

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

INTERNATIONAL AS BIOLOGY (9610)

Unit 2 Biological Systems and Disease

Friday 9 January 2026

07:00 UK Time

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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- 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	
TOTAL	



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

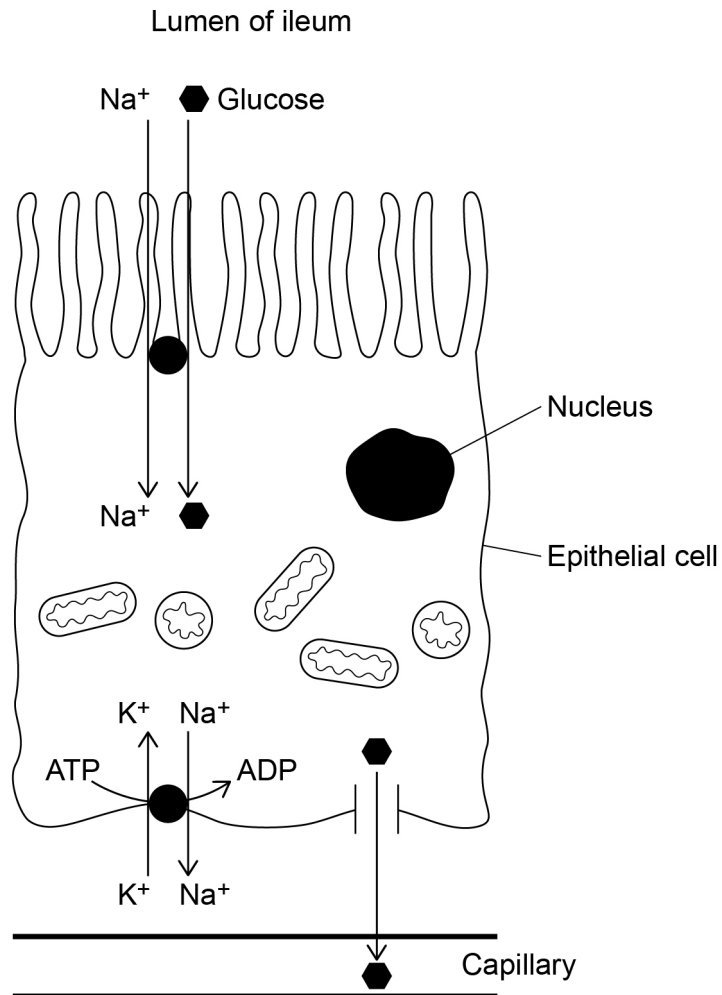
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box

0 1

After digestion of food, glucose is absorbed by co-transport with sodium ions.

Figure 1 shows the mechanism of glucose absorption in the ileum.

Figure 1



[4 marks]

[illegible]

[4 marks]

Feature 1 _____

Explanation _____

Feature 2 _____

Explanation

Question 1 continues on the next page

Turn over ►



People with Type 1 diabetes can have very high blood glucose concentrations.

This can lead to organ damage.

Recent treatments include the use of sodium-glucose co-transport protein inhibitors (SGLT inhibitors).

0 1 . 3

Suggest a mechanism to explain how SGLT inhibitors work as a treatment for Type 1 diabetes.

[3 marks]

11



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ANSWER IN THE SPACES PROVIDED**

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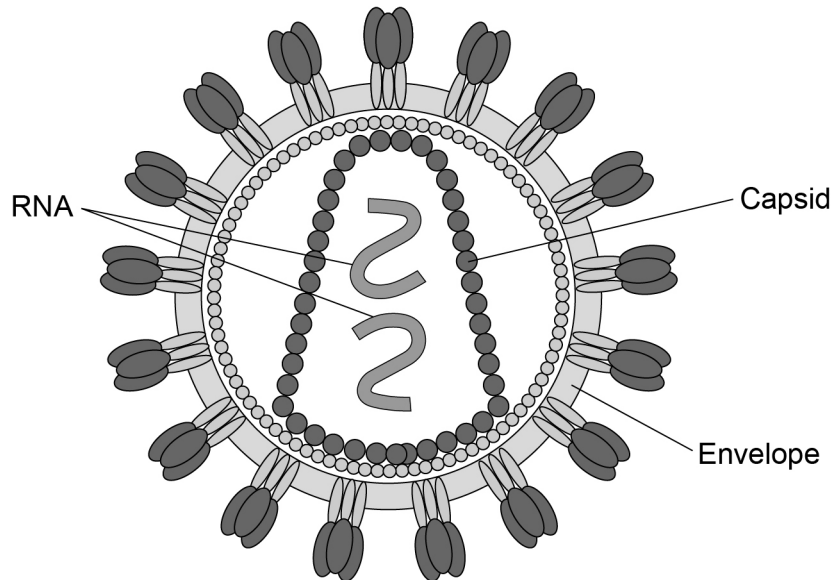
0 5

0 2

The human immunodeficiency virus (HIV) causes disease in humans.

Figure 2 shows the structure of HIV.

Figure 2



0 2

. 1

Name **one** type of molecule that is part of the envelope of HIV.

[1 mark]

0 2

. 2

Describe the function of the RNA shown in **Figure 2**.

[2 marks]



0 2 . 3

The HIV shown in **Figure 2** has a spherical shape and it has a volume of $6.97 \times 10^{-4} \mu\text{m}^3$

Calculate the diameter of this HIV.

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

Use $\pi = 3.14$

Give your answer to the nearest whole nanometre.

[3 marks]

Diameter of HIV = _____ nm

0 2 . 4

Explain why HIV **only** infects some types of host cell.

[2 marks]

0 2 . 5

Scientists have investigated the use of different types of vaccines for HIV.

Suggest **one** reason why vaccines for HIV have **not** been considered safe for vaccination programmes.

[1 mark]

Turn over for the next question

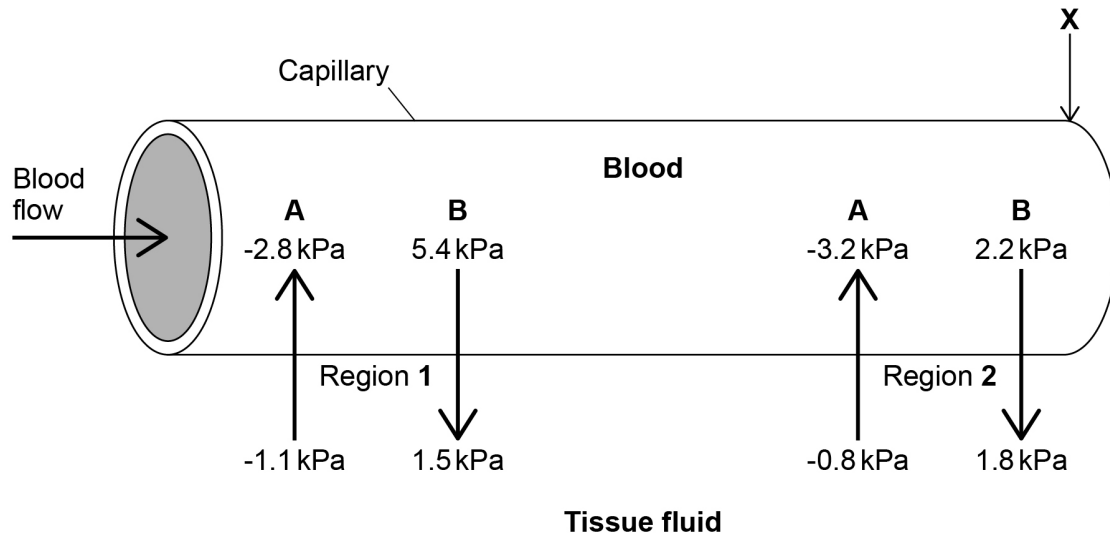


0 3

Capillaries are the site of exchange of substances between the blood and the tissues.

Figure 3 shows the water potential gradients at two ends of a capillary.

Figure 3



0 3 . 1

Describe what causes the two water potential gradients represented by the two arrows at region 1.

[2 marks]

Gradient **A** _____

Gradient **B** _____

0 3 . 2

Calculate the net water potential of the blood in the capillary and the direction of fluid movement in region 1 and region 2.

[2 marks]

Net water potential of blood at region 1 _____ kPa

Direction of fluid movement at region 1 _____

Net water potential of blood at region 2 _____ kPa

Direction of fluid movement at region 2 _____



Tissue fluid surrounds the cells of the body and allows the exchange of substances between the blood and the cells.

0 3 . 3

Water is one substance found in tissue fluid. Name **two** other substances found in tissue fluid.

[2 marks]

1 _____

2 _____

0 3 . 4

Approximately 90% of tissue fluid returns to the capillary.

Describe how the remaining tissue fluid is returned to the circulatory system.

[2 marks]

0 3 . 5

The section of capillary in **Figure 3** has a diameter of $9\ \mu\text{m}$

Blood flows through this capillary at a rate of $1\ \text{mm s}^{-1}$

Blood contains approximately 5 million red blood cells per mm^3

Use these figures to calculate the number of red blood cells that would pass point **X** in one minute.

Use $\pi = 3.14$

[3 marks]

Number of red blood cells passing point **X** in one minute = _____

Question 3 continues on the next page

Turn over ►



0	3	.	6
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Explain **three** ways the structure of capillaries results in efficient exchange of substances between the blood and cells.

[3 marks]

1 _____

2 _____

3 _____

14



0 4

A student investigates cell division in tissue from the root tip of a plant.

The student:

- puts a 20 mm length of root in hydrochloric acid for 15 minutes
- rinses the length of root in distilled water
- cuts off the end 1 mm from the tip of the root
- puts the root tip on a microscope slide and adds toluidine blue stain
- puts a coverslip on top of the root tip and presses the coverslip downwards
- observes the cells of the root tip using an optical microscope
- records the number of cells at different stages in the cell cycle.

0 4 . 1

Give **two** reasons why the student puts the length of root in hydrochloric acid.

[2 marks]

1 _____

2 _____

0 4 . 2

Give **two** safety precautions the student should use when using hydrochloric acid.

[1 mark]

1 _____

2 _____

Question 4 continues on the next page

Turn over ►

0 4 . 3

The student views the cells of the root tip using an optical microscope but the image is **not** clear.

Describe **two** ways the student could make the image of these cells clearer.

[2 marks]

1 _____

2 _____

Table 1 shows the student's results.

Table 1

Stage in the cell cycle	Number of cells
Interphase	90
Prophase	15
Metaphase	28
Anaphase	9
Telophase	8

Use **Table 1** to answer Questions **04.4** and **04.5**

0 4 . 4

Calculate the mitotic index from the student's results.

[1 mark]

Mitotic index = _____



The student:

- researches how long it would take for the cells to complete one cell cycle
- calculates that during one complete cell cycle, the cells would spend a total of 648 minutes in interphase.

0 4 . 5

Calculate the number of hours it would take for the cells to complete **one** cell cycle.

[2 marks]

Number of hours to complete one cell cycle = _____

0 4 . 6

Some cancer drugs prevent spindle fibres in cells from forming.

Suggest how these drugs can slow the growth of tumours.

[2 marks]

10

Turn over for the next question

Turn over ►



0 5

Scientists investigate transport in a plant at different times of the day.

The scientists measure:

- the changes in the rate of water movement in the xylem
- the changes in pressure in the phloem.

Table 2 shows the scientists' results.

Table 2

Time of day	Rate of water movement in the xylem / kg hour ⁻¹	Pressure in the phloem / arbitrary units
08:00	1.2	10.8
10:00	4.8	8.7
12:00	5.2	8.4
14:00	6.3	8.2
16:00	2.6	12.9
18:00	1.2	10.2
20:00	0.2	11.5

0 5**1**

Describe the relationship, shown in **Table 2**, between the rate of water movement in the xylem and the pressure in the phloem between 08:00 and 14:00

[1 mark]



0	5	.	2
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Explain the change in pressure in the phloem between 08:00 and 14:00

Use the information in **Table 2** and your knowledge of the mass flow hypothesis.

[2 marks]

Question 5 continues on the next page

Turn over ►



A plant virus called cauliflower mosaic virus (CaMV) can be transferred between plants by aphids.

Scientists investigate the transfer of CaMV using two groups of plants:

- source plants – infected with CaMV
- test plants – **not** infected with CaMV.

The scientists investigate if adding water to the soil of the source plants affects the transfer of CaMV from the source plants to the test plants by aphids.

The scientists use the following method.

1. Grow source plants for 7 days but do **not** add water to the soil they grow in.
2. Measure the concentration of CaMV in the source plants after 7 days.
3. Add 20 aphids to each source plant and let the aphids feed.
4. Transfer 1 aphid to each of 200 test plants.
5. Remove the aphids after 3 hours.
6. Count the number of test plants infected with CaMV after 3 weeks.

The scientists repeat steps **1–6** but in step **1** they add water to the soil the source plants grow in each day.

0 5 . 3

The scientists keep the plants in a room where the light intensity and temperature are controlled.

Give **one** other environmental factor the scientists must control.

[1 mark]

0 5 . 4

The scientists use the same species of aphid for the investigation.

Give **two** other features of the aphids the scientists must control.

[2 marks]

1

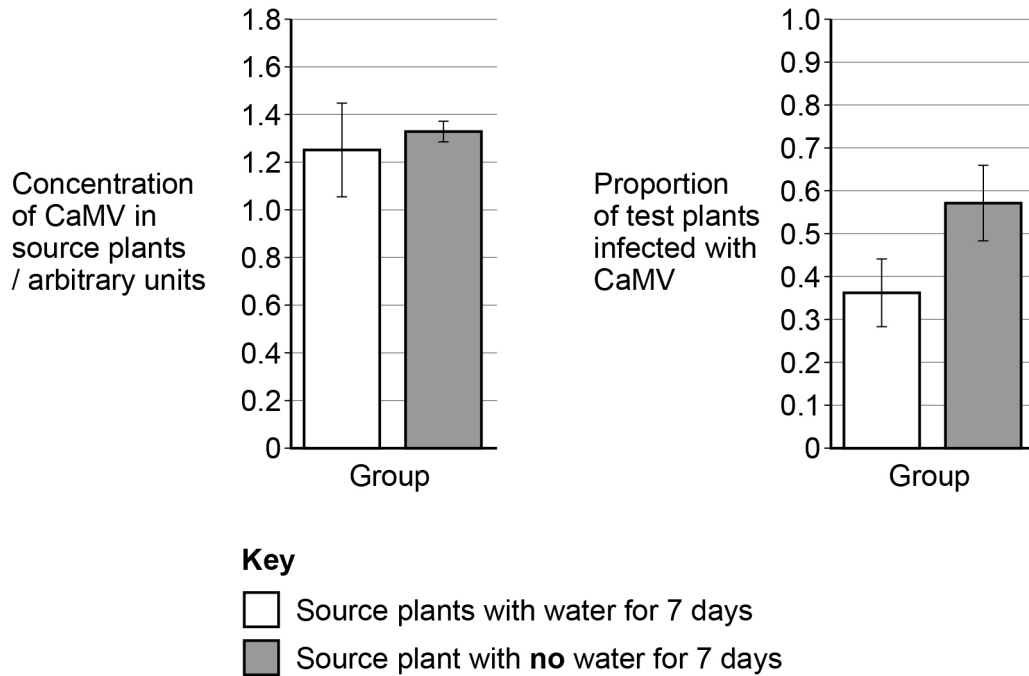
2



Figure 4 shows the results.

The error bars show $\pm$ standard deviation

Figure 4



0 5 . 5

Give **two** conclusions the scientists can make about the transfer of CaMV.

Use information from **Figure 4**.

[2 marks]

1 _____

2 _____

Turn over for the next question

Turn over ►



0 6

Atheroma is a lipid-containing material that builds up in the walls of arteries.

Atheromas are linked to coronary heart disease (CHD) because they increase the risk of aneurysm and thrombosis.

0 6 . 1

Define the terms **aneurysm** and **thrombosis**.

[2 marks]

Aneurysm _____

Thrombosis _____

0 6 . 2

High blood pressure and high blood cholesterol are two risk factors for CHD.

Give **two** more risk factors for CHD.

[2 marks]

1 _____

2 _____



Scientists study the importance of the risk factors linked to CHD.

The scientists:

- use a sample of 22 000 people aged between 45 and 84 years
- monitor each person's blood pressure and blood cholesterol concentration between 1992 and 2002
- use the data to write a computer program (a model).

Each person did **not** have CHD at the start of the study.

The model predicts the reduction in the risk of developing CHD when blood pressure and blood cholesterol are lowered.

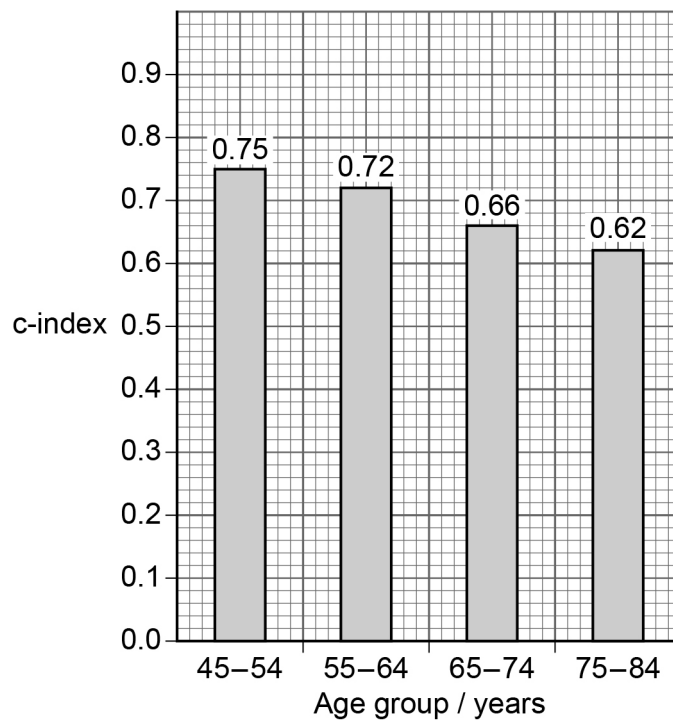
Question 6 continues on the next page

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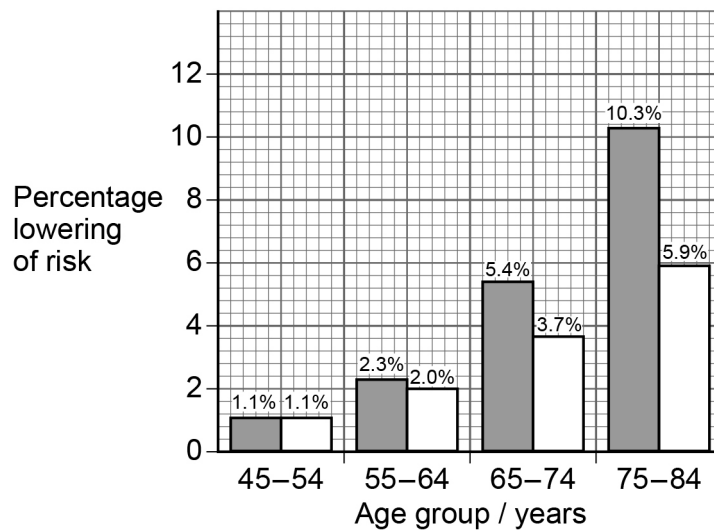
Figures 5 and 6 show data from the study.

Figure 5



The c-index (maximum 1.0) is used to evaluate how well the model (the computer program) predicts the risk of CHD.

Figure 6



The lowering of risk when blood pressure and blood cholesterol concentration are reduced to a recommended level by treatment.

Key

- Blood pressure
- Blood cholesterol



0 6 . 3

State what **Figure 5** shows about the effectiveness of the model for predicting the lowering of the risk of developing CHD.

[1 mark]

0 6 . 4

Compare the lowering of the risk of developing CHD:

- when blood pressure is lowered
- when blood cholesterol concentration is lowered.

Use information from **Figure 6**.

[3 marks]

Question 6 continues on the next page

Turn over ►



A newspaper article states:

Evaluate this statement using **all** the information in Question 06.

[5 marks]

[illegible]

13



0	7	.	1
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[4 marks]

[illegible]

Question 7 continues on the next page



[6 marks]

[illegible]

10

END OF QUESTIONS



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