



**Paya Lebar Methodist Girls' School (Secondary)**  
**End-of-year Examination 2025**  
**Secondary 3 Express/G3**

|                   |  |       |  |                       |  |
|-------------------|--|-------|--|-----------------------|--|
| CANDIDATE<br>NAME |  | CLASS |  | CLASS INDEX<br>NUMBER |  |
|-------------------|--|-------|--|-----------------------|--|

TG

Subject Teacher

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**BIOLOGY**

**6093/02**

Paper 2

**2 Oct 2025**

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

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**READ THESE INSTRUCTIONS FIRST**

Write your name and index number on all the work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use a soft pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

**Section A (60 marks)**

Answer **all** questions.

Write your answers in the spaces provided.

**Section B (10 marks)**

Answer **one** question.

Write your answers in the spaces provided.

The use of an approved scientific calculator is expected, where appropriate.

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

| For Examiner's Use |  |
|--------------------|--|
| Section A          |  |
| Section B          |  |
| 7                  |  |
| 8                  |  |
| Total              |  |

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This document consists of **22** printed pages.

**[Turn over**

**Section A****[60 marks]**Answer **all** questions in this section.

Write your answers in the spaces provided.

- 1 Fig. 1.1 shows a drawing of a cell from the lining of the small intestine. The lumen is the space inside the intestine where food is digested.

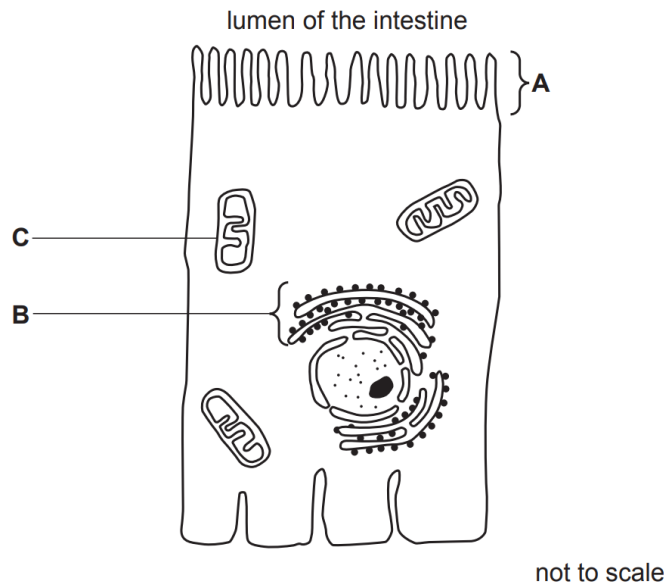


Fig. 1.1

- (a) State the names of labelled structures **A** and **C** in Fig. 1.1 and describe the role of each structure in the intestinal cell.

**A**.....  
 .....  
 .....  
 .....

**C**.....  
 .....  
 .....  
 ..... [4]

- (b) Cholera is a transmissible disease that causes watery faeces. The cholera bacterium can survive in the large intestine and reduces the absorption of water. The bacterium releases a toxin that interacts with receptors on the surface of cells causing the release of chloride ions into the lumen of the intestine.

Fig. 1.2 shows the effect of the toxin. The arrows indicate the direction of movement of the molecules.

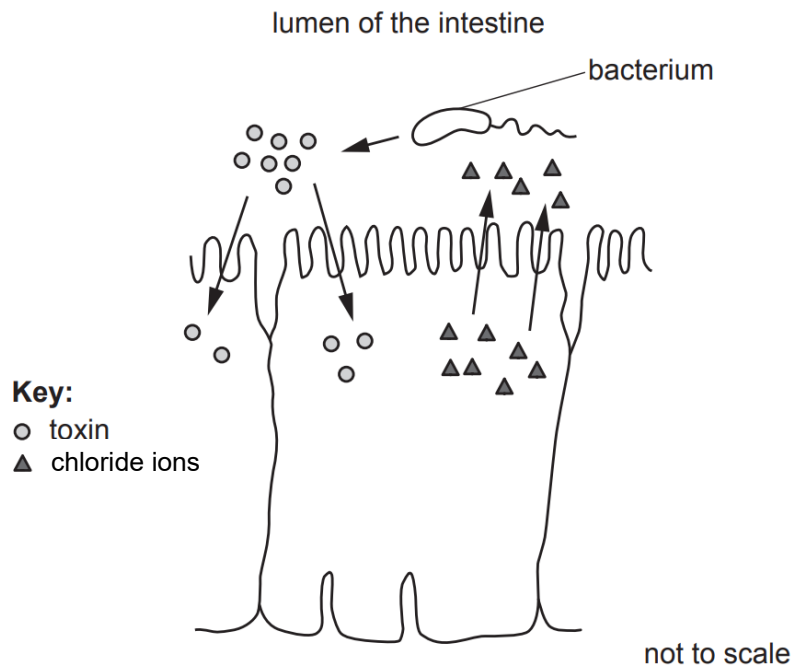


Fig. 1.2

Suggest how cholera causes watery faeces.

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.....[3]

- (c) Scientists have found that there are different types of starch which have molecules of different shapes. Some molecules are digested rapidly and others are digested slowly. The graph in Fig. 1.3 shows the effect on the concentration of glucose in the blood after eating two types of starch.

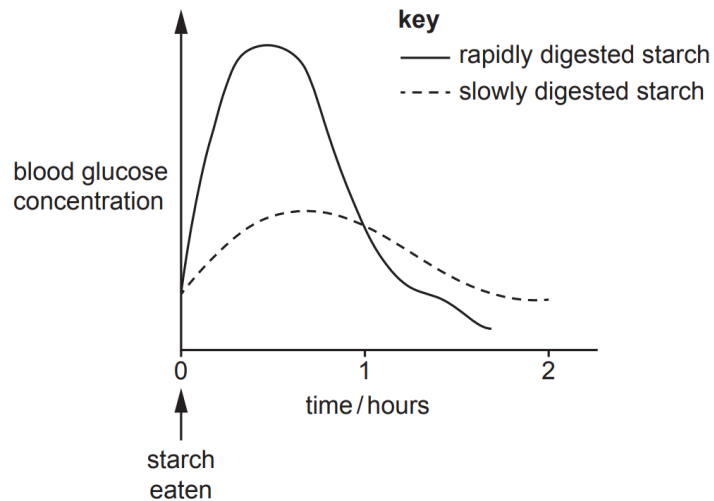


Fig.1.3

- (i) Both graph lines show an initial increase in blood glucose concentration followed by a decrease.

Suggest **two** reasons why the blood glucose concentrations decrease.

- 1.....  
 .....  
 2.....  
 ..... [2]

- (ii) Use information from Fig. 1.3 to suggest which type of starch is healthier to have in the diet. Give a reason for your answer.

- .....  
 .....  
 .....  
 ..... [2]

[Total: 11m]

- 2 The liver is responsible for the breakdown of alcohol. Fig. 2.1 shows a computer model of the enzyme responsible for breaking down alcohol.



Fig. 2.1

- (a)(i) Enzymes have a specific three-dimensional shape.

Explain why the shape of an enzyme is important.

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.....[2]

- (ii) Describe and explain the effect of increasing the temperature from 25°C to 35°C on the activity of the enzyme above.

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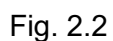
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.....[3]



Use the information in Fig. 2.2 and your knowledge of the human digestive system to discuss the effectiveness of using bromelain in this way.

.....[5]

- 3 (a) The alveolus is the gas exchange surface in humans. For efficient oxygen uptake, a steep diffusion gradient is maintained between the alveolar air and the blood.
- State two ways how the steep diffusion gradient for oxygen is maintained at the gas exchange surface.

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.....[2]

- (b) A person who wanted to begin a fitness programme did some vigorous exercise. A fitness trainer took a drop of blood from the person's finger before, during and after vigorous exercise and tested it for lactic acid.

The results of the tests for lactic acid are shown in Fig. 3.1.

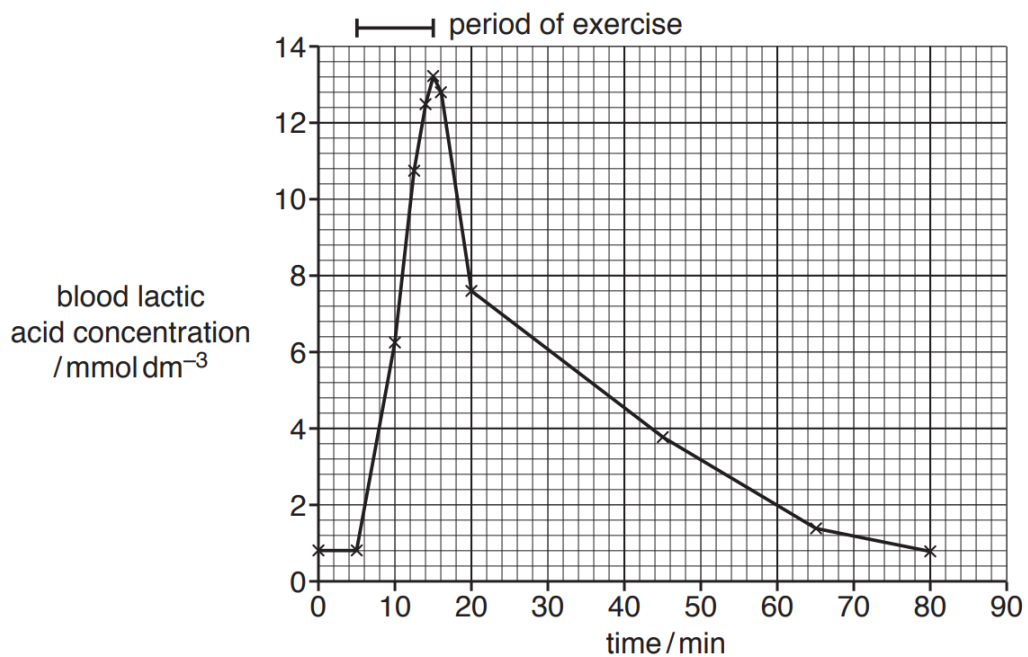


Fig. 3.1

Describe and explain the changes in blood lactic acid concentration shown in Fig. 3.1.

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..... [5]

- (c) The concentration of lactic acid in the blood of two athletes was investigated. One athlete, **P**, had been training and the other, **Q**, was returning to training after an injury. Blood samples were taken from both athletes during a training session. The results are shown in Fig. 3.2.

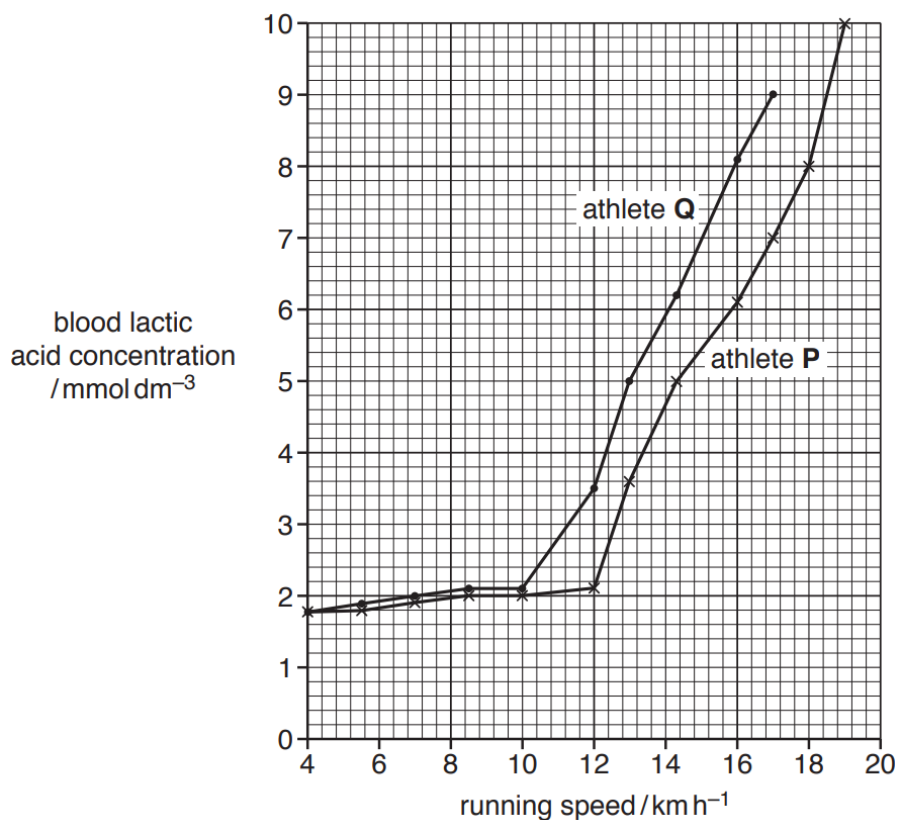


Fig. 3.2

- (i) The lactic acid threshold is the level of exercise where the lactic acid concentration begins to increase exponentially.

State the lactic acid threshold for athletes **P** and **Q**

**P** ..... kmh<sup>-1</sup>

**Q** ..... kmh<sup>-1</sup> [1]

- (ii) Suggest reasons for the difference in lactic acid threshold of athletes **P** and **Q**.

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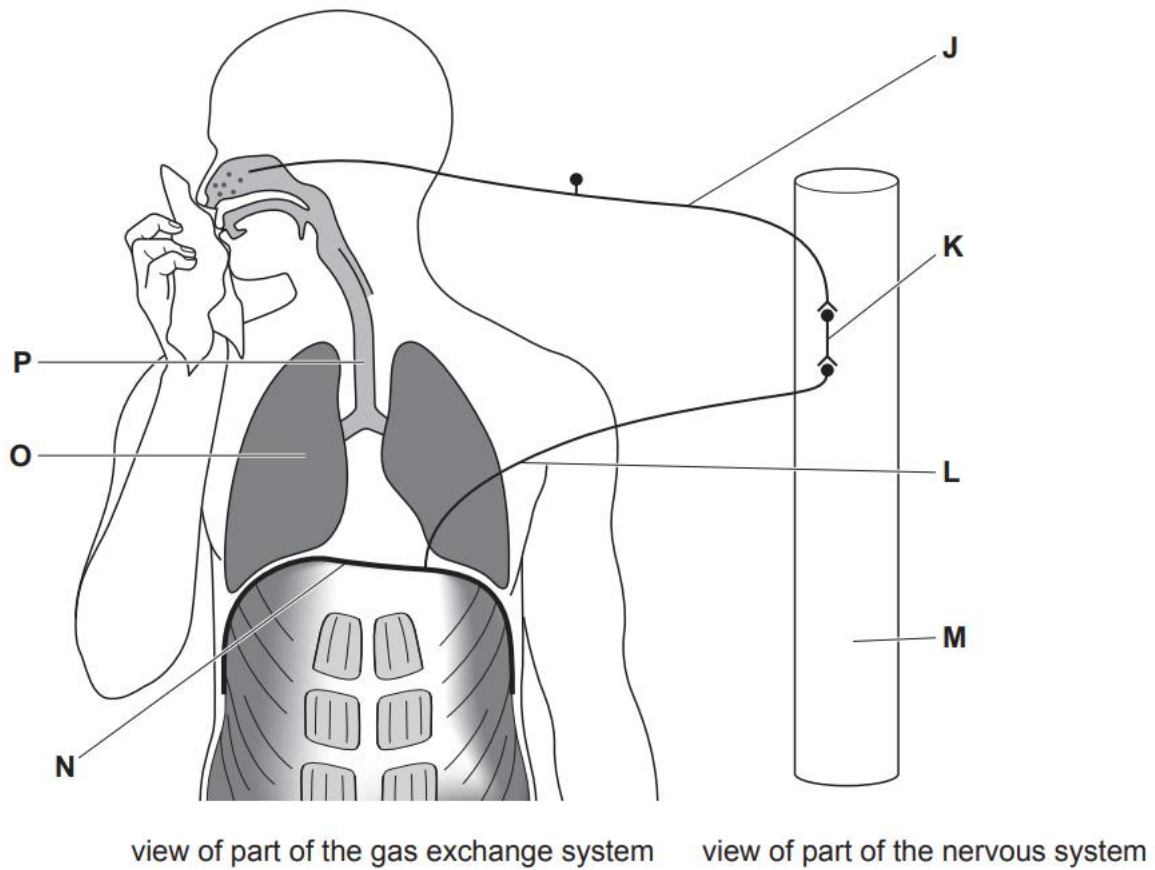
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.....[3]

[Total:11m]

[Turn over

- 4 Fig. 4.1 is a diagram showing parts of two organ systems that are active when a person sneezes.



**not to scale**

Fig 4.1

- (a) Sneezing is an action that occurs in response to a stimulus in the nose.  
State the name of this type of action.

.....[1]

- (b) Table 4.1 shows the names and functions of some of the parts of the human body that are involved when a person sneezes, and the letters in Fig. 4.1 that identify these parts. Complete Table 4.1. [6]

Table 4.1

| function                                       | name of structure | letter in Fig. 4.1 |
|------------------------------------------------|-------------------|--------------------|
|                                                | sensory neurone   |                    |
| changes the air pressure in the thorax         |                   |                    |
|                                                |                   | <b>M</b>           |
|                                                |                   | <b>K</b>           |
| contains cilia to move mucus out of the airway |                   |                    |

[Total: 7m]

[Turn over]

5 Fig. 5.1 is a simplified diagram of the circulatory system in humans.

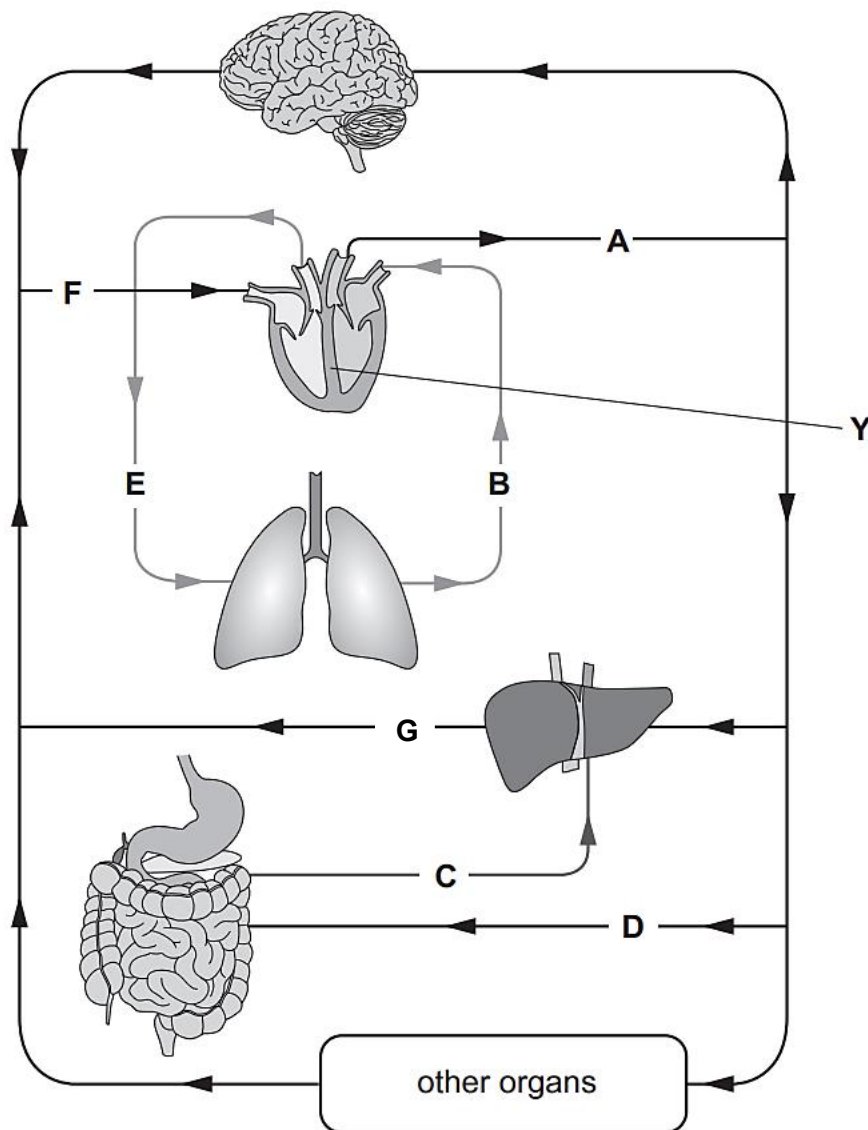


Fig. 5.1

(a)(i) State the letter from Fig. 5.1 that represents the blood vessel that contains blood with the highest concentration of oxygen.

.....[1]

(ii) State the letter from Fig. 5.1 that represents the hepatic portal vein.

.....[1]

- (iii) Compare the structures of blood vessels **D** and **E**.

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.....[3]

- (iv) Explain the importance of the part labelled **Y** in Fig. 5.1

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.....[2]

- (b) Fig. 5.2 shows the pressure of blood flowing through different blood vessels as it travels around the body. (Venules are narrow vessels that connect capillaries to veins.)

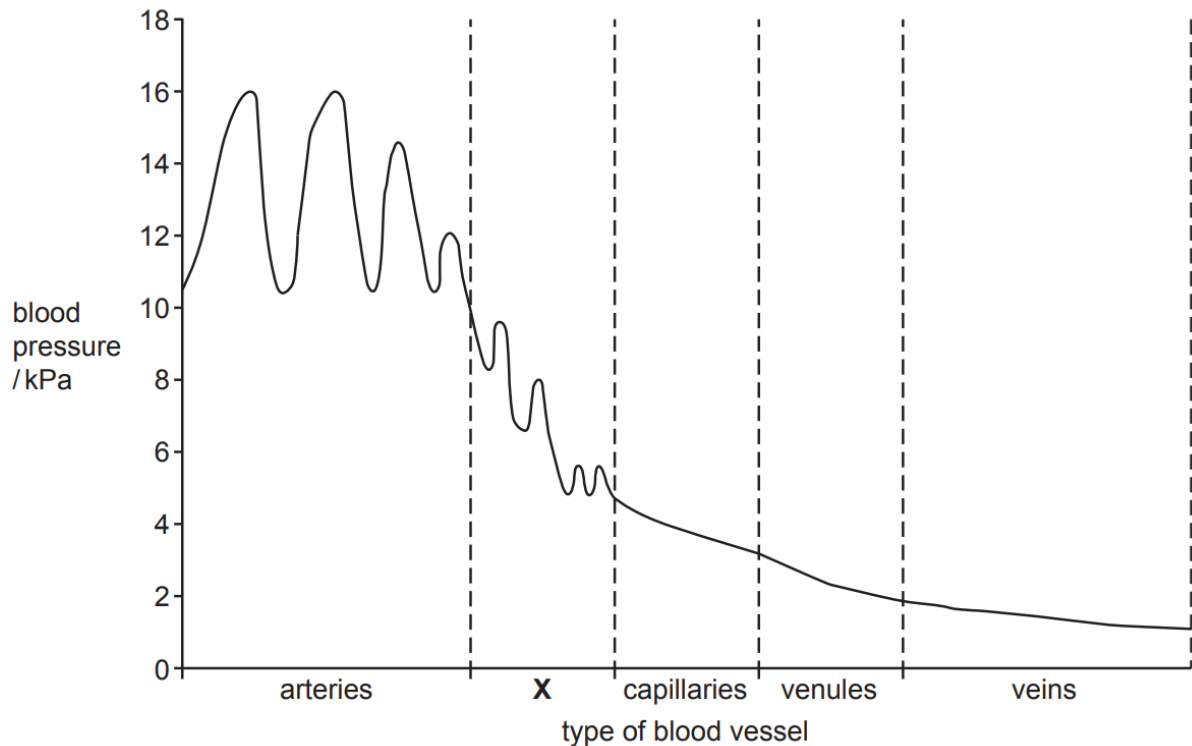


Fig. 5.2

- (i) Identify blood vessel **X** in Fig. 5.2.

.....[1]

- (ii) Explain reasons for the changes in pressure seen in the **arteries** in Fig. 5.2.

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.....[3]

[Total: 11m]

- 6** A student investigated the effect of different concentrations of sucrose solution on potato sticks.

The student used this method:

- cut six potato sticks to the same dimensions
- measure the initial mass of each potato stick
- place each potato stick in a different concentration of sucrose solution
- leave the potato sticks in the sucrose solutions for one hour
- after one hour remove the potato sticks, dry carefully with blotting paper and measure the final mass of each potato stick.

The percentage change in mass was then calculated.

Table 6.1 below shows the results.

Table. 6.1

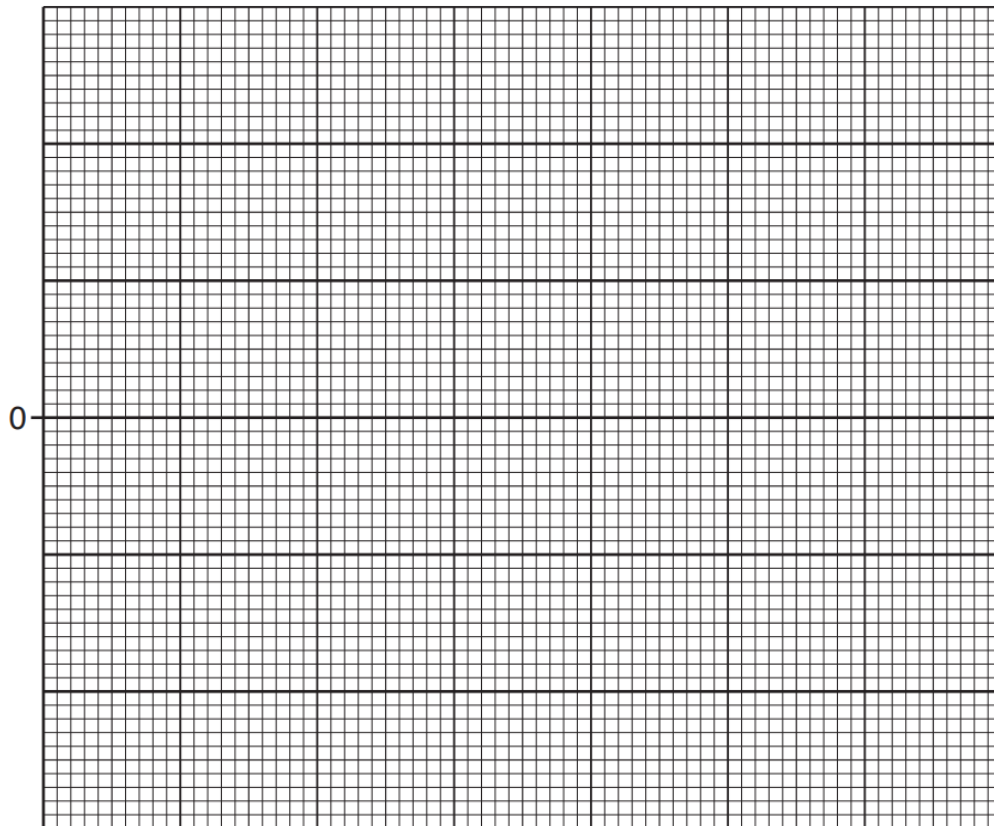
| concentration of<br>sucrose solution<br>/g per dm <sup>3</sup> | percentage<br>change<br>in mass |
|----------------------------------------------------------------|---------------------------------|
| 0                                                              | 29.5                            |
| 70                                                             | 12.0                            |
| 140                                                            | −3.0                            |
| 210                                                            | −15.0                           |
| 280                                                            | −26.0                           |
| 350                                                            | −29.5                           |

- (a)(i)** All of the potato sticks were left in the sugar solutions for the same length of time.  
State two other variables that the student should have kept constant during their investigation.

1.....

2.....[2]

- (ii) Using Table 6.1, plot a graph on the grid to show the effect of the concentration of sucrose solution on the percentage change in mass.



[4]

- (iii) Use your graph to find the concentration of sucrose solution that would cause no change in mass of potato stick.

Mark this point on your graph with a ⊗ and record the concentration.

Include the unit.

.....[1]

- (iv) Students tested other potatoes and found different values for the concentration of sucrose solution that would cause no change in mass.

Suggest **one** reason for this.

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.....[1]

- (b) A dandelion scape was cut into long strips for an investigation on the effect of two salt solutions of different concentrations, **A** and **B**.

Immediately after the scape was cut, the pieces of scape bent outwards, as shown in Fig. 6.1.

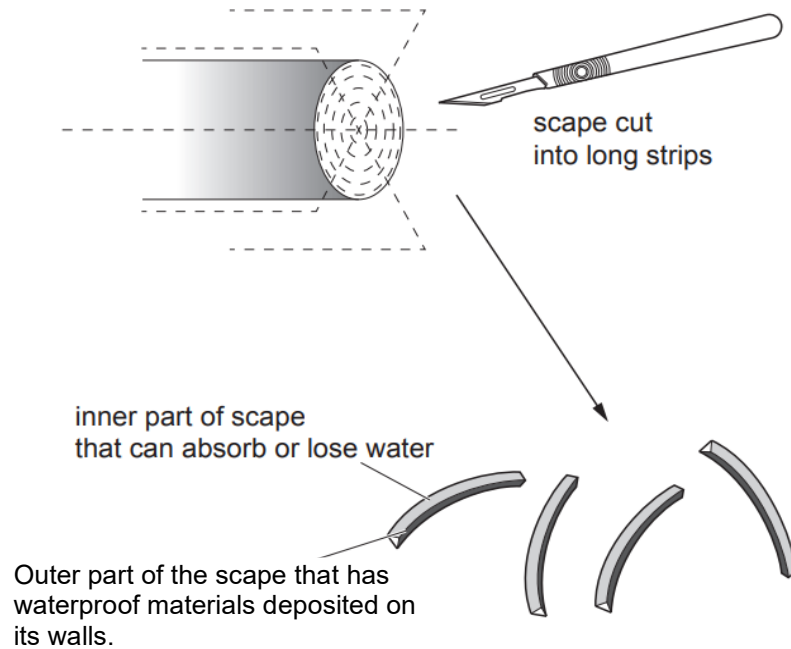


Fig. 6.1

Strips of dandelion scape were placed in two dishes, **A** and **B**, 30 minutes. Each dish contained a different concentration of salt solution. Fig. 6.2 shows the appearance of the two strips of scape after 30 minutes.

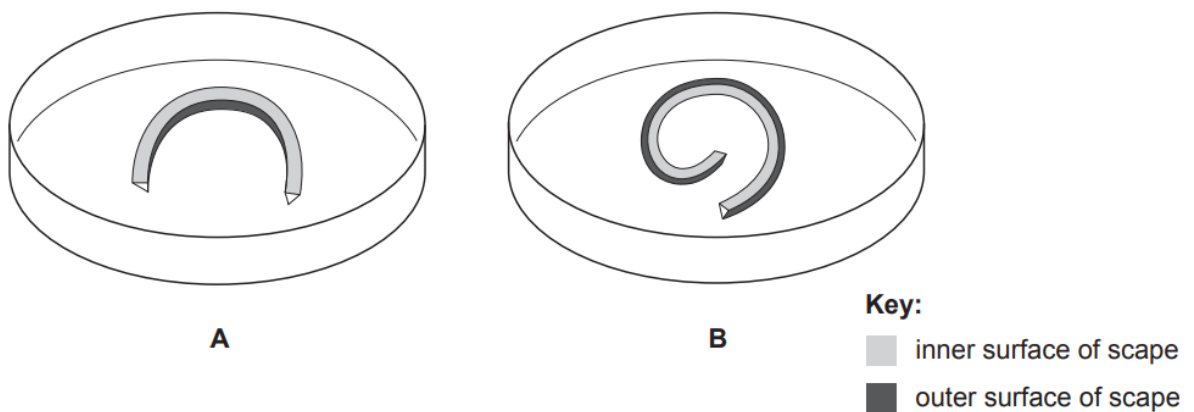


Fig. 6.2

Using the information in Fig. 6.1 and Fig. 6.2, deduce and explain the shape of the scape in Solution **A**.

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.....[2]

[Total: 10m]

**End of Section A**

## Section B

**[10 marks]**

Answer **one** question from this section.

- 7 (a) Describe how a molecule of oxygen present in inhaled air reaches a **muscle cell** in the wall of the left atrium.

[6]

- (b) Pulmonary Arterial Hypertension (PAH) is the thickening of the inside of the arterioles in the lungs that branch from the pulmonary artery, as shown in Fig. 7.2.

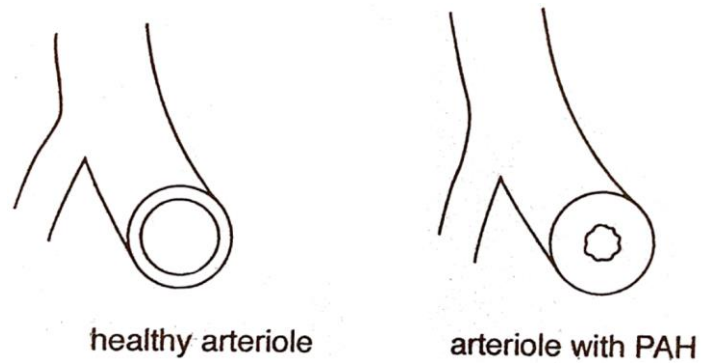


Fig. 7.2

Describe and explain how the health of a person suffering from PAH may be affected.

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.....[4]

[Total: 10m]

- 8 (a)** Describe the similarities and differences in structure and function of root hair cells and villi.

[4]

- (b) Some muscles in our body work as antagonistic pairs to create movement.

With reference to named muscles, describe how antagonistic pairs of muscles bring about the following:

- (i) moving of food in the oesophagus after ingestion of food.

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.....[3]

- (ii) breathing in air from the atmosphere into our lungs.

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[Total: 10m]

**End of paper**