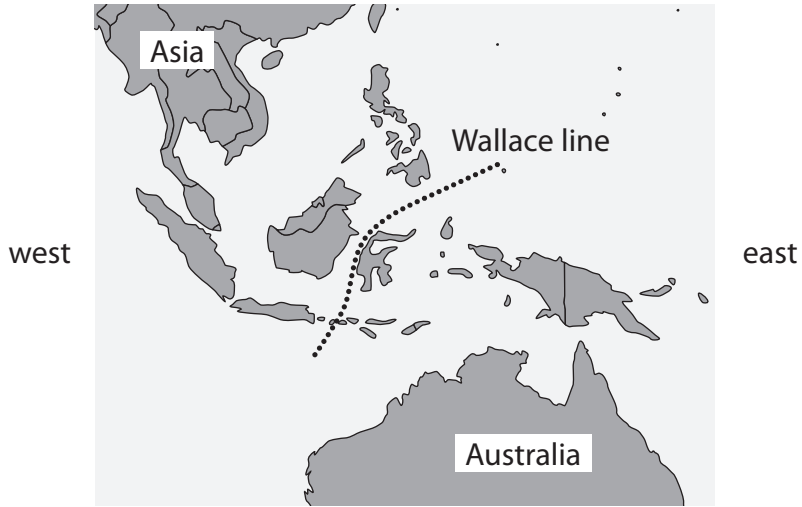
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(b) Figure 2 shows the location of the Wallace line, an imaginary line Alfred Wallace suggested, based on his research.

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



(Source: <https://www.dailymail.co.uk/sciencetech/article-4279382/Animal-evolution-shaped-movements-Earth.html>)

**Figure 2**

(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)

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2 .....

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

(1)

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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.

Figure 3 shows the results of an investigation into the activity of pepsin and trypsin at different pH levels.

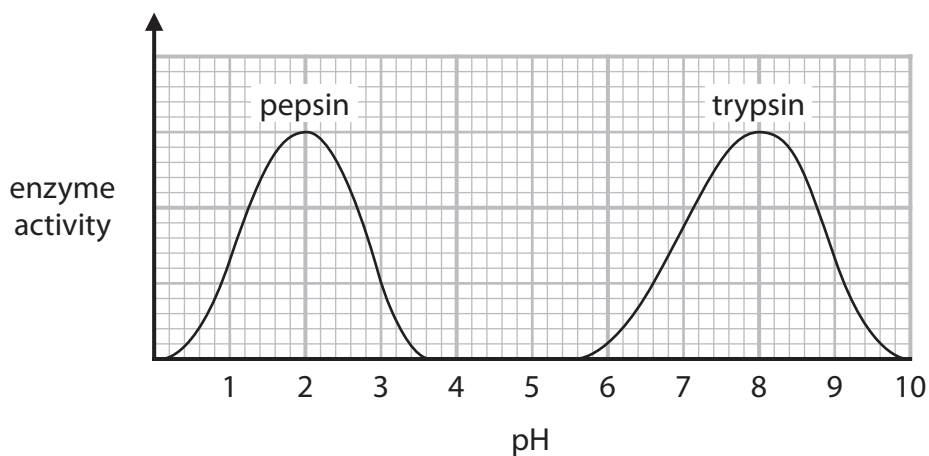


Figure 3

(i) Which molecules are produced when a protein is broken down?

(1)

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

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

Use data from the graph to support your answer.

(3)

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(iii) State the optimum pH for the enzyme trypsin.

(1)

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

(3)

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

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

(1)

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



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

(i) Which type of pathogen causes malaria?

(1)

- A a bacterium
- B a fungus
- C a protist
- D a virus

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

(1)

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

Figure 4 shows the number of measles cases reported in England and Wales from 1985 to 2015.

year	number of measles cases reported
1985	97 408
1995	7 447
2005	2 089
2015	1 193

Figure 4

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

(2)

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

The flowers of the offspring were all purple, as shown in Figure 5.

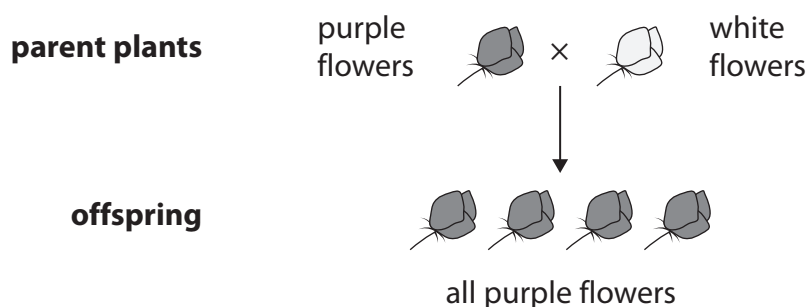


Figure 5

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

(1)

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

- (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)

Number of pea plants with purple flowers = .....



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

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

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)

		white flowers	
purple flowers	<b>A</b>		
	<b>a</b>		

Percentage of pea plants that produce white flowers = ..... %

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

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

(2)

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(c) Flower colour is controlled by genes.

(i) Which is a definition of a gene?

(1)

- 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

(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)

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



- 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.

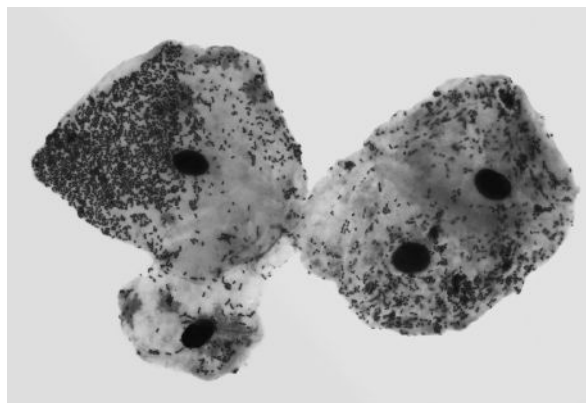
Give **one** other safety precaution the student should take.

(1)

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- (ii) A light microscope was used to obtain an image similar to the one shown in Figure 6.



(Source: © STEVE GSCHMEISSNER/SCIENCE PHOTO LIBRARY)

**Figure 6**

Describe how the student used the light microscope to view these cells at a magnification of  $\times 400$ .

(3)

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

Explain the role of **one** other structure in the cytoplasm of a human cell.

(2)

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(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)

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(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)

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2 .....

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



6 (a) Figure 7 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.

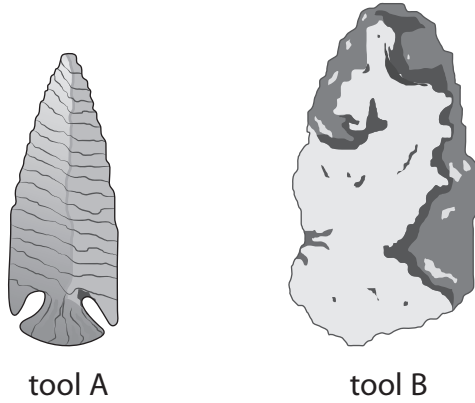


Figure 7

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

(1)

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

(2)

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(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)

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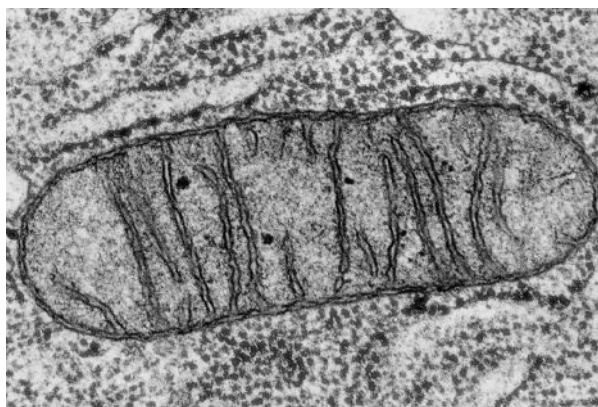
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(c) The migration patterns of humans can be tracked by analysing DNA in mitochondria.

Figure 8 shows a mitochondrion viewed using an electron microscope.



(Source: © CNRI/SCIENCE PHOTO LIBRARY)

**Figure 8**

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

Calculate the actual length of this mitochondrion.

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

(3)

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(ii) Explain why an electron microscope is used to see mitochondria clearly.

(2)

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



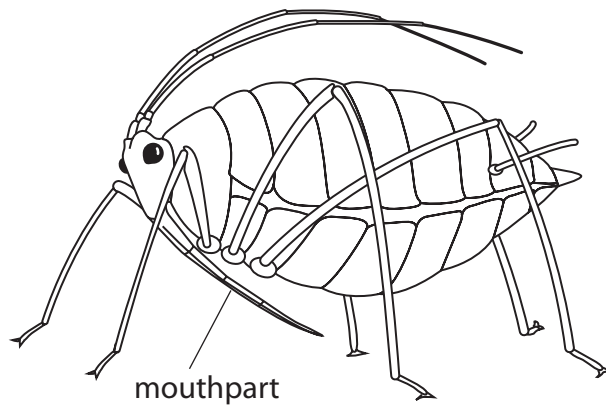
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7 (a) Figure 9 shows an aphid.

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



(Source: <http://www.biology-resources.com/drawing-aphid-wingless.html>)

**Figure 9**

(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)

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

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

(2)

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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)

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

(1)

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



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

The percentage of people who reported muscle pain was recorded.

Figure 10 shows the results of this study.

years after starting to take statins or placebo	people reporting muscle pain taking statins (%)	people reporting muscle pain taking placebo (%)
1	14.8	14.0
2	7.4	7.5
3	5.1	5.3
4	3.0	3.1

**Figure 10**

(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)

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(ii) State what happens to the cell cycle in cancerous cells.

(1)

(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)

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





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10 Stomach ulcers can be caused by bacteria.

(a) (i) Name the bacteria that cause stomach ulcers.

(1)

(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)

(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)

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