UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

9622949895

BIOLOGY **9700/21**

Paper 2 Structured Questions AS **October/November 2011**

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 ink.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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.

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1	
2	
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4	
5	
6	
Total	

This document consists of **15** printed pages and **1** blank page.

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Answer **all** the questions.

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1 Fig. 1.1 is a diagram of a cell surface membrane.

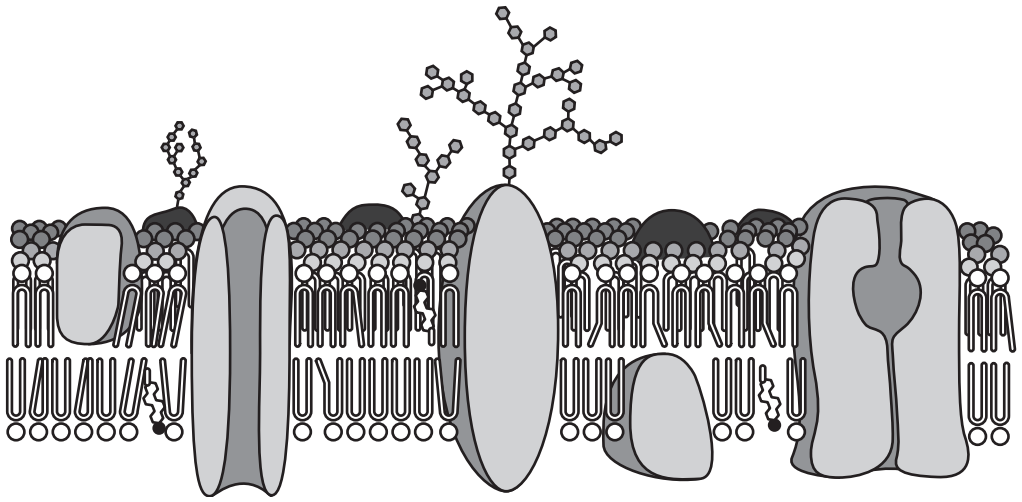


Fig. 1.1

(a) Use a label line and the appropriate letter to label each of the following on Fig. 1.1.

P protein for active uptake of potassium ions

Q protein for facilitated diffusion of polar molecules

R receptor site for a hormone

S hydrophilic heads of phospholipids on the internal surface of the membrane

T molecule that modifies the fluidity of the membrane [5]

(b) Some cells take in bacteria by endocytosis.

Explain how endocytosis occurs at a cell surface membrane.

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[Total: 8]

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2 A student investigated the initial rate of reaction of catalase in breaking down hydrogen peroxide into oxygen and water:

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$$2H_2O_2 \xrightarrow{\text{catalase}} O_2 + 2H_2O$$

The volume of oxygen collected was recorded over a period of 140 seconds. The results are shown in Fig. 2.1.

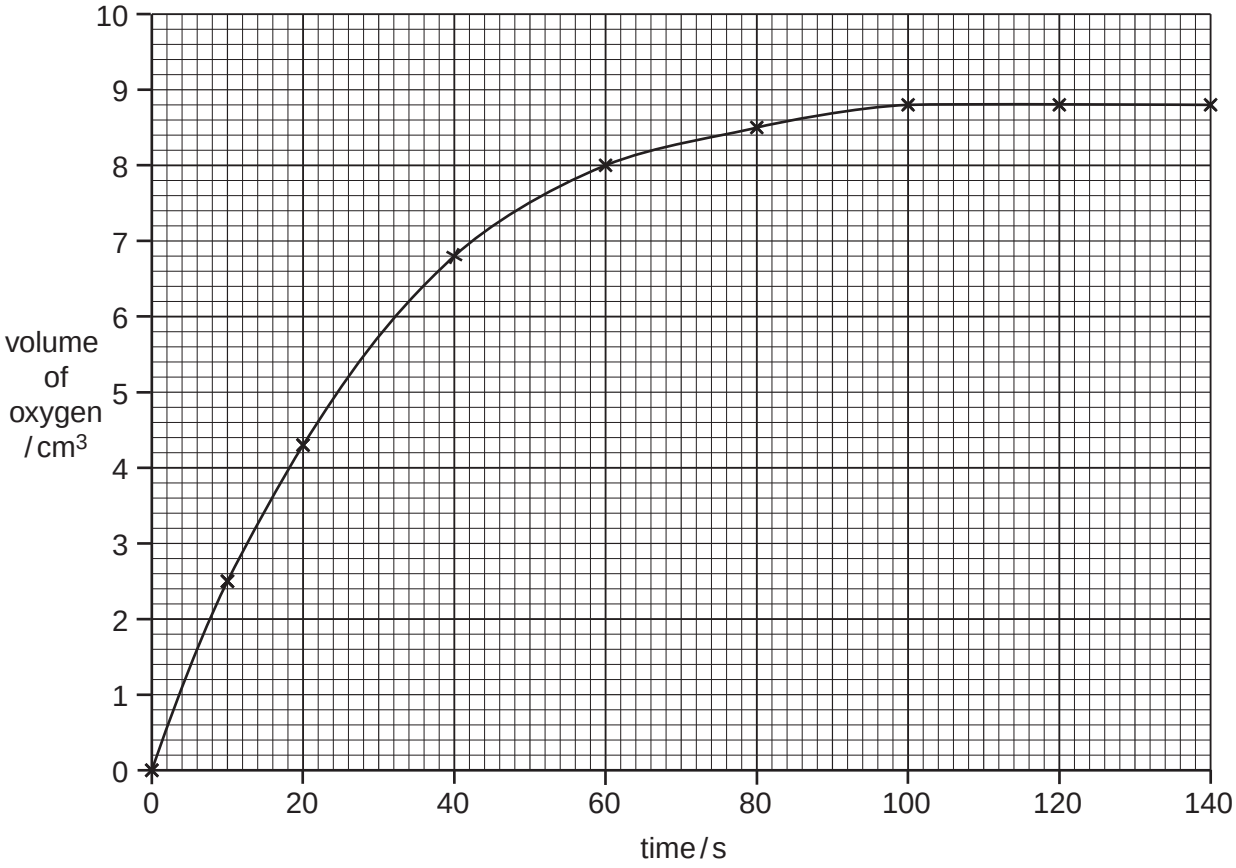


Fig. 2.1

(a) (i) Use the information in Fig. 2.1 to calculate the **initial rate of reaction** in $cm^3\ s^{-1}$.

Show your working.

answer ..... $cm^3\ s^{-1}$ [2]

(ii) Explain the change in volume of oxygen collected as shown in Fig. 2.1.

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The student continued the investigation by determining the initial rates of reaction for five different concentrations of hydrogen peroxide. The line marked **W** in Fig. 2.2 shows the results.

The whole procedure was repeated after adding copper ions to the different concentrations of hydrogen peroxide. The line marked **V** on Fig. 2.2 shows the results.

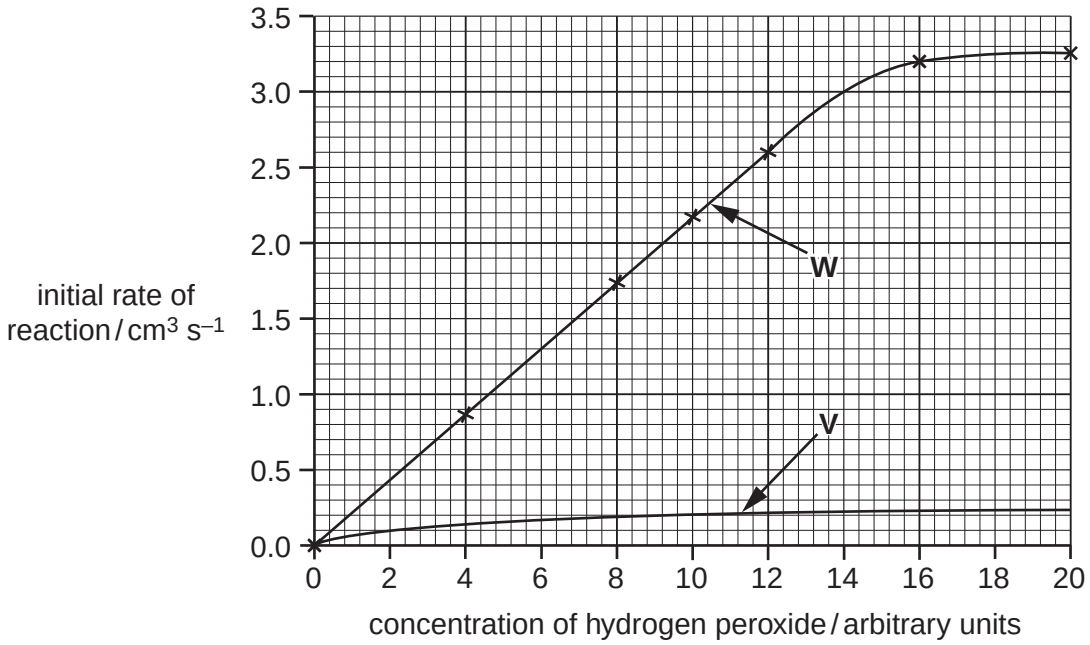


Fig. 2.2

(b) Use the information in Fig. 2.2 to explain the effect of copper ions on the action of an enzyme, such as catalase.

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(c) Enzyme molecules in cells eventually stop working and are broken down.

Outline how cells replace the enzymes that are broken down.

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[Total: 12]

3 Fig. 3.1 shows a molecule of haemoglobin.

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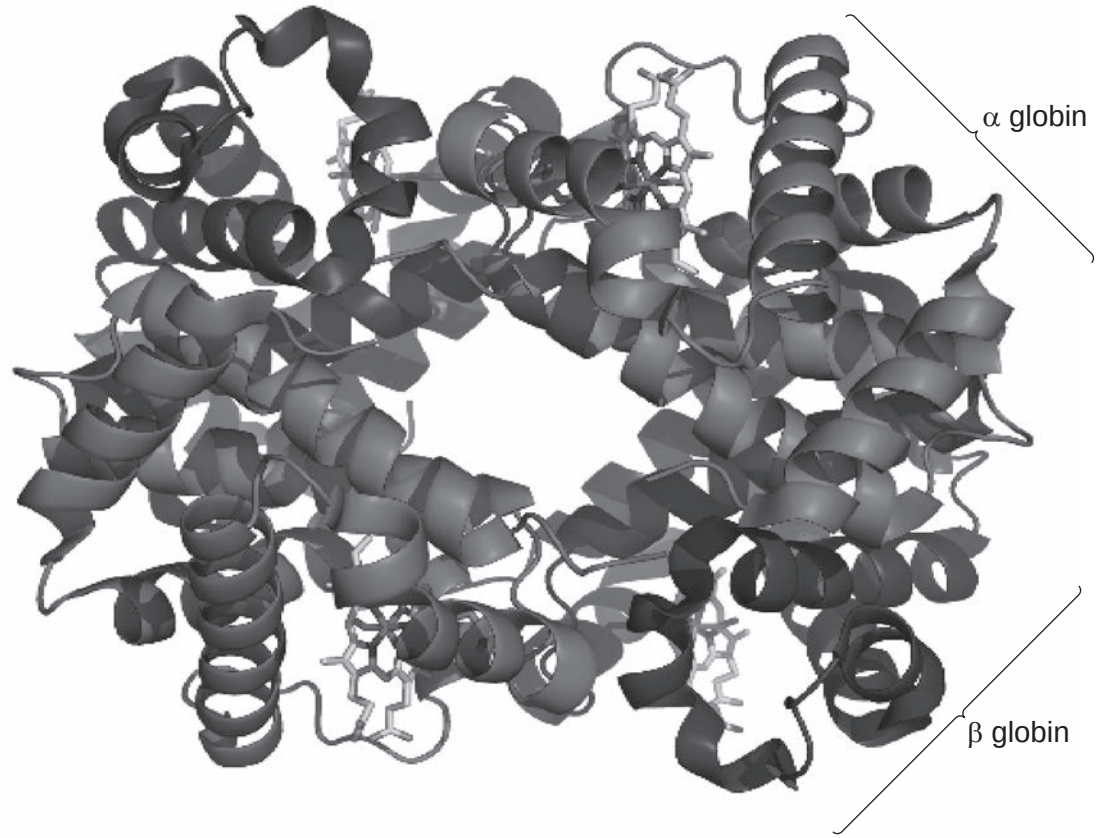


Fig. 3.1

(a) Explain how a molecule of haemoglobin shows the four levels of organisation of protein molecules.

primary structure .....

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secondary structure .....

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tertiary structure .....

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quaternary structure .....

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For Examiner's Use

There are many different variants of haemoglobin. The sequence of bases in DNA that code for the first seven amino acids in two variants of the β-globin polypeptide are shown in Fig. 3.2.

The genetic dictionary for some of the amino acids is in Table 3.1.

Variant 1

1	2	3	4	5	6	7
CAC	GTG	GAC	TGA	GGA	CTC	CTC

Variant 2

1	2	3	4	5	6	7
CAC	GTG	GAC	TGA	GGA	CAC	CTC

Fig. 3.2

Table 3.1

amino acid	**abbreviation**	**DNA triplets on the coding polynucleotide**
valine	val	CAA, CAC, CAG, CAT
proline	pro	GGA, GGC, GGG, GGT
threonine	thr	TGA, TGC, TGG, TGT
histidine	his	GTA, GTG
glutamic acid	glu	CTC, CTT
leucine	leu	AAC, AAT, GAA, GAC, GAG, GAT

(b) Use the genetic dictionary to describe the similarities and differences between the two variants of haemoglobin.

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[Turn over

(c) Collagen is a fibrous protein found in many tissues in animals.

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(i) State the function of collagen in the walls of arteries.

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(ii) State **one** way in which the **structure** of collagen differs from the structure of haemoglobin.

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[Total: 9]

4 (a) (i) Name two factors that increase the chances that cancer will develop.

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1. .....

2. .....[2]

(ii) State why lung cancer is categorised as a non-infectious disease.

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The effectiveness of anti-cancer drugs may be determined by growing different tumours in culture.

The effectiveness of two drugs on two human tumours (**A** and **B**) from different tissues was assessed. The two drugs, T138067 and vinblastine, were added to the tumours in culture on days 5, 12 and 19. The volumes of the tumours were compared with the volumes of tumours that were not treated with any drugs.

The results are shown in Fig. 4.1.

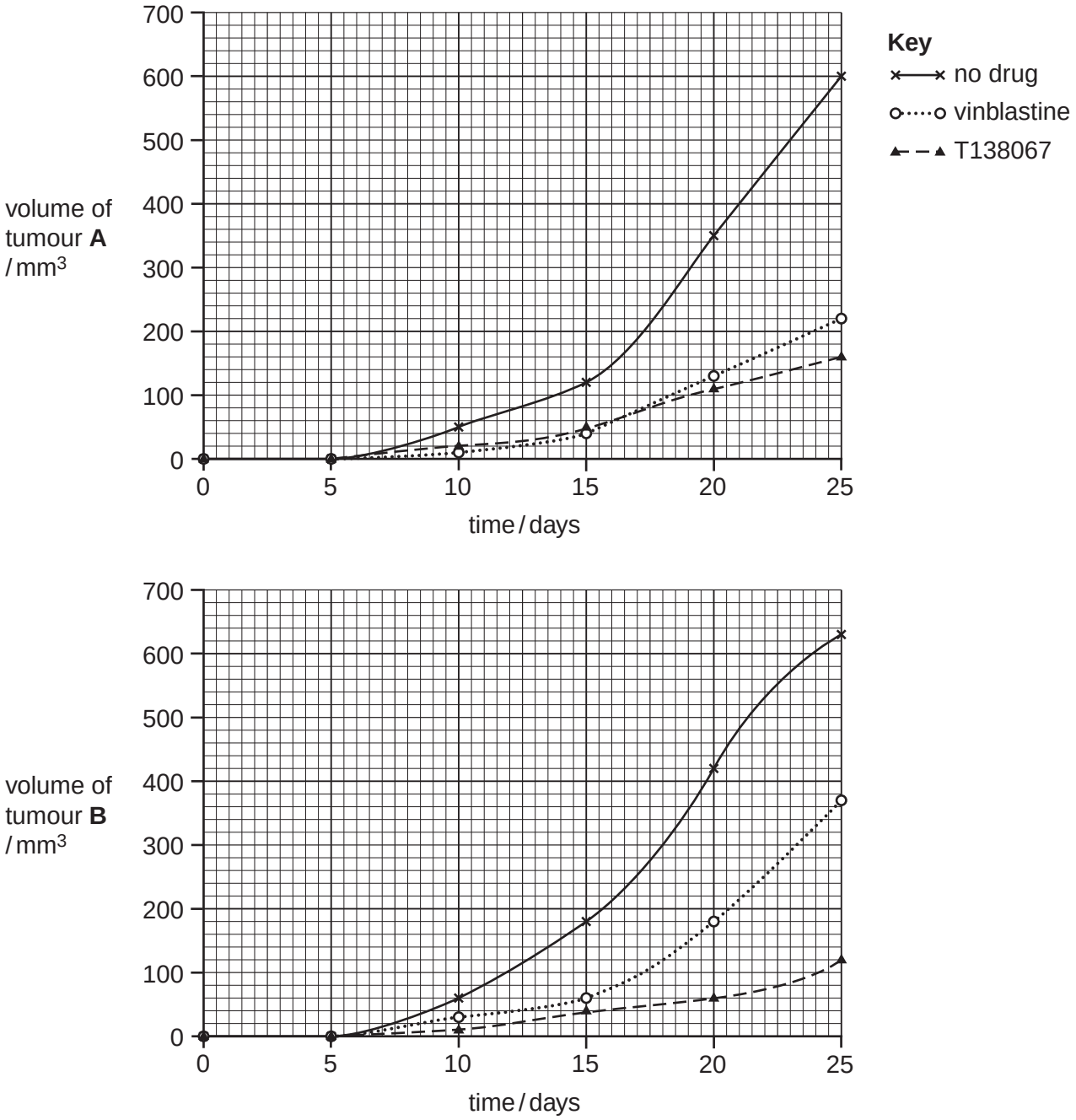


Fig. 4.1

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(b) Use the data in Fig. 4.1 to compare the effectiveness of the two drugs used to treat the tumours.

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(c) Vinblastine disrupts the formation of the spindle apparatus during mitosis.

Explain how vinblastine has its effect as an anti-cancer drug.

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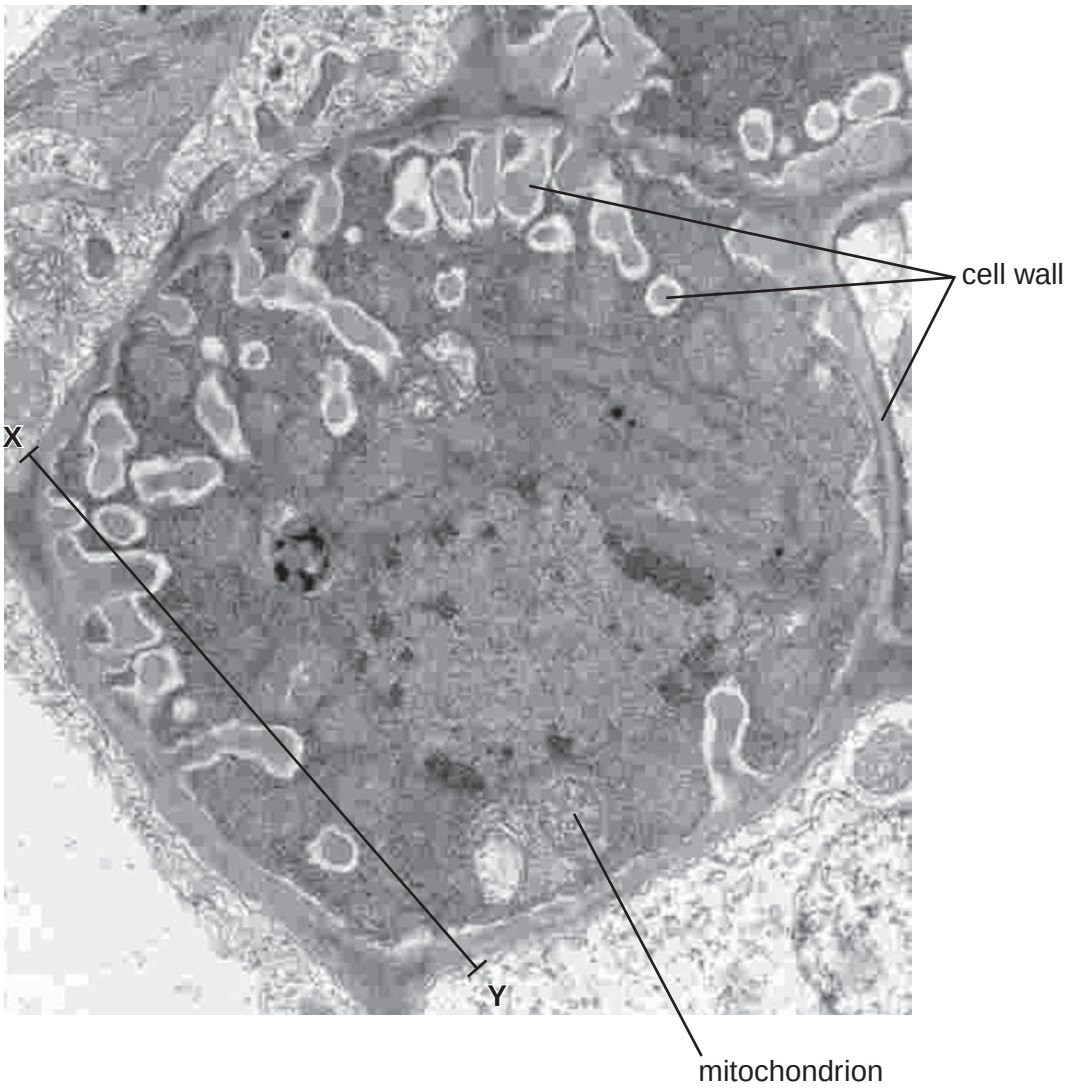
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[Total: 10]

5 Phloem transfer cells are modified companion cells that move sucrose and other assimilates from mesophyll tissue into phloem sieve tube elements.

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Fig. 5.1 is an electron micrograph of a phloem transfer cell.



magnification = × 10 000

Fig. 5.1

(a) Calculate the actual distance across the transfer cell from **X** to **Y**.

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

answer ..... µm [2]

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(b) With reference to Fig. 5.1, explain how phloem transfer cells help in the movement of sucrose from the mesophyll of a leaf into a phloem sieve tube element.

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(c) Explain how sucrose in the phloem sap is moved from sieve tube elements in leaves to cells in a sink, such as a root.

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[Total: 11]

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6 Phagocytes and lymphocytes are part of the body's cellular response to infection by pathogens.

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Fig. 6.1 shows the origin and maturation of phagocytes and lymphocytes.

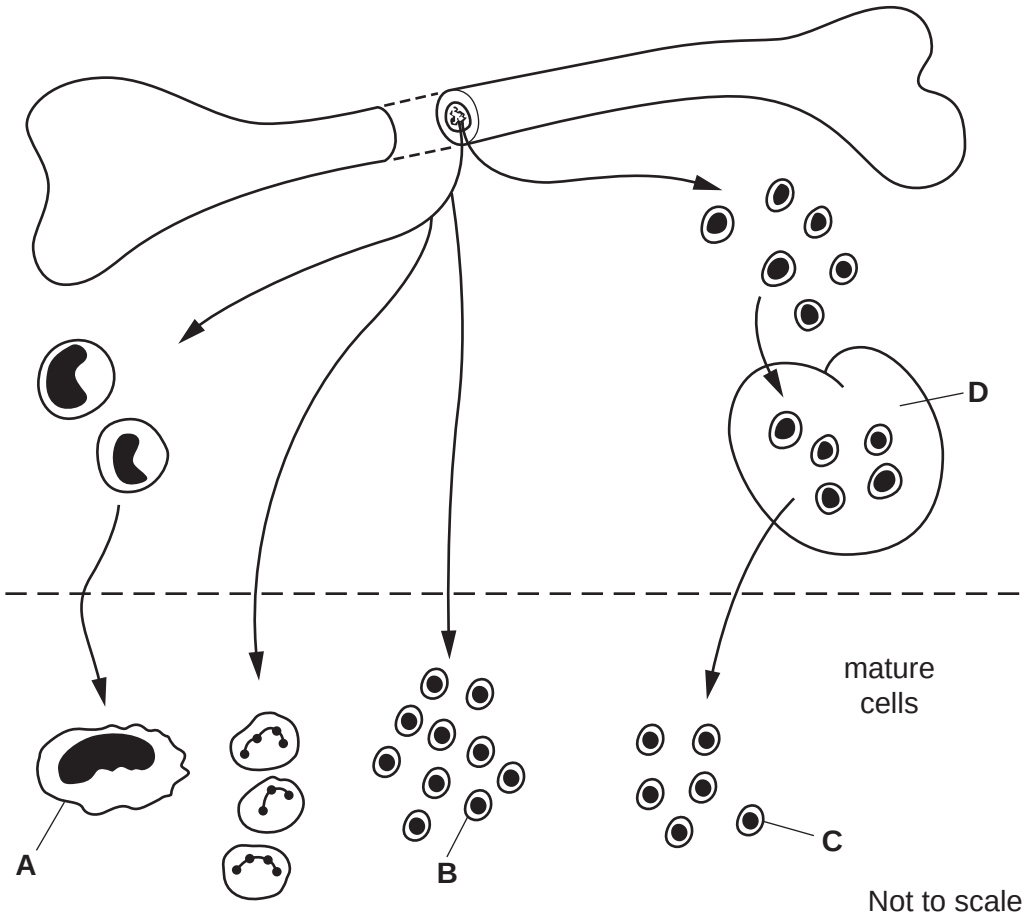


Fig. 6.1

(a) Name the site of origin of phagocytes and lymphocytes.

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(b) Name:

(i) cells **A**, **B** and **C**

A .....

B .....

C .....[3]

(ii) organ **D**.

.....[1]

(c) Explain the roles of the cells, **A**, **B** and **C** in an immune response.

In your answer use the terms *antigen* and *non-self*.

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[Total: 10]

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