Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1190302152

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **October/November 2020**

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 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

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Answer **all** questions.

1 Fig. 1.1 shows a section through the human chest. The gross structure of the human gas exchange system is shown.

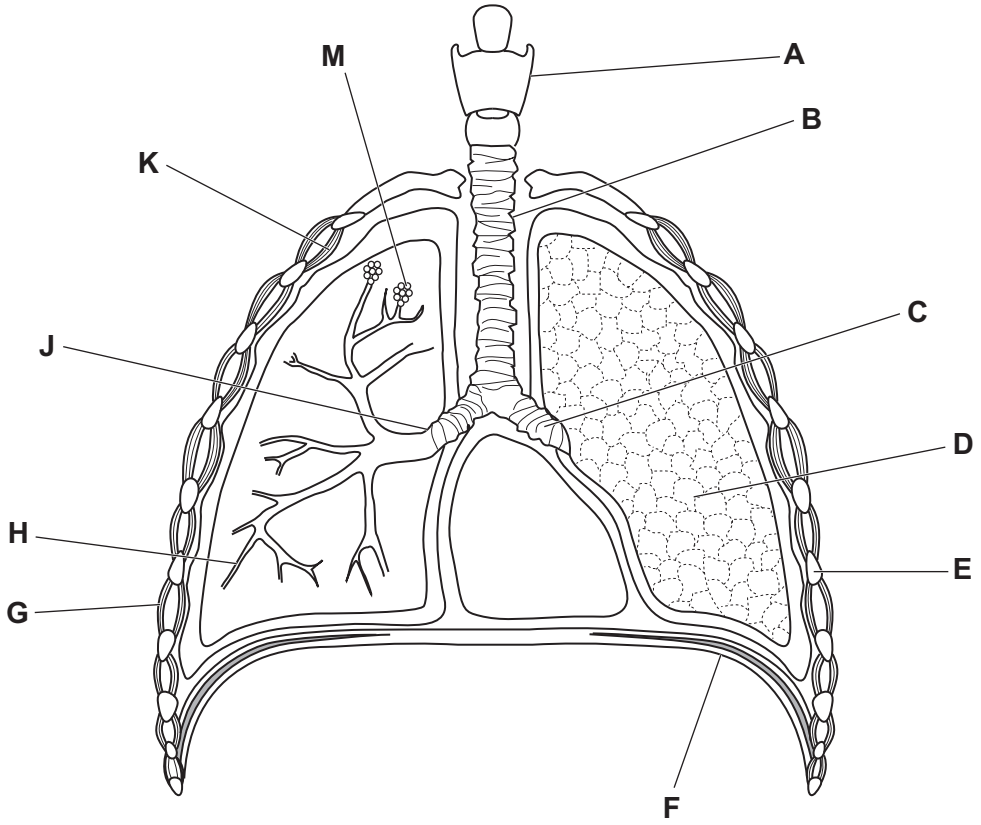


Fig. 1.1

(a) Descriptions of some parts of the gas exchange system are shown in Table 1.1.

Complete Table 1.1 to:

- state the name of the part described
- write a letter from Fig. 1.1 to identify each part.

Table 1.1

description	name of part of gas exchange system	letter from Fig. 1.1
supported by incomplete (C-shaped) rings of cartilage		
lined by ciliated epithelium and supported by blocks of cartilage		
lined by squamous epithelium		
lined by ciliated epithelium, but not supported by cartilage		

[4]

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(b) Tobacco smoke contains a number of compounds which can affect the body.

State the appropriate term that matches each of the statements **A** to **E**.

A The type of chemical that causes mutation of genes that control the cell cycle.

.....

B A component that causes a short-term increase in blood pressure.

.....

C A component that reduces the carrying capacity of haemoglobin for oxygen.

.....

D A component that increases the production and secretion of mucus from goblet cells.

.....

E A component that causes a short-term increase in heart rate.

.....

[5]

[Total: 9]

2 The veins of a leaf contain transport tissues. Fig. 2.1 is a drawing made from an electron micrograph showing a cross-section of the transport tissue in a leaf vein.

The cells labelled **A** are modified companion cells, known as phloem transfer cells. Transfer cells move sucrose and other assimilates from mesophyll cells, **B**, into the phloem sieve tube element, **C**.

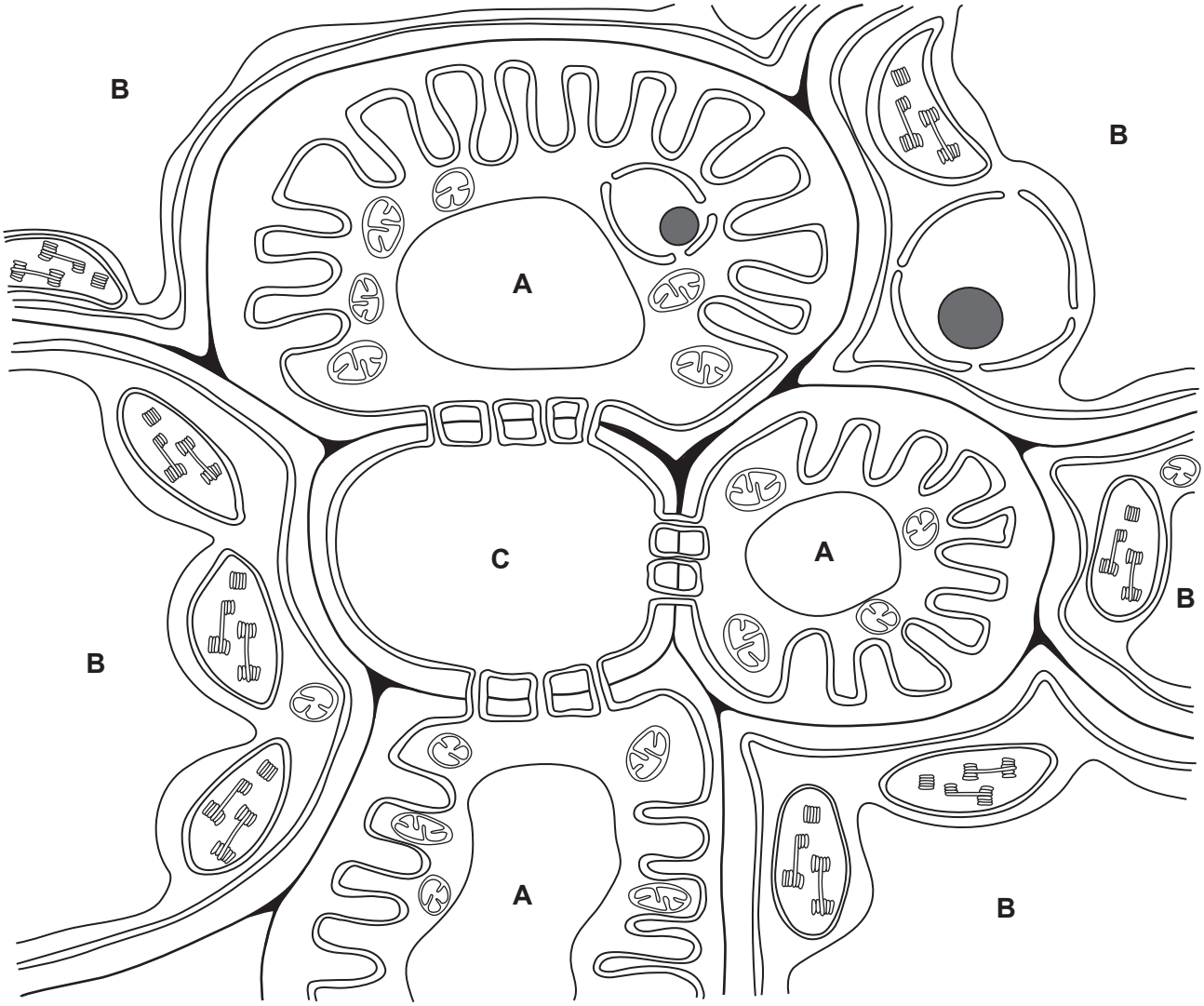


Fig. 2.1

(a) State the functions of the mesophyll cells, **B**, and sieve tube element, **C**, **and** explain how their structure is adapted for their function.

cell **B** – function .....

adaptation .....

.....

.....

.....

cell **C** – function .....

adaptation .....

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.....

[5]

(b) The cell walls of the transfer cells, **A**, shown in Fig. 2.1, have infoldings.

Explain the advantages of these cell wall infoldings for the movement of sucrose from mesophyll cells to phloem sieve tubes.

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..... [3]

[Total: 8]

3 Fig. 3.1 shows the nematode worm, *Caenorhabditis elegans*.



magnification ×250

Fig. 3.1

Stem cells of *C. elegans* have been studied.

Fig. 3.2 shows the change in mass of DNA per nucleus in a stem cell during one cell cycle.

$1\,pg = 1 \times 10^{-12}\,g$

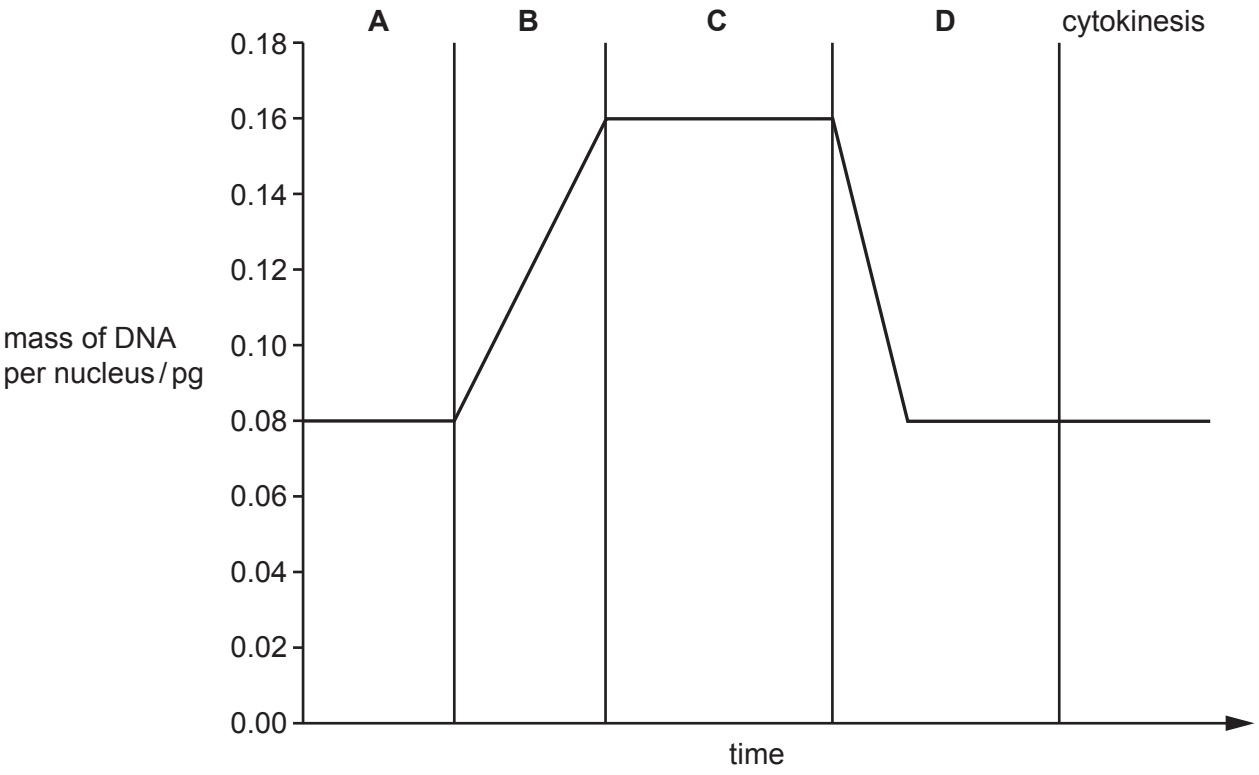


Fig. 3.2

(a) (i) State the phases of interphase shown by **A** and **B** in Fig. 3.2.

A .....

B .....

[2]

(ii) State the stage of mitosis shown by **D** in Fig. 3.2.

..... [1]

(iii) Outline what happens in a cell in preparation for cytokinesis.

.....

.....

.....

.....

.....

..... [2]

(iv) A stem cell of a female *C. elegans* has 12 chromosomes.

Complete Table 3.1 to show the number of nuclei within the stem cell in stages **A**, **B** and **D** of the cell cycle shown in Fig. 3.2 **and** the number of chromosomes in each nucleus during these stages.

Table 3.1

	stage of the cell cycle		
	A	**B**	**D**
number of nuclei within the stem cell			
number of chromosomes in each nucleus			

[2]

(b) Young nematodes have stem cells throughout the body.

Fig. 3.3 summarises three cell cycles of one of these stem cells.

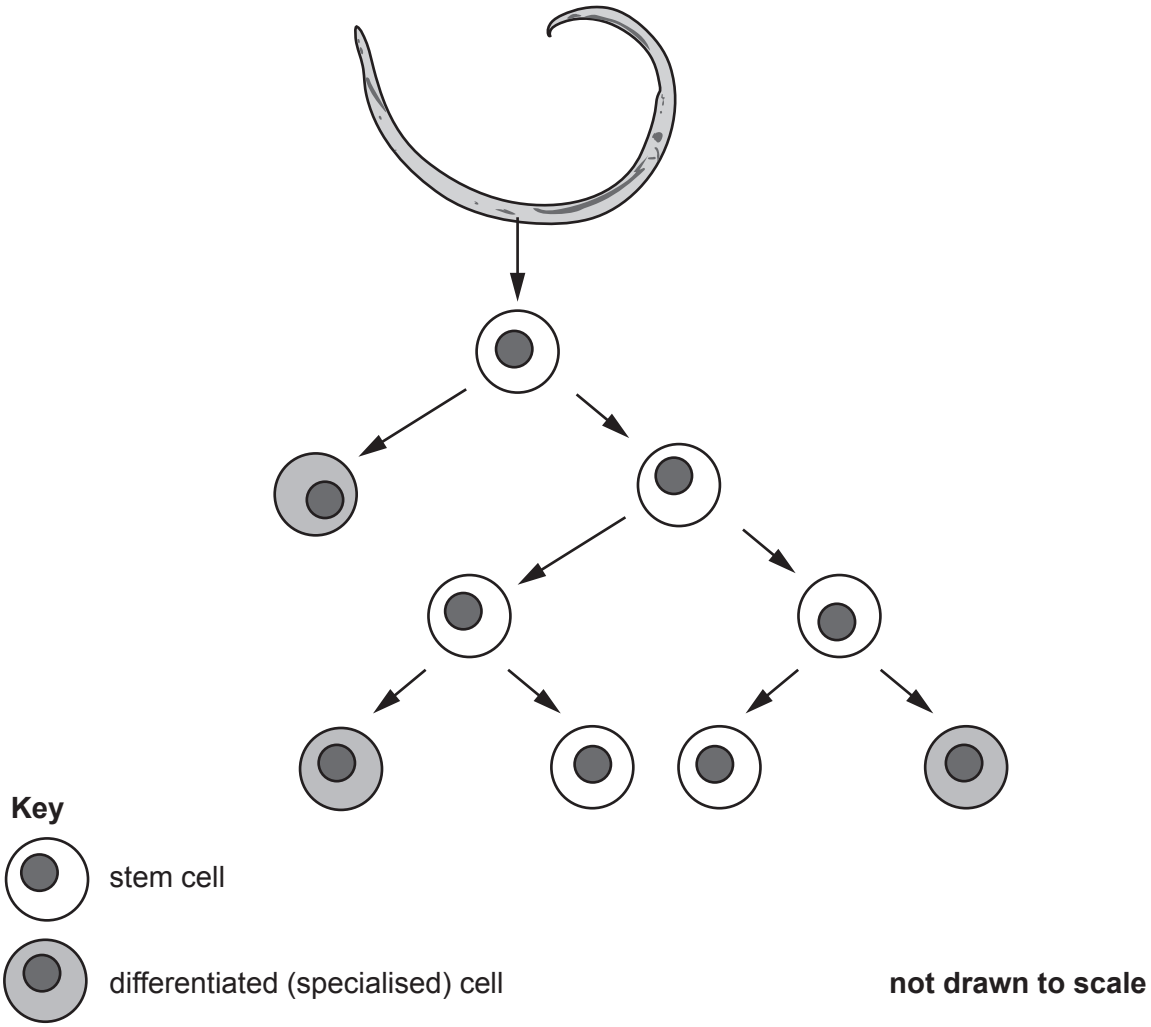


Fig. 3.3

With reference to Fig. 3.3, outline the role of stem cells in animals.

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..... [3]

[Total: 10]

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4 Antibiotic sensitivity tests can be carried out to choose appropriate antibiotics to use for treatment of bacterial diseases.

A researcher carried out an antibiotic sensitivity test using two pathogenic bacteria, **X** and **Y**.

The researcher prepared two Petri dishes containing agar.

- A culture of each bacterium was spread over the surface of the agar.
- Filter paper discs containing antibiotics were placed on the surface of the agar in each dish.
- The Petri dishes were incubated at 25 °C for two days.

The results of the test using three antibiotics, **P**, **Q** and **R**, are shown in Fig. 4.1.

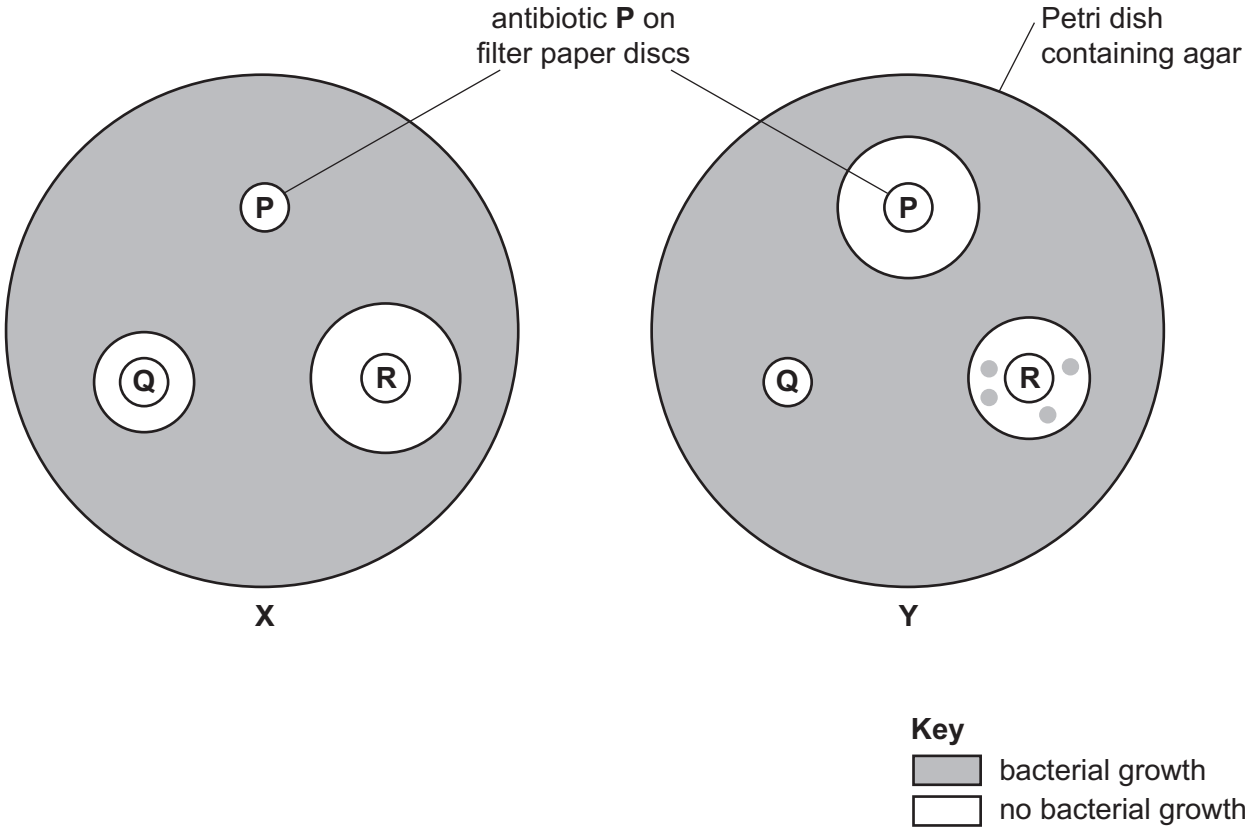


Fig. 4.1

(a) (i) State the most effective antibiotic to treat infections of bacterium **X** and bacterium **Y**.

bacterium **X** .....

bacterium **Y** .....

[1]

(ii) Suggest why bacterium **Y** had a different sensitivity to each of the three antibiotics.

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..... [2]

(b) Explain how the use of vaccines in the control of infectious diseases differs from the use of antibiotics.

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..... [3]

[Total: 6]

5 A molecule of collagen consists of three identical polypeptides that form a triple helix.

The amino acid glycine forms one third of the amino acids in a collagen molecule.

Fig. 5.1**A** shows a polypeptide molecule during protein synthesis. A molecule of glycine is shown just before it is added to the polypeptide.

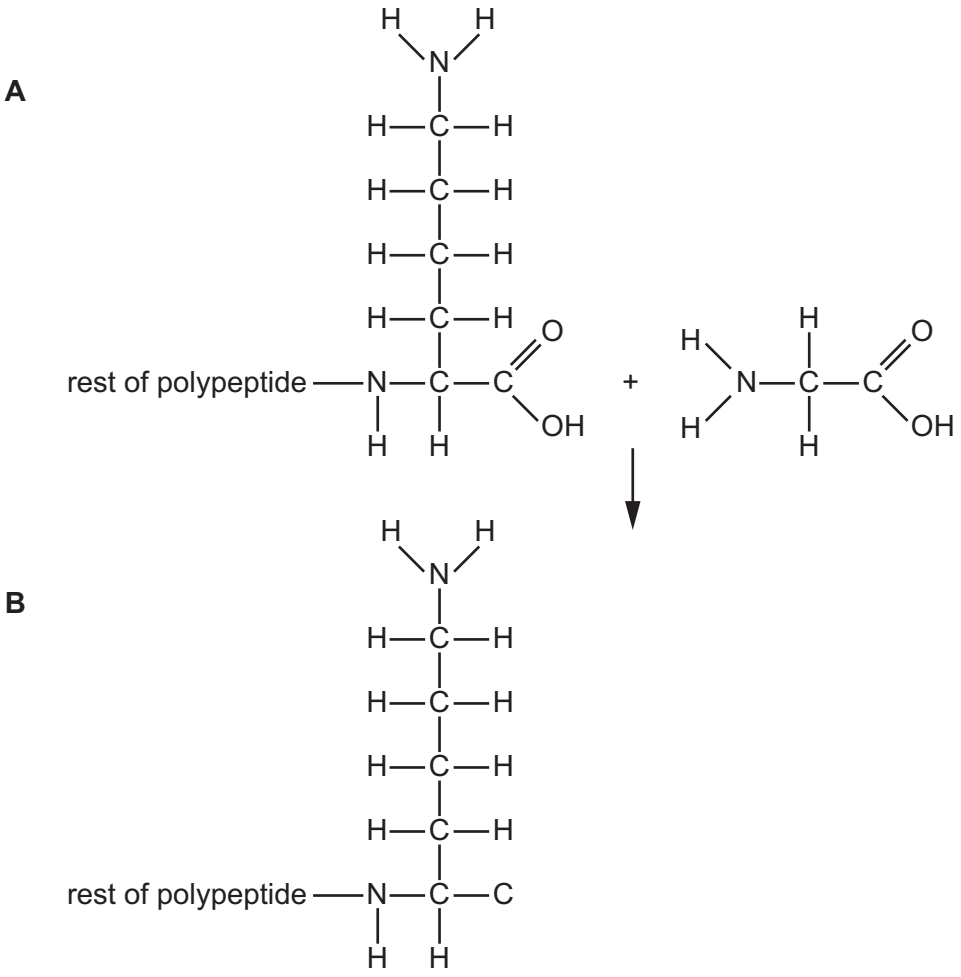


Fig. 5.1

(a) (i) Complete Fig. 5.1**B** to show the molecule of glycine added to the end of the polypeptide. [2]

(ii) State the type of reaction that occurs when glycine is added to the end of the polypeptide.

..... [1]

(iii) Explain the importance of glycine in a collagen molecule.

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..... [2]

(b) Collagen is a fibrous protein.

Explain how the structure of collagen is related to its functions within the mammalian body.

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..... [4]

(c) The enzyme collagenase catalyses the breakdown of collagen molecules. This enzyme acts by using an induced fit mechanism.

Describe the mode of action of collagenase.

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..... [5]

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(d) Students investigated the effect of pH on the activity of collagenase extracted from the bacterium *Bacillus licheniformis* at 50 °C.

The results are shown in Fig. 5.2.

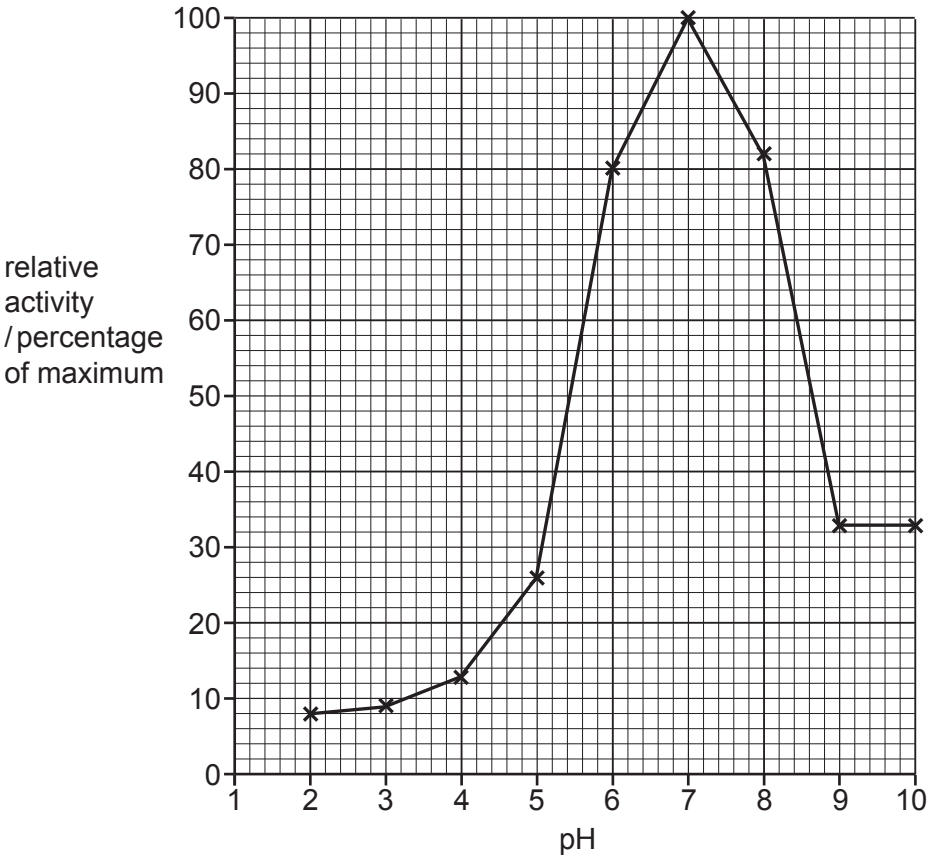


Fig. 5.2

With reference to Fig. 5.2, describe **and** explain the effect of pH on the activity of collagenase.

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..... [4]

[Total: 18]

6 **(a)** Fig. 6.1 shows *Vorticella*, which is a single-celled organism that lives in freshwater. *Vorticella* has many cilia which it uses for feeding.

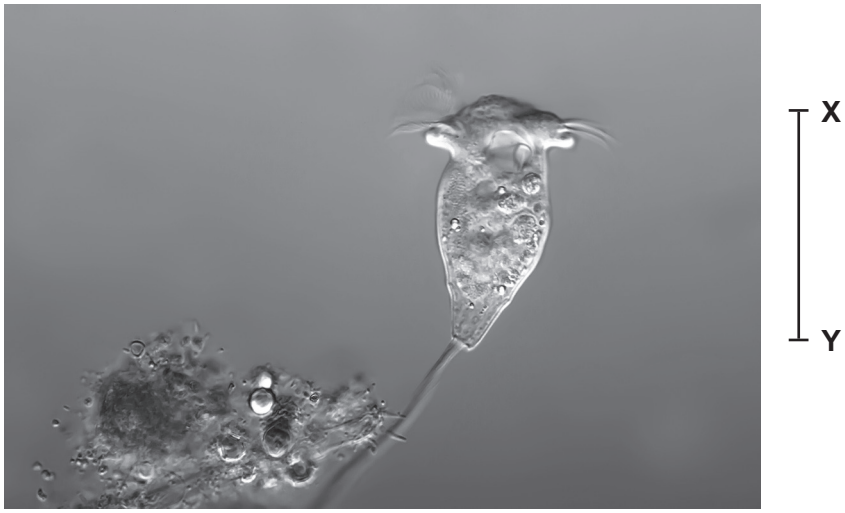


Fig. 6.1

The distance shown by **X**–**Y** on Fig. 6.1 is 150 μm.

Calculate the magnification of Fig. 6.1.

State the formula that you will use and show your working.

Write your answer to the nearest whole number.

formula

..... [3]

(b) The food particles are taken into the gullet by a current of water created by movement of cilia.

Any particles suspended in the water, such as bacteria, are taken into the cell as shown in Fig. 6.2.

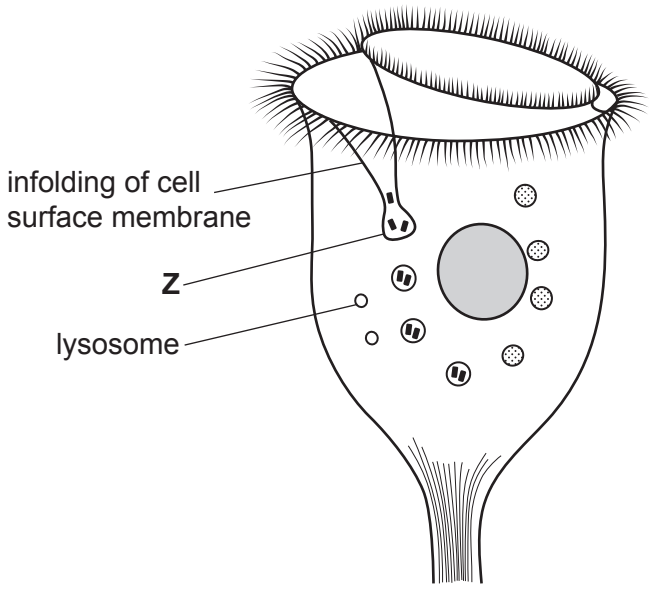


Fig. 6.2

(i) State the name of the process which takes the bacteria into the cell at **Z and** describe the way in which it occurs.

name .....

description .....

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.....

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[3]

(ii) Describe the role of lysosomes in intracellular digestion in *Vorticella*.

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..... [3]

[Total: 9]

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