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Cambridge Assessment International Education

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BIOLOGY **0610/43**

Paper 4 Theory (Extended) **October/November 2022**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

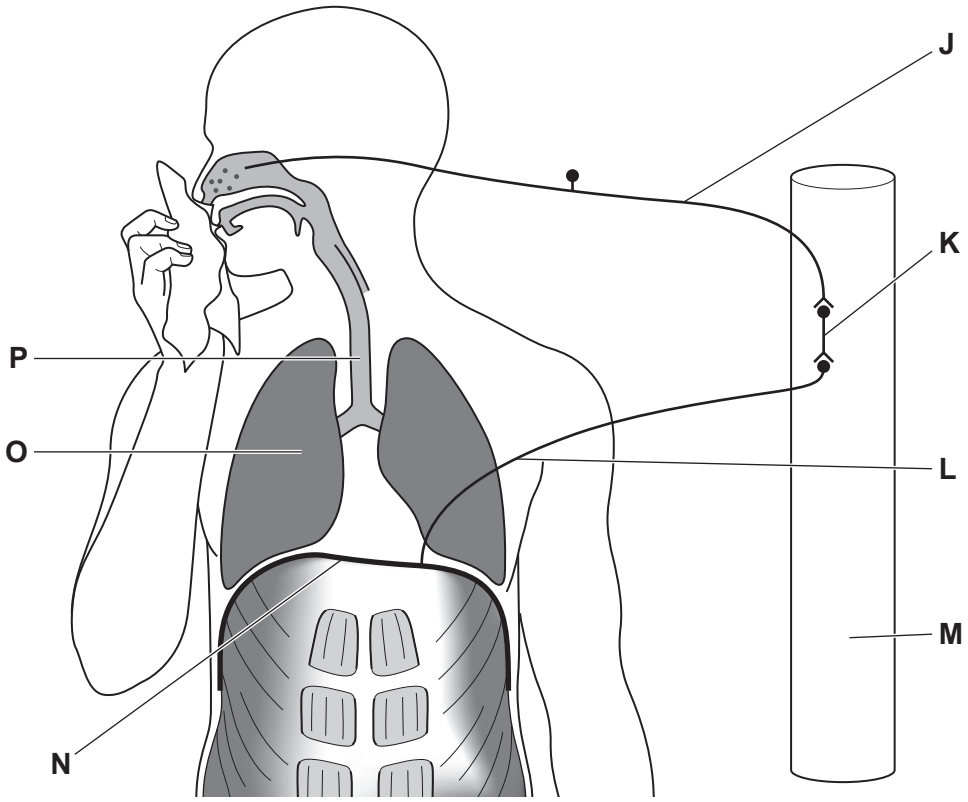
- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **24** pages. Any blank pages are indicated.

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1 **(a)** Fig. 1.1 is a diagram showing parts of two organ systems that are active when a person sneezes.



view of part of the gas exchange system view of part of the nervous system

not to scale

Fig. 1.1

(i) Sneezing is an automatic action that occurs in response to a stimulus in the nose.

State the name of this type of automatic action.

..... [1]

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(ii) Table 1.1 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. 1.1 that identify these parts.

Complete Table 1.1.

Table 1.1

function	name of structure	letter in Fig. 1.1
cell that transmits an impulse from the receptor to the central nervous system		
	diaphragm	
		M
		K
contains cilia to move mucus out of the airway		

[5]

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(b) Fig. 1.2 is a diagram of a cell from the human nervous system.

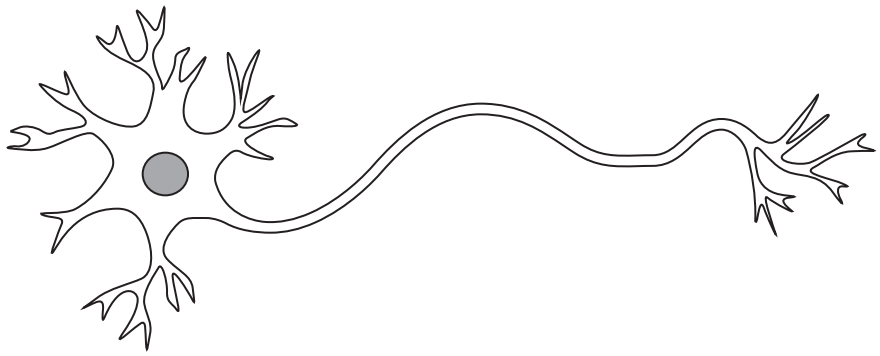


Fig. 1.2

(i) On Fig. 1.2, label **two** visible cell structures. [2]

(ii) Draw an **X** on the cell in Fig. 1.2 to show where a receptor molecule for a neurotransmitter would be found. [1]

(iii) Explain how the cell in Fig. 1.2 is adapted for transmitting impulses.

.....

.....

.....

.....

..... [2]

(c) Describe how nervous communication differs from hormonal communication.

.....

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.....

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..... [3]

[Total: 14]

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2 **(a)** Digestive enzymes are secreted into the alimentary canal.

(i) As well as enzymes, other substances that are important for digestion are also secreted into the alimentary canal.

State the names of **two** of these other substances.

1 .....

2 .....
[2]

(ii) Table 2.1 summarises some facts about the enzymes that are secreted into the alimentary canal.

Complete Table 2.1.

Table 2.1

name of the enzyme	organ where the enzyme is secreted	organ when the enzyme acts	products of digestion involving this enzyme
	salivary glands		
pepsin			
	pancreas		fatty acids and glycerol
	small intestine	epithelial lining of the small intestine	

[4]

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[Turn over

(b) The activity of the enzyme pepsin was measured at different temperatures.

The results are shown in Fig. 2.1.

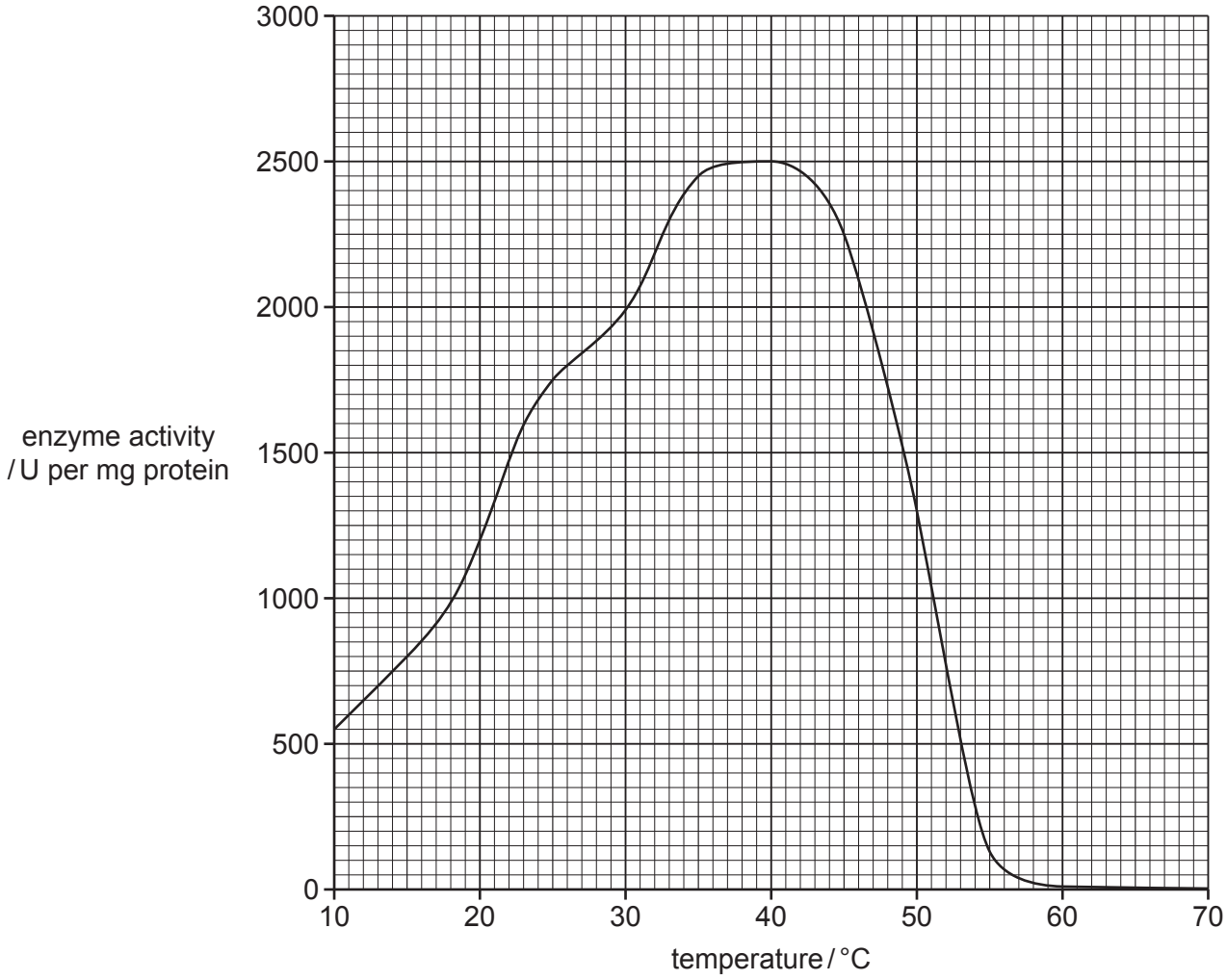


Fig. 2.1

Describe and explain the effect of temperature on the activity of pepsin.

Use the information in Fig. 2.1 to support your answer.

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..... [6]

(c) Lactase is another digestive enzyme, which is produced by human babies.

(i) Explain why lactase is important for the nutrition of young babies.

.....

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.....

..... [2]

(ii) Most people stop producing lactase when they become adults. If they drink milk, this may give them diarrhoea.

Describe the symptoms of diarrhoea.

.....

.....

..... [1]

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(iii) Cholera can also cause diarrhoea.

Explain how the cholera bacterium causes diarrhoea.

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..... [3]

[Total: 18]

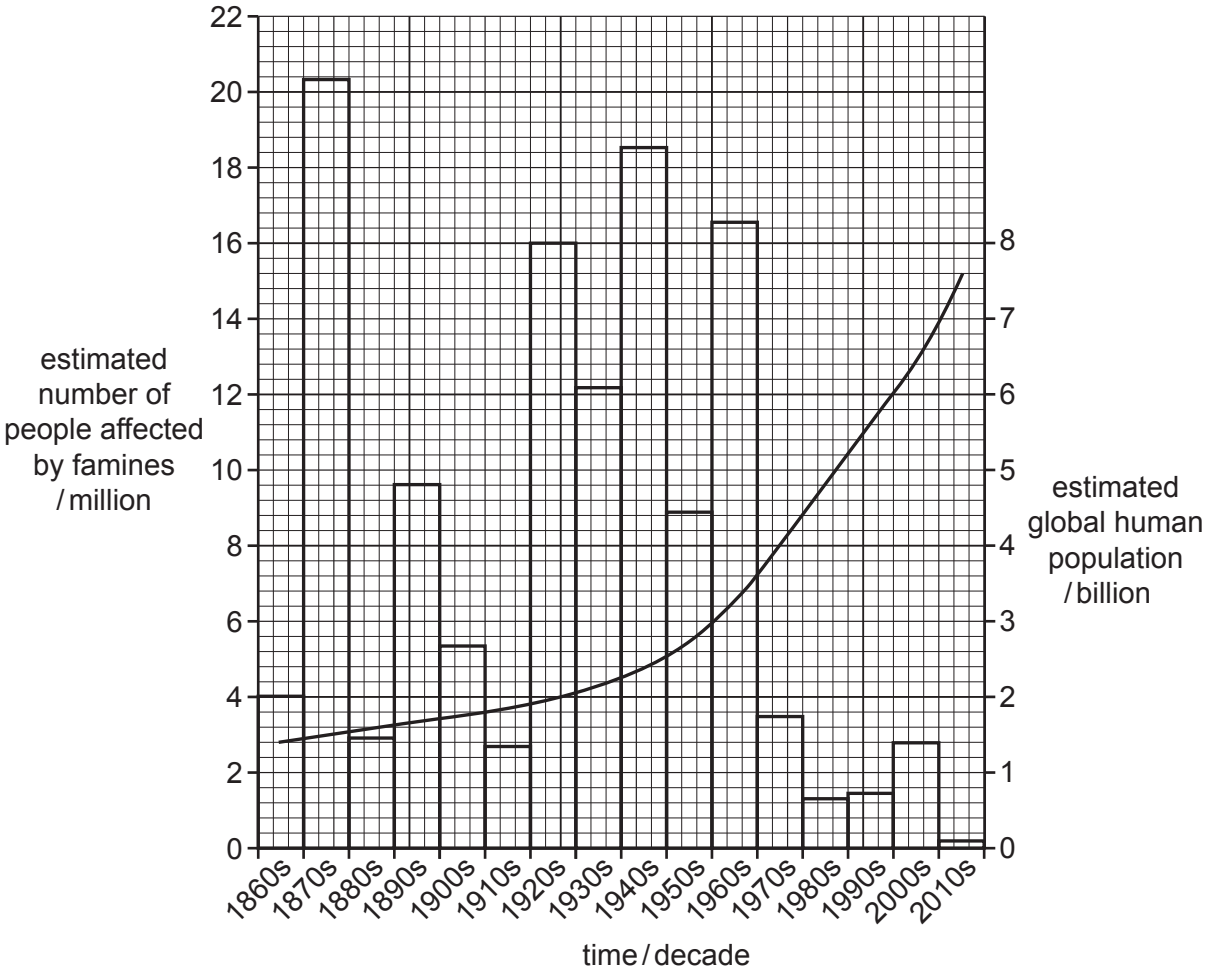
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3 Fig. 3.1 shows the estimated growth of the global human population between the 1860s and 2010s.

It also shows the estimated number of people that were affected by famines between these dates.



1 billion = 1 000 000 000

Key:

estimated number of people affected by famines

estimated global human population

Fig. 3.1

(a) (i) State the final size of the estimated global human population shown in the 2010s in Fig. 3.1.

..... [1]

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(ii) Using the information in Fig. 3.1, calculate the percentage of the estimated global human population that was affected by famine during the 1860s.

Give your answer to **one** significant figure.

..... %
[2]

(b) An increase in the size of the human population can cause famine.

(i) Describe **other** factors that could have caused famines since the 1970s.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Chemical fertilisers have helped farmers to increase food production.

Discuss the negative impact on the natural environment of using chemicals, **other than** fertilisers, in modern farming methods.

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..... [4]

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[Turn over

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(iii) Crops are often grown as monocultures.

State what is meant by a monoculture.

.....

.....

..... [1]

(iv) Scientists are developing crop plants that can produce antigens so that people gain immunity to different diseases such as hepatitis B.

State the process which can be used to develop crop plants that can produce proteins from other species.

..... [1]

[Total: 12]

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4 **(a)** Fig. 4.1 shows a dandelion plant, *Taraxacum officinale*, in a field. The flower stalk is called a scape.



Fig. 4.1

(i) The scape of a dandelion responds to sunlight by growing upwards.

State the name of this growth response.

..... [1]

(ii) The scapes of dandelions keep the plant upright without the need for structures such as bones.

Explain how cells in plant scapes and stems keep plants upright.

.....

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.....

.....

..... [2]

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(b) Fig. 4.2 is part of a cross-section through the scape of a dandelion.

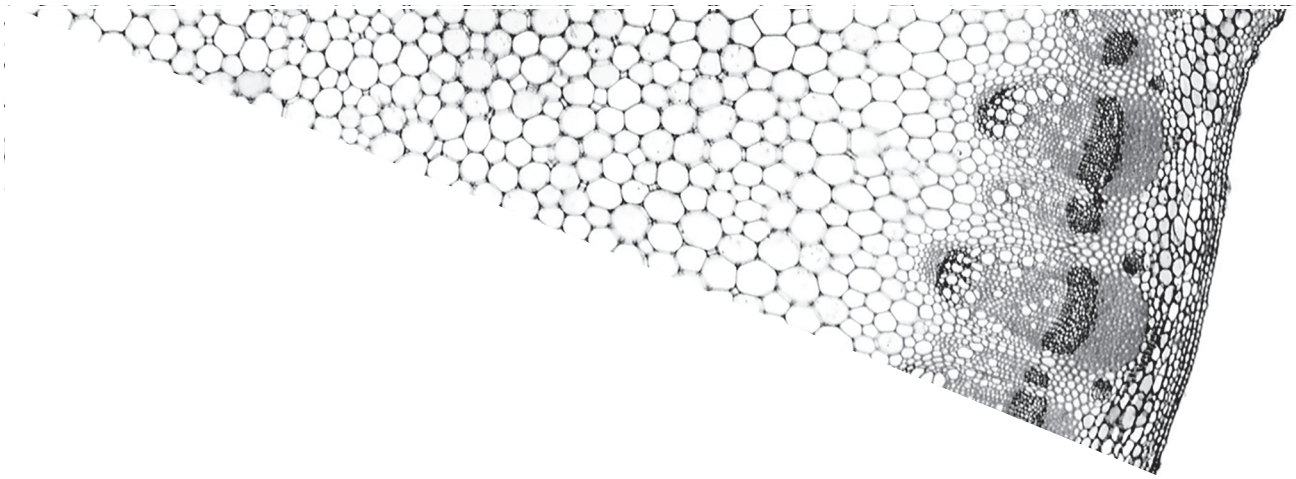


Fig. 4.2

Draw a line and add a label **on Fig. 4.2** to identify one area of **xylem** tissue. [1]

(c) Describe the function of **phloem** tissue.

.....

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..... [3]

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(d) A dandelion scape was cut into long strips for an osmosis investigation.

Immediately after the scape was cut, the pieces of scape bent outwards, as shown in Fig. 4.3.

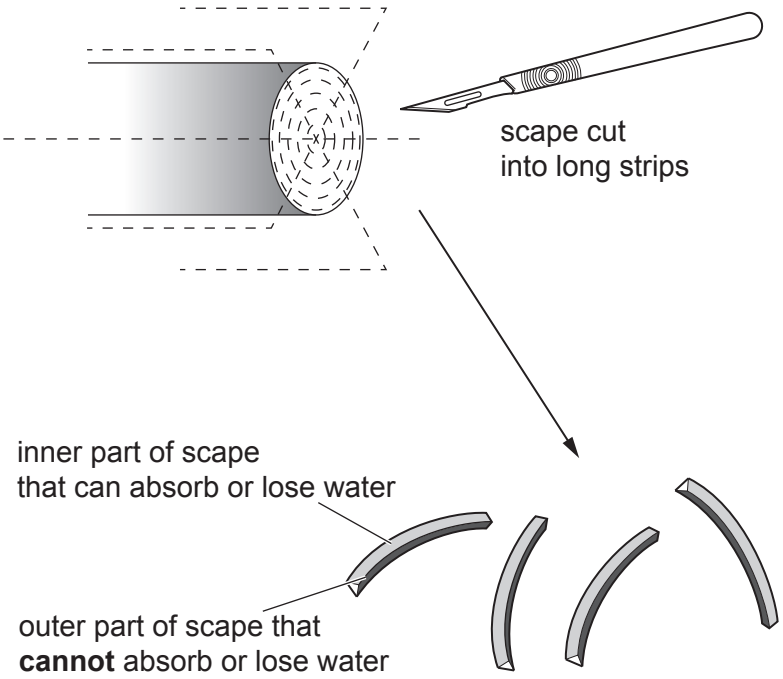


Fig. 4.3

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Strips of dandelion scape were placed in four dishes, **A**, **B**, **C** and **D**, for 30 minutes.

Each dish contained a different concentration of salt solution.

Fig. 4.4 shows the appearance of the four strips of scape after 30 minutes.

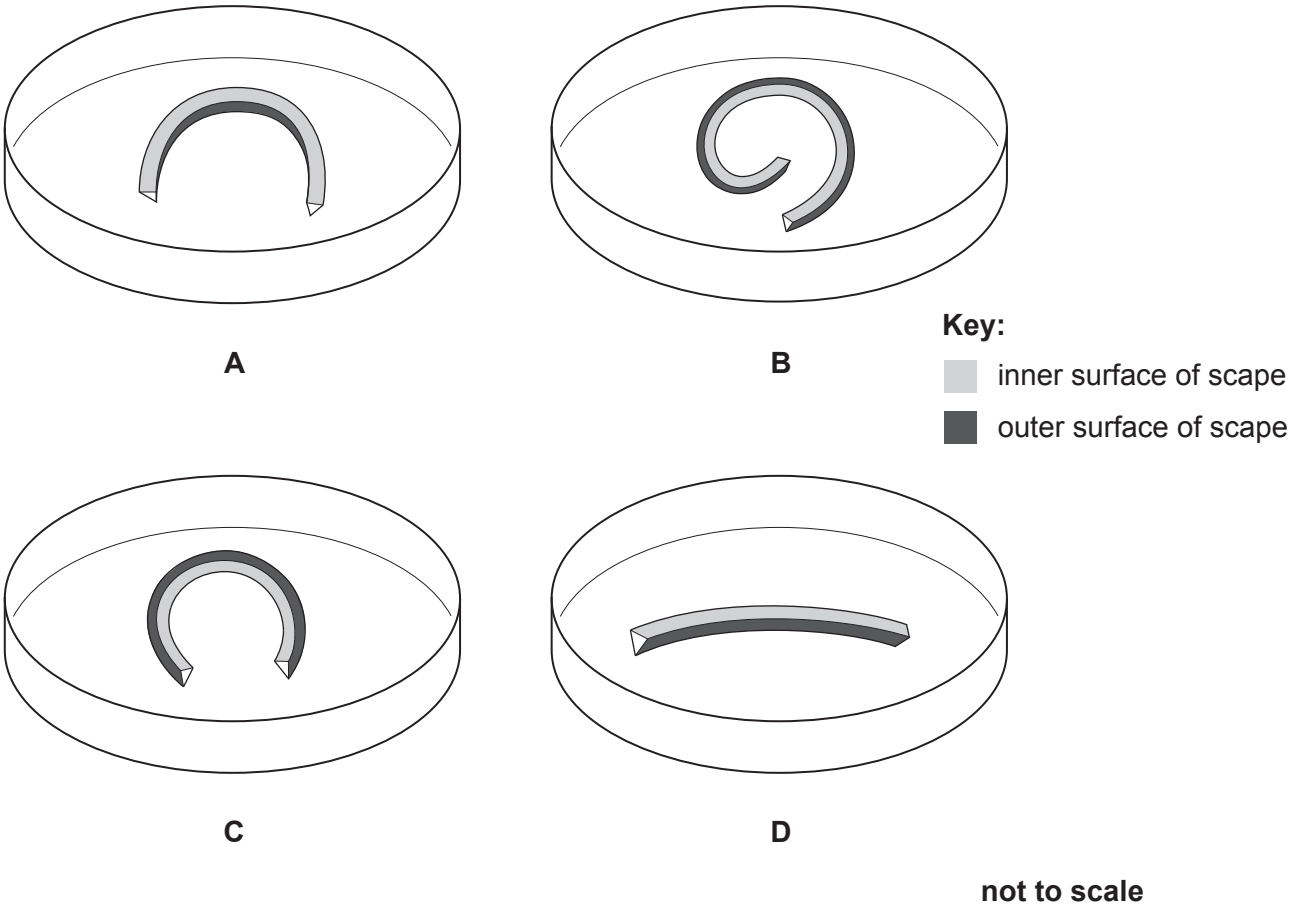


Fig. 4.4

Using the information in Fig. 4.3 and Fig. 4.4, deduce and explain which strip of scape was in the most concentrated salt solution.

strip of scape .....

explanation .....

.....

.....

.....

.....

[3]

[Total: 10]

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5 (a) Researchers investigated water pollution in the centre of a lake for 11 days.

Fig. 5.1 shows researchers collecting samples of aquatic organisms from the lake with a net which was placed at a specified water depth.



Fig. 5.1

Each day, the researchers collected 5 dm^3 of water from the lake. Fish and other large organisms were released back into the lake. The researchers extracted the chlorophyll from all the microorganisms that were collected in the sample of lake water.

They determined the concentration of chlorophyll by measuring the mass of chlorophyll extracted from each dm^3 of lake water.

Fig. 5.2 shows a researcher lowering a Secchi disc on a long string into a lake from a boat. A Secchi disc is a plastic disc which is divided into black and white sections. It is used to measure the transparency of water in lakes, rivers and oceans.

The researcher recorded the maximum water depth at which the Secchi disc was still visible.



Fig. 5.2

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The results of the investigation are shown in Fig. 5.3.

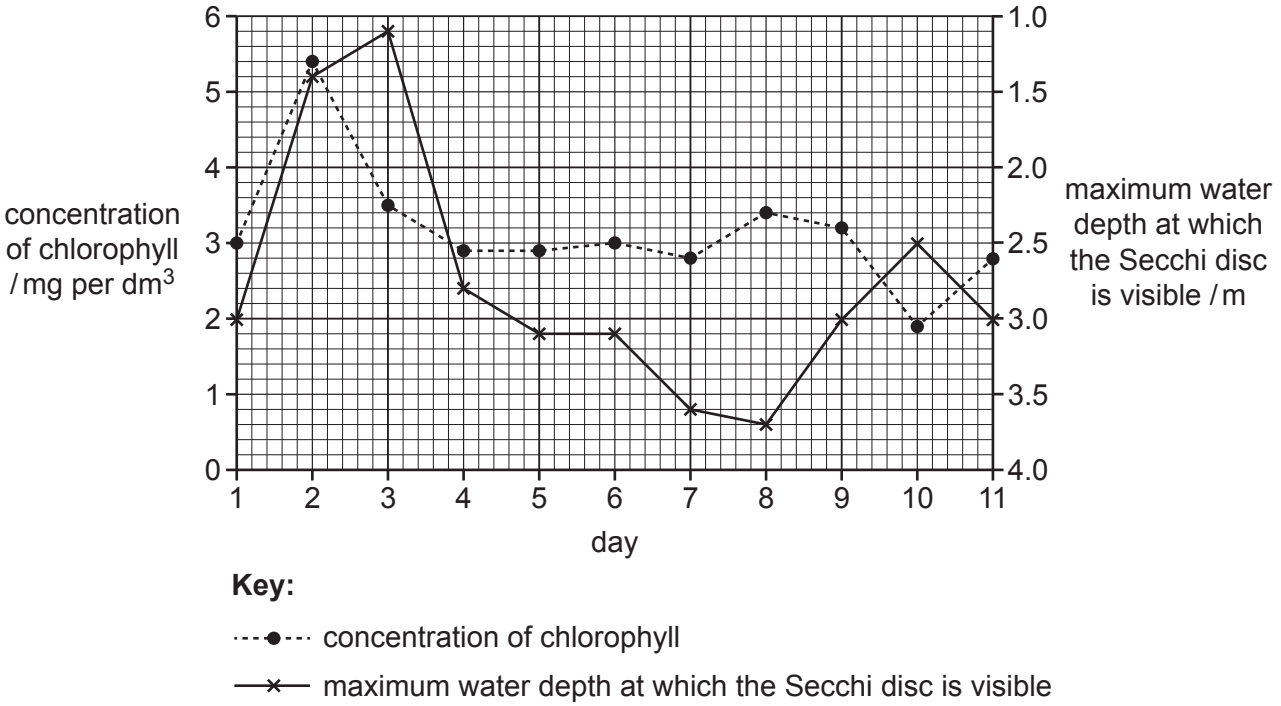


Fig. 5.3

(i) State the type of microorganism that contains chlorophyll.

..... [1]

(ii) The researchers collected 5 dm^3 of water from the lake each day. Using this information and the information in Fig. 5.3, calculate the total mass of chlorophyll in the sample on day 1.

Include the appropriate units with your answer.

.....
[2]

(iii) Suggest why the researchers determined the concentration of chlorophyll rather than counting the number of microorganisms in the sample.

.....

.....

..... [1]

(iv) Using the information in Fig. 5.3, identify the day when the water was the **most** transparent.

..... [1]

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(v) Explain why the transparency of the water is important for organisms that contain chlorophyll.

.....

.....

.....

.....

..... [2]

(b) (i) Heavy rainfall in nearby fields caused ions from fertilisers to wash into the lake on day 1 of the investigation.

State which ions can cause an increase in the number of organisms that contain chlorophyll in the lake.

..... [1]

(ii) Many of the organisms that contain chlorophyll died on day 2 of the investigation.

Explain the consequences of the death of these organisms to the lake ecosystem.

.....

.....

.....

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.....

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..... [3]

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(c) The researchers monitored the water in the lake for pollution.

Outline how sewage should be treated so that the water it contains is safe to put into the lake.

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..... [5]

[Total: 16]

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6 Plants can be classified according to the position and shape of the structures in their flowers.

(a) Fig. 6.1 shows sections of flowers from six different plant species.

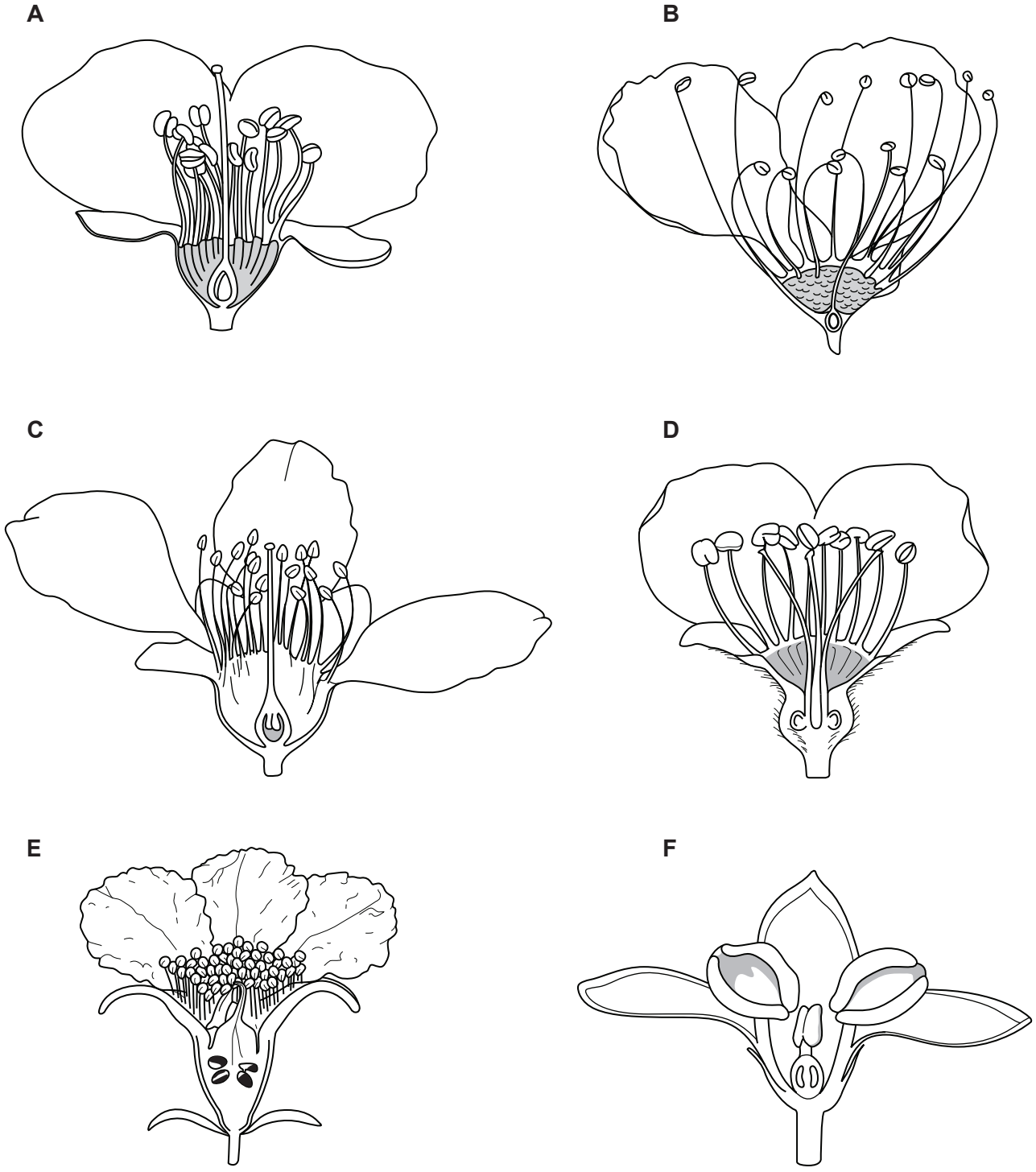


Fig. 6.1

(i) Use the key to identify each species. Write the letter of each species (**A** to **F**) in the correct box in the key.

key

1(a)	two petals visible	go to 2	
(b)	three petals visible	go to 4	
2(a)	one stigma per flower	go to 3	
(b)	more than one stigma per flower	*Pyrus communis*	
3(a)	stigma higher than anther	*Prunus domestica*	
(b)	stigma at same level or lower than anther	*Prunus salicina*	
4(a)	two ovules visible	go to 5	
(b)	more than two ovules visible	*Punica granatum*	
5(a)	anther smaller than carpel	*Prunus amygdalus*	
(b)	anther larger than carpel	*Olea europaea*	

[4]

(ii) The large petals of the flowers shown in Fig. 6.1 indicate that they are pollinated by insects.

List **four** other structural adaptations of insect-pollinated flowers.

1 .....

2 .....

3 .....

4 .....

[4]

(b) Flowering plants are distinguished from ferns because they all produce flowers.

State **one** other morphological feature that can be used to distinguish flowering plants from ferns.

..... [1]

(c) The fruit of a pear tree, *Pyrus communis*, is often used to make juice.

State what protein biotechnologists will use to increase the volume of juice produced from pear fruit.

..... [1]

[Total: 10]

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