Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

6205867921

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.

CAMBRIDGE International Examinations

Answer **all** the questions

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

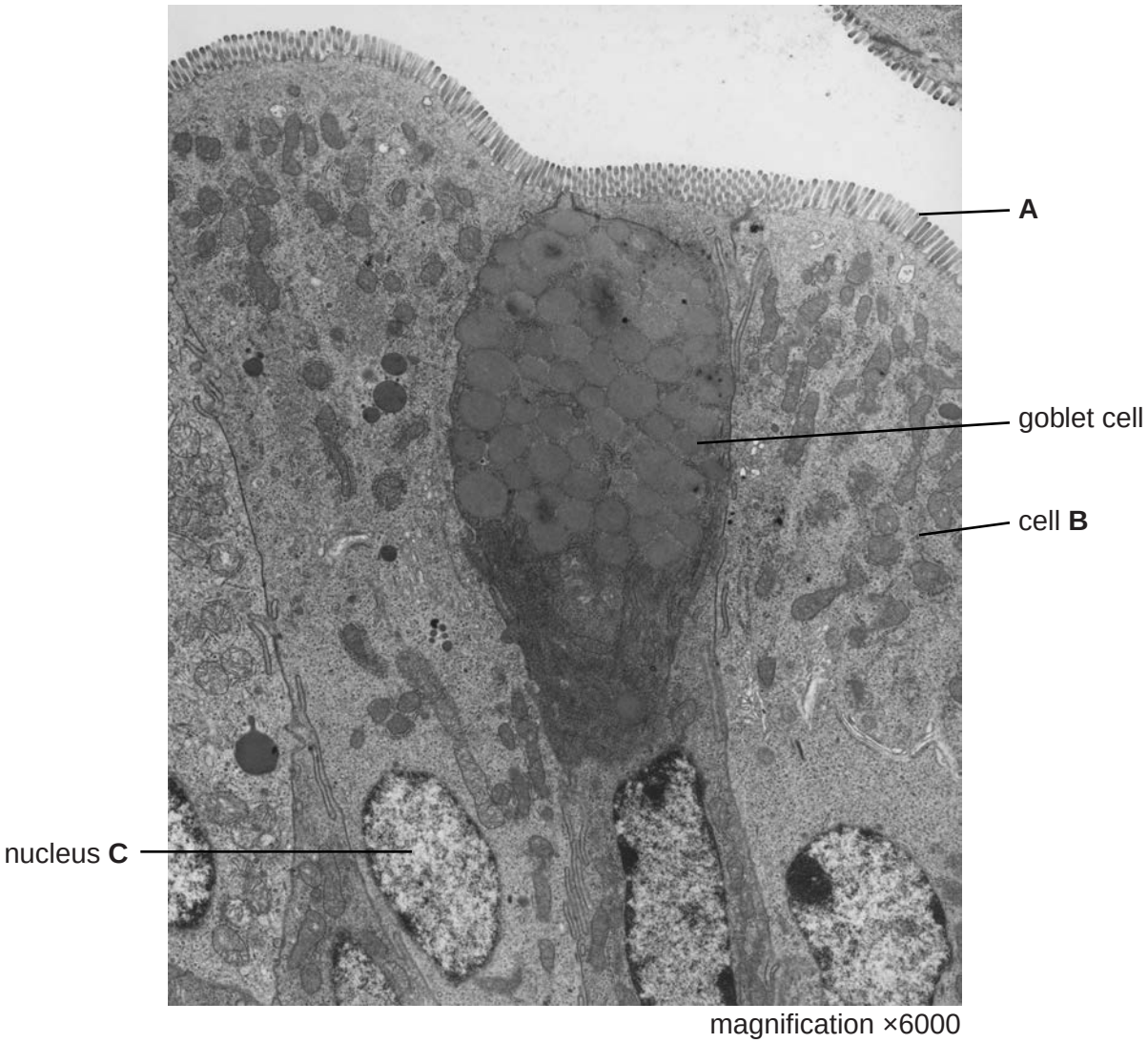

Fig. 1.1

(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]

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2 **(a)** Define the term *disease*.

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..... [1]

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

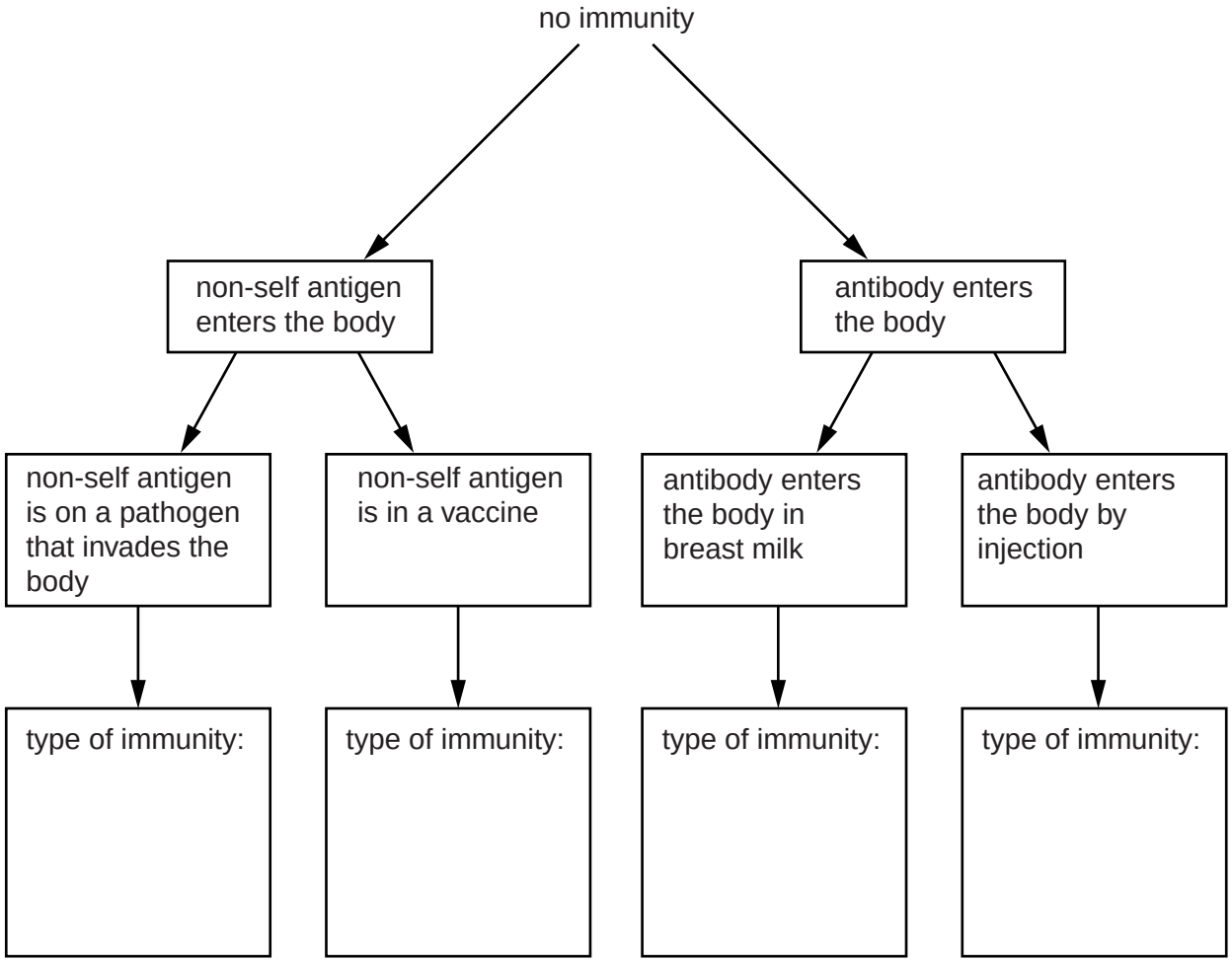

Fig. 2.1

(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.

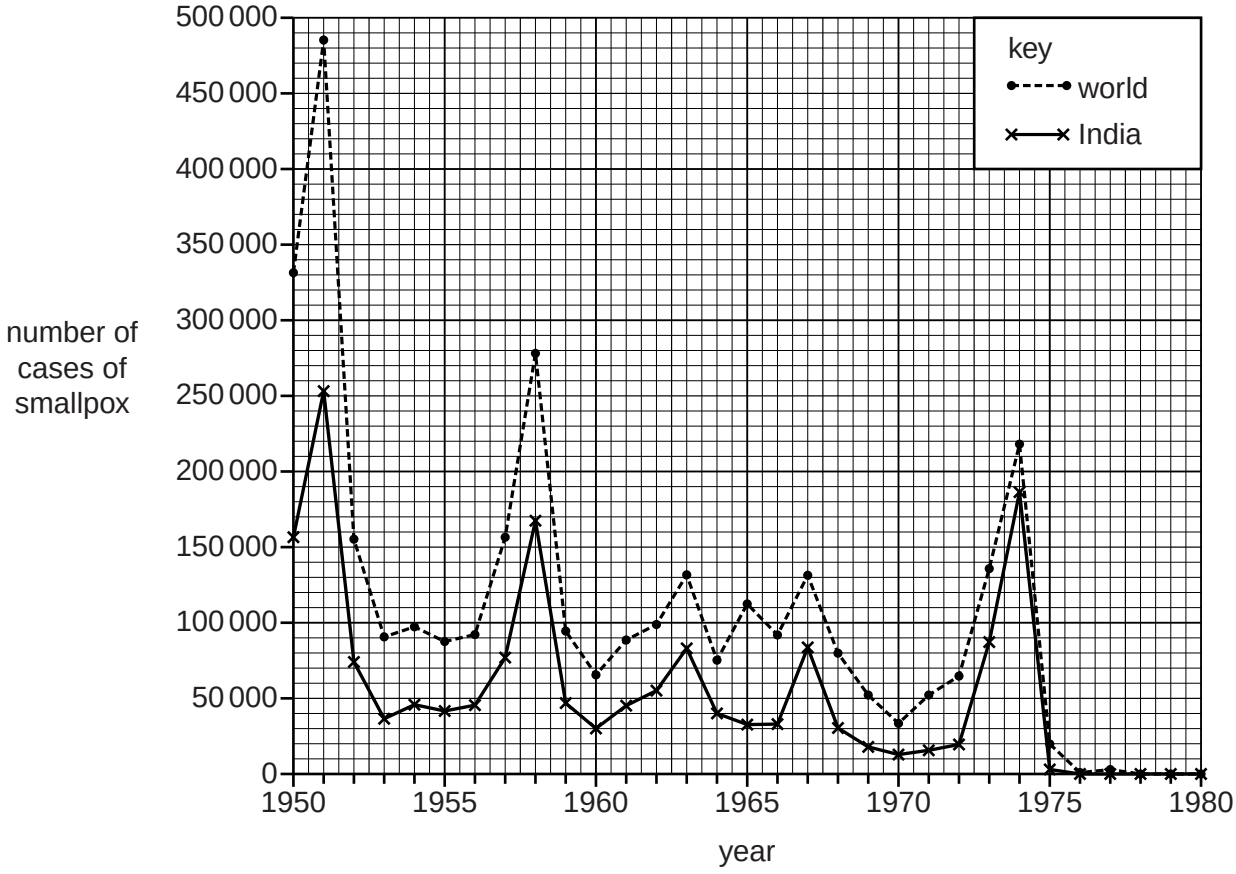

Fig. 2.2

(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]

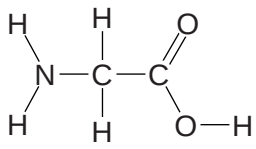
3 There are many types of amino acids, but only twenty that are polymerised to make polypeptides and proteins in animals.

(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.

glycine



valine

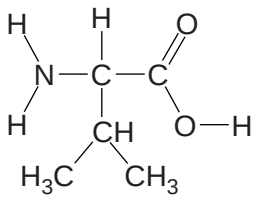


Fig. 3.1

[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.

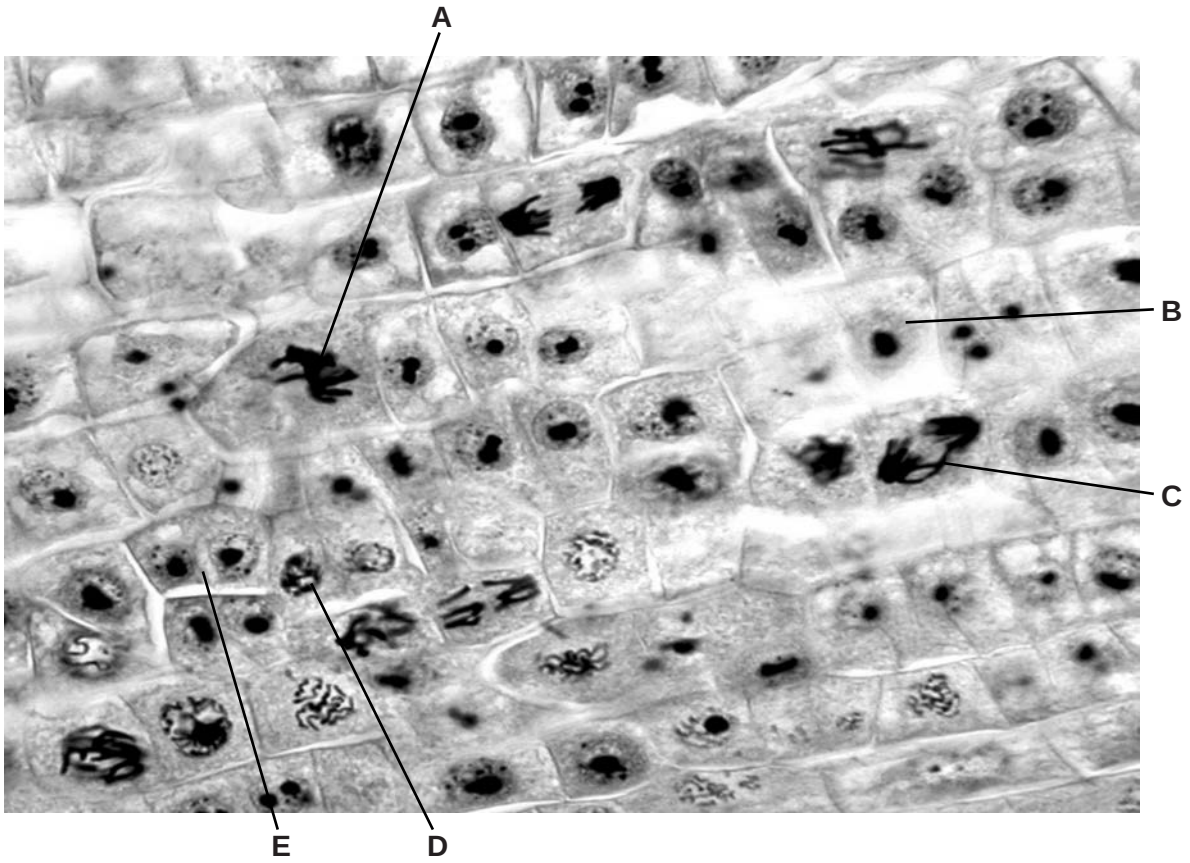

Fig. 4.1

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.

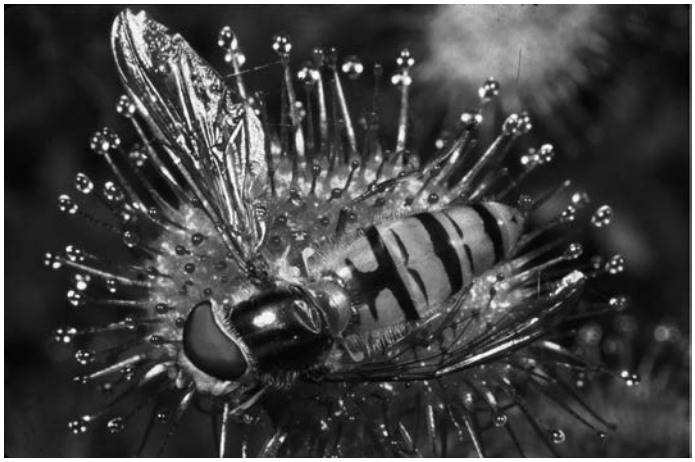

Fig. 5.1

(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 (N_2) 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]

[Turn over

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

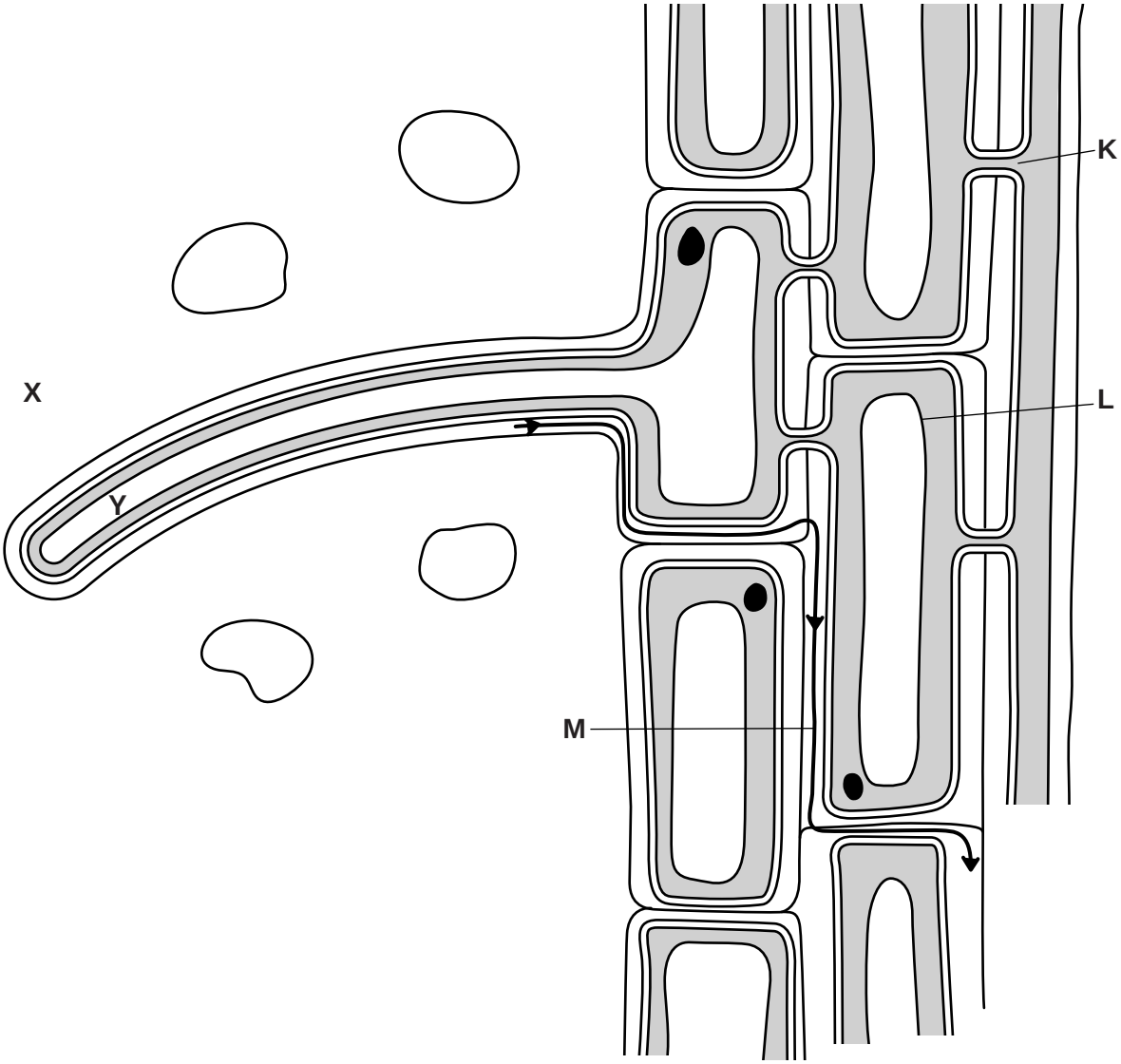

Fig. 6.1

(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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