Name: _____ ( ) Class: _____

YEAR FOUR INTEGRATED PROGRAMME
END-OF-YEAR EXAMINATION

BIOLOGY

Paper 2

2 October 2024
1 hour 45 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, register number, and class on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use paper clips, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer **only ONE** question.
Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.
You are reminded of the need for clear presentation in your answers.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A (70)	
Section B (10)	
10 Either	
10 Or	
Total (80)	

This document consists of **21** printed pages and **1** blank page.

Section A

Answer **all** questions.
Write your answer in the spaces provided.

1 Fig. 1 shows a unicellular organism.

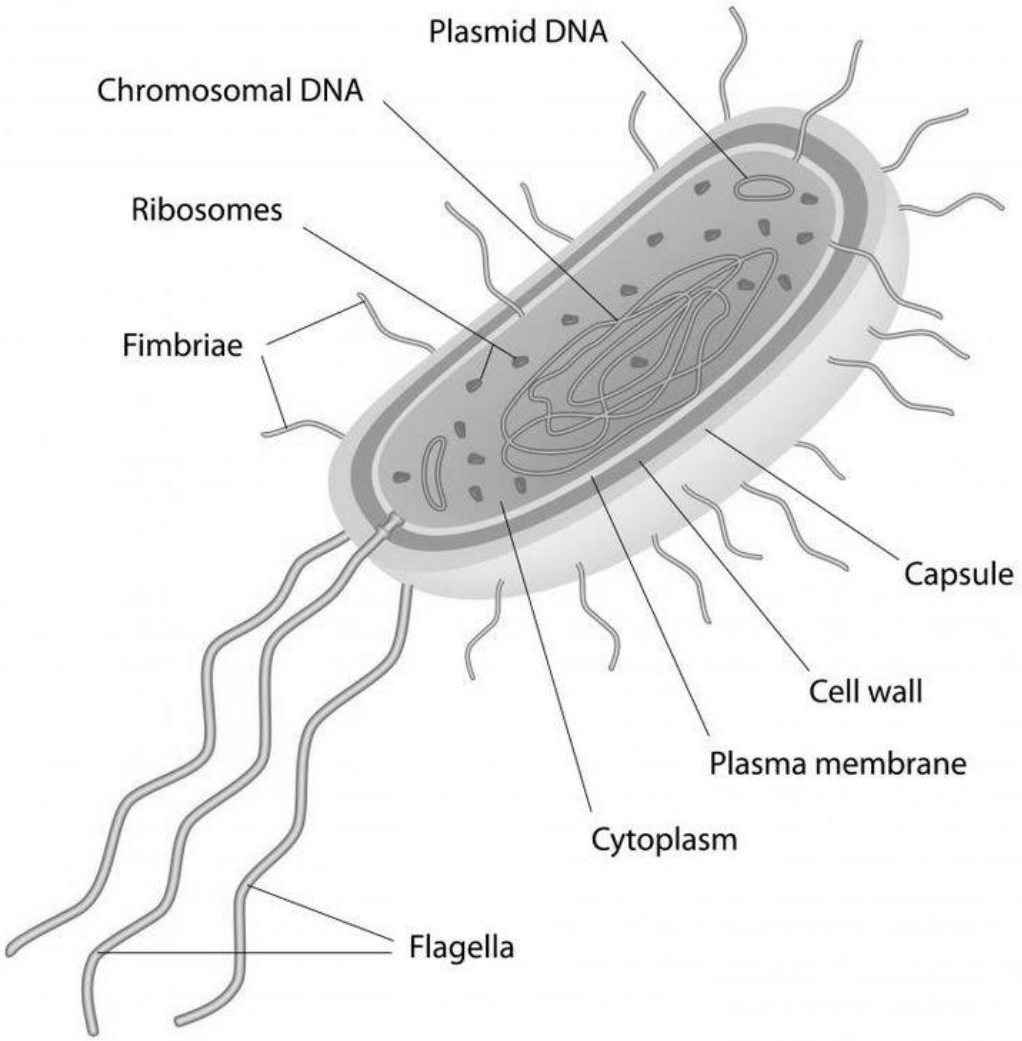

Fig. 1

(a) State whether the organism in Fig. 1 should be classified as an animal, plant, bacteria, or virus. Give two reasons to support your answer.

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…….. [3]

(b) Suggest how the flagella of the organism in Fig. 1 would help it to survive.

……

…… [1]

(c) An experiment was conducted where some of the organisms in Fig. 1 were placed in a test tube of concentrated sugar solution and observed over a period of time. State and explain the changes you would observe in the size of the cells.

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…….. [3]

[Total: 7 marks]

2 A student investigates the action of an enzyme from the human alimentary canal on starch. The setup for the investigation is shown in Fig. 2.

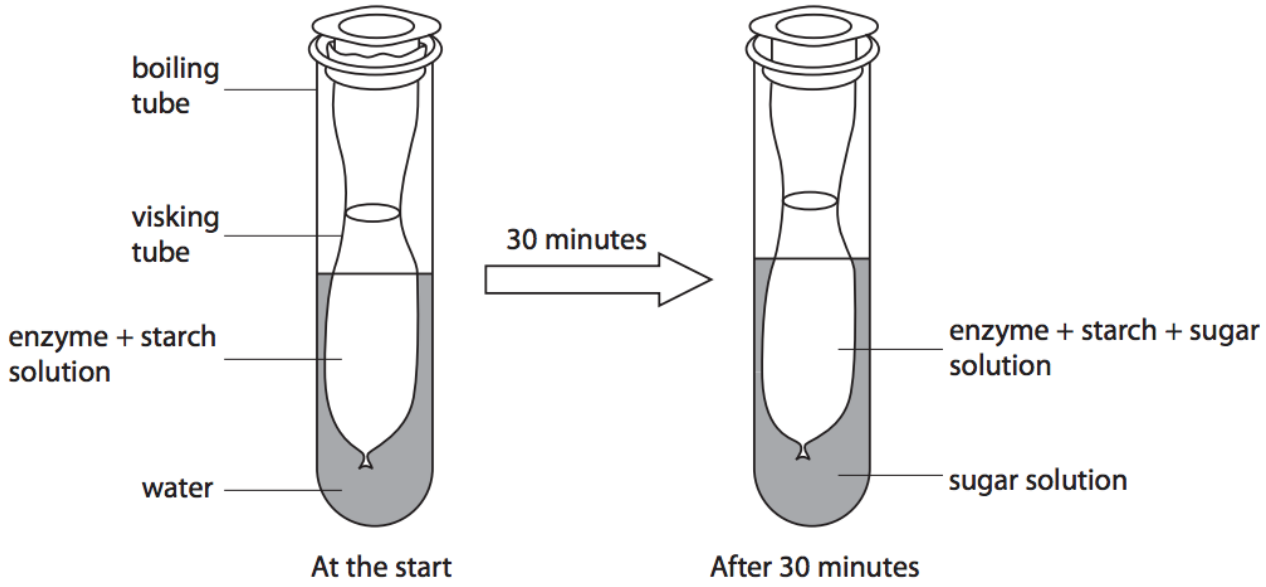

Fig. 2

(a) Identify the enzyme and the sugar present in the solution after 30 minutes.

Enzyme: …… Sugar: …… [2]

(b) Describe and explain a change that could be made to the investigation to ensure that there will be no more starch remaining in the visking tube after 30 minutes.

……

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…… [2]

(c) The student compared the experimental setup to the human alimentary canal. Describe one similarity and one difference in terms of **structure** between the setup in Fig. 2 and the human alimentary canal.

Similarity: ……..

……

Difference: ……

……... [2]

[Total: 6 marks]

3 Fig. 3 shows an X-ray image of the blood vessels supplying the muscles of the heart. The arrows indicate areas where the blood vessels have been found to be narrowed.

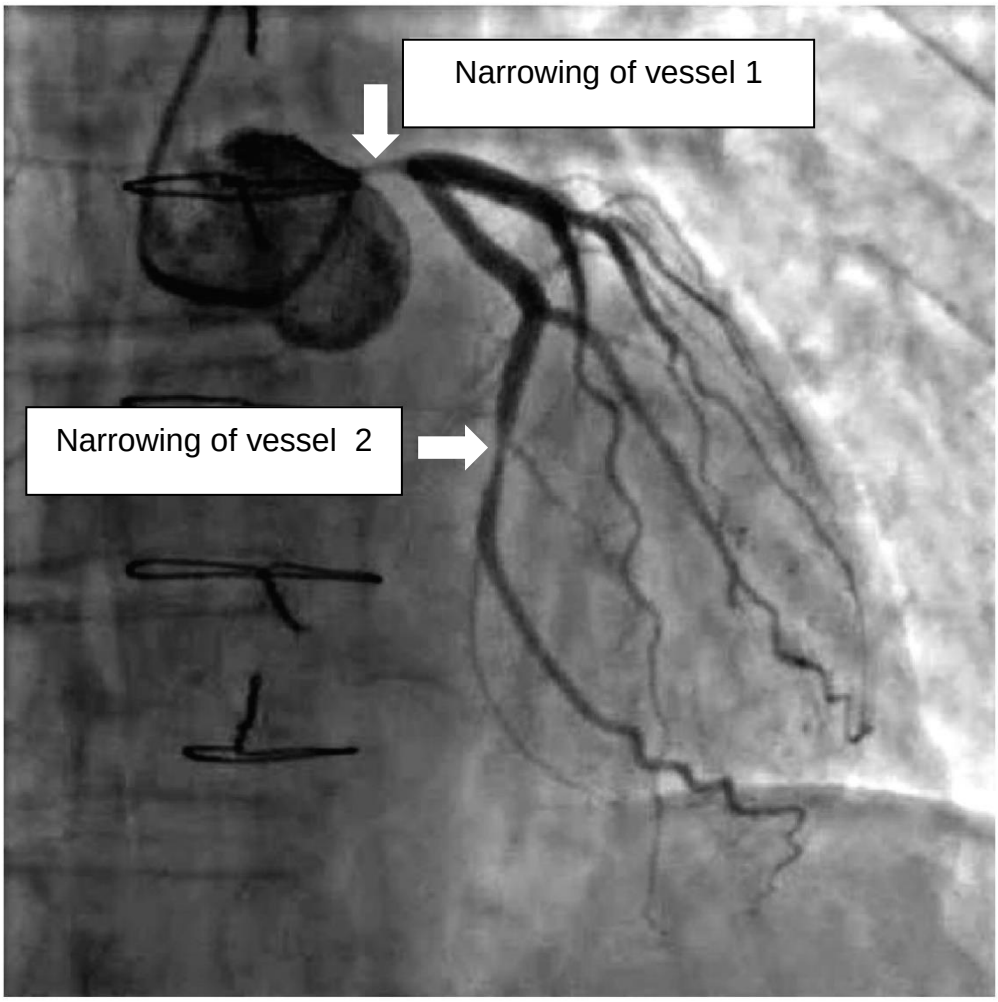

Fig. 3

(a) Name the blood vessels shown in Fig. 3.

……... [1]

(b) Suggest the cause of the narrowing of these blood vessels.

……

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…… [2]

(c) A surgical procedure called a coronary bypass can be performed on the patient, where an artery can be taken from another part of the patient's body and used to bypass the narrowed vessels, ensuring that the heart muscles have enough blood.

Explain why the blood vessel taken from another part of the body should be an artery, and not a vein.

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…… [2]

(d) State an improvement that the patient could make to his lifestyle to reduce his likelihood of dying from heart disease.

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…… [1]

[Total: 6 marks]

4 Fig. 4.1 shows structures from the respiratory system that aid the gaseous exchange of two gases, **X** and **Y**.

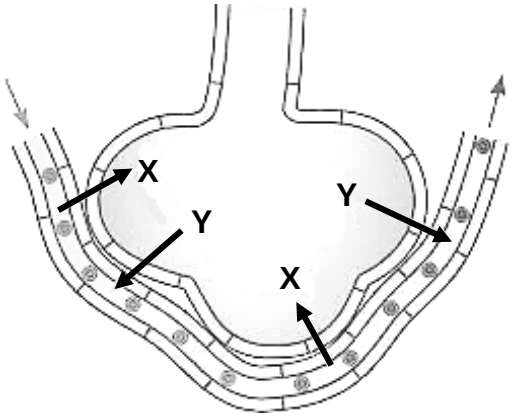

Fig. 4.1

(a) Explain two ways in which structures in Fig. 4.1 are suited to their function.

……

……

……

…… [2]

(b) During vigorous exercise, the usual intake of gas **Y** may be inadequate to support muscular contractions. Describe and explain how the human body responds in such a situation in order to take in sufficient amounts of gas **Y**.

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…… [3]

(c) Gas **X** is removed from the body by the process of excretion.

(i) Define excretion.

…… [1]

(ii) State the chemical equation for the process that forms Gas **X** in the human body.

…… [1]

(d) There are other excretory organs in the human body. **Fig. 4.2** shows a machine used to aid patients who have lost their function in such an organ.

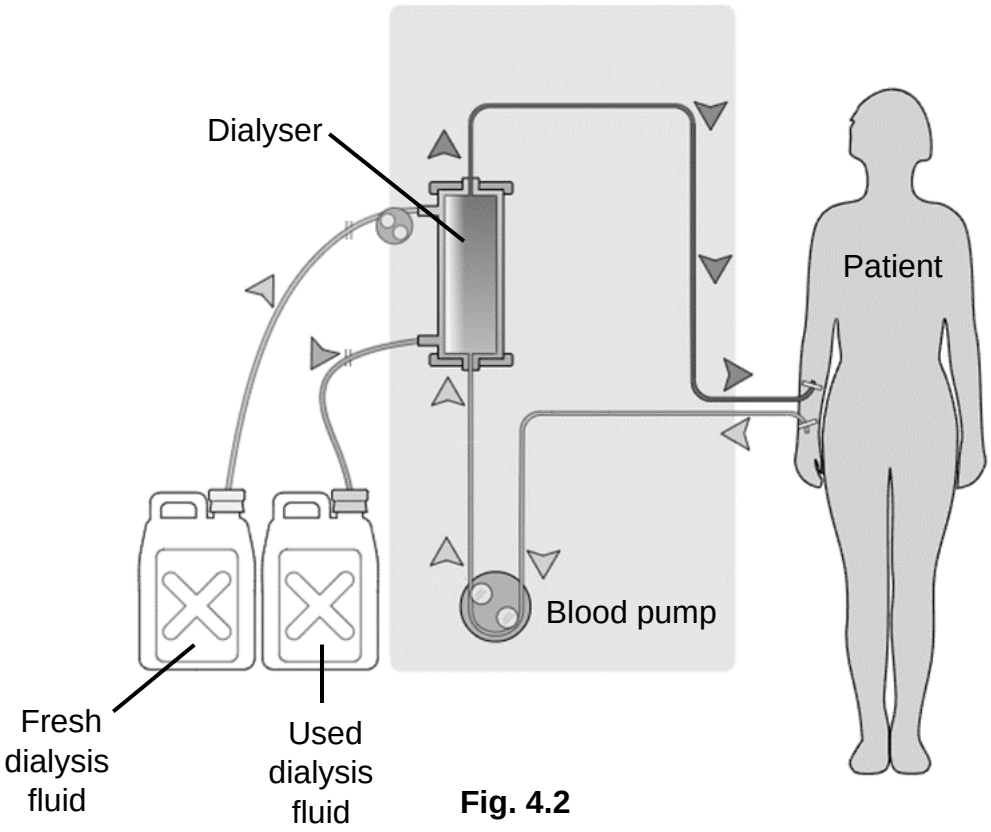

Fig. 4.2

(i) Name the organ in the human body that carries out the processes shown in Fig. 4.2.

…….. [1]

(ii) Explain how the machine in Fig. 4.2 effectively aids the patients when this organ has failed.

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…….. [3]

[Total: 11 marks]

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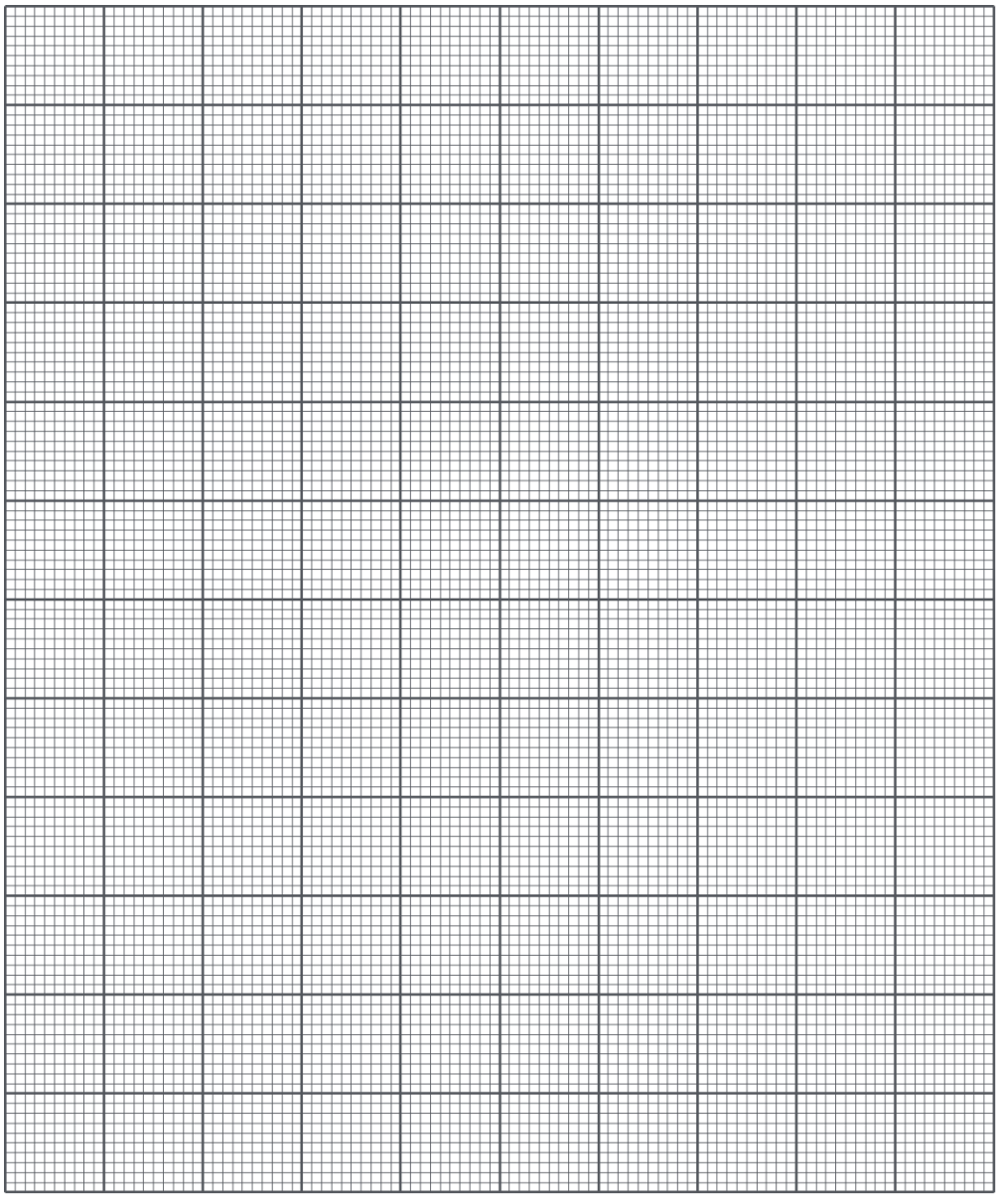
5 An investigation was conducted to compare between the thermal regulation of a mouse and a lizard. Table 5 shows the results of the investigation.

Table 5

environmental temperature / ^{o}C	body temperature of mouse / ^{o}C	body temperature of lizard / ^{o}C
0	31.0	0.2
10	30.9	9.8
20	31.2	20.3
30	31.3	29.9
40	31.2	39.8

(a) Plot a graph using the given data.



[4]

(b) With reference to your graph, describe the differences between the thermal regulation of the mouse and the lizard.

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……... [3]

(c) Suggest two ways in which the mouse was able to maintain its body temperature when environmental temperature was at 40 ^{o}C.

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……... [2]

(d) The mouse was observed to salivate when it saw food placed in front of it. Assuming that mice have similar nervous pathways to that of humans, outline the reflex pathway in the mouse that produces this response.

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……... [4]

[Total: 13 marks]

6 Fig. 6.1 shows the how rates of photosynthesis in two different plants varies with the carbon dioxide concentration of the surrounding air.

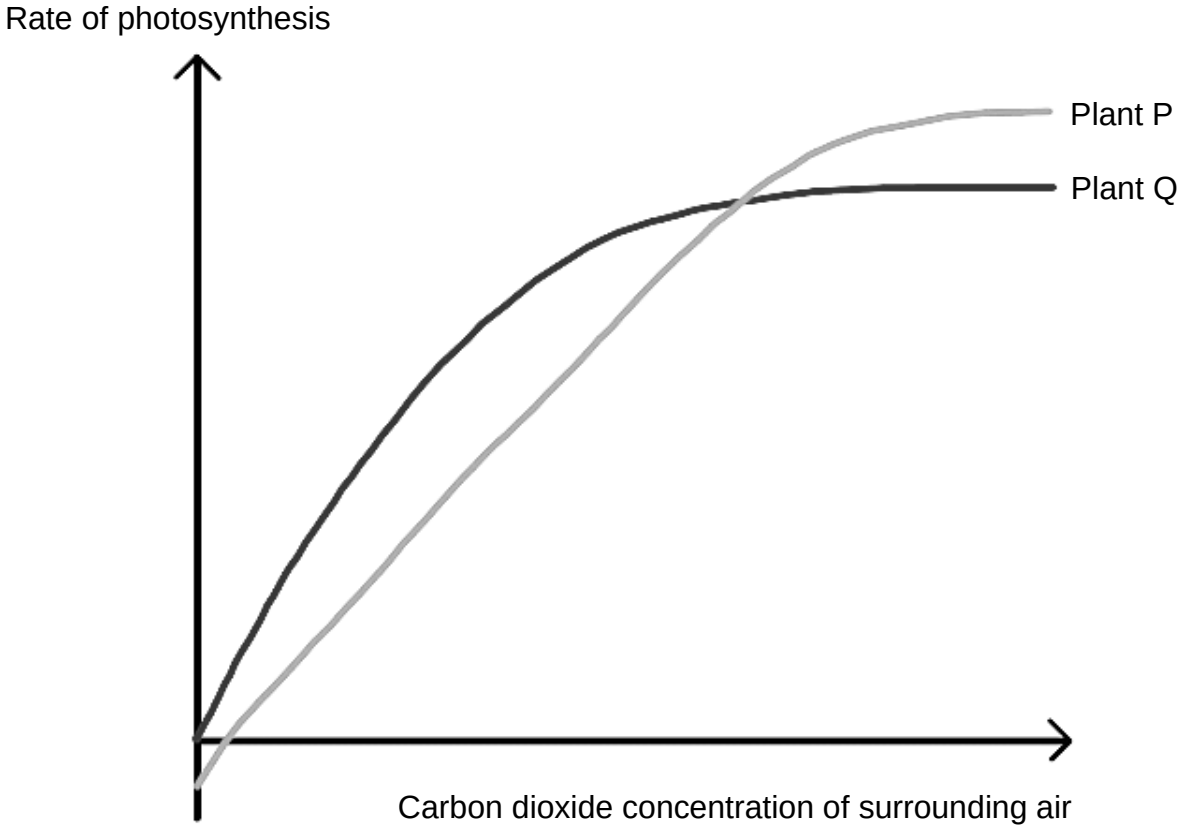

Fig. 6.1

(a) Label on Fig. 6.1 the point at which carbon dioxide concentration ceases to be a limiting factor in both Plant P and Q. [1]

(b) Describe how carbon dioxide reaches the mesophyll cells in a leaf.

……

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……

…… [3]

(c) Fig. 6.2 shows a closed terrarium, in which plants are placed and sealed in an airtight container.

Fig. 6.2

(i) Suggest a reason why the plants in a closed terrarium can survive even though the container is airtight.

……..

……. [1]

(ii) Given the information in Fig. 6.1, would Plant **P** or **Q** be better suited for growth in a closed terrarium? Explain your reasoning.

……..

……..

……..

……. [2]

(iii) A common garden plant, plant **R**, is sealed in a new closed terrarium, and placed under a bright light. Sketch a graph of rate of transpiration in plant **R** against time for the first hour after it was placed in the terrarium.

[2]
[Total: 9 marks]

7 Marine organisms are susceptible to entanglement in sea debris discarded by humans, such as used fishing lines and fishing nets.

Fig. 7 shows the reported instances of entanglement of various animal species in the marine ecosystem. The sizes of the squares represent the relative numbers of each animal species that have been reported to be found entangled in sea debris.

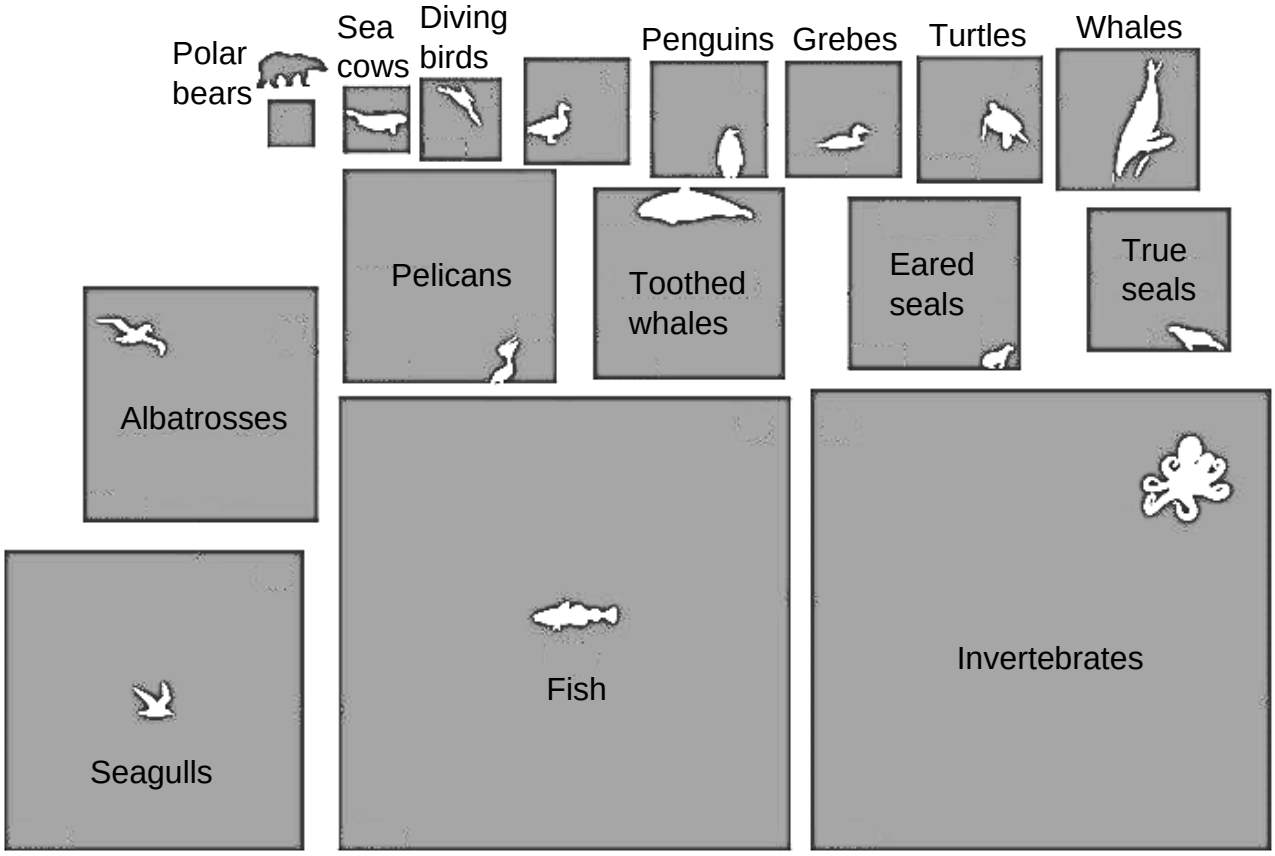

Fig. 7

(a) **(i)** Many food chains link the organisms shown in Fig. 7. Fill in the blanks below to show one of these possible food chains.

phytoplankton → zooplankton → …… → …… [1]

(ii) Phytoplankton are microscopic organisms in the water that have a very high rate of reproduction. In the space below, draw a pyramid of numbers for the food chain in **(a)(i)**.

[2]

(b) Suggest one way in which an increase in entanglement of marine organisms might negatively affect humans.

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…….. [1]

(c) Suggest two other ways in which humans can negatively affect the ecosystem shown in Fig. 7.

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…….. [2]

[Total: 6 marks]

8 Fig. 8.1 shows a method used by farmers to grow additional plants.

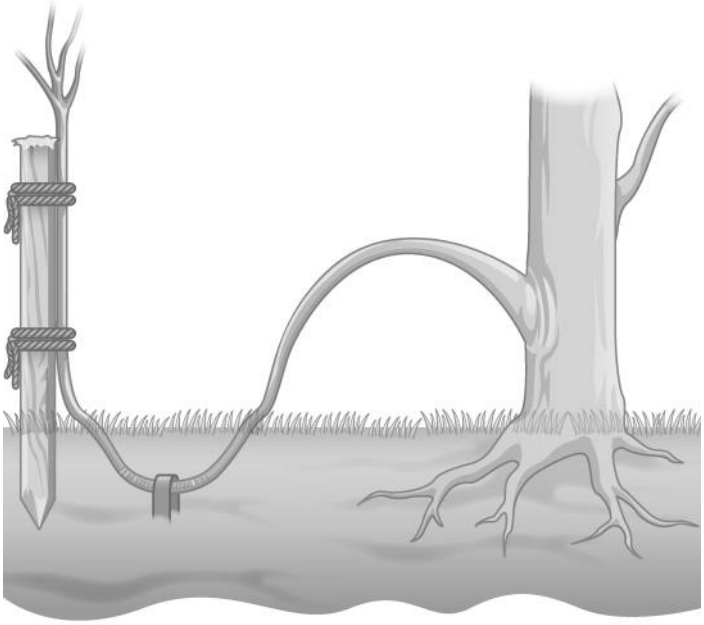

Fig. 8.1

(a) Fill in the table below to show the difference between the parent and offspring plant in Fig. 8.1.

plant	nature of cells found in leaf of plant	number of chromosomes found in root hair cell	number of chromosomes found in male gamete of a pollen grain
parent	diploid	32	……
offspring	……	……	……

[2]

(b) State and explain how the farmer would benefit economically from using this form of reproduction to grow more plants.

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…… [2]

(c) Fig. 8.2 shows a flower taken from the plant in Fig. 8.1.

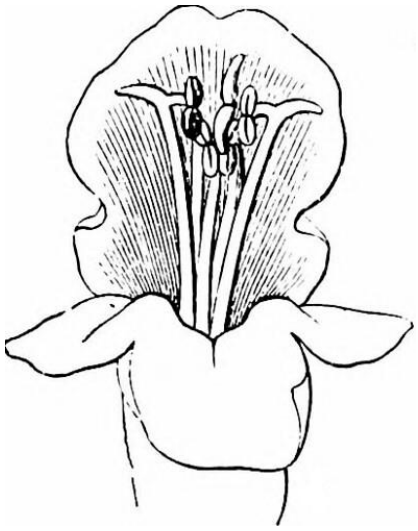

Fig. 8.2

State the mode of pollination for this flower. Support your answer with evidence from Fig. 8.2.

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…… [2]

[Total: 6 marks]

9 Fig. 9 shows how a genetic condition is inherited in an extended family.

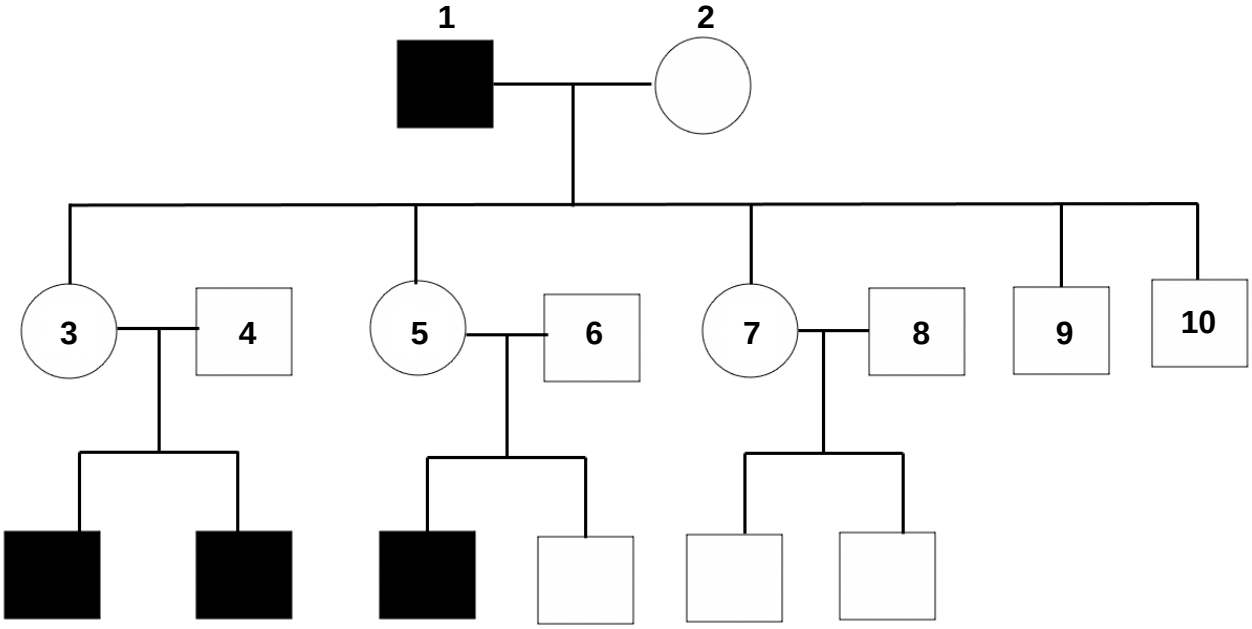

Fig. 9

(a) Explain how individuals **1** and **2** were able to have offspring that were all not affected by the condition.

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…….. [2]

Using the letters **T** and **t** to represent the alleles,

(b) state the possible genotype(s) of individual **9**.

…….. [1]

(c) draw a Punnett Square and show possible phenotypes of the offspring of individuals **3** and **4**. State their chance of having an offspring with the condition.

chance of offspring with condition: …… [3]

[Total: 6 marks]

Section B

Question 10 is in the form of an **Either/Or** question.
Answer only **ONE** question.

EITHER

10 Fig. 10.1 shows the number of hectares of genetically modified crops grown in various countries.

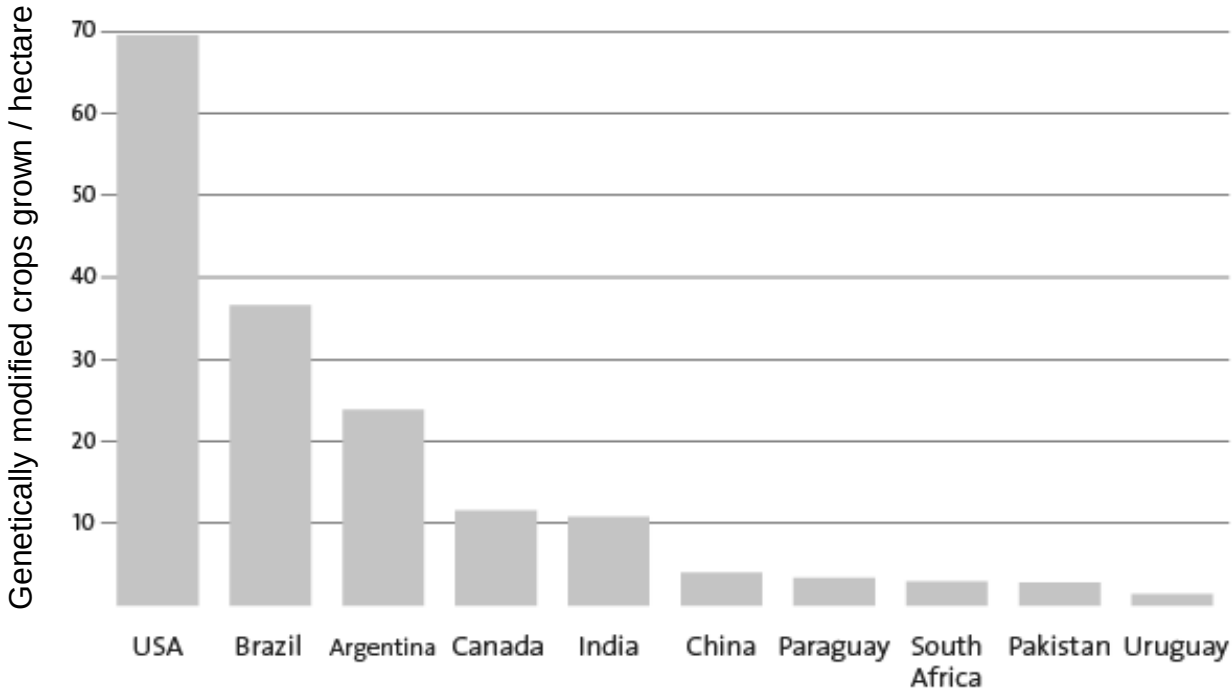

Fig. 10.1

(a) State two conclusions that can be made from the data shown in Fig. 10.1.

……

……

……

…….. [2]

(b) Suggest two benefits of growing genetically modified crops.

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…….. [2]

(c) Another example of genetically modified organisms is the use of *E. coli* bacteria to produce human insulin.

(i) Explain how *E. coli* can be genetically modified to produce human insulin.

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……..

……. [5]

(ii) The following sequence is of the first 12 bases that make up the human insulin gene:

AGCCCTCCAGGA

Write out the base sequence on the complementary strand of DNA.

……. [1]

[Total: 10 marks]

OR

10 Fig. 10.2 shows the percentage of youth living with HIV in various African countries.

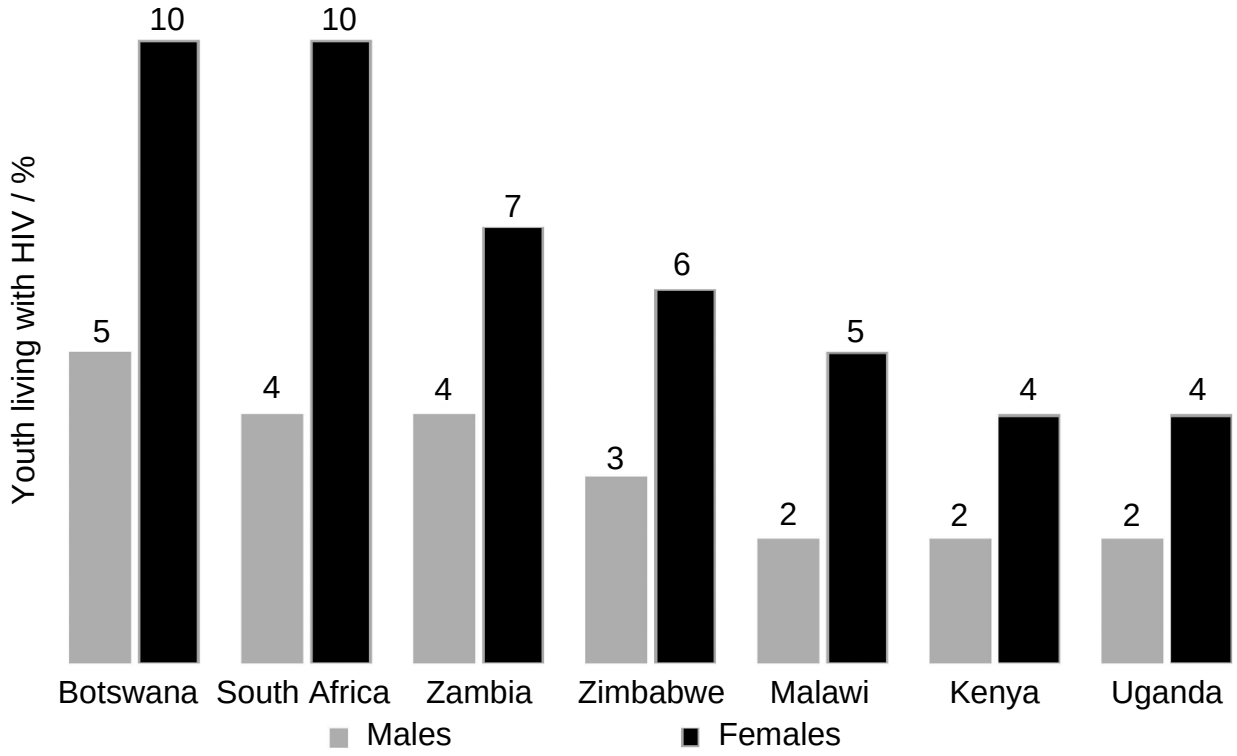

Fig. 10.2

(a) State two conclusions that can be made from the data shown in Fig. 10.2.

……

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…… [2]

(b) Suggest two methods by which the numbers of youth with HIV can be reduced in these countries.

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…… [2]

(c) HIV can mutate very quickly. With reference to natural selection, explain how HIV can evolve into forms that cannot be recognised by white blood cells.

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…… [5]

(d) Explain why antibiotics cannot be used to treat HIV.

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…… [1]

[Total: 10 marks]

End of paper