



Answer **all** the questions.

- 1 (a) Each of the statements **A** to **D** describes a structure found in eukaryotic cells.

Identify the structure that is described in each statement.

**A** An organelle that contains 70S ribosomes.

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**B** A thread-like structure composed of DNA and histone proteins.

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**C** The organelle that modifies and packages proteins for secretion.

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**D** The structure that synthesises rRNA and combines it with proteins.

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[4]

- (b) Prokaryotes and plant cells have cell walls.

Outline the composition of the cell wall of a prokaryote **and** the composition of the cell wall of a plant cell to show how they differ.

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.....[2]

[Total: 6]



4

- (b) The students investigated a different phosphatase enzyme (enzyme **B**) and found the value of  $K_m$  to be higher than  $0.3 \text{ mmol dm}^{-3}$ .

Explain the difference between the values of  $K_m$  for these two phosphatase enzymes.

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- (c) The students repeated their investigation on enzyme **A** with a competitive inhibitor.

They used the same concentrations of substrate as before, but added a competitive inhibitor to each reaction mixture.

They used the same concentration of the inhibitor in each reaction mixture.

The students found that  $V_{\text{max}}$  was the same as before, but  $K_m$  was higher than  $0.3 \text{ mmol dm}^{-3}$ .

Explain how the addition of the competitive inhibitor results in the same value for  $V_{\text{max}}$  but a higher value for  $K_m$ .

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[Total: 8]

3 Fig. 3.1 is a diagram that shows the structure of an antibody molecule.

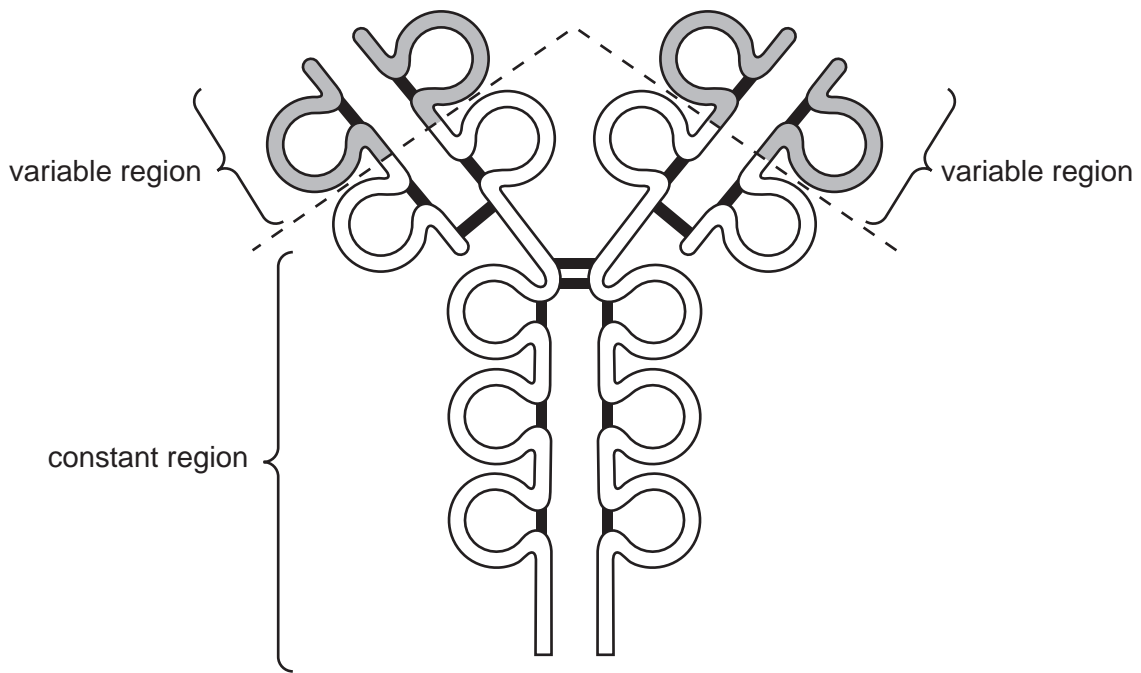


Fig. 3.1

(a) State why the antibody molecule shown in Fig. 3.1 has quaternary structure.

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.....[1]

(b) (i) Use Fig. 3.1 to explain how the structure of the variable region of an antibody molecule is related to its function.

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(ii) State the role of the constant region of an antibody.

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(c) Monoclonal antibodies are used both in diagnosis and in treatment of disease.

(i) Outline how monoclonal antibodies are produced.

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(ii) Suggest the advantages of using monoclonal antibodies in diagnosis of disease.

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[Total: 11]



(b) Fig. 4.2 shows:

- the first seven amino acids of the  $\beta$  chain of haemoglobin
- the first amino acid in the sequence is valine (Val)
- the 21 base pairs in the sequence of DNA that code for these seven amino acids.

amino acid sequence	Val	His	Leu	Thr	Pro	Glu	Glu
base sequence in DNA	CAC	GTG	GAC	TGA	GGA	CTC	CTC
	GTG	CAC	CTG	ACT	CCT	GAG	GAG

**Fig. 4.2**

Table 4.1 shows the triplets of bases that code for seven amino acids.

Using Fig. 4.2 and Table 4.1, state what will happen to the sequence of amino acids in the first part of the  $\beta$  chain of haemoglobin:

(i) if the base pair at position 6 is deleted

.....  
 .....[1]

(ii) if the three base pairs at positions 7, 8 and 9 are deleted.

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 .....[1]

**Table 4.1**

amino acid		DNA triplets
cysteine	(Cys)	TGT TGC
glutamic acid	(Glu)	GAA GAG
histidine	(His)	CAT CAC
leucine	(Leu)	CTT CTC CTA CTG
proline	(Pro)	CCT CCC CCA CCG
threonine	(Thr)	ACT ACC ACA ACG
valine	(Val)	GTT GTC GTA GTG
no amino acid	STOP	TAA TAG TGA



5 Sugar molecules enter cells through transport proteins.

(a) Explain why transport proteins are required for the movement of sugar molecules, such as glucose and fructose, into cells.

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Some plant cells convert fructose and glucose into sucrose for transport from sources to sinks. Sucrose is moved into phloem sieve tubes as shown in Fig. 5.1.

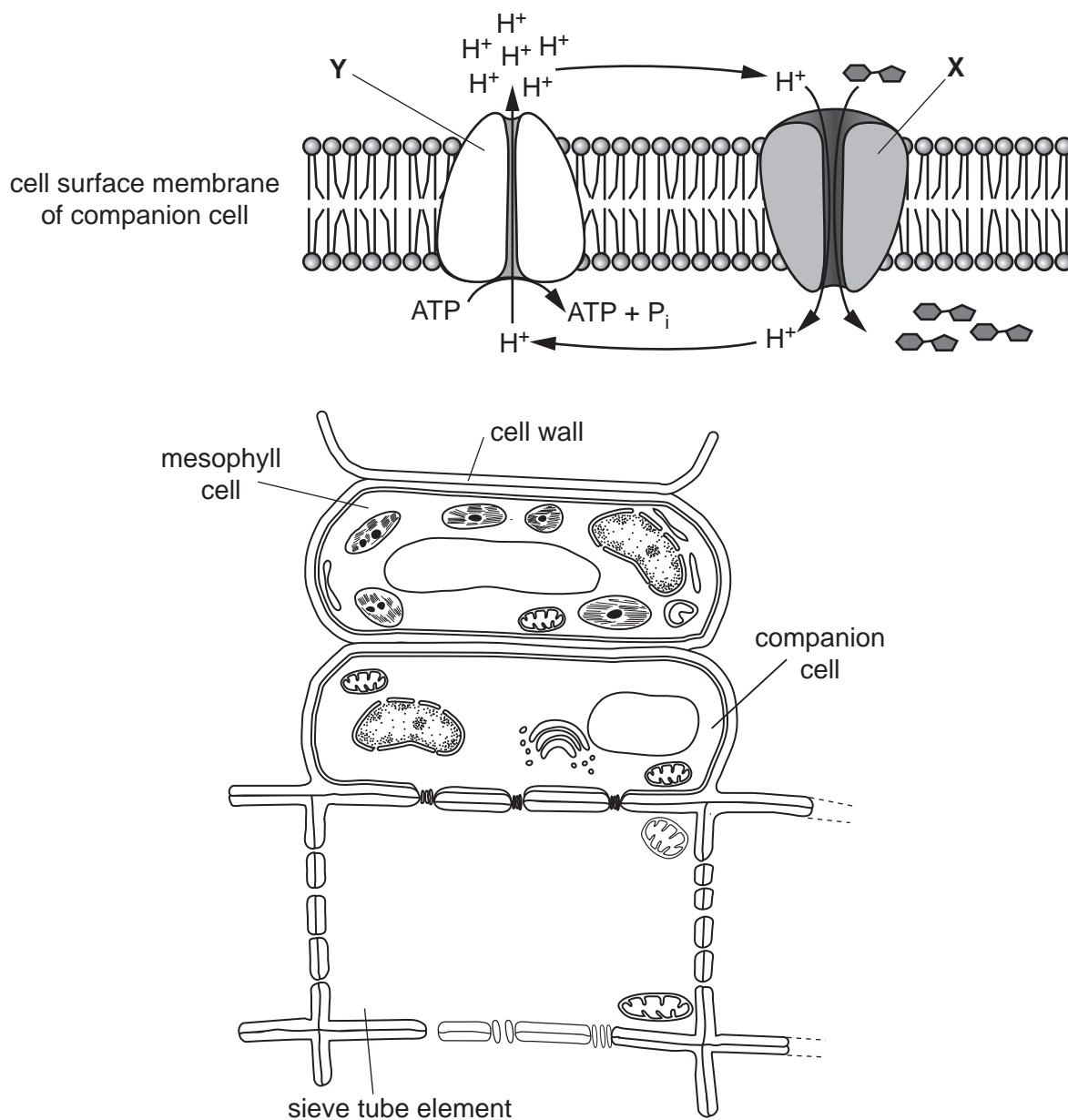


Fig. 5.1

not to scale



6 Cholera bacteria release the toxin, cholera toxin, when they are in the intestine.

(a) (i) Name the bacterium that is the pathogen of cholera.

.....[1]

(ii) Describe the way in which cholera is transmitted from an infected person to an uninfected person.

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Gangliosides are glycolipids that bind cholera toxin. These glycolipids are found on many cell surface membranes.

When cholera toxin is released from the bacteria in the intestine, it binds to gangliosides on epithelial cells and enters these cells as shown in Fig. 6.1.

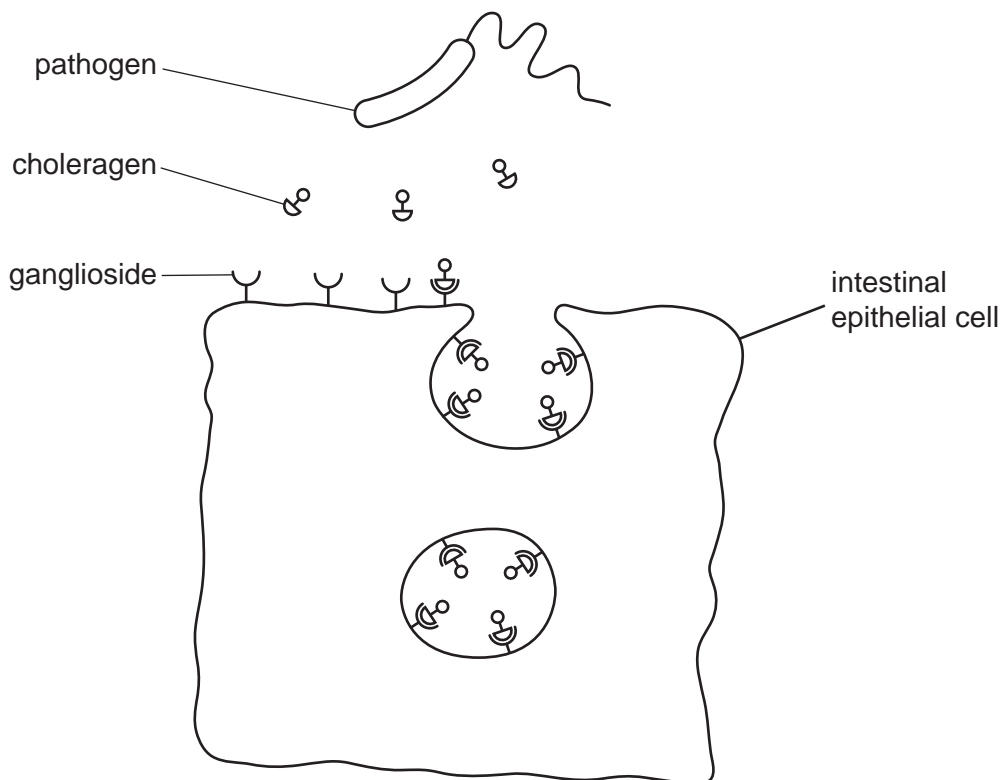


Fig. 6.1

not drawn to scale

(b) Suggest how cholera toxin interacts with gangliosides on intestinal epithelial cells.

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.....[2]

(c) Name the process by which cholera toxin enters the intestinal epithelial cell as shown in Fig. 6.1.

.....[1]

Once inside the cells cholera toxin is activated. One effect is to increase the movement of chloride ions through channel proteins out of cells.

(d) Suggest **and** explain the likely consequences on the intestinal epithelial cells of the loss of chloride ions through the channel proteins.

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.....[2]

(e) Health authorities recommend that antibiotics, such as tetracycline, are **only** to be used for treating people with severe cases of cholera.

Explain why it is recommended that antibiotics should **not** be given to people with mild cases of cholera or to protect people from cholera.

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[Total: 11]





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