Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

AS
BIOLOGY

Paper 1

Thursday 25 May 2017 Afternoon Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

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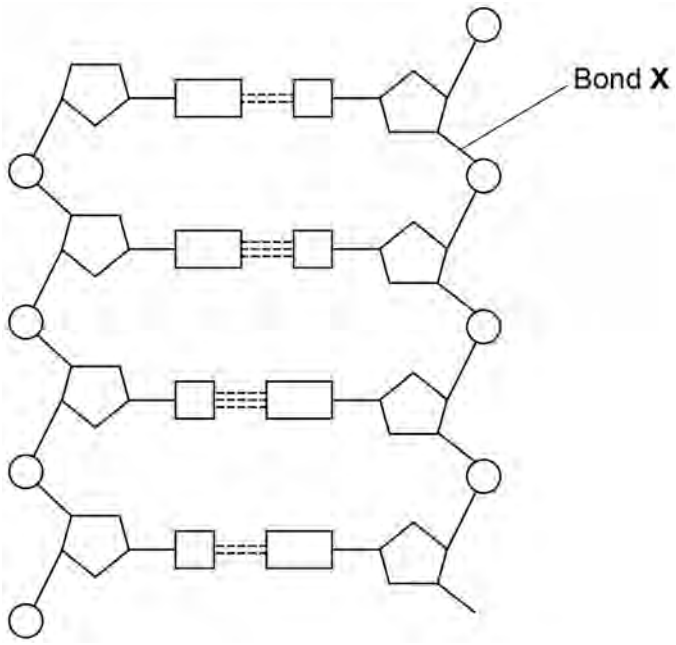
Answer **all** questions in the spaces provided.

0 1 **Figure 1** shows part of a DNA molecule.

Figure 1



0 1 . 1 How many nucleotides are shown in **Figure 1**?

[1 mark]

0 1 . 2 Name the type of bond labelled **X** in **Figure 1**.

[1 mark]

Do not write outside the box

0 1 . 3 The enzymes DNA helicase and DNA polymerase are involved in DNA replication.

Describe the function of each of these enzymes.

[2 marks]

DNA helicase _____

_____

_____

_____

DNA polymerase _____

_____

_____

_____

0 1 . 4 Adenosine triphosphate (ATP) is a nucleotide derivative.

Contrast the structures of ATP and a nucleotide found in DNA to give **two** differences.

[2 marks]

1 _____

_____

_____

_____

2 _____

_____

_____

_____

6

Do not write outside the box

0 2 A student investigated the effect of three types of disinfectant on the growth of *Lactobacillus* bacteria.

During the investigation, the student:

- boiled the agar before pouring the agar plates
- transferred 0.5 cm^3 of a diluted liquid culture of *Lactobacillus* onto each agar plate
- left some agar plates as controls
- added to other agar plates different concentrations of the disinfectants as shown in **Table 1** on page 5.

After 2 days, she counted the number of colonies of bacteria on each agar plate.

0 2 . 1 Explain the purpose of:

[2 marks]

boiling the agar _____

_____

_____

_____

transferring the same volume of liquid culture onto each agar plate.

_____

_____

_____

_____

The three disinfectants used by the student were Lysol, propan-2-ol and ammonia.

Table 1 shows the student's results.

Table 1

Concentration of disinfectant / arbitrary units	Number of colonies of bacteria		
	Lysol	Propan-2-ol	Ammonia
0	300	300	300
5	0	290	300
10	0	195	295
15	0	0	275
20	0	0	240

0 2 . 2 The liquid culture the student transferred was diluted by 1 in 10 000 (10^{-4}).

Use information in this question to calculate how many bacteria were present in 1 cm^3 of undiluted liquid culture.

[2 marks]

Answer = _____

Question 2 continues on the next page

Do not write outside the box

0 2 . 3 The student concluded that the minimum concentration of propan-2-ol needed to stop the growth of *Lactobacillus* was 15 units. This conclusion is incorrect.

Describe how you could obtain a more accurate estimate of the minimum concentration of propan-2-ol needed to stop the growth of this species of bacterium.

[2 marks]

6

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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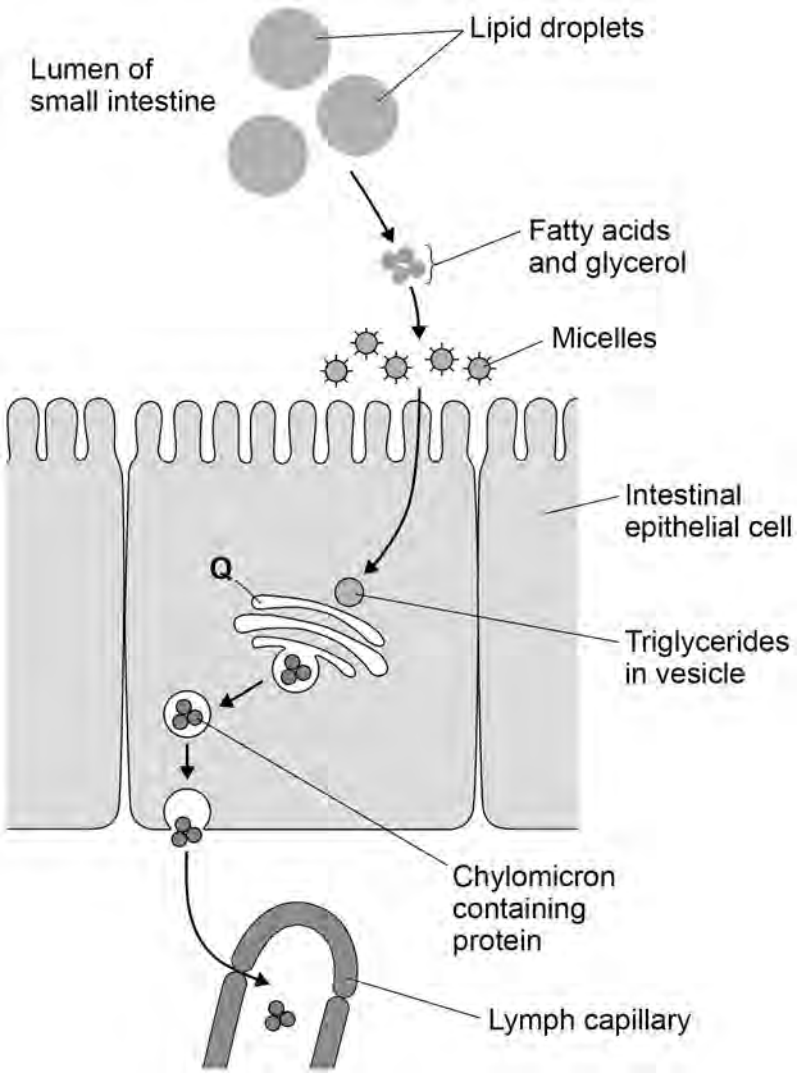
0 3 **Figure 2** outlines the digestion and absorption of lipids.

Figure 2



0 3 . 1 Tick (✓) the box by the name of the process by which fatty acids and glycerol enter the intestinal epithelial cell.

[1 mark]

Active transport ☐

Diffusion ☐

Endocytosis ☐

Osmosis ☐

Do not write outside the box

0 3 . 2 Explain the advantages of lipid droplet and micelle formation.

[3 marks]

[Extra space]

0 3 . 3 Name structure **Q** in **Figure 2** and suggest how it is involved in the absorption of lipids.

[4 marks]

Name

How it is involved

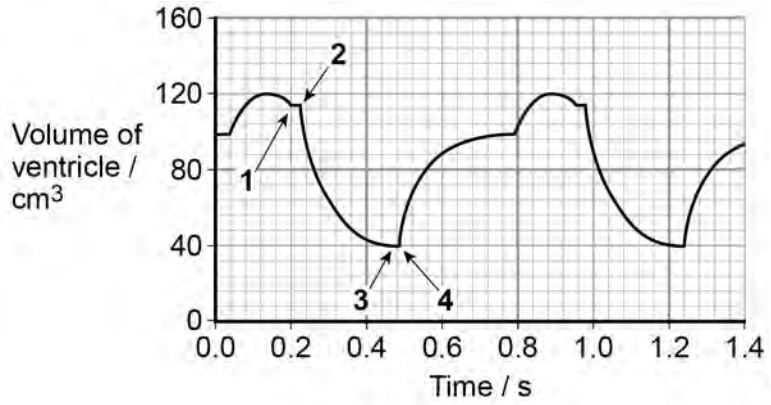
[Extra space]

8

Do not write outside the box

0 4 **Figure 3** shows the volume changes in the left ventricle of a human heart during two cardiac cycles. The numbers **1**, **2**, **3** and **4** represent times when heart valves open or close.

Figure 3



0 4 . 1 Use information from **Figure 3** to complete **Table 2**. Place the number **1**, **2**, **3** or **4** in the appropriate box.

[2 marks]

Table 2

	Valve opens	**Valve closes**
Semi-lunar valve		
Atrioventricular valve		

0 4 . 2 Use **Figure 3** to calculate the volume of blood pumped per minute by the left ventricle.

[2 marks]

Answer = _____ $cm^3\ min^{-1}$

Do not write outside the box

0 4 . 3 Explain the role of the heart in the formation of tissue fluid.

[2 marks]

0 4 . 4 Lymphoedema is a swelling in the legs which may be caused by a blockage in the lymphatic system.

Suggest how a blockage in the lymphatic system could cause lymphoedema.

[1 mark]

7

Turn over for the next question

Do not write outside the box

0 5 Scientists measured the mean amino acid concentration in white wines made from grapes grown organically and white wines made from grapes that were not grown organically.

0 5 . 1 Which test could the scientists have used to identify that there are amino acids in white wine?

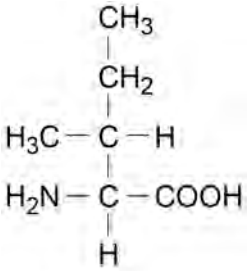
[1 mark]

0 5 . 2 All amino acids have the same general structure. **Figure 4** shows the structure of the amino acid isoleucine.

Draw a box around the part of the molecule that would be the same in all amino acids.

[1 mark]

Figure 4



Isoleucine

0 5 . 3 Name the chemical element found in all amino acids that is **not** found in triglycerides.

[1 mark]

Do not write outside the box

0 5 . 4 The scientists used a statistical test to determine whether there was a significant difference in the amino acid concentration in the two types of white wine.
They obtained a value for P of 0.04.

Name the statistical test the scientists used and give a reason for your answer.

Was the difference significant? Give a reason for your answer.

[3 marks]

Name of statistical test _____

Reason for choice _____

_____

_____

Explanation of test result _____

_____

_____

_____

_____

_____

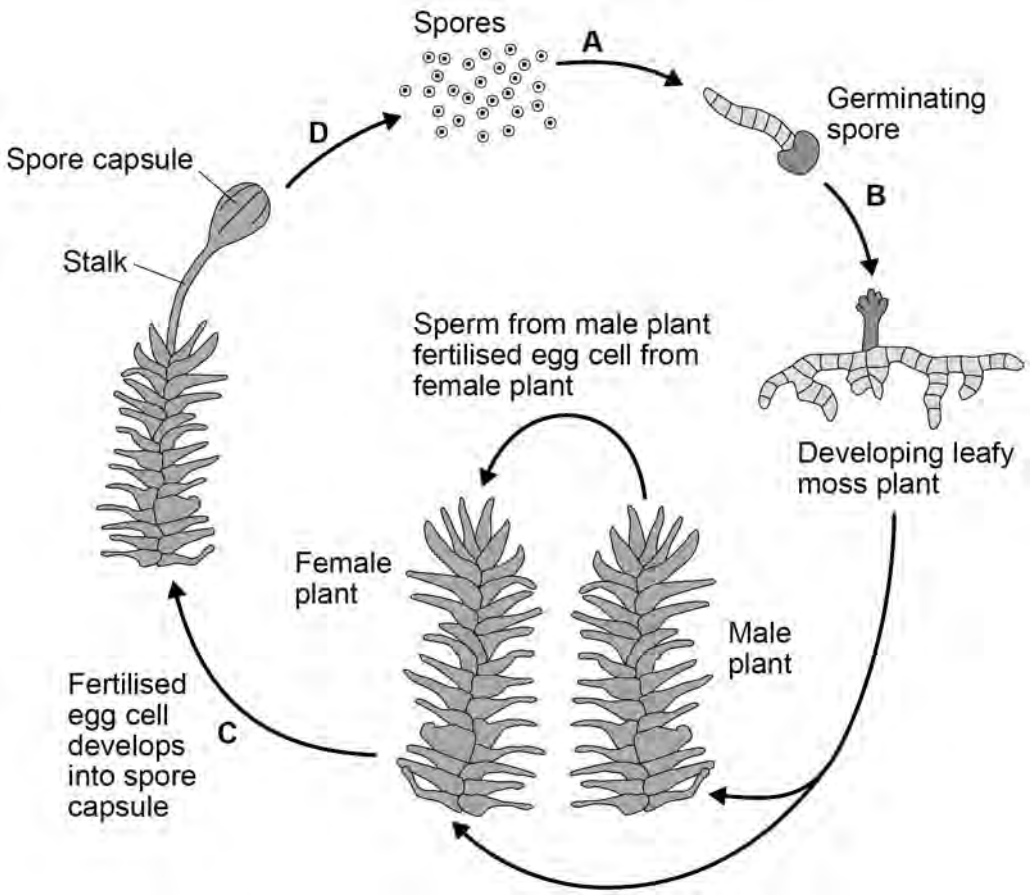
6

Turn over for the next question

Do not write outside the box

0 6 **Figure 5** shows the life cycle of a moss plant. In this life cycle, **only** the stalk and spore capsule are **diploid**. All the cells in all the other stages of the life cycle of the moss are **haploid**.

Figure 5



0 6 . 1 Which letter, **A**, **B**, **C** or **D**, in **Figure 5**, shows where meiosis occurs in the life cycle of the moss? Write the appropriate letter in the box provided.

[1 mark]

Do not write outside the box

0 6 . 2 Explain how the chromosome number is halved during meiosis.

[2 marks]

Figure 6 shows a cell from the moss plant.

The cell is in the **second** meiotic division.

Figure 6

0 6 . 3 What is the haploid number of chromosomes for this species of moss?

[1 mark]

Question 6 continues on the next page

Do not write outside the box

0 6 . 4 Crossing over greatly increases genetic diversity in this species of moss.

Describe the process of crossing over and explain how it increases genetic diversity.

[4 marks]

[Extra space]

8

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 7 . 1 Describe how you would use cell fractionation techniques to obtain a sample of chloroplasts from leaf tissue. Do **not** include in your answer information about any solutions.

[3 marks]

0 7 . 2 **Table 3** shows features of a mitochondrion and a chloroplast. Complete **Table 3** with ticks where a feature is present.

[3 marks]

Table 3

Feature	Mitochondrion	Chloroplast
Double outer membrane		
Starch grains		
Diffusion of oxygen into the organelle		

Do not write outside the box

0 7 . 3 Give the function of a mitochondrion.

[1 mark]

0 7 . 4 Scientists investigated the effect of an exercise programme on the number and size of mitochondria in skeletal muscle. They took samples of muscle from a large number of volunteers before and after the exercise programme. From each sample, they cut thin sections and used these to determine the mean number of mitochondria per μm^2 and the mean area of inner mitochondrial membranes.

Their results are shown in **Figure 7** and **Figure 8**.

Figure 7

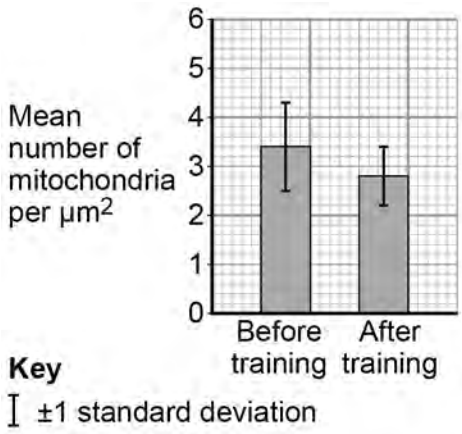
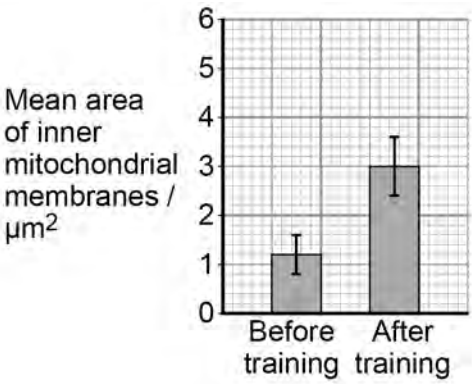


Figure 8



What do the data in **Figure 7** and **Figure 8** suggest about the effect of the exercise programme on mitochondria?

[2 marks]

9

Turn over ►

Do not write outside the box

0 8 . 1 Give **three** properties of water that are important in biology.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

A student investigated the effect of different concentrations of sucrose solution on "chips" cut from a potato. Each chip had the same dimensions.

The student:

- weighed each chip at the start
- placed each chip in a separate test tube, each containing 10 cm^3 of sucrose solution at a different concentration
- left the chips in the sucrose solution for 24 hours
- dried the surface of the chips and then weighed them again.

Table 4 shows the student's results.

Table 4

Concentration of sucrose solution / mol dm^{-3}	Initial mass of chip / g	Final mass of chip / g	Ratio of final mass to initial mass of chips
0.0	2.79	3.82	
0.2	2.75	2.97	
0.4	2.78	2.67	
0.6	2.69	2.31	
0.8	2.72	2.20	
1.0	2.77	1.99	

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0 8 . 2 The student produced the sucrose solutions with different concentrations from a concentrated sucrose solution.

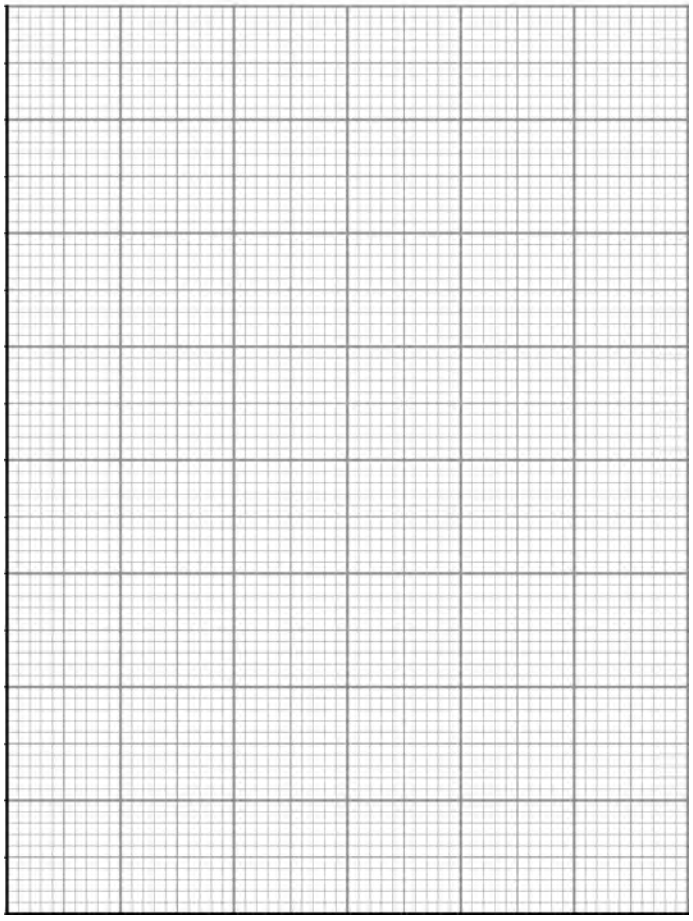
Name the method she would have used to produce these sucrose solutions.

[1 mark]

Name of method _____

0 8 . 3 Calculate the ratio of final mass to initial mass of potato chips and plot a suitable graph of your processed data. Express the ratios in **Table 4** as a single number (for example 5.26:1 would be expressed as 5.26).

[3 marks]



Question 8 continues on the next page

Do not write outside the box

0 8 . 4 Explain the result for the chip in 0.8 mol dm^{-3} sucrose solution.

[2 marks]

9

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 9 . 1 Define each of the following terms.

[2 marks]

Species _____

_____

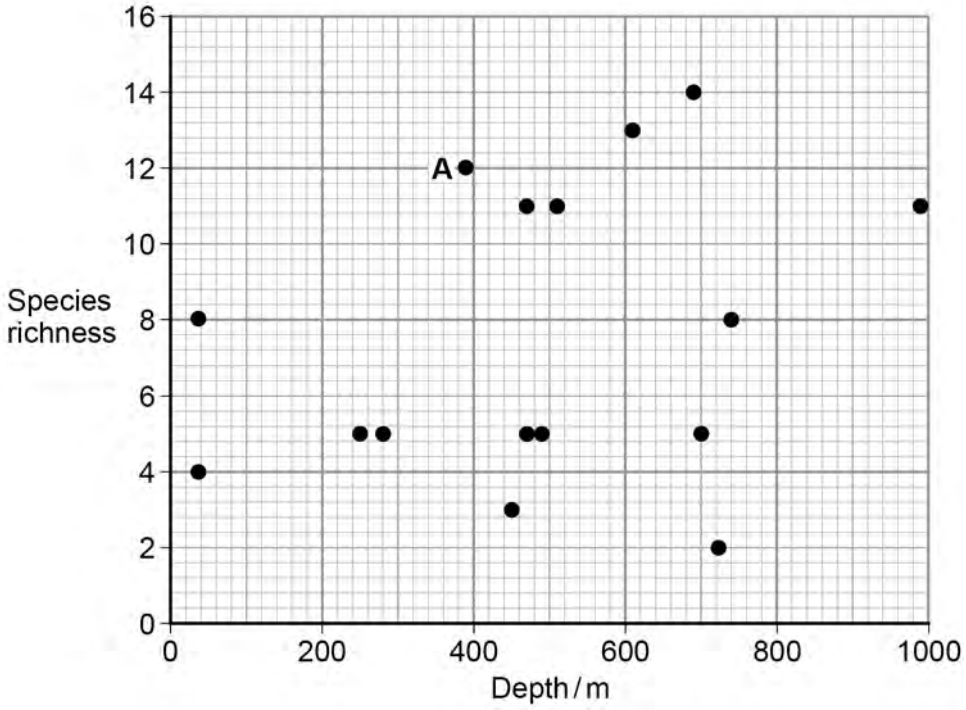
Species richness _____

_____

Scientists investigated the species richness of fish caught at various depths in the Pacific Ocean close to the western coast of Chile.

Figure 9 shows the scientists' results. 68% of all the fish caught in this investigation came from sample **A**.

Figure 9



0 9 . 2 What is the modal value of species richness?

[1 mark]

_____

Do not write outside the box

0 9 . 3 68% of all the fish caught in this investigation came from sample **A**.
A student thought this showed that sample **A** had a greater index of diversity than any of the other samples.

It is **not** possible to draw this conclusion from the given data. Give reasons why.
[3 marks]

6

Turn over for the next question

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1 0 Read the following passage.

Azidothymidine (AZT) is a drug used to treat people infected with human immunodeficiency virus (HIV). It inhibits the enzyme that synthesises DNA from HIV RNA. This does not destroy HIV in the body but stops or slows the development of AIDS.

In the past, some people who took AZT on its own eventually developed AIDS. Some of the HIV in their bodies had become resistant to AZT. To prevent this from happening, people infected with HIV are now treated with highly active antiretroviral therapy (HAART). This involves taking AZT with other anti-HIV drugs at the same time.

AZT is taken in low doses. This is because people who took high doses over long periods of time suffered muscle wastage. It was found that high doses of AZT inhibit replication of mitochondria.

Use information from the passage and your own knowledge to answer the questions.

1 0 . 1 Suggest and explain why AZT does not destroy HIV in the body but stops or slows the development of AIDS (lines 3–4).

[4 marks]

[Extra space]

Do not write outside the box

1 0 . 2 Suggest and explain **two** advantages of using HAART (lines 7–9).

[4 marks]

Advantage 1 _____

Advantage 2 _____

Question 10 continues on the next page

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1 0 . 3 Suggest why high doses of AZT lead to muscle wastage (lines 10–11).

[2 marks]

10

END OF QUESTIONS