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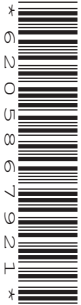
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BIOLOGY

9700/21

Paper 2 Structured Questions AS

October/November 2014

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

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

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

At the end of the examination, fasten all your work securely together.

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

This document consists of **14** printed pages and **2** blank pages.

Answer **all** the questions

1 Fig. 1.1 is an electron micrograph of cells from the lining of the small intestine.

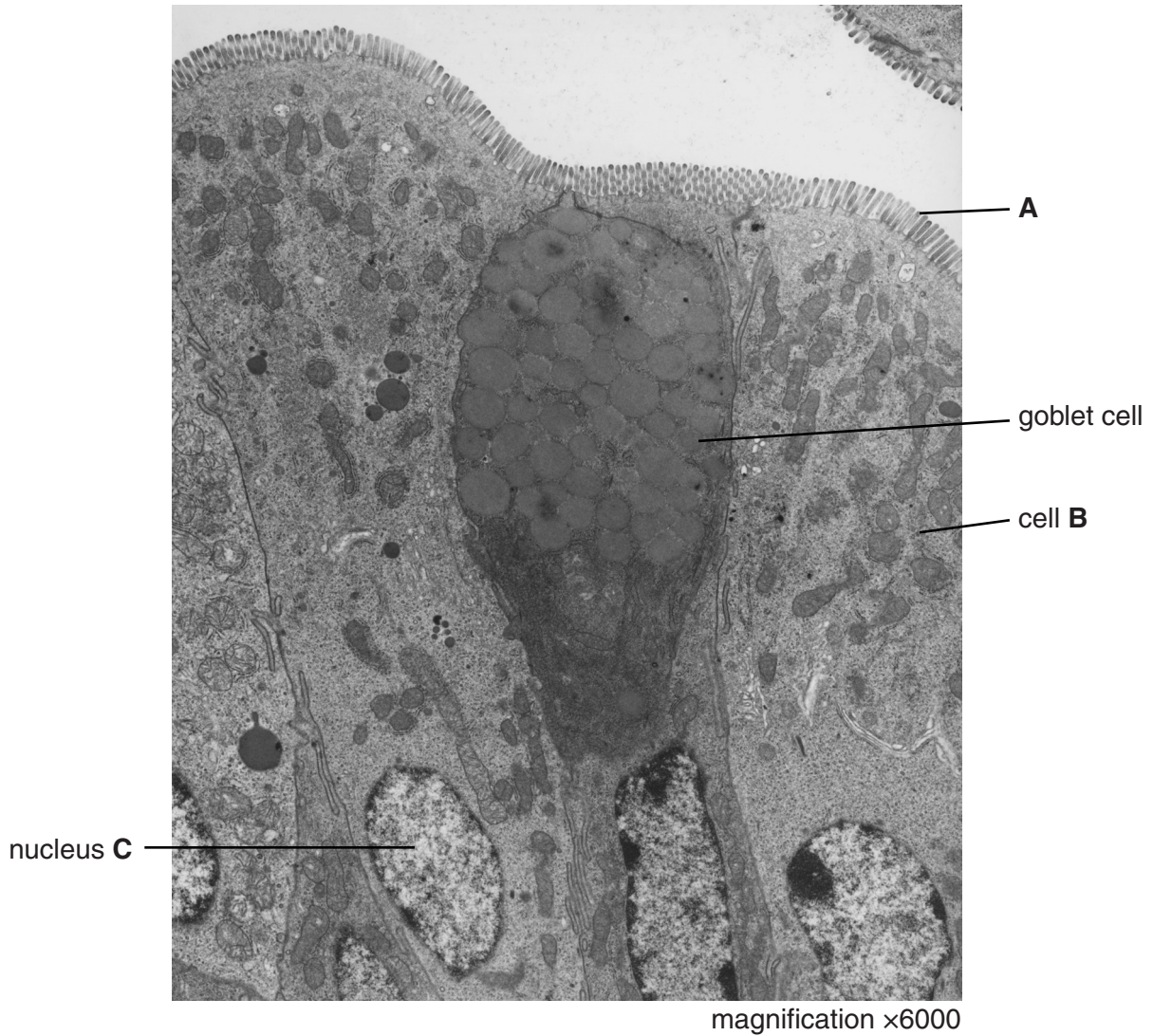


Fig. 1.1

(a) Identify the structures labelled **A** and state their role for the cell.

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..... [2]

(b) There are many mitochondria in cell **B**.

Suggest why cell **B** contains a large number of mitochondria.

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..... [2]

(c) Calculate the actual length of the nucleus **C**.

Show your working and express your answer to the nearest 0.1 micrometre.

answer μm [2]

(d) There are many goblet cells within the epithelium lining the trachea and the bronchi in the gas exchange system.

Describe the role of goblet cells in the gas exchange system.

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..... [3]

(e) State two ways in which the cells lining the alveoli in the lungs differ from cell **B** shown in Fig. 1.1.

1.
2. [2]

[Total: 11]

2 (a) Define the term *disease*.

.....

.....

..... [1]

Fig. 2.1 is a flow chart that shows the four different ways that a person can become immune to an infectious disease.

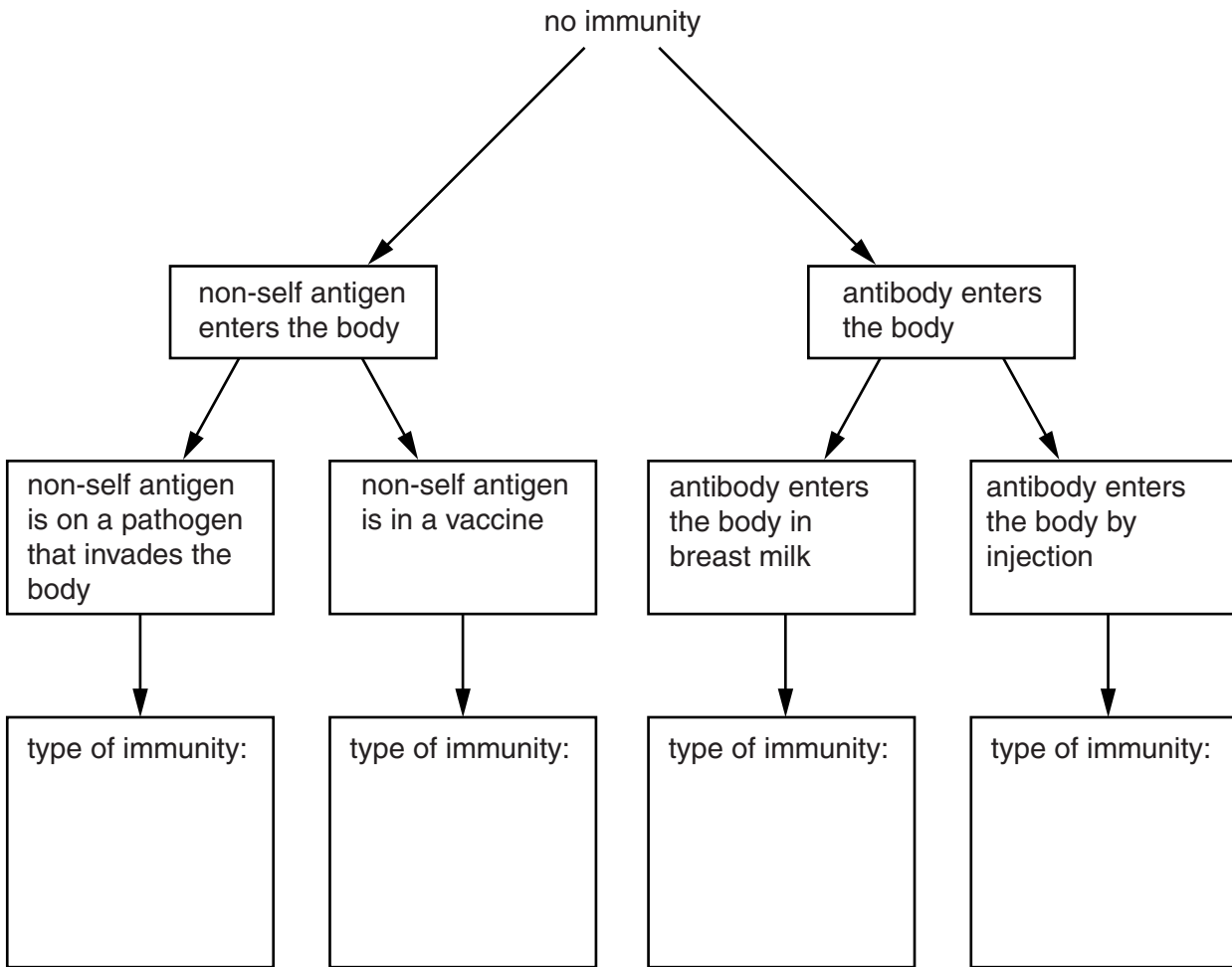


Fig. 2.1

(b) Complete Fig. 2.1 by writing in the boxes provided the four types of immunity described. [4]

Fig. 2.2 shows the number of cases of smallpox from 1950 to 1980:

- in all the countries of the world
- in India.

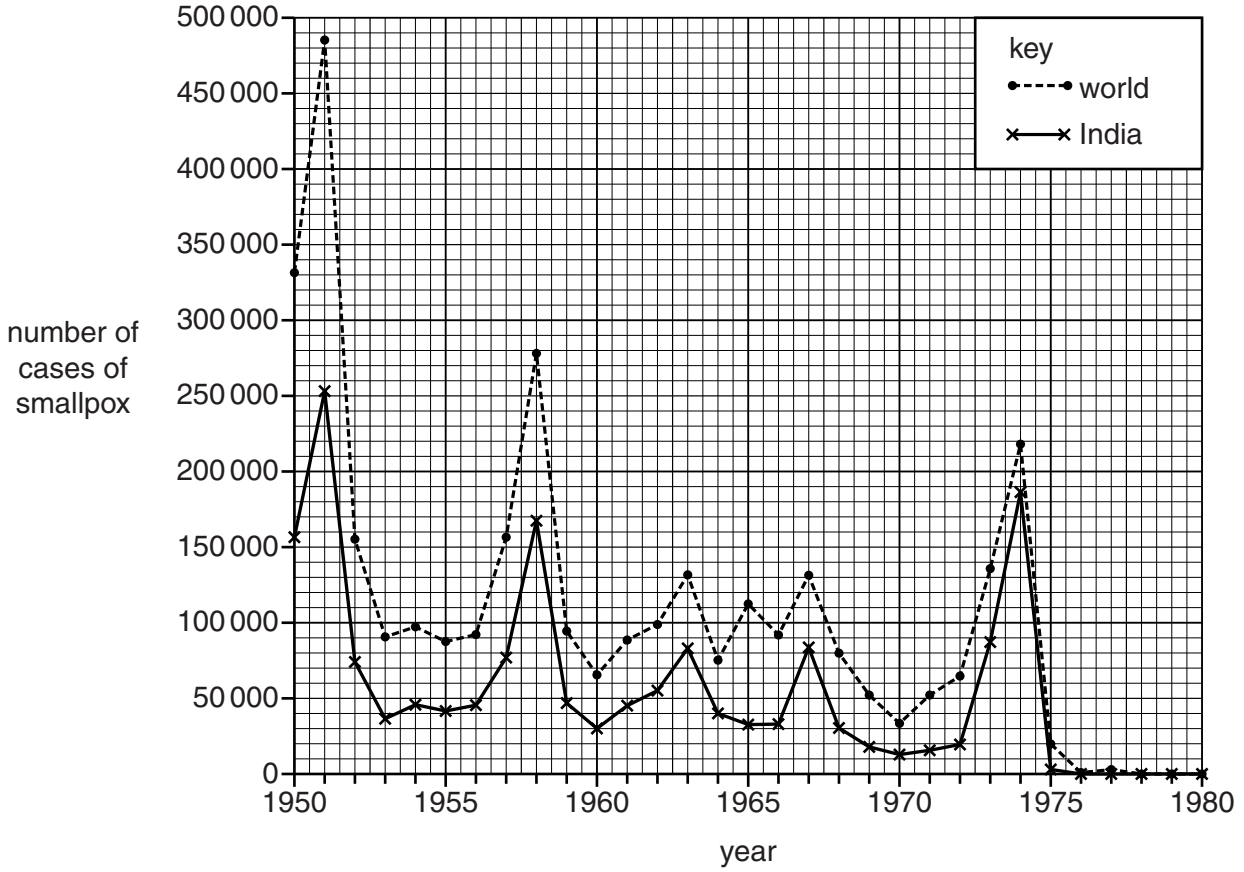


Fig. 2.2

(c) Describe the changes in number of cases of smallpox as shown in Fig. 2.2.

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..... [3]

The World Health Organization (WHO) declared the world to be free of smallpox in 1980.

(d) Outline some of the factors that led to the successful eradication of smallpox from the world population.

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..... [4]

[Total: 12]

- 3 There are many types of amino acids, but only twenty that are polymerised to make polypeptides and proteins in animals.

(a) Name the type of chemical reaction that occurs when two amino acids form a dipeptide.

..... [1]

(b) Fig. 3.1 shows two amino acids, glycine and valine. Use the space below to make a drawing to show what happens when these two molecules join together to form a dipeptide.

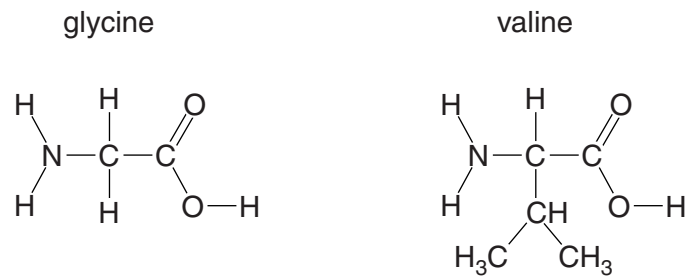


Fig. 3.1

[4]

- (c) Angiotensinogen is an inactive protein molecule. When blood pressure decreases, part of angiotensinogen is removed to form a short polypeptide, angiotensin that stimulates an increase in blood pressure.

Fig. 3.2 shows the base sequence within the gene for angiotensinogen that codes for this short polypeptide, the RNA codons and the primary structure of angiotensin.

| | | | | | | | | |
|-------------------------------|-------|-----|-------|-----|-----|-----|-----|-------|
| DNA base sequence | CTA | GCA | CAA | ATG | TAG | GTG | GGG | |
| RNA codons | | CGU | | UAC | AUC | CAC | CCC | UUC |
| polypeptide primary structure | Asp | Arg | Val | Tyr | Ile | His | Pro | Phe |

Fig. 3.2

- (i) Complete Fig. 3.2 to show the missing DNA triplet and the RNA codons. [1]
- (ii) State the full name of the type of RNA shown in Fig. 3.2.

..... [1]

Table 3.1 shows the blood pressure in the right ventricle and in the pulmonary artery of a person who is in good health.

Table 3.1

| phase of cardiac cycle | blood pressure / kPa | |
|------------------------|----------------------|------------------|
| | right ventricle | pulmonary artery |
| Ventricular systole | 3.33 | 3.33 |
| Ventricular diastole | 0.67 | 1.33 |

- (d) Use the information in Table 3.1 to explain why the blood pressure in the pulmonary artery is the same as the pressure in the right ventricle during systole, but higher during diastole.

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..... [3]

- (e) People with long-term chronic obstructive pulmonary disease (COPD) usually have blood which is poorly oxygenated during its passage through the lungs. This leads to a constriction of blood vessels in the lungs.

Suggest the likely effect of this on the heart.

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..... [2]

- (f) Describe the signs and symptoms of COPD that help doctors make an early diagnosis of this condition.

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..... [2]

[Total: 14]

- 4 (a) A student cut thin sections of a root tip of *Allium cepa* and stained them to show chromosomes. A photomicrograph of part of one of these sections is shown in Fig. 4.1.

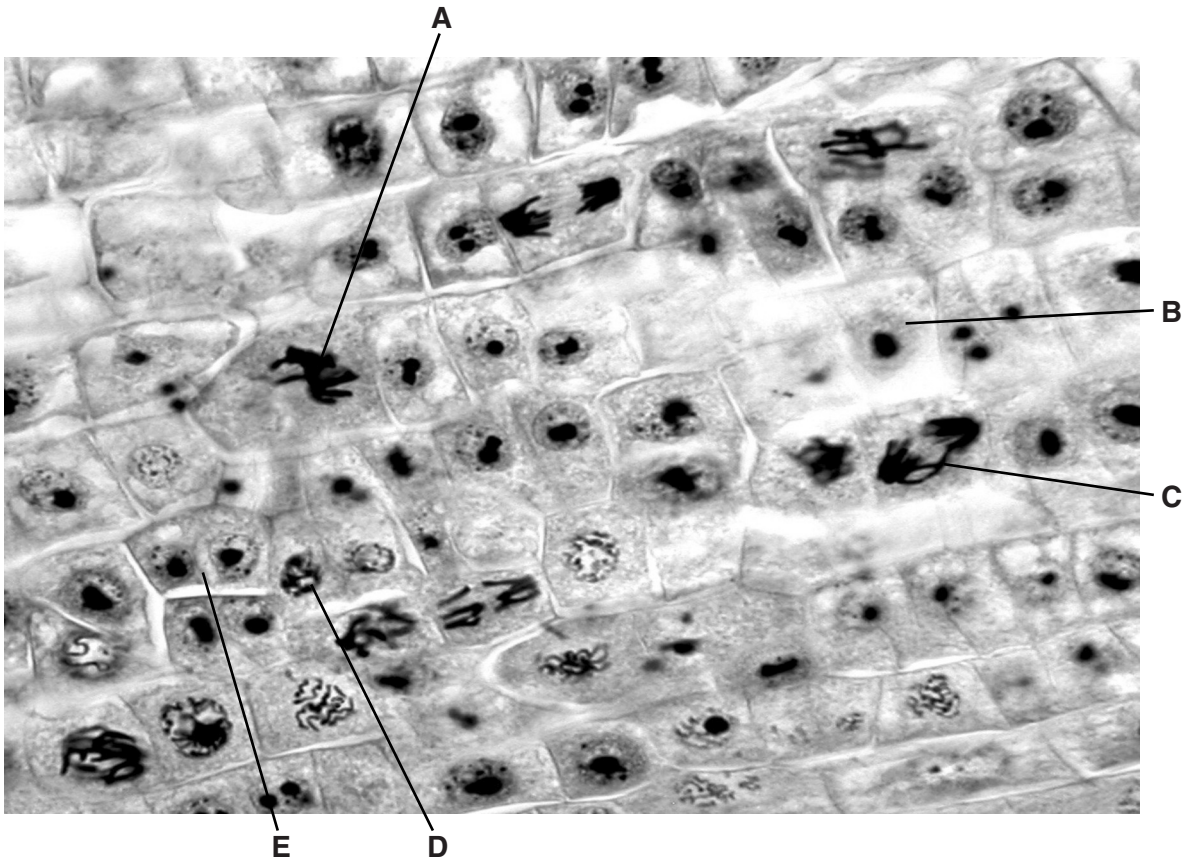


Fig. 4.1

Table 4.1 shows the behaviour of chromosomes and the changes that occur to the nuclear envelope during a mitotic cell cycle in the root tip of *A. cepa*.

Complete Table 4.1.

Table 4.1

| name of stage | cell in Fig. 4.1 | behaviour of chromosomes | nuclear envelope |
|---------------|------------------|--|------------------------------|
| | B | chromosomes uncoiled, may be replicating | intact |
| prophase | | | intact, but then breaks down |
| metaphase | | | not present |
| anaphase | | chromosomes / chromatids, moving to opposite poles | |
| telophase | | chromosomes uncoiling | |

[5]

(b) Explain why the growth of roots, such as those of *A. cepa*, involves mitosis and **not** meiosis.

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..... [3]

(c) State two processes, **other than growth**, in which mitosis is involved.

1.

2.

[2]

[Total: 10]

5 In some ecosystems there are very low concentrations of nitrate ions in the soil. Some species of flowering plants are able to obtain the nitrogen that they need from other sources. Carnivorous plants have modified leaves that trap animals.

Leaves of *Drosera rotundifolia* have hairs around each leaf that secrete a sticky solution. Insects, such as the one shown in Fig. 5.1, stick to this solution. The leaves curl around the insect and secrete enzymes to digest its body.



Fig. 5.1

(a) Explain why *D. rotundifolia* can be considered to be both an autotroph and a heterotroph.

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..... [4]

(b) In 1999, Dutch scientists discovered a new reaction, the anammox reaction, to add to the nitrogen cycle. They discovered the bacterium *Brocadia anammoxidans* that converts ammonia, nitrite ions and nitrate ions to nitrogen gas (N₂) in anaerobic environments.

The reaction carried out by these bacteria is thought to be responsible for the loss of a large quantity of nitrogen-containing compounds from marine ecosystems, such as the oceans.

Suggest and explain the effect that this reaction has on marine ecosystems.

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..... [3]

[Total: 7]

6 Fig. 6.1 shows the pathway taken by water as it enters the root of a flowering plant.

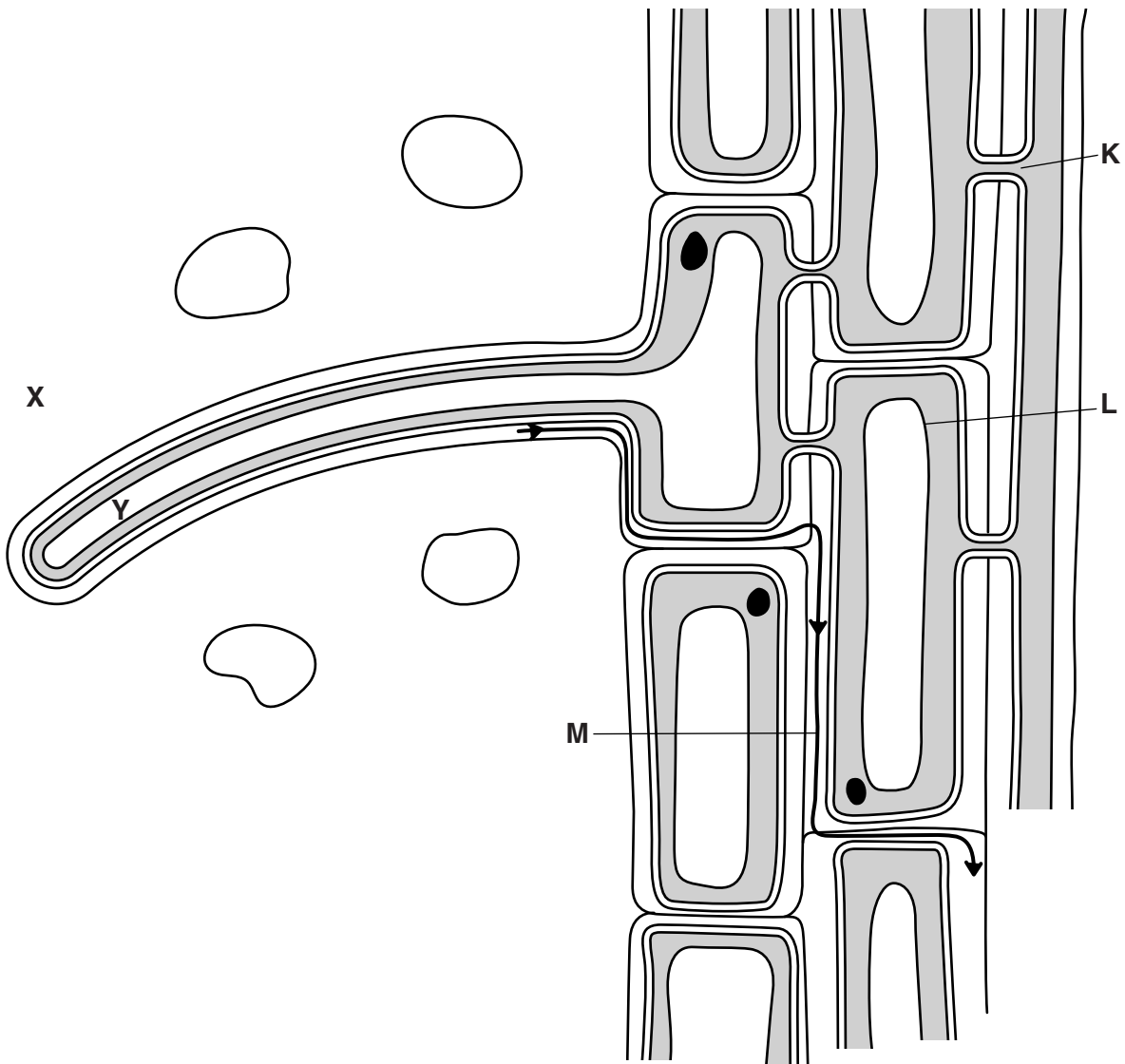


Fig. 6.1

(a) Explain how water passes from X to Y.

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..... [3]

(b) Name:

(i) the structures **K** and **L**

K

L

[2]

(ii) the pathway indicated by **M**.

.....[1]

[Total: 6]

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Fig 5.1 © CLAUDE NURIDSANY & MARIE PERENNOU/SCIENCE PHOTO LIBRARY.

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