Cambridge Assessment International Education

Cambridge International AS & A Level

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4485788656

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **May/June 2021**

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

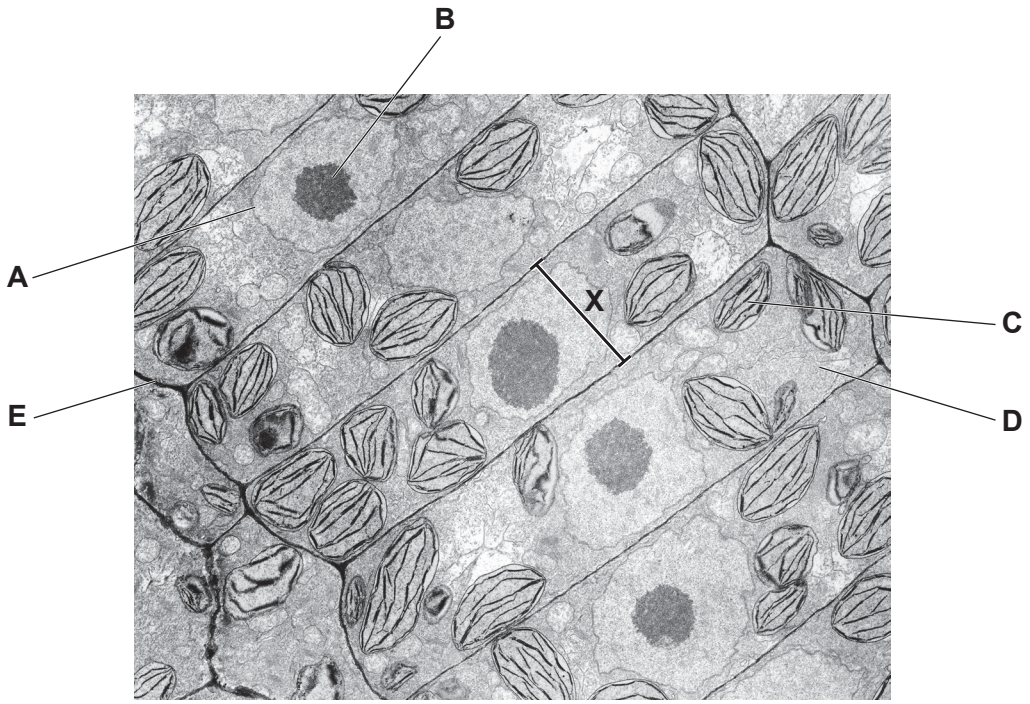
- The total mark for this paper is 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

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Answer **all** questions.

1 Fig. 1.1 is a transmission electron micrograph of cells from duckweed, *Spirodela oligorrhiza*.



magnification ×4275

Fig. 1.1

(a) Calculate the actual width of the cell labelled **X**.

Write down the formula you will use to make your calculation.

Show your working and give your answer in micrometres to one decimal place.

formula

..... μm [3]

(b) (i) Table 1.1 lists some biological molecules found in plant cells.

Complete Table 1.1 by choosing **one** letter from Fig. 1.1 that indicates a cell structure where each biological molecule is found.

Table 1.1

biological molecule	letter from Fig. 1.1
DNA	
cellulose	
phospholipid	
histone proteins	

[4]

(ii) State the name of a cell structure, **visible in Fig. 1.1**, where ATP is synthesised.

..... [1]

(iii) Name a cell structure that produces mRNA.

..... [1]

(c) Describe the evidence from Fig. 1.1 that shows that the image is a transmission electron micrograph.

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..... [2]

[Total: 11]

2 Fig. 2.1 shows three molecules of water.

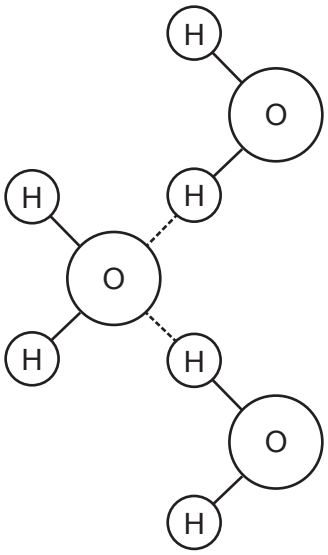


Fig. 2.1

(a) Describe the hydrogen bonding that occurs between the water molecules shown in Fig. 2.1.

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..... [3]

(b) The human enzyme, salivary amylase, is composed of one polypeptide. Fig. 2.2 represents the structure of a molecule of salivary amylase.



Fig. 2.2

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(i) Explain the role of hydrogen bonding in maintaining the secondary structure of proteins, such as salivary amylase.

.....

.....

..... [1]

(ii) Explain the role of hydrogen bonding in maintaining the tertiary structure of proteins such as salivary amylase.

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..... [2]

(c) Outline the importance of water as a solvent in **plants**.

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..... [3]

[Total: 9]

3 Visking tubing can be used to investigate the properties of cell membranes.

A student carried out an experiment to investigate osmosis using Visking tubing. An outline of the investigation is shown in Fig. 3.1.

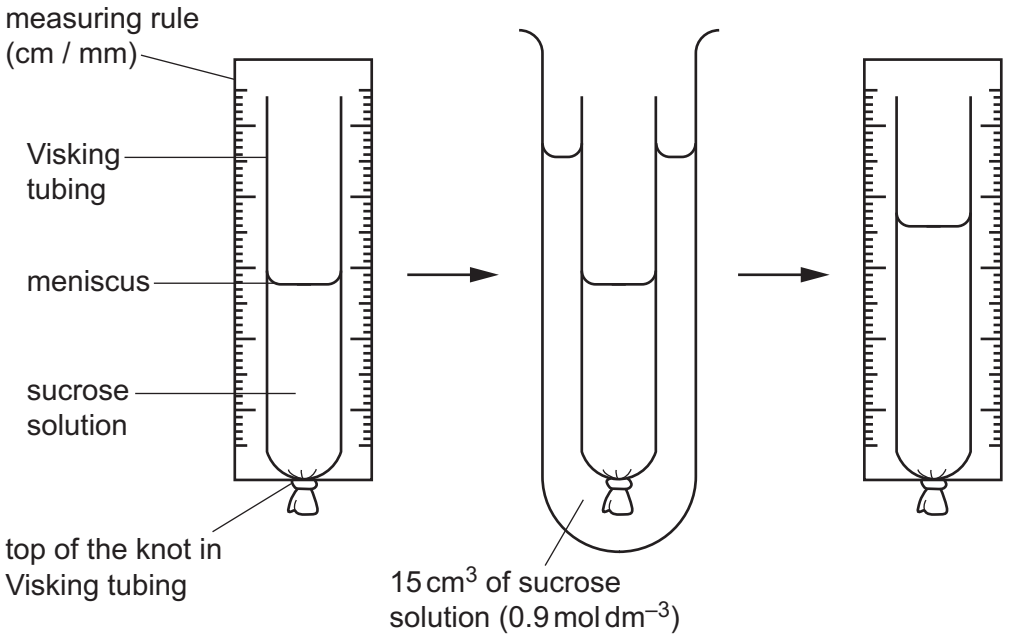


Fig. 3.1

- Six pieces of Visking tubing were filled with 10 cm^3 of different concentrations of sucrose solution: 0.0, 0.4, 0.8, 1.2, 1.6 and 2.0 $mol\,dm^{-3}$.
- The height of the meniscus of each solution in the Visking tubing was measured.
- The pieces of Visking tubing were put into test-tubes containing 15 cm^3 of 0.9 $mol\,dm^{-3}$ sucrose solution.
- After 20 minutes, the pieces of Visking tubing were removed from the test-tubes and the height of the meniscus in each was measured.

The results are shown in Table 3.1.

Table 3.1

concentration of sucrose solution inside Visking tubing / mol dm^{-3}	**difference in height of meniscus after 20 minutes / mm**
0.0	–12
0.4	–4
0.8	–2
1.2	+1
1.6	+6
2.0	+11

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(a) The Visking tubing used by the student was **not** permeable to sucrose.

Explain the results shown in Table 3.1.

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..... [3]

(b) When red blood cells are placed in water they are destroyed by bursting.

The student also investigated how red blood cells are affected by immersion in solutions of sodium chloride of different concentration. Blood samples of the same volume were added to solutions of sodium chloride in separate test-tubes.

After 10 minutes, the student took 0.1 cm^3 of the blood samples from the test-tubes and estimated the percentage of red blood cells that had burst in each blood sample.

Fig. 3.2 shows the student's results.

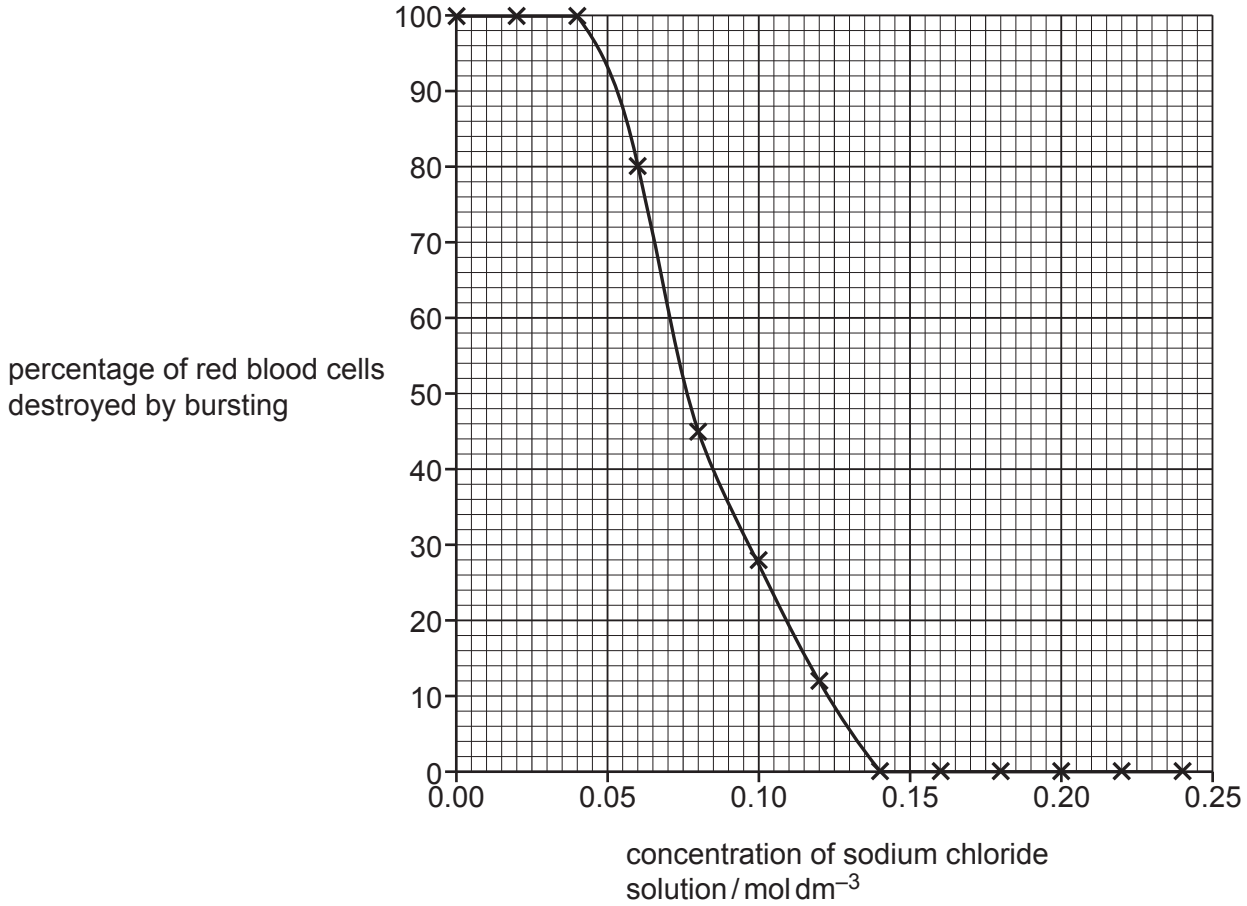


Fig. 3.2

Describe **and** explain the effects on red blood cells of immersion in different concentrations of sodium chloride as shown in Fig. 3.2.

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..... [4]

[Total: 7]

4 **(a)** The induced-fit hypothesis and the lock-and-key hypothesis are used to describe the mode of action of enzymes.

Explain the induced-fit hypothesis.

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..... [3]

(b) Radish plants contain the enzyme peroxidase that catalyses the breakdown of hydrogen peroxide.

Students investigated the effect of increasing the concentration of hydrogen peroxide on the activity of peroxidase extracted from radish.

The results of their investigation are shown in Fig. 4.1.

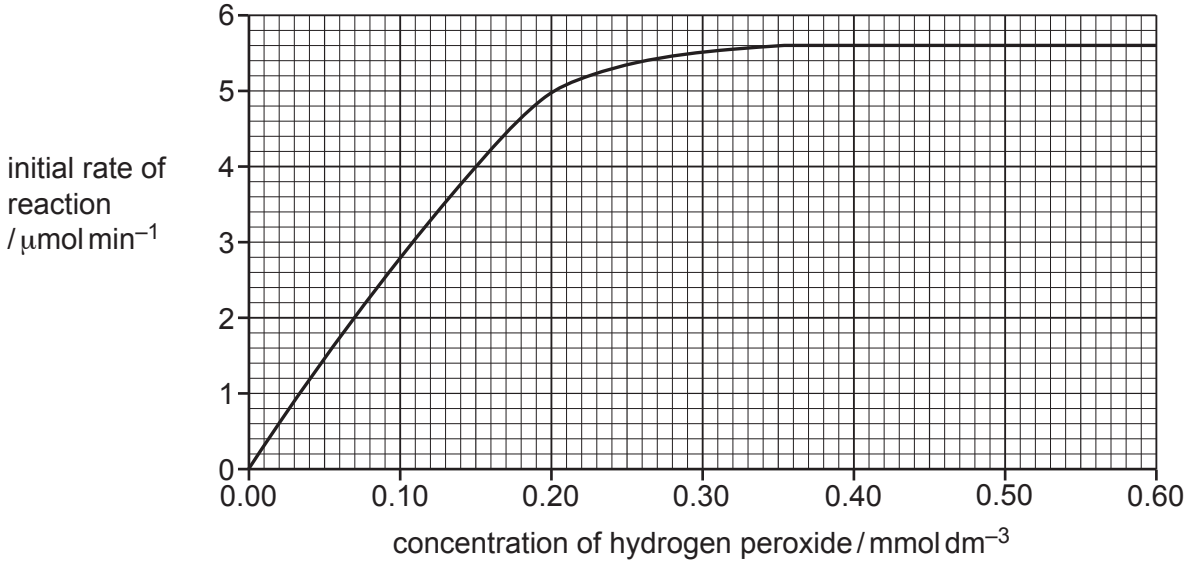


Fig. 4.1

(i) Explain the effect of increasing the concentration of hydrogen peroxide on the initial rate of reaction as shown in Fig. 4.1.

.....

.....

.....

.....

.....

..... [3]

(ii) The students determined the K_m for radish peroxidase as 0.10 mmol dm^{-3}.

With reference to Fig. 4.1, describe how they determined the K_m.

.....

.....

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..... [2]

(c) A further investigation found that the K_m for carbonic anhydrase is 12 mmol dm^{-3}.

Describe the role of carbonic anhydrase in the transport of carbon dioxide.

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..... [3]

[Total: 11]

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[Turn over

5 Much success was made in reducing the number of cases of malaria between 2000 and 2015.

(a) Explain how malaria is transmitted.

.....

.....

.....

.....

..... [2]

(b) Diagnostic test strips for malaria contain monoclonal antibodies. The test strips detect antigens produced by the pathogens that cause malaria.

Fig. 5.1 shows stages in the production of monoclonal antibodies. The information in three of these stages is incomplete.

Complete Fig. 5.1.

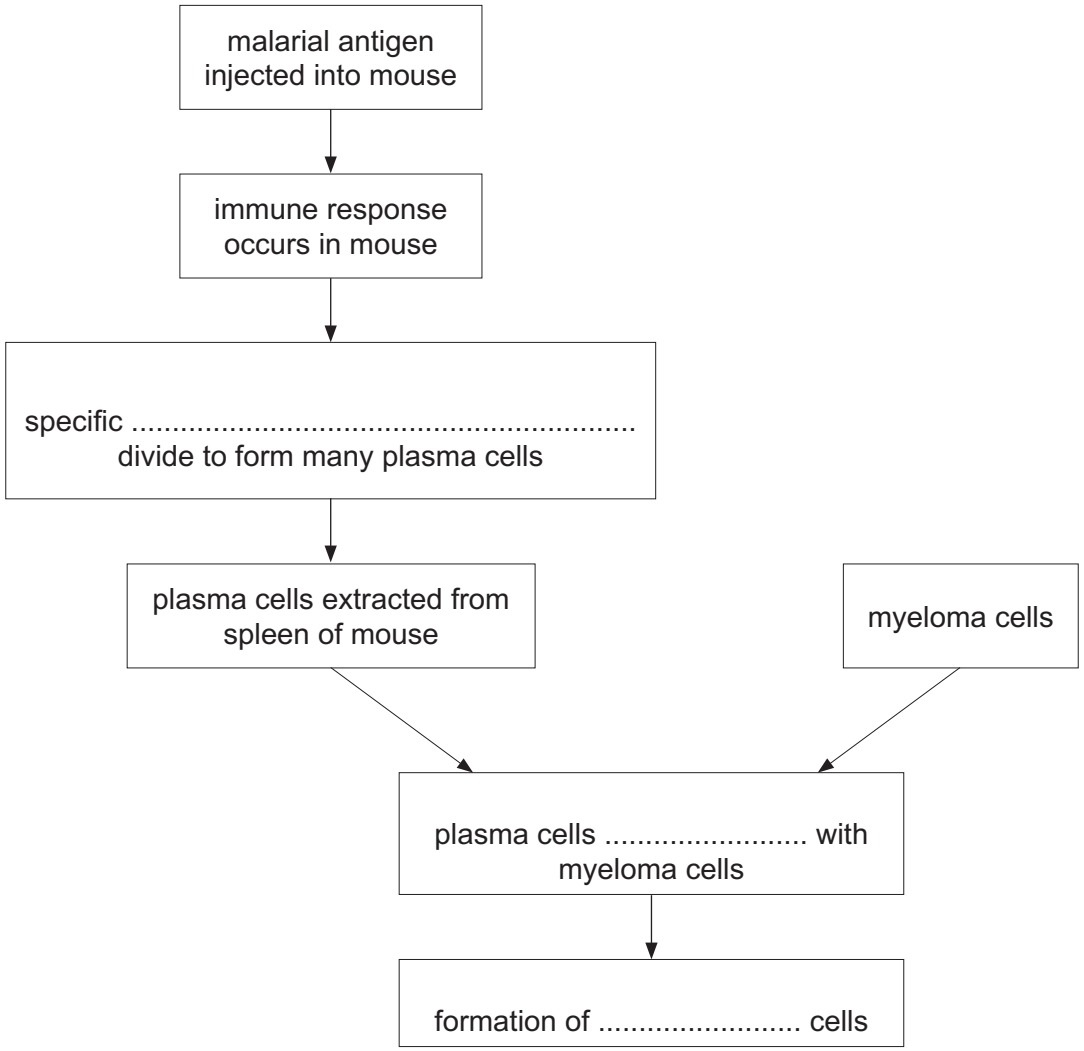


Fig. 5.1

[3]

(c) Fig. 5.2 shows two diagnostic test strips for malaria.

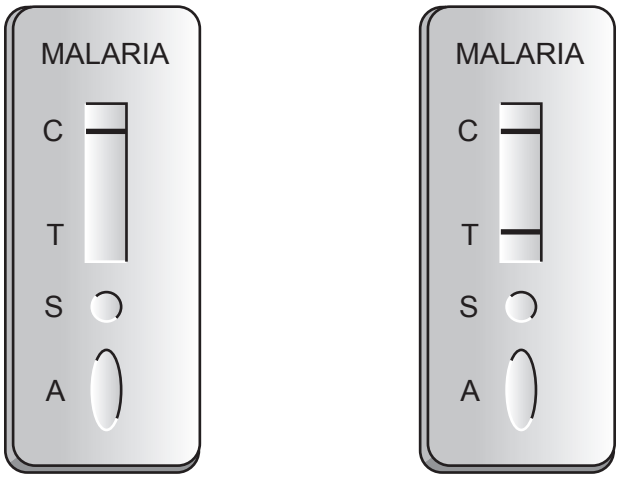


Fig. 5.2

- A sample of blood from a person suspected of having malaria is put into the well labelled **S**.
- A buffer solution is put into the well labelled **A**.
- The buffer solution moves the blood towards the results window.
- A line at position **C** indicates that the test is working correctly.
- A line at position **T** indicates a positive result for malaria.

State **three** advantages of using test strips for malaria, such as those shown in Fig. 5.2.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(d) The highest number of cases of malaria occur in sub-Saharan Africa and South-East Asia.

Discuss the factors that determine the global distribution of malaria.

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..... [5]

[Total: 13]

6 Lysosomes are cell structures that contain enzymes known as acid hydrolases.

Fig. 6.1 shows some processes that occur in animal cells.

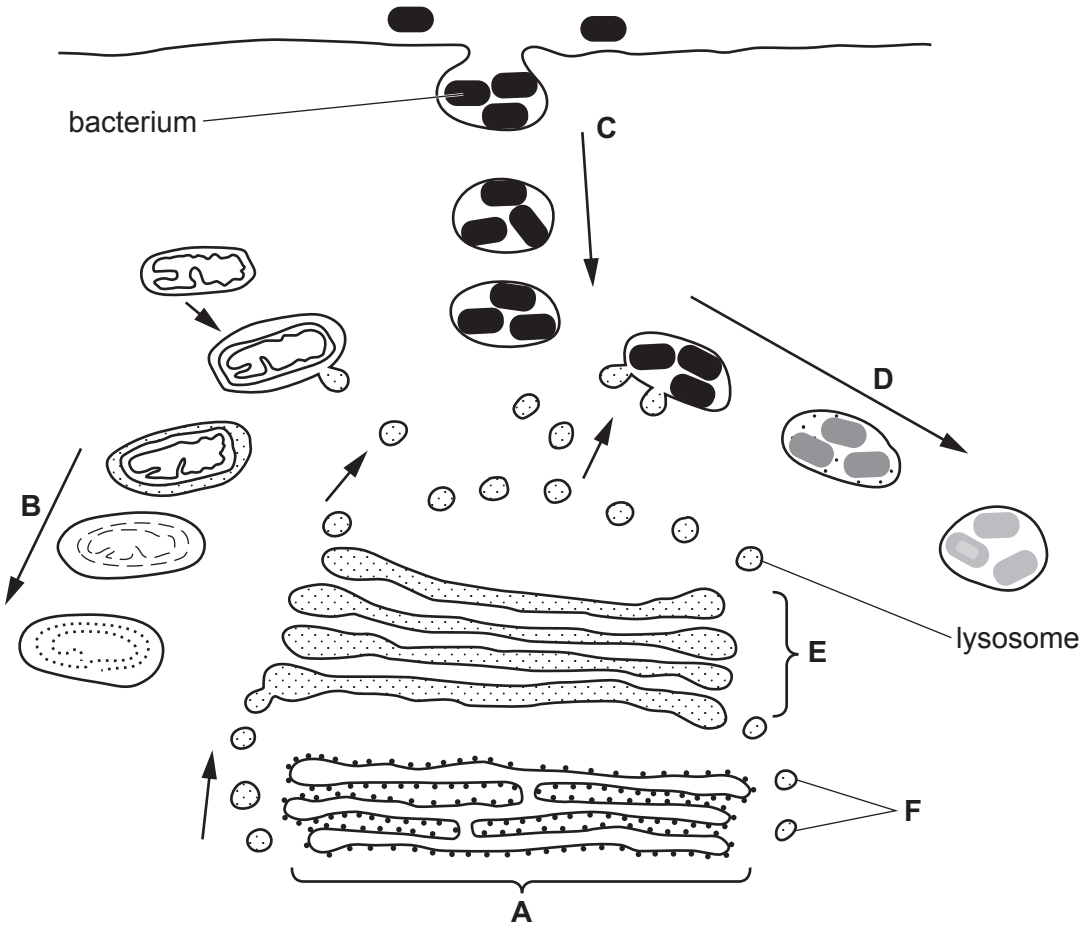


Fig. 6.1

(a) Name the cell structures labelled **A** and **E**.

A .....

E .....
[2]

(b) State the function of the structures labelled **F**.

.....

..... [1]

(c) Name the process by which bacteria are taken into the cell at **C**.

..... [1]

(d) With reference to the processes occurring at **B** and at **D** in Fig. 6.1, outline the role of acid hydrolases in lysosomes.

.....

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..... [3]

(e) Carrier proteins in the membranes of lysosomes maintain a lower pH than the surrounding cytoplasm by moving hydrogen ions.

Suggest how the carrier proteins maintain the lower pH within the lysosomes.

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..... [2]

[Total: 9]

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CENTRE NUMBER

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BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **May/June 2021**

1 hour 15 minutes

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Answer **all** questions.

1 **(a)** Fig. 1.1 is a photomicrograph of a region of eukaryotic tissue. Some of the cells are in stages of mitosis.

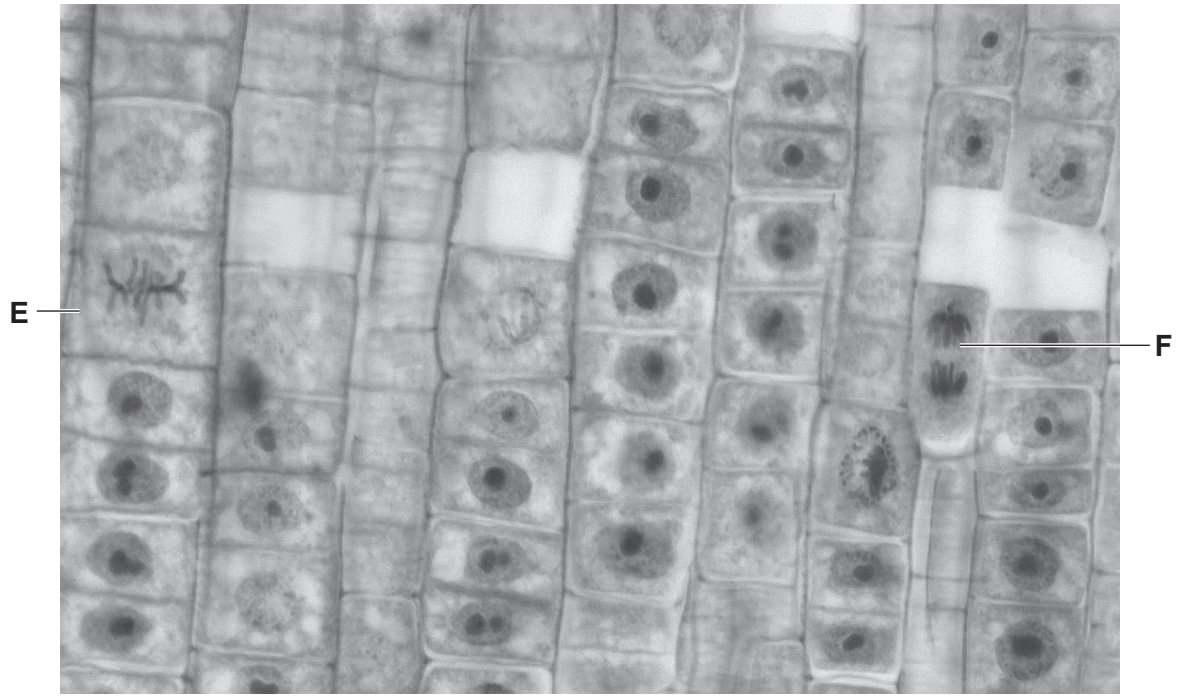


Fig. 1.1

(i) Identify which stage of mitosis is shown in cell **E** and in cell **F** in Fig. 1.1.

E .....

F ..... [2]

(ii) Microtubules are present within the cells that are in stages of mitosis, but these are not visible in Fig. 1.1.

State the function of microtubules in mitosis.

.....

.....

..... [1]

(iii) State, with a reason, whether Fig. 1.1 shows a region of animal or plant tissue.

.....

.....

..... [1]

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(b) Semi-conservative replication of DNA occurs during interphase, before mitosis begins.

Write the correct term in the spaces provided to complete each of statements **A** to **D**.

A The DNA double helix unwinds and is separated into two template strands when ..... bonds holding the two strands together are broken.

B One of the template strands of DNA is copied in fragments. The enzyme ..... is required to join the fragments together to form a continuous strand of DNA.

C Complementary DNA nucleotides are added to the template strands, catalysed by the enzyme ..... .

D ..... are regions of repeating nucleotide sequences at the ends of chromosomes that allow the continued replication of DNA, without the loss of genes.

[4]

[Total: 8]

2 Sugars are transported within phloem sieve tubes from a source, such as a mature leaf, to a young leaf, which acts as a sink. The young leaf also needs water and dissolved mineral ions, which arrive at the leaf within xylem vessels.

(a) As the young leaf matures, the quantity of sugar taken up by the leaf decreases to zero, but the need for water increases.

Suggest **and** explain why the quantity of sugar taken up by the developing leaf decreases to zero over time, but the need for water increases.

.....

.....

.....

.....

.....

.....

..... [3]

(b) The features listed in Table 2.1 are present in one or more of the three cell types:

- companion cell
- phloem sieve tube element
- xylem vessel element.

Complete Table 2.1 using a tick (✓) if the feature is present and a cross (✗) if the feature is absent.

Table 2.1

feature	companion cell	phloem sieve tube element	xylem vessel element
cytoplasm			
cell surface membrane			
lignified cell wall			
nucleus			

[4]

[Total: 7]

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3 In mammals, some cell signalling molecules are steroid (lipid) hormones. These hormones are transported in the bloodstream to reach capillary networks.

At a capillary network, hormones pass out of the blood into tissue fluid.

(a) Fig. 3.1 is a diagram of a capillary network.

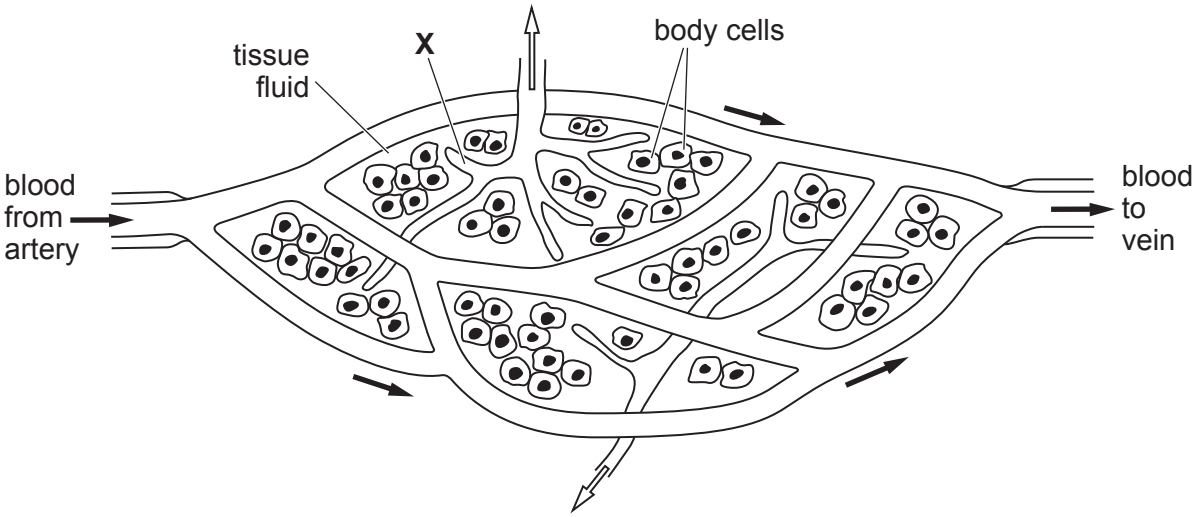


Fig. 3.1

(i) Describe the **differences** between the blood arriving at the arterial end of the capillary network and the tissue fluid surrounding the body cells.

.....

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.....

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.....

.....

..... [3]

(ii) Not all the tissue fluid passes back into the blood capillaries to enter the bloodstream. Some of the tissue fluid drains into blind-ended vessels, such as vessel **X** shown in Fig. 3.1.

Name the fluid that is formed in vessel **X**.

..... [1]

Hormone **S** is a steroid hormone involved in cell signalling.

Fig. 3.2 shows the sequence of events that occurs when hormone **S** enters a target cell.

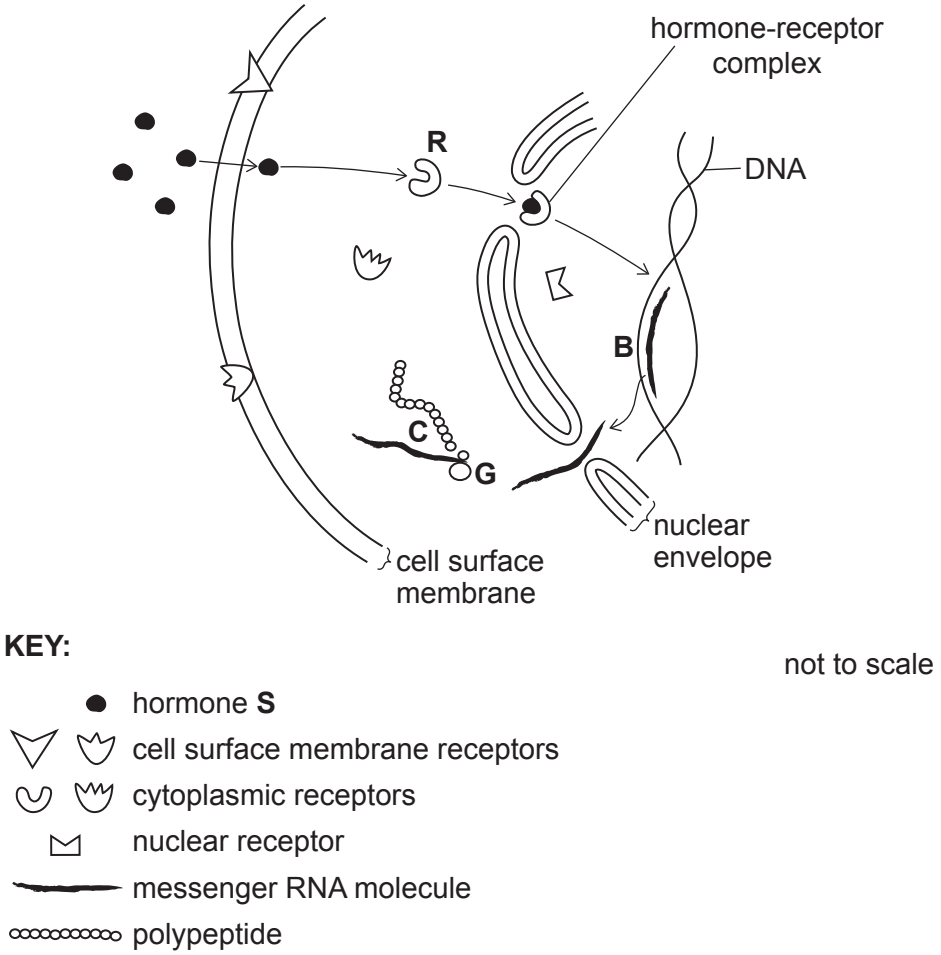


Fig. 3.2

(b) Explain why hormone **S**, shown in Fig. 3.2, does not need to pass through a transport protein to enter the cytoplasm of the target cell.

.....

.....

.....

.....

..... [2]

(c) The target cell can respond to other cell signalling molecules in addition to hormone **S**. The cell has receptors in the cell surface membrane, in the cytoplasm and in the nucleus.

Explain why hormone **S** binds only with receptor **R** in the cytoplasm and **not** with the other receptors shown in Fig. 3.2.

.....

.....

..... [1]

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(d) The hormone-receptor complex shown in Fig. 3.2 enters the nucleus and binds to DNA. This switches on a gene coding for a polypeptide that is synthesised in the cytoplasm.

(i) Name the structure through which the hormone-receptor complex enters the nucleus.

..... [1]

(ii) Name the processes occurring at **B** and **C**.

B .....

C ..... [2]

(iii) Name structure **G**.

..... [1]

(e) Cell signalling by hormone **S** results in the production of a functioning globular protein molecule composed of three identical polypeptide chains.

After the synthesis of these polypeptides, changes need to occur to form the functioning globular protein molecule.

Outline the changes that need to occur to form the functioning globular protein molecule.

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..... [4]

[Total: 15]

4 A person who is exposed to tobacco smoke is at greater risk of lung cancer and chronic obstructive pulmonary disease (COPD).

Many people with COPD have both chronic bronchitis and emphysema. These diseases cause changes in the gas exchange system. For example, changes occur in the total lung surface area to volume ratio (SA:V).

(a) Tar in tobacco smoke has a number of effects on the cells lining the gas exchange system.

State the main effects of tar on the cells lining the gas exchange system that are related to lung cancer **and** to chronic bronchitis.

lung cancer .....

.....

.....

.....

chronic bronchitis .....

.....

.....

..... [3]

(b) A student investigated the effect of SA:V on diffusion.

Agar was prepared with Universal Indicator solution and sodium hydroxide solution. The agar was coloured blue.

Three cubes, **A**, **B**, and **C**, were cut from a solid block of blue agar. Each cube was a different size.

Universal Indicator solution changes to a red colour in the presence of acid.

The student prepared Table 4.1 to show the sizes and SA:V of each cube.

Table 4.1

cube	length of each side / cm	total surface area / cm^2	volume /	SA:V
A	1	6	1	6:1
B	2	24	8	3:1
C	3			2:1

Complete Table 4.1 by:

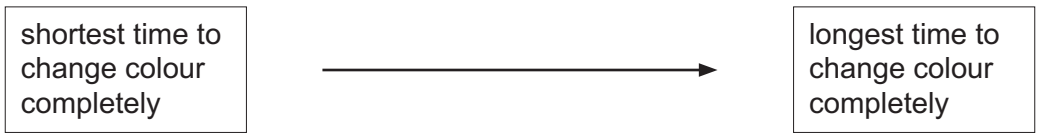
- writing the correct units for volume
- calculating the total surface area, and volume, of cube **C**.

[2]

(c) Cubes **A**, **B** and **C** were placed in a small beaker. At time 0 seconds, dilute hydrochloric acid was added to the beaker to cover the cubes.

The student timed how long it took for each cube to change colour completely.

Complete Fig. 4.1 to show the results that were obtained.



cube ..... → cube ..... → cube .....

[1]

Fig. 4.1

(d) Some people with emphysema may be offered lung volume reduction surgery (LVRS), in which diseased lung tissue is surgically removed.

One expected outcome of the surgery is an improvement in total lung surface area to volume ratio (total lung SA:V).

Suggest why there is an improvement in total lung SA:V after the surgery has been carried out.

.....

.....

.....

.....

..... [2]

(e) In humans, blood that becomes oxygenated in the lungs reaches body tissues without coming into contact with blood that is deoxygenated.

Explain how the blood that becomes oxygenated in the lungs is kept separate from blood that is deoxygenated.

.....

.....

.....

.....

..... [2]

[Total: 10]

5 Fig. 5.1 is a transmission electron micrograph showing parts of two plant cells. The function of the middle lamella is cell-to-cell adhesion. The middle lamella is composed of a polysaccharide known as pectin.

Pectin interacts with the polysaccharides cellulose and hemicellulose in the cell walls of the plant cells so that the cell walls are held close together, as shown in Fig. 5.1.

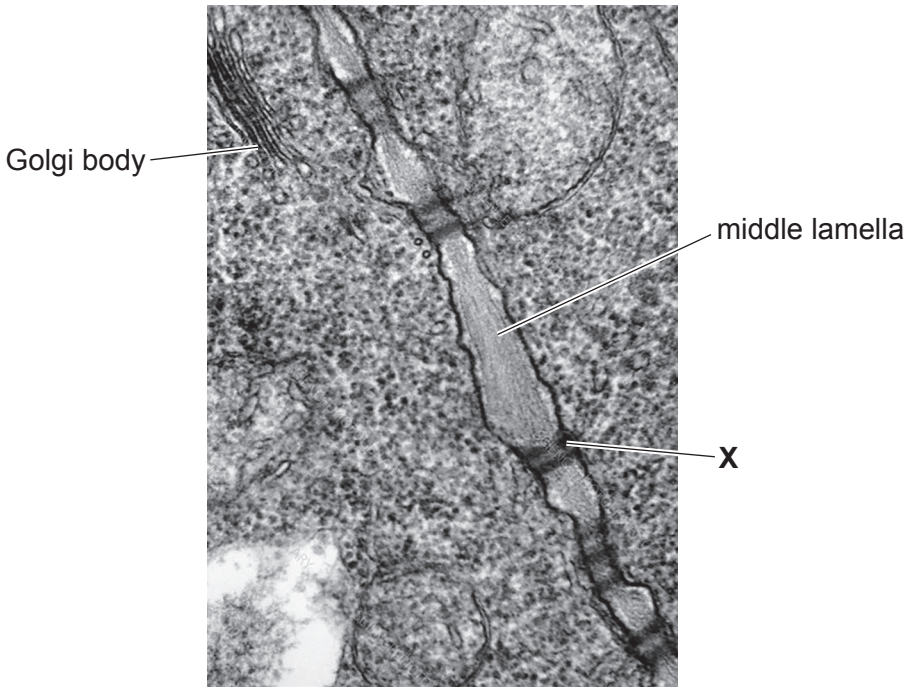


Fig. 5.1

(a) Cell structure **X** in Fig. 5.1 is a cytoplasmic channel with strands of cytoplasm passing through the cell walls of the two cells.

Name cell structure **X and** state **one** function of this cell structure.

name .....

function .....

..... [2]

(b) Researchers have discovered that pectin is synthesised within the Golgi body. Golgi vesicles containing pectin are moved to the cell surface membrane for release.

(i) Suggest why researchers would **not** have investigated ribosomes as being the possible location for the synthesis of pectin.

.....

..... [1]

(ii) Name the mechanism that is used to transport pectin out of the cell.

..... [1]

Juices that are extracted commercially from fruits can be made less cloudy by the breakdown of the cell wall using the enzymes cellulase, pectinase and xylanase:

- cellulase hydrolyses cellulose
- pectinase hydrolyses pectin
- xylanase hydrolyses hemicellulose.

(c) Fig. 5.2 is a graph showing the effect of cellulose concentration on the activity of cellulase, which is used in making fruit juice less cloudy.

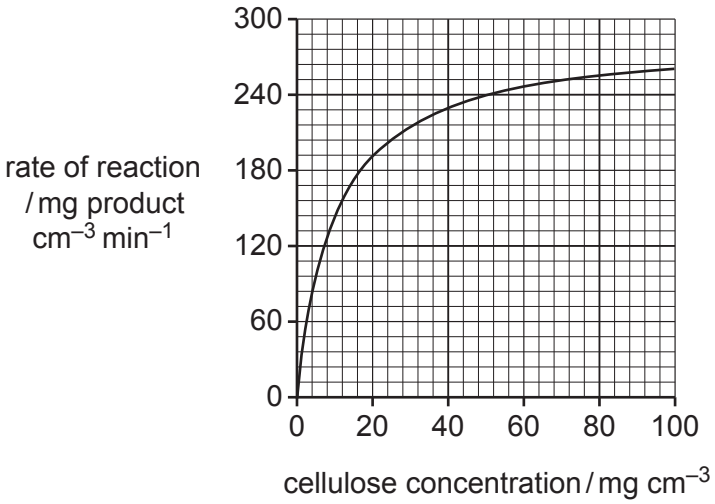


Fig. 5.2

Describe **and** explain the curve shown in Fig. 5.2.

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..... [3]

(d) Ultrasound is one possible method that can be used to destroy microorganisms that contaminate fruit juices. Ultrasound is the term given to sound waves that are out of the range of human hearing.

An investigation was carried out into the effect of ultrasound on the activity of cellulase, pectinase and xylanase used in fruit juice manufacture.

For each enzyme, the effect of ultrasound was compared with no ultrasound on the:

- maximum rate of reaction (V_{max})
- Michaelis-Menten constant (K_m)
- catalytic efficiency (V_{max}/K_m)

Table 5.1 summarises the results. A higher V_{max}/K_m indicates a higher catalytic efficiency.

Table 5.1

enzyme	method	comparison of V_{max}	comparison of K_m	V_{max}/K_m / min^{-1}
cellulase	ultrasound	higher	higher	34
	no ultrasound	lower	lower	29
pectinase	ultrasound	same	lower	945
	no ultrasound	same	higher	759
xylanase	ultrasound	higher	same	146
	no ultrasound	lower	same	125

(i) In terms of changes in the interaction between enzyme and substrate when ultrasound is used, suggest explanations for the lower K_m for pectinase and the higher V_{max} for xylanase, as shown in Table 5.1.

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..... [3]

(ii) Explain whether the data shown in Table 5.1 supports the recommendation that ultrasound can be used in the manufacture of fruit juices.

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..... [1]

[Total: 11]

6 The diseases myasthenia gravis (MG) and HIV/AIDS both involve disorders of the immune system.

(a) The cause of MG involves a response by B-lymphocytes.

Explain why MG is called a disorder of the immune system.

.....

.....

.....

.....

..... [2]

(b) Studies have indicated that T-lymphocytes are involved in stimulating the B-lymphocyte response that causes MG.

Research has been carried out on a vaccine that will provide a person with **active immunity** against these T-lymphocytes and B-lymphocytes.

Suggest **and** explain how this vaccine will provide a person with active immunity against the T-lymphocytes and B-lymphocytes responsible for causing MG.

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..... [3]

(c) Many people who are living with HIV (infected with HIV) develop tuberculosis (TB). If a person does not have any symptoms of TB, one preventive measure is to prescribe antibiotics. This reduces the overall number of cases of TB and deaths from TB.

State the **disadvantage** of prescribing antibiotics as a preventive measure against TB.

.....

..... [1]

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(d) Fig. 6.1 is a summary of some of the statistics published by UNAIDS (Joint United Nations Programme on HIV and AIDS) about HIV and HIV/AIDS for the year 2017.

The figures shown in Fig. 6.1 for 2017 are estimated.

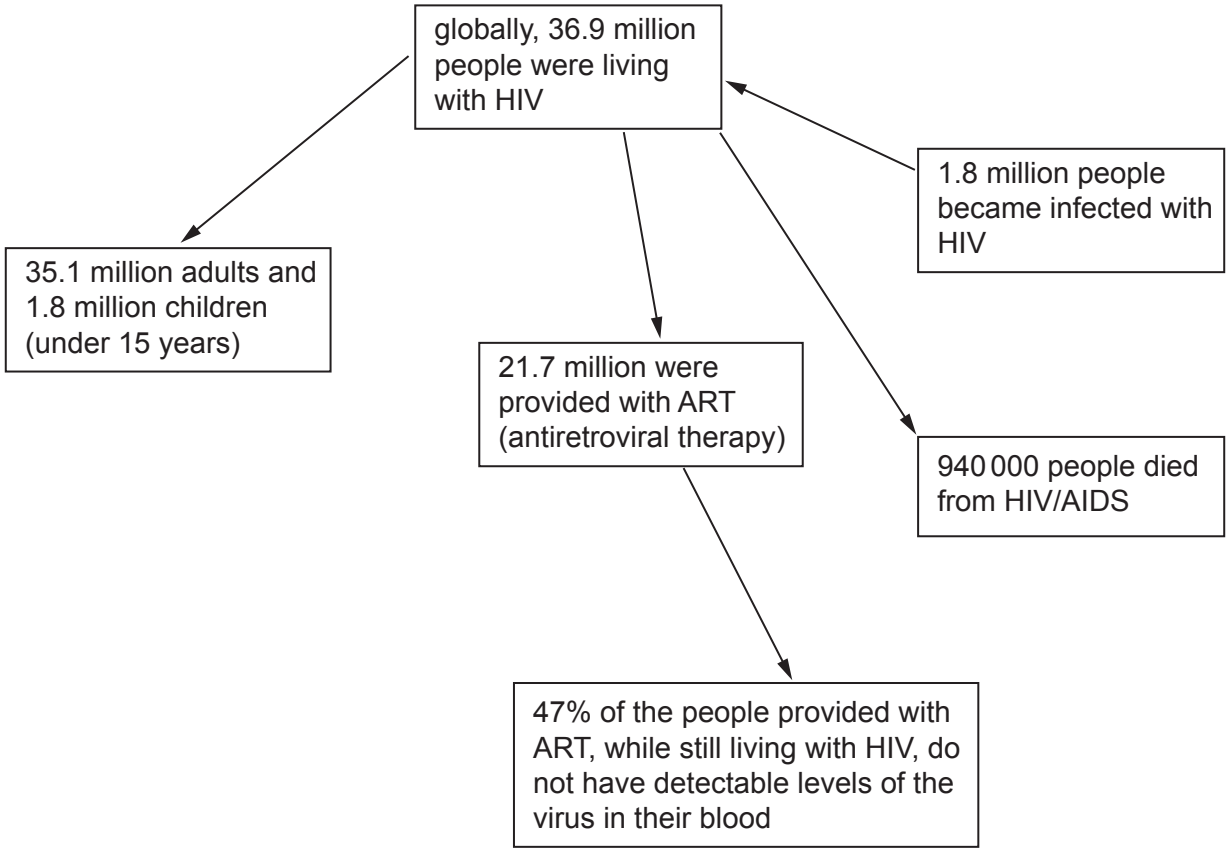


Fig. 6.1

One other statistic published by UNAIDS indicated that, in 2017, only 75% of the estimated 36.9 million people living with HIV knew that they had been infected with the virus.

With reference to the information in Fig. 6.1, discuss the importance of this statistic.

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..... [3]

[Total: 9]

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BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 2021**

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. Any blank pages are indicated.

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Answer **all** questions.

1 The Golgi body, rough endoplasmic reticulum (RER) and smooth endoplasmic reticulum (SER) form part of the internal membrane system of a cell. The membranes have a fluid mosaic structure.

Fig. 1.1 is a transmission electron micrograph of one area of a liver cell showing a region with RER and a region with SER. Mitochondria are also visible in the image.

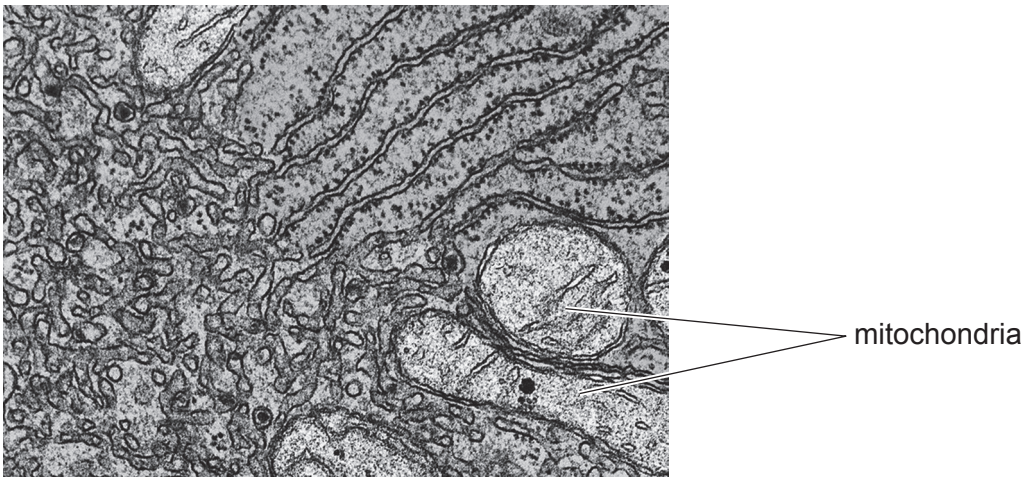


Fig. 1.1

(a) Describe the differences in structure **and** function between RER and SER.

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..... [3]

(b) Phospholipids are one of the main components of membranes.

Describe the structure of a phospholipid molecule.

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..... [2]

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(c) One function of a Golgi body is to package molecules into Golgi vesicles.

(i) A Golgi body and Golgi vesicles are **not** visible in Fig. 1.1.

Describe the features, **other than** the presence of Golgi vesicles, that would help you identify a Golgi body in a transmission electron micrograph of another area of the same liver cell.

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..... [2]

(ii) Some Golgi vesicles contain secretory proteins for release from the cell.

Describe the sequence of events that occurs following the packaging of a secretory protein into a Golgi vesicle to its release from the cell.

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..... [3]

(iii) Some Golgi vesicles contain glycoproteins or glycolipids to be added to the cell surface membrane.

Outline the role of **glycolipids** in the cell surface membrane.

.....

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..... [1]

[Total: 11]

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[Turn over

2 Smallpox, measles and HIV/AIDS are infectious diseases caused by different viruses. These different viruses share some structural features.

(a) State **one** structural feature that would confirm that a pathogen is a virus.

..... [1]

(b) The virus that causes smallpox belongs to a different genus to the virus that causes measles.

Name the viruses that cause these diseases.

smallpox .....

measles ..... [2]

(c) Explain why antibiotics, such as penicillin, **cannot** be used to treat measles.

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..... [2]

(d) Antibiotics may be prescribed for a person with HIV/AIDS.

Suggest why antibiotics may be prescribed for a person with HIV/AIDs.

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..... [1]

(e) Smallpox is the only infectious disease of humans that has been globally eradicated. This eradication was due mainly to a successful global vaccination programme. Most people who were given the vaccine gained immunity to the disease.

A student correctly listed four reasons for the success of the global vaccination programme for smallpox. These reasons are listed in Fig. 2.1.

- The virus did not mutate.
- A live virus, closely related to the smallpox virus, was used in the vaccine.
- The vaccine was freeze-dried and so was thermostable (heat stable).
- The vaccine was easy to administer (give), so little training was required.

Fig. 2.1

(i) Discuss how the reasons listed in Fig. 2.1 contributed to the success of the eradication of smallpox.

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..... [4]

(ii) Table 2.1 lists four types of immunity.

Complete each row of Table 2.1 with a tick (✓) or a cross (✗) to summarise the types of immunity gained by a person who received the smallpox vaccine.

Table 2.1

type of immunity	**gained (✓) not gained (✗)**
active immunity	
artificial immunity	
natural immunity	
passive immunity	

[1]

[Total: 11]

3 HIV protease is an enzyme composed of two identical polypeptide chains. Each polypeptide chain is 99 amino acids long. During translation, the amino acids are joined by peptide bonds to form the polypeptide chain.

(a) Describe how a polypeptide of HIV protease is produced by the process of translation.

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..... [4]

(b) The synthesised polypeptide has a primary protein structure and can form a tertiary protein structure after translation. There are more bond types in the tertiary structure.

Compare the peptide bond formed during translation with the types of bond made during tertiary structure formation.

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..... [3]

(c) Some polypeptides are translated as part of one long polyprotein chain. After translation, enzymes cut the polyprotein into separate functioning proteins.

HIV protease cuts a polyprotein that has been produced within the host cells of actively replicating HIV. The separate proteins are required in the replication of the virus.

Fig. 3.1 shows how the two polypeptide chains of HIV protease form an enzyme with an active site enclosed by flaps, forming the flap region.

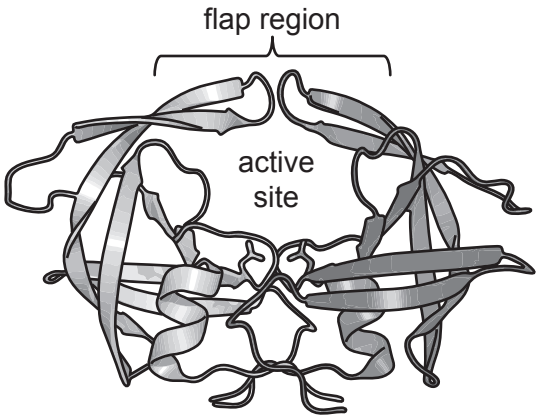


Fig. 3.1

(i) The flap region of HIV protease is flexible.

With reference to Fig. 3.1, suggest **and** explain how the mechanism of action of HIV protease can be described as an induced fit.

.....

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.....

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.....

.....

..... [3]

(ii) Indinavir is one of the therapeutic drugs used in HIV anti-retroviral therapy (ART). It is similar to the polyprotein substrate of HIV protease.

Suggest **and** explain how indinavir acts as a therapeutic drug.

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.....

.....

..... [2]

[Total: 12]

4 Phloem sap is transported within phloem sieve tubes.

(a) Monosaccharides and disaccharides are transported as part of phloem sap, but polysaccharides are not components of phloem sap.

Define the terms disaccharide **and** polysaccharide.

.....

.....

.....

..... [2]

(b) Sieve tubes are composed of phloem sieve tube elements.

Fig. 4.1 is a diagram of one sieve tube element and its companion cell.

Some of the structural features of the sieve tube element have not been included in the diagram.

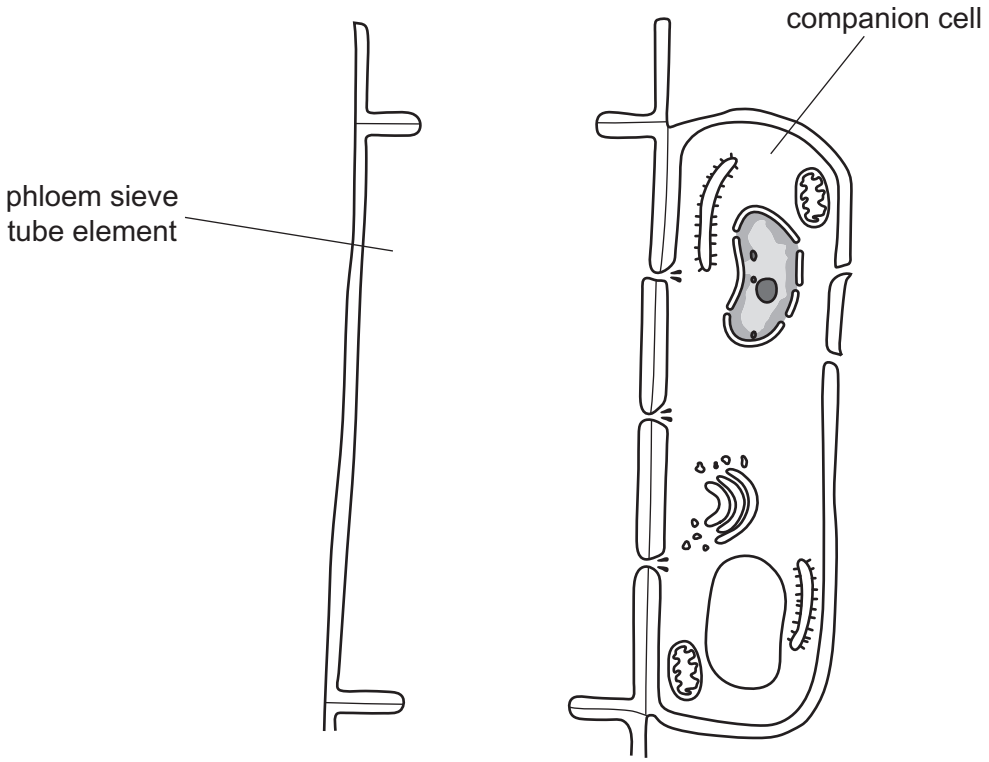


Fig. 4.1

(i) Complete Fig. 4.1 by drawing **and** labelling the structural features of the sieve tube element that have not been included in the diagram. [3]

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(ii) A pressure gradient in a sieve tube causes the mass flow of phloem sap from the source to the sink.

At the source, a decrease in water potential in the phloem sap and an increase in the hydrostatic pressure of the phloem sap can be measured.

Describe the events that cause each of these changes in the phloem sap.

decrease in water potential .....

.....

.....

increase in hydrostatic pressure .....

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..... [2]

[Total: 7]

5 **(a)** Fig. 5.1 shows four types of cell that can be seen in a prepared slide of blood taken from a mammal.

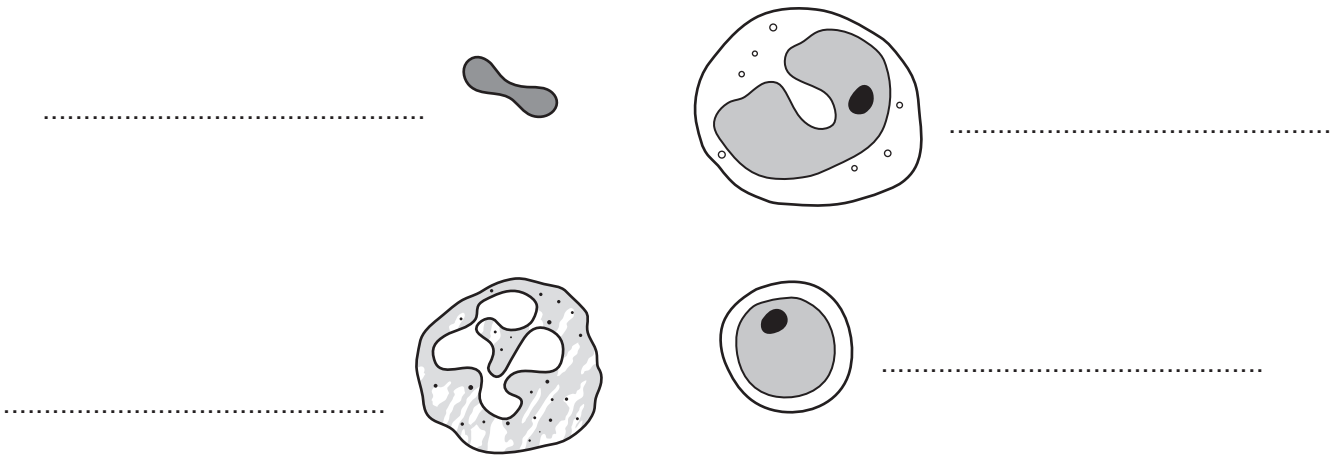


Fig. 5.1

Identify the four types of cell shown in Fig. 5.1.

Write the name of the cell type on the answer line provided by each cell in Fig. 5.1. [4]

(b) During systole and diastole of the cardiac cycle, changes in blood pressure occur in the four chambers of the heart.

Fig. 5.2 shows changes in the blood pressure in the **left** side of the heart and the aorta during one cardiac cycle.

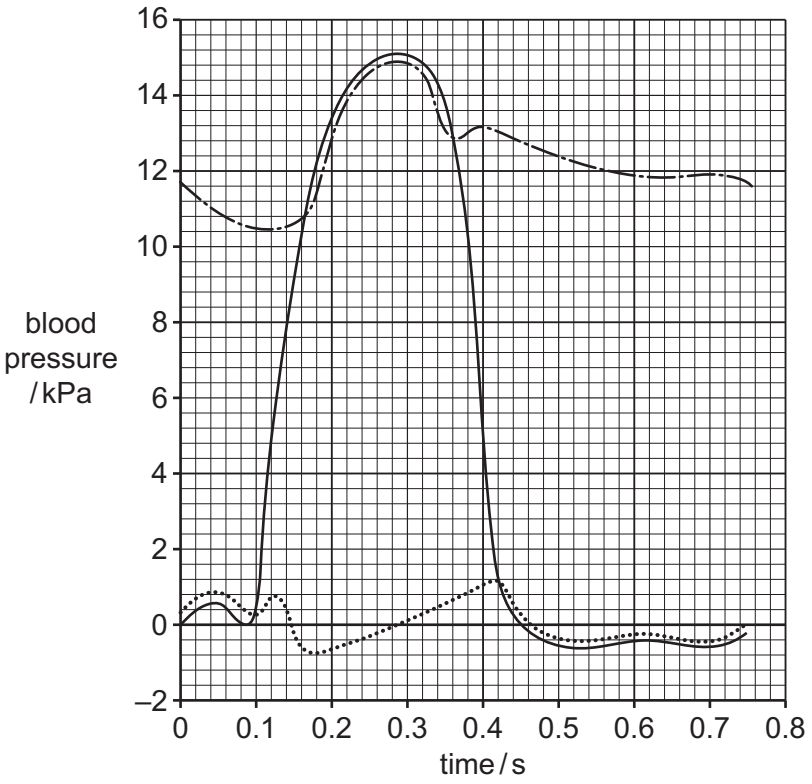


Fig. 5.2

With reference to the blood pressure changes shown in Fig. 5.2:

- state the maximum blood pressure reached in the left ventricle ..... kPa
- state the time at which the bicuspid (left atrioventricular) valve closes. ..... s

[2]

(c) Chronic obstructive pulmonary disease (COPD) can cause a condition known as pulmonary hypertension. This involves an increase in systolic blood pressure in the right ventricle and in the pulmonary arteries.

Fig. 5.3 is a summary of some of the events that can result from COPD.

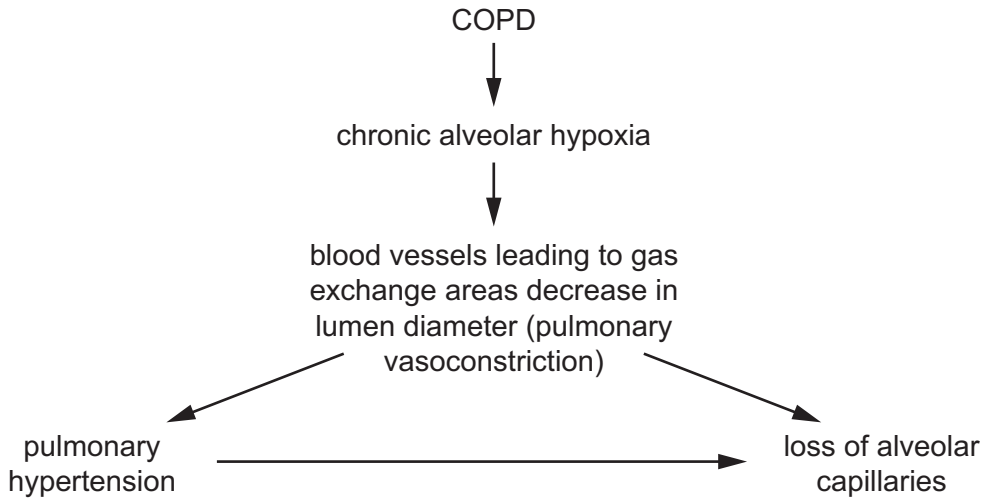


Fig. 5.3

(i) Chronic alveolar hypoxia describes a condition where the partial pressure of oxygen in the gas exchange regions of the lungs is always lower than normal.

Explain how COPD leads to chronic alveolar hypoxia.

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..... [3]

(ii) Explain how the loss of alveolar capillaries affects the functioning of the lungs in a person with COPD.

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..... [2]

[Total: 11]

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6 The best time to obtain a clear image of chromosomes during a mitotic cell cycle is during the metaphase stage.

Fig. 6.1 is a scanning electron micrograph of a group of human chromosomes at metaphase.

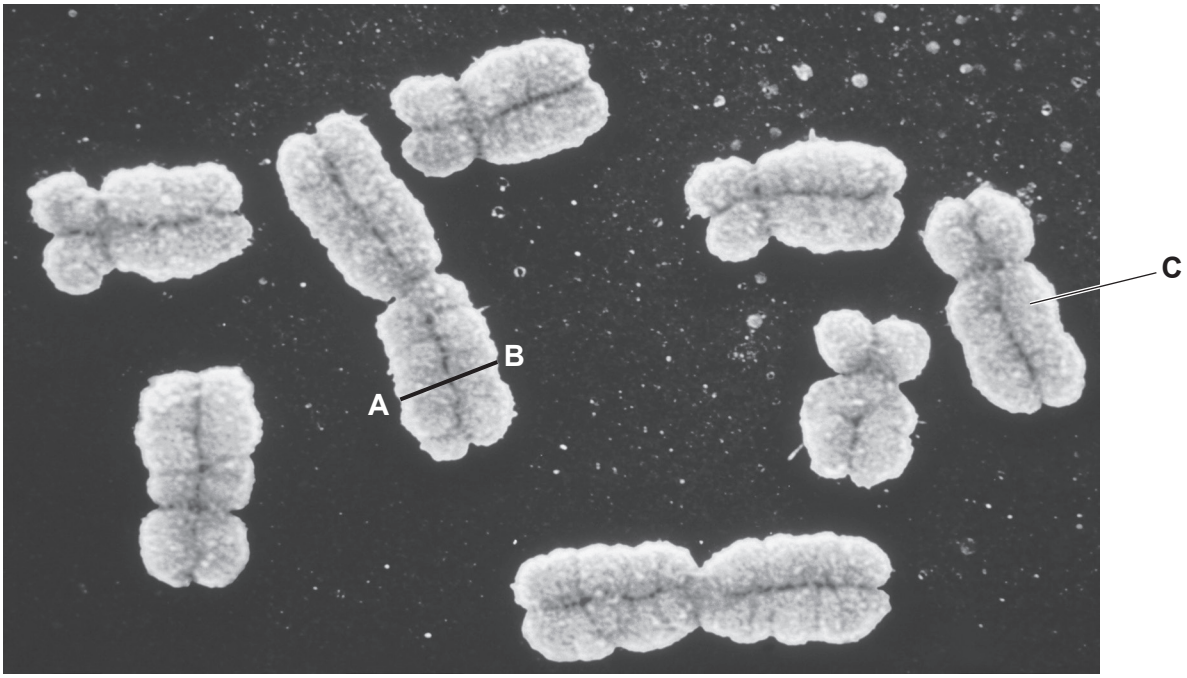


Fig. 6.1

(a) The group of chromosomes shown in Fig. 6.1 is magnified many times.

The actual width of the human chromosome between **A**—**B** is 1400 nm.

Calculate the magnification of the scanning electron micrograph shown in Fig. 6.1.

magnification × .....

[2]

(b) Draw chromosome **C** in Fig. 6.1 in the space provided.

Label your drawing to show the structure of the chromosome.

[4]

(c) Suggest why the metaphase stage is the best time during a mitotic cell cycle to obtain a clear image of chromosomes.

.....

.....

..... [1]

(d) Name the stage of mitosis that immediately follows metaphase.

..... [1]

[Total: 8]

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