Cambridge Assessment International Education

Cambridge International AS & A Level

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2730774458

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **May/June 2023**

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.
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- 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.

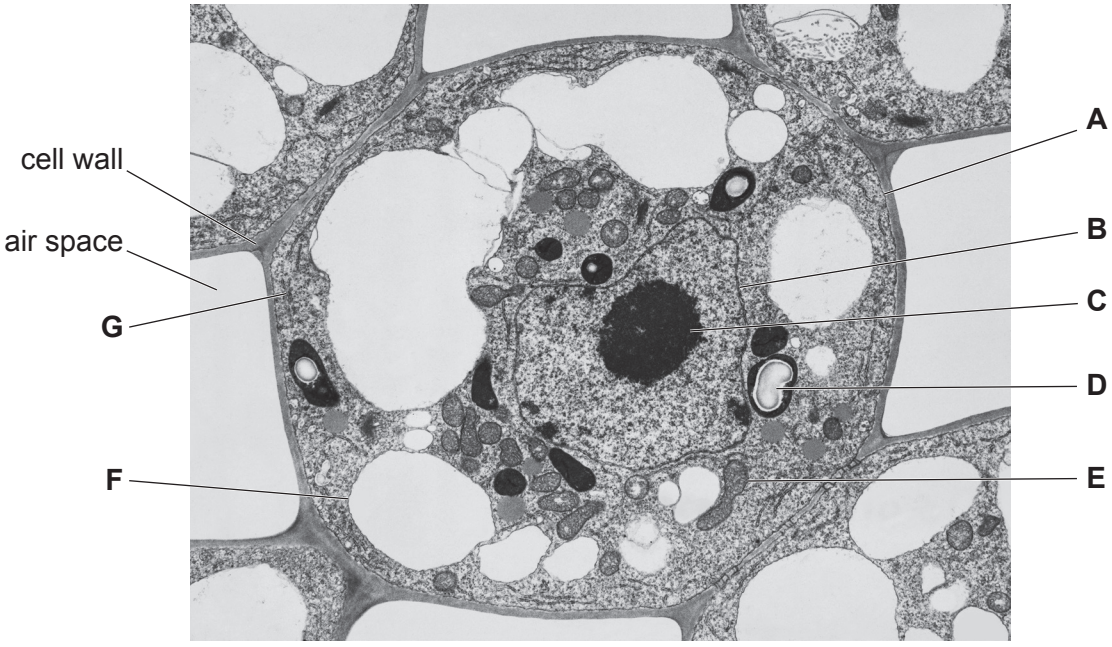
INFORMATION

- 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 **20** pages. Any blank pages are indicated.

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1 Fig. 1.1 is a transmission electron micrograph of a cell from the stem of sago pondweed, *Stuckenia pectinata*.



magnification ×2500

Fig. 1.1

(a) (i) State the evidence from Fig. 1.1 that shows that the cell is from the stem of *S. pectinata* and **not** from the mesophyll of a leaf.

.....

..... [1]

(ii) Complete each row in Table 1.1 to identify a cell structure shown in Fig. 1.1 that carries out the function listed.

Table 1.1

function	name of cell structure	letter on Fig. 1.1
gas exchange		
production of subunits of ribosomes		
active transport of ions		
aerobic respiration		

[4]

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(b) Plant vacuoles develop when vesicles fuse together. The vacuoles increase in size as more vesicles fuse.

Fig. 1.2 shows the movement of vesicles within a plant cell during the development of a vacuole.

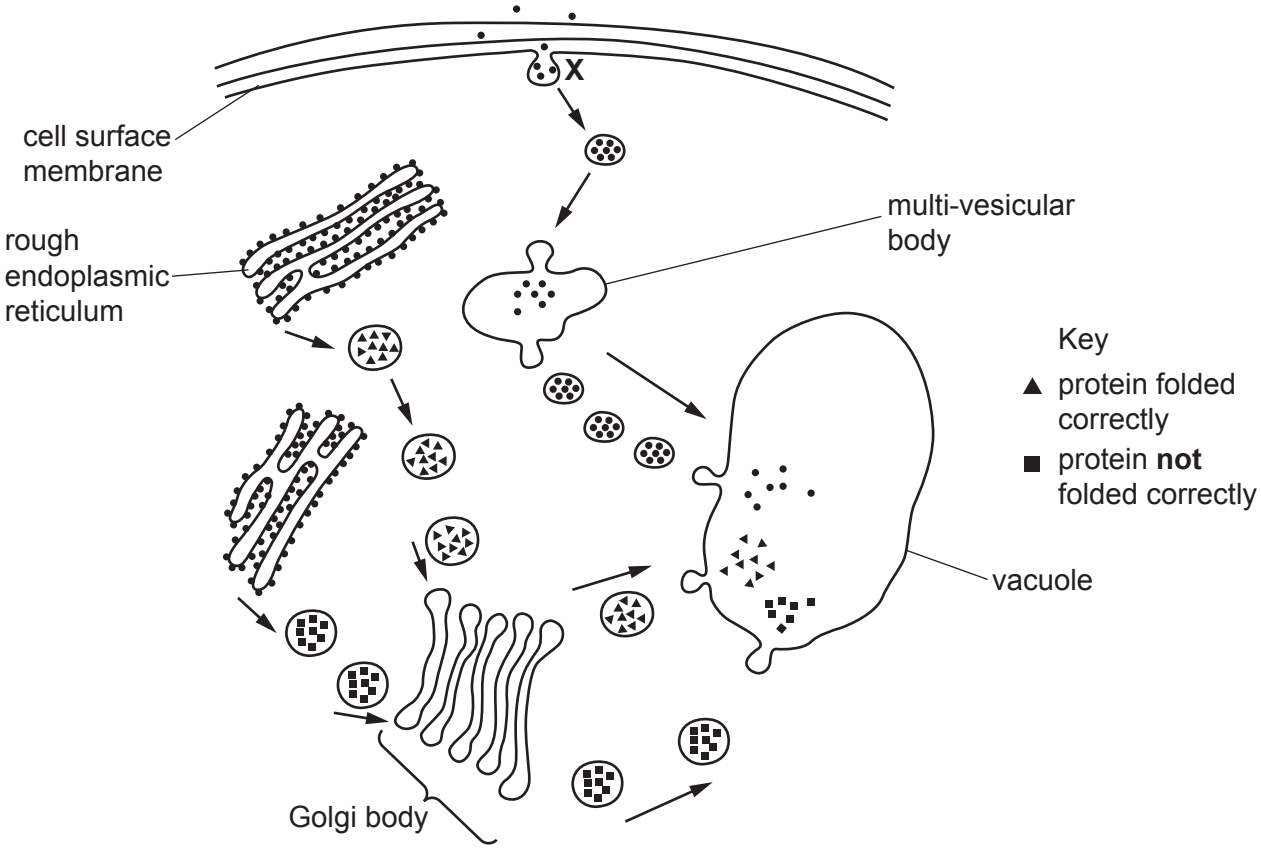


Fig. 1.2

(i) Name the process that is occurring at **X**.

..... [1]

(ii) Some of the vesicles formed by the Golgi body pass to the vacuole. These vesicles contain proteins that have been folded correctly and some that have **not** folded into their correct shapes. The proteins that have **not** folded correctly pass to the vacuole where they are broken down.

Explain how proteins that have **not** folded correctly are broken down in the vacuole.

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..... [3]

(c) Small vacuoles in *S. pectinata* may have roles similar to lysosomes in animal cells.

Describe the role of lysosomes in animal cells in defence against pathogens.

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..... [2]

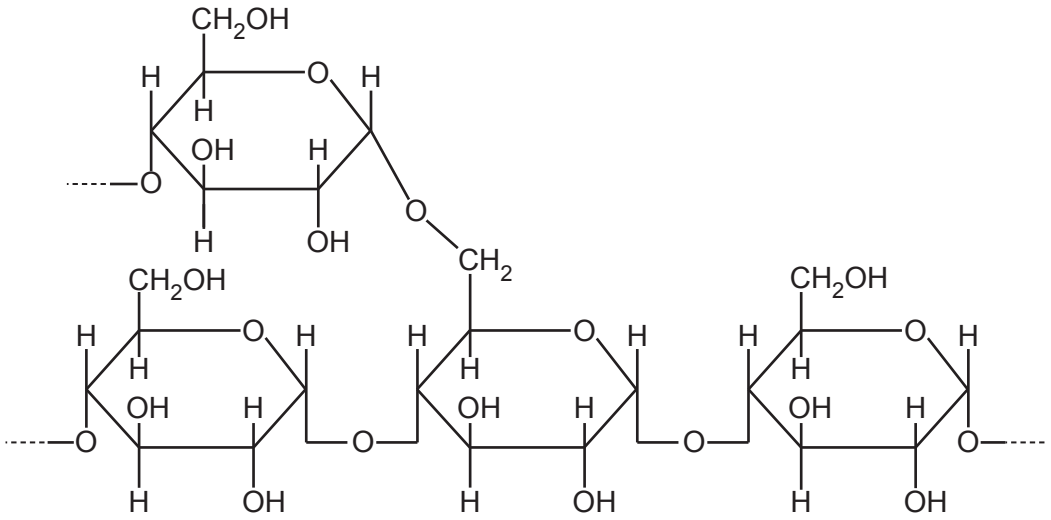
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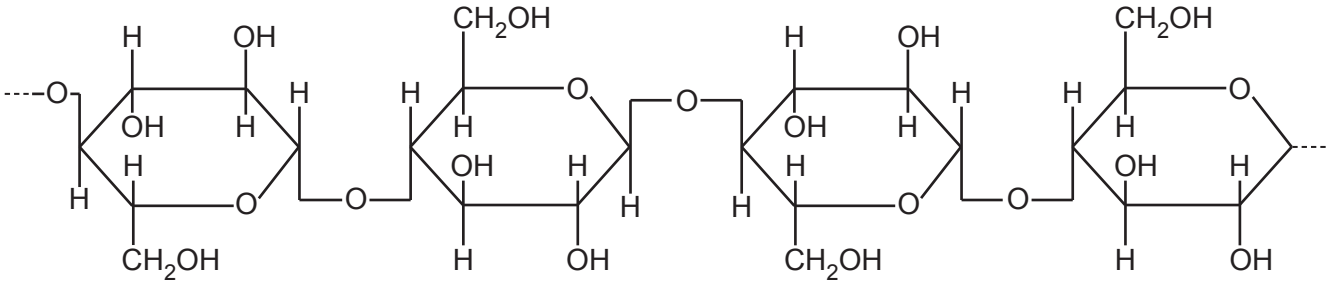
Question 2 is on page 6.

2 Glycogen and cellulose are polymers.

Fig. 2.1 shows small, representative regions of a glycogen molecule and a cellulose molecule.



glycogen



cellulose

Fig. 2.1

(a) Describe **three** ways, **visible in Fig. 2.1**, in which the molecule of glycogen differs from the molecule of cellulose.

1 .....

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2 .....

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3 .....

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[3]

(b) Glycogen is found in the form of granules in mammalian liver and muscle cells. Fig. 2.2 is a diagram of part of a molecule of glycogen isolated from a glycogen granule.

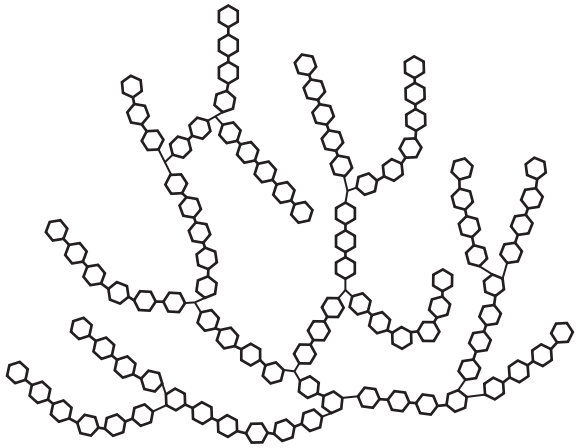


Fig. 2.2

Explain how the structure of glycogen is related to its function in cells.

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..... [3]

(c) Explain how the arrangement of cellulose molecules in plant cell walls is related to their function.

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..... [3]

[Total: 9]

3 Fig. 3.1 shows some fruits (grapes) of the grapevine, *Vitis vinifera*.

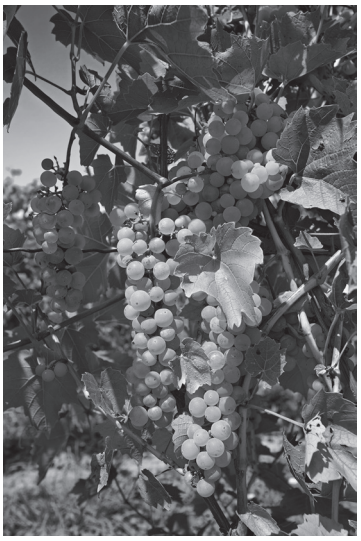


Fig. 3.1

Sucrose is transported in the phloem of the grapevine to the fruits. In the fruits, sucrose is hydrolysed by the enzyme sucrase, which is found in cell walls. The glucose and fructose produced by the hydrolysis of sucrose pass through membrane proteins, known as hexose transporters, into the cytoplasm of the fruit cells.

(a) State why membrane proteins are required for the movement of molecules, such as glucose, across cell surface membranes into cells.

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.....

..... [1]

Researchers investigated one type of hexose transporter, known as VvHT1, which is found in the fruit cells of *V. vinifera*. They used a mutant strain of yeast that has very few hexose transporters in its cell surface membranes to investigate the properties of VvHT1. The researchers inserted molecules of VvHT1 into the cell surface membranes of the mutant strain of yeast.

- Equal volumes of mutant yeast cells with VvHT1 were kept in eight different concentrations of glucose solution.
- The rate of uptake of glucose by the yeast cells in each solution was determined.
- All the solutions were kept at the same temperature and pH.

The results are shown in Fig. 3.2.

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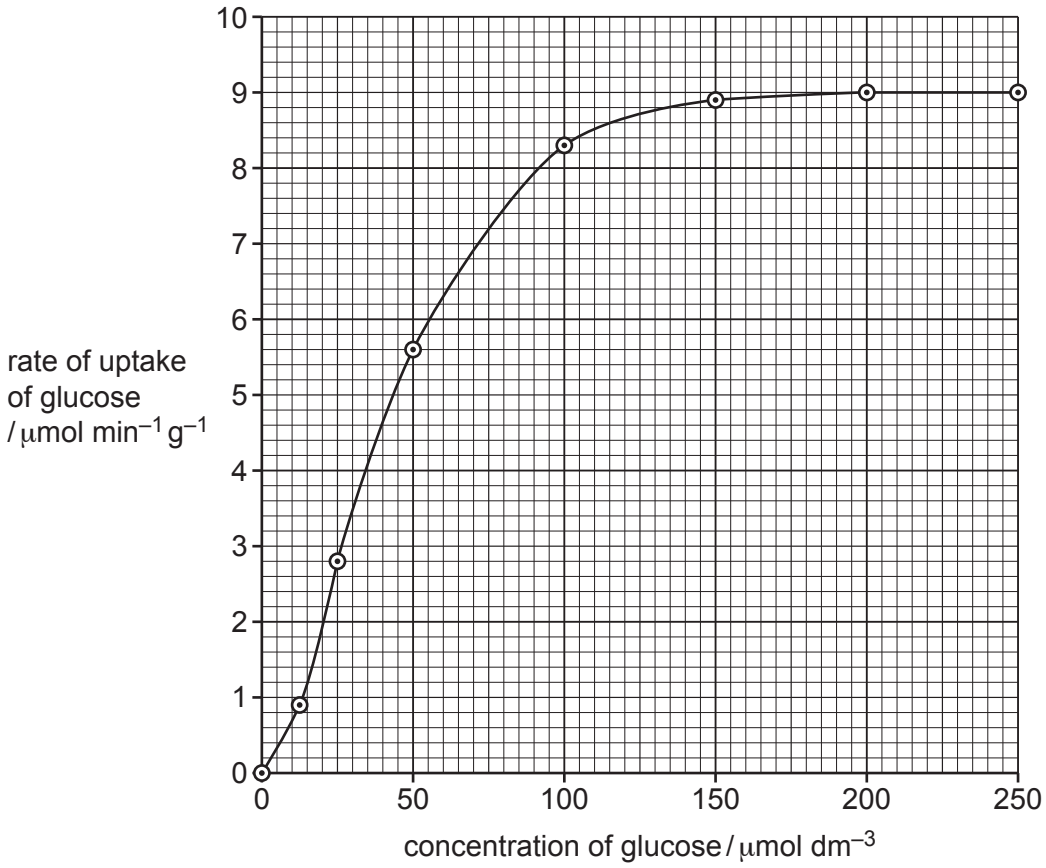


Fig. 3.2

(b) (i) The researchers concluded that VvHT1 is responsible for the facilitated diffusion of glucose into the cells.

Explain how the results in Fig. 3.2 provide evidence to support this conclusion.

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..... [2]

(ii) The researchers thought that grapevines could be modified to have more hexose transporters to increase the size and quality of grapes.

Explain why increasing the number of hexose transporters could be commercially important to growers of grapevines.

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..... [2]

(c) Fig. 3.3 is a diagram of a protein in the cell surface membrane of a macrophage from a mouse.

Macrophages use these proteins in antigen presentation. Non-self antigens bind to the proteins and are involved in the activation of specific T-lymphocytes during the immune response.

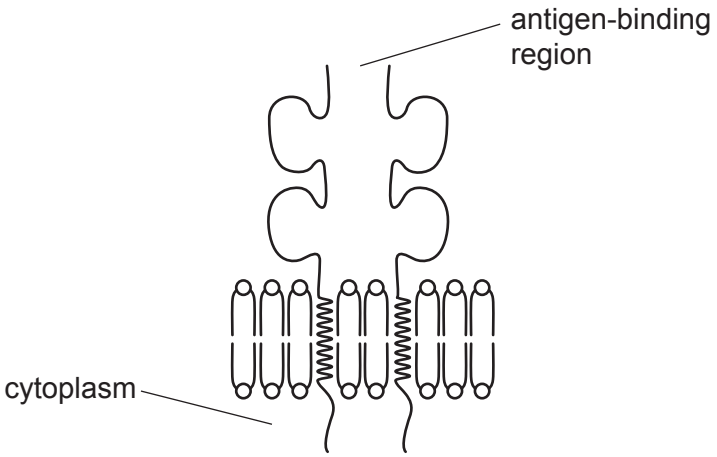


Fig. 3.3

(i) State what is meant by a non-self antigen.

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..... [1]

(ii) Some pathogens enter human cells. Macrophages partially digest these pathogens and present antigens to T-lymphocytes during immune responses.

With reference to Fig. 3.3, explain how T-lymphocytes respond to infection by a specific type of pathogen.

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..... [4]

[Total: 10]

4 The gene for the enzyme catalase is on chromosome 11 in humans.

(a) Explain the meaning of the term gene.

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..... [2]

(b) Two enzymes, DNA polymerase and DNA ligase, are involved in the replication of DNA.

Fig. 4.1 shows the replication of part of human chromosome 11 by DNA polymerase. The arrows show the direction of synthesis of the new polynucleotides by DNA polymerase.

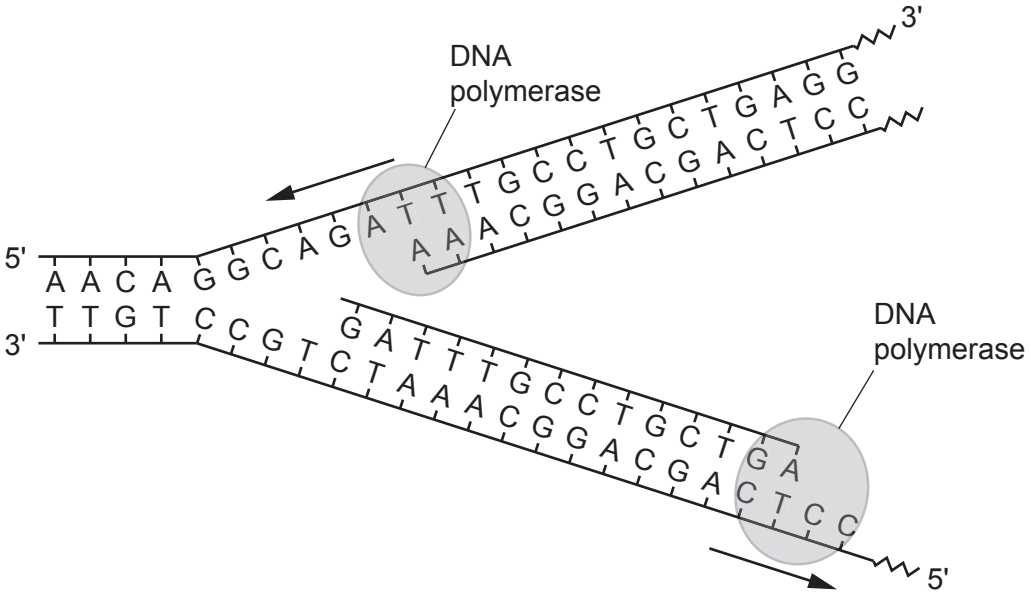


Fig. 4.1

(i) Describe the roles of DNA polymerase and DNA ligase in the replication of DNA.

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..... [5]

(ii) State the name of the stage of interphase in the cell cycle when DNA replication occurs.

..... [1]

(c) Fig. 4.2 is a diagram of chromosome 11 at metaphase of mitosis.

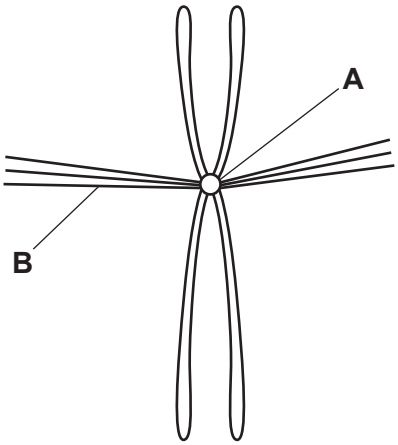


Fig. 4.2

(i) State the names **and** functions of structures **A** and **B**.

structure **A** .....

function .....

.....

structure **B** .....

function .....

.....

[2]

(ii) Complete Fig. 4.3 to show what happens to chromosome 11 in anaphase, so that the daughter nuclei are genetically identical.

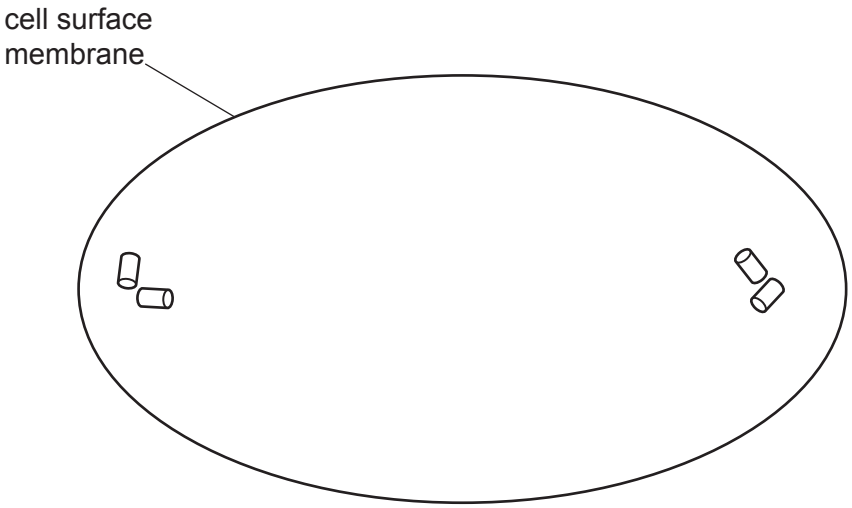


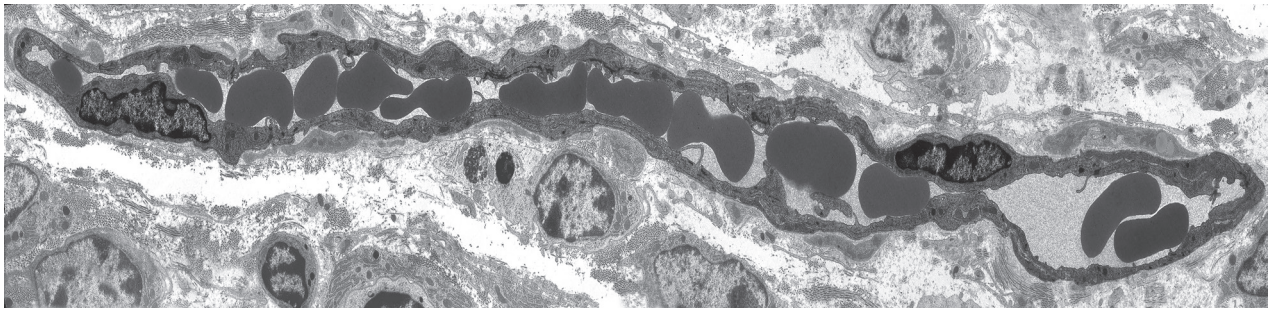
Fig. 4.3 [3]

[Total: 13]

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Question 5 is on page 16.

5 Fig. 5.1 is a longitudinal section of a capillary in muscle tissue as viewed with a transmission electron microscope.



magnification ×2000

Fig. 5.1

(a) State the evidence, **visible in Fig. 5.1**, that identifies the cells inside the capillary as red blood cells.

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..... [2]

(b) Explain how the structure of the capillary wall is related to its functions.

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..... [3]

(c) Fig. 5.2 is a diagram showing some of the events that occur as blood flows through a capillary in a respiring tissue.

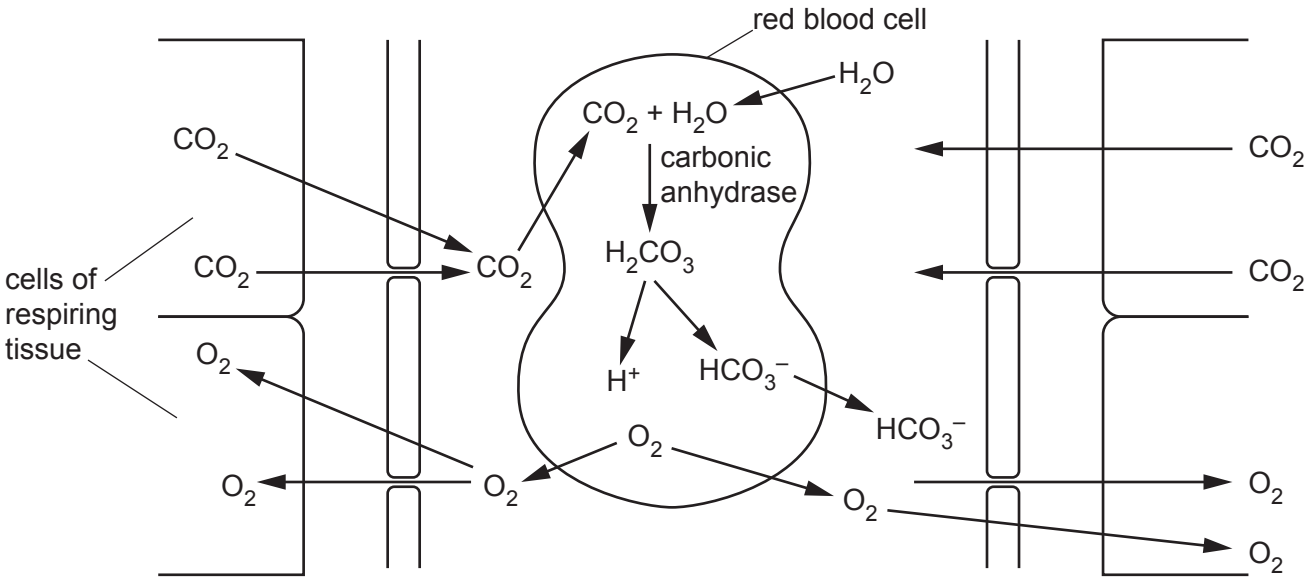


Fig. 5.2

(i) An increase in respiration results in an increase in the carbon dioxide concentration in the blood and the release of more oxygen from red blood cells to tissues.

Explain how an increase in carbon dioxide in the blood leads to the release of more oxygen from red blood cells.

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..... [4]

(ii) Chloride ions are a constituent of blood plasma. The concentration of chloride ions in the plasma of deoxygenated blood is between 2–4 mmol dm^{-3} lower than in the plasma of oxygenated blood.

Explain why the concentration of chloride ions in the blood plasma of deoxygenated blood is lower than in the plasma of oxygenated blood.

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..... [2]

[Total: 11]

6 Fig. 6.1 is a diagram showing the passage of water through the tissues of a flowering plant from the soil to the atmosphere. The arrows show the direction of water movement.

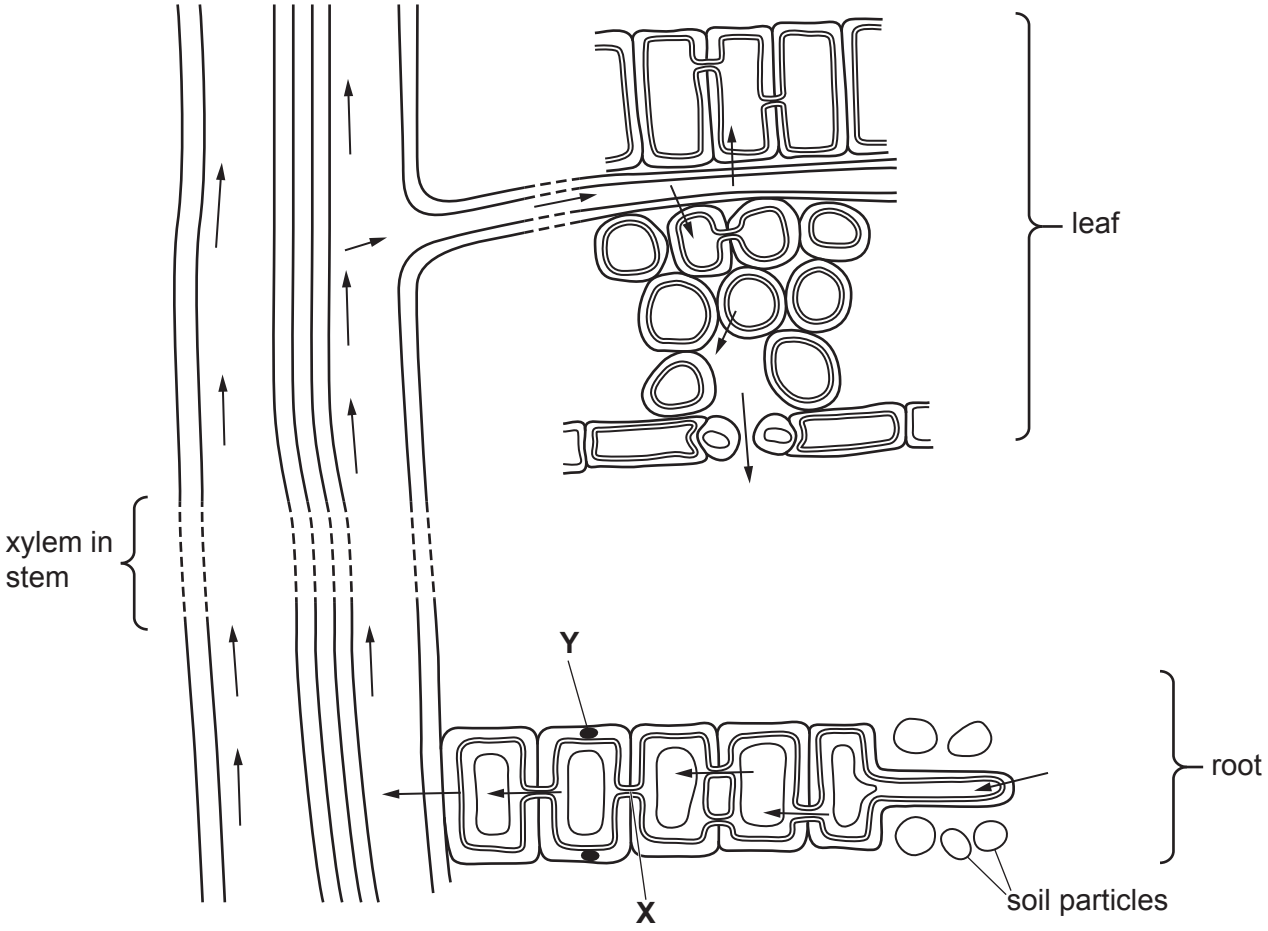


Fig. 6.1

(a) The structure labelled **X** is part of the symplast pathway. State the name of structure **X**.

..... [1]

(b) The structure labelled **Y** in the cell wall is a barrier to the apoplast pathway. State the name of structure **Y**.

..... [1]

(c) With reference to Fig. 6.1, complete the statements about the movement of water in the flowering plant.

Water moves from the soil solution to the cytoplasm of root hair cells by .....

Water moves from the xylem in the root to the leaf by .....

Water moves from mesophyll cell walls to intercellular air spaces by .....

Water vapour moves from intercellular air spaces to the atmosphere outside the leaf by .....

[4]

[Total: 6]

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BIOLOGY **9700/22**

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1 hour 15 minutes

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[Turn over

1 The sinoatrial node (SAN) and the atrioventricular node (AVN) have an important role in the control of the cardiac cycle. The timing of atrial and ventricular systole and diastole must be controlled so that blood passes through the heart efficiently.

(a) Fig. 1.1 is a summary of blood flow through the **right** side of the heart during one cardiac cycle. Three boxes in Fig. 1.1 are **not** complete.

Complete boxes **3**, **5** and **7** in Fig. 1.1 using **only** the terms **systole** and **diastole**.

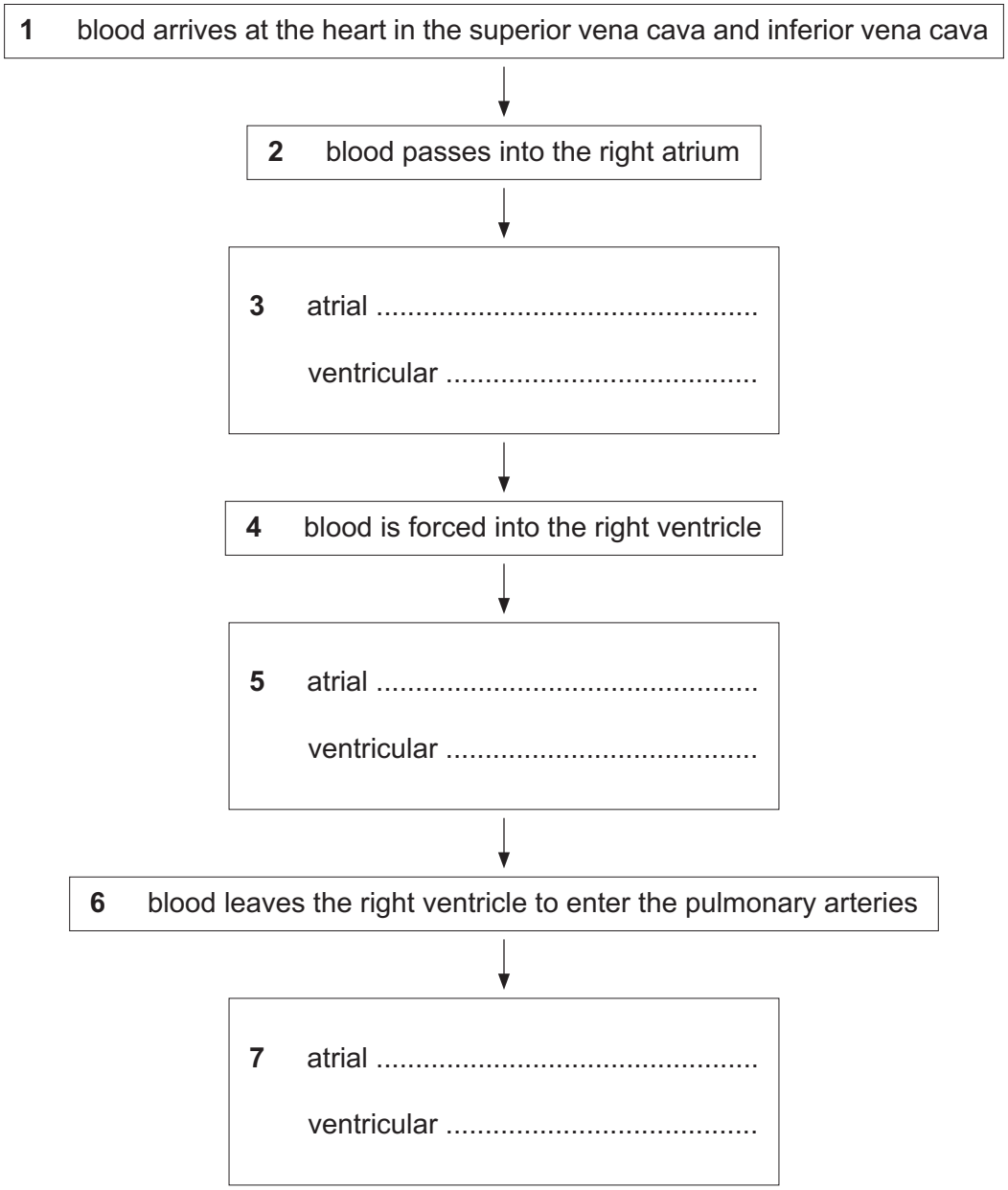


Fig. 1.1

[2]

(b) Impulses sent out by the SAN pass to the AVN, where there is a short delay.

With reference to Fig. 1.1, explain why it is important for the control of the cardiac cycle that there is a short delay at the AVN after impulses have been sent out by the SAN.

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..... [2]

(c) Changes in blood pressure occur in the heart during the cardiac cycle. These changes cause the opening and closing of the bicuspid and tricuspid (atrioventricular) valves and the aortic and pulmonary (semilunar) valves.

Explain how blood pressure changes:

- cause the **opening** of the **tricuspid** valve
- cause the **opening** of the **pulmonary** valve
- help the flow of blood through the heart.

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..... [3]

[Total: 7]

2 Fig. 2.1 is a photomicrograph of a longitudinal section (LS) through a root tip. Two different regions are visible:

- the root apical meristem
- the root cap.

Cells in the root cap synthesise a gel-like, sticky secretion known as mucilage, which is important in reducing friction between soil and the growing root. It is composed mainly of polysaccharides and also contains some amino acids and enzymes.

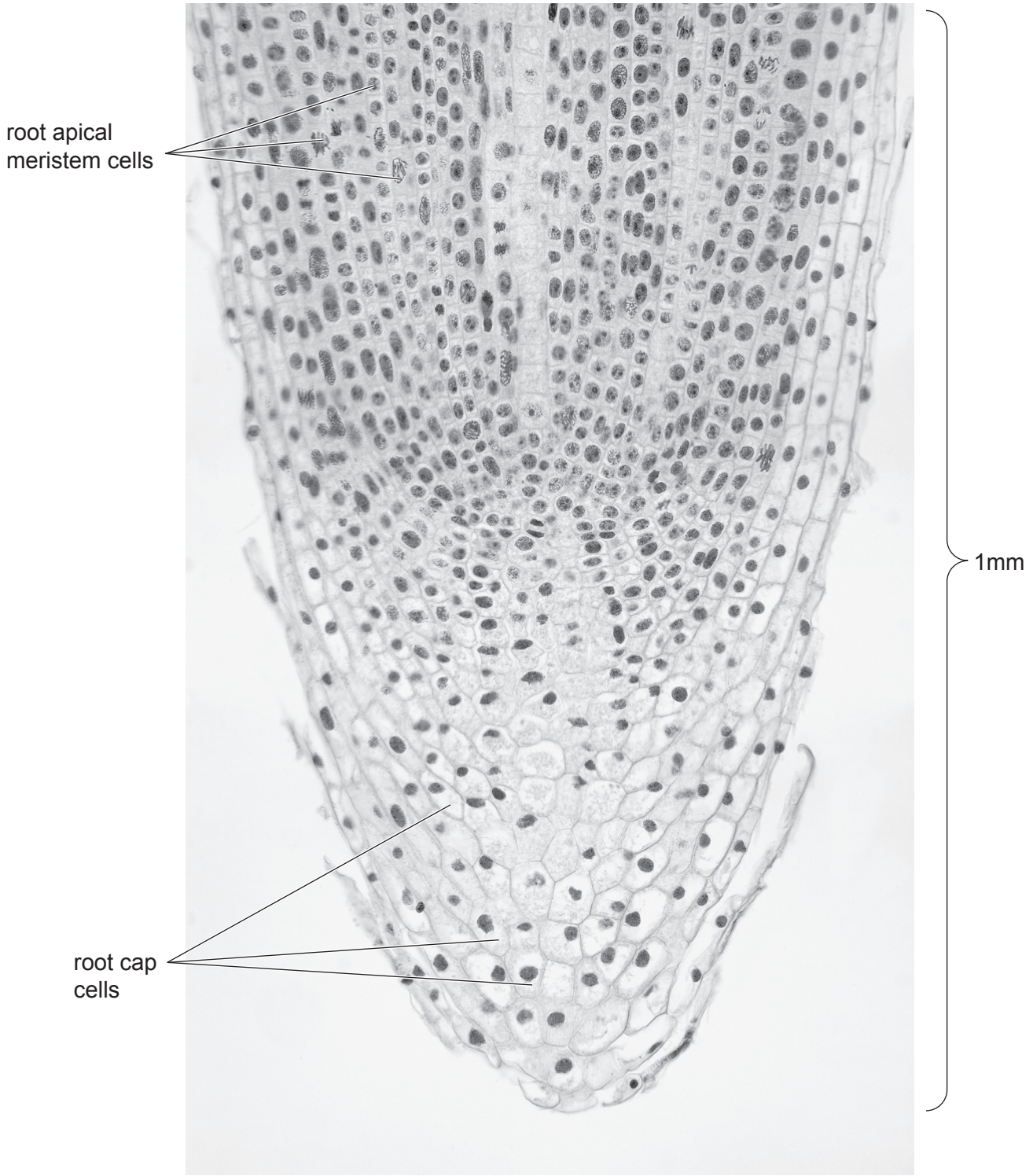


Fig. 2.1

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(a) Describe **three** differences, **visible** in Fig. 2.1, between root apical meristem cells and root cap cells.

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2 .....

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3 .....

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..... [3]

(b) Mucilage acts as a glue to bind tiny soil particles together, forming small clumps close to the root. These small clumps help to maintain the soil water around the root tip and prevent the loss of water.

With reference to the cohesive **and** adhesive properties of water, suggest **and** explain how the formation of small clumps of soil helps to maintain the soil water around the root tip.

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..... [3]

(c) Enzymes present in mucilage catalyse the breakdown of organic compounds in the soil. This increases the presence of mineral ions in the soil.

State the term used to describe enzymes that act **outside** the cells that synthesise them.

..... [1]

(d) The polysaccharides and amino acids present in the mucilage are a source of nutrients for soil microorganisms that live in the area surrounding the root. Some of these microorganisms can break down soil compounds to release mineral ions.

(i) Explain what is meant by a polysaccharide.

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..... [2]

(ii) The soil microorganisms use amino acids to synthesise proteins. All of the twenty different amino acids that are present in proteins have the same general structure.

Draw the general structure of an amino acid in the space provided **and** use this drawing to explain how it is possible to have many different amino acids.

.....

.....

..... [2]

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(iii) Mineral ions are usually present in the soil in very low concentrations. The action of mucilage enzymes and soil microorganisms can help to increase the presence of mineral ions.

Root hair cells are specialised for the uptake of these mineral ions **and** for the absorption of water from the soil.

Suggest **and** explain how the presence of mineral ions in the root hair cell can **increase** the absorption of water by the root hair cells.

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..... [3]

[Total: 14]

3 Cells of the immune system respond to the presence of non-self antigens.

(a) Outline the features of non-self antigens.

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..... [3]

(b) Four different types of cells of the immune system are shown in Table 3.1.

Complete Table 3.1:

- use a tick (✓) if the description applies to the named cell of the immune system
- use a cross (✗) if the description does **not** apply.

Table 3.1

description of cell	cell of the immune system			
	B-lymphocyte	**plasma cell**	**T-helper cell**	**T-killer cell**
able to go through a number of cell cycles (clonal expansion)				
main role is to secrete cytokine during an immune response				
present during a **primary** immune response to a virus				

[4]

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(c) The cell cycle can be divided into different parts.

Complete sentences **A**, **B** and **C** to provide more information about the mitotic cell cycle.

A The part of the cell cycle that occurs immediately after mitosis is

.....

B The part of the cell cycle in which the S phase occurs is

.....

C The main event that occurs during the S phase is

.....

[3]

[Total: 10]

4 *Trypanosoma brucei* is a unicellular organism that causes the infectious disease known as sleeping sickness. Insects known as tsetse flies pass on the organism from infected people to uninfected people when male and female tsetse flies feed on human blood.

(a) Fig. 4.1 is a transmission electron micrograph of the form of *T. brucei* found in human blood.

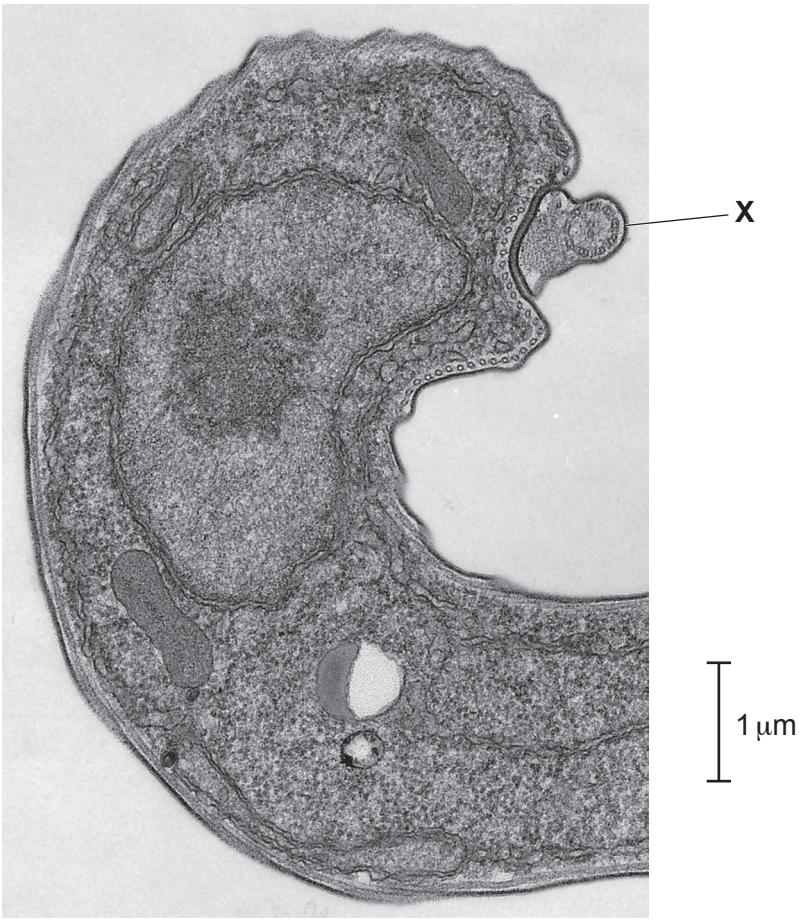


Fig. 4.1

(i) Draw an arrow on Fig. 4.1 to indicate the location in the cell where ribosomal RNA (rRNA) and proteins are assembled to make ribosomal subunits. [1]

(ii) With reference to Fig. 4.1, explain how the structure labelled **X** provides evidence that *T. brucei* is motile (able to move).

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..... [2]

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(iii) With reference to Fig. 4.1, explain whether *T. brucei* is a eukaryote or prokaryote.

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..... [3]

(b) Malaria is an infectious disease caused by organisms belonging to the genus *Plasmodium*.

(i) State the term used to describe an organism that causes disease.

..... [1]

(ii) Name **one** of the species of *Plasmodium* that causes malaria.

Plasmodium ..... [1]

(c) Outline the similarities **and** differences between the modes of transmission of malaria and sleeping sickness.

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..... [3]

[Total: 11]

5 Nucleotide and nucleoside analogues are therapeutic drugs that have a similar structure to nucleotides or nucleosides of RNA and DNA.

A nucleoside is composed of a nitrogenous organic base (base) and a pentose sugar.

(a) The names of the bases present in RNA and DNA nucleotides can be abbreviated using a single letter. These are shown in Table 5.1.

Complete Table. 5.1 by stating:

- the name of each base
- whether the base is a purine **or** pyrimidine
- whether the base is present
  - **only** in an RNA molecule (write **RNA** in the table)
  - **only** in a DNA molecule (write **DNA** in the table)
  - in RNA **and** in DNA molecules (write the word **both** in the table).

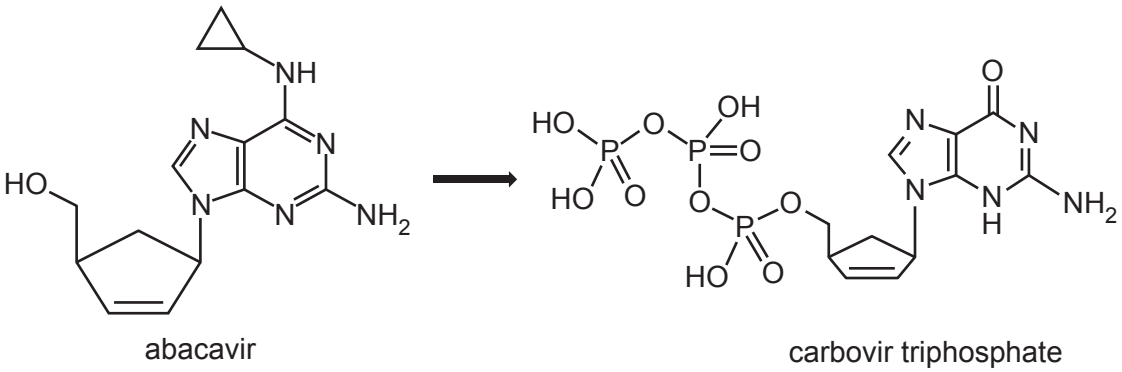
Table 5.1

base	name of base	purine or pyrimidine	present in RNA, DNA, or both
A			
C			
G			
T			
U			

[4]

(b) Abacavir is an analogue drug used in the treatment of some viral diseases. It enters a cell infected by a virus and is metabolised to the analogue carbovir triphosphate.

Fig. 5.1 shows the molecular structure of abacavir and carbovir triphosphate.



abacavir carbovir triphosphate

Fig. 5.1

Carbovir triphosphate can be inserted into an elongating polynucleotide chain instead of a nucleotide. This interferes with the action of DNA polymerase during the synthesis of viral DNA.

(i) With reference to Fig. 5.1, explain whether carbovir triphosphate will replace a purine or a pyrimidine nucleotide in the elongating polynucleotide chain.

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..... [1]

(ii) With reference to Fig. 5.1 **and** the action of DNA polymerase, suggest why the conversion of abacavir to carbovir triphosphate increases the chance of the analogue being added to the viral polynucleotide chain.

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..... [2]

(iii) Suggest **and** explain how carbovir triphosphate interferes with the action of DNA polymerase **and** how this may prevent the synthesis of viral DNA.

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..... [4]

[Total: 11]

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6 The Weibel Lung model was developed after an extensive study of the gas exchange system. The model includes detailed measurements of airway diameters (lumen diameters of the airways). In the model, different parts of the gas exchange system are identified with a generation number, as outlined in Fig. 6.1.

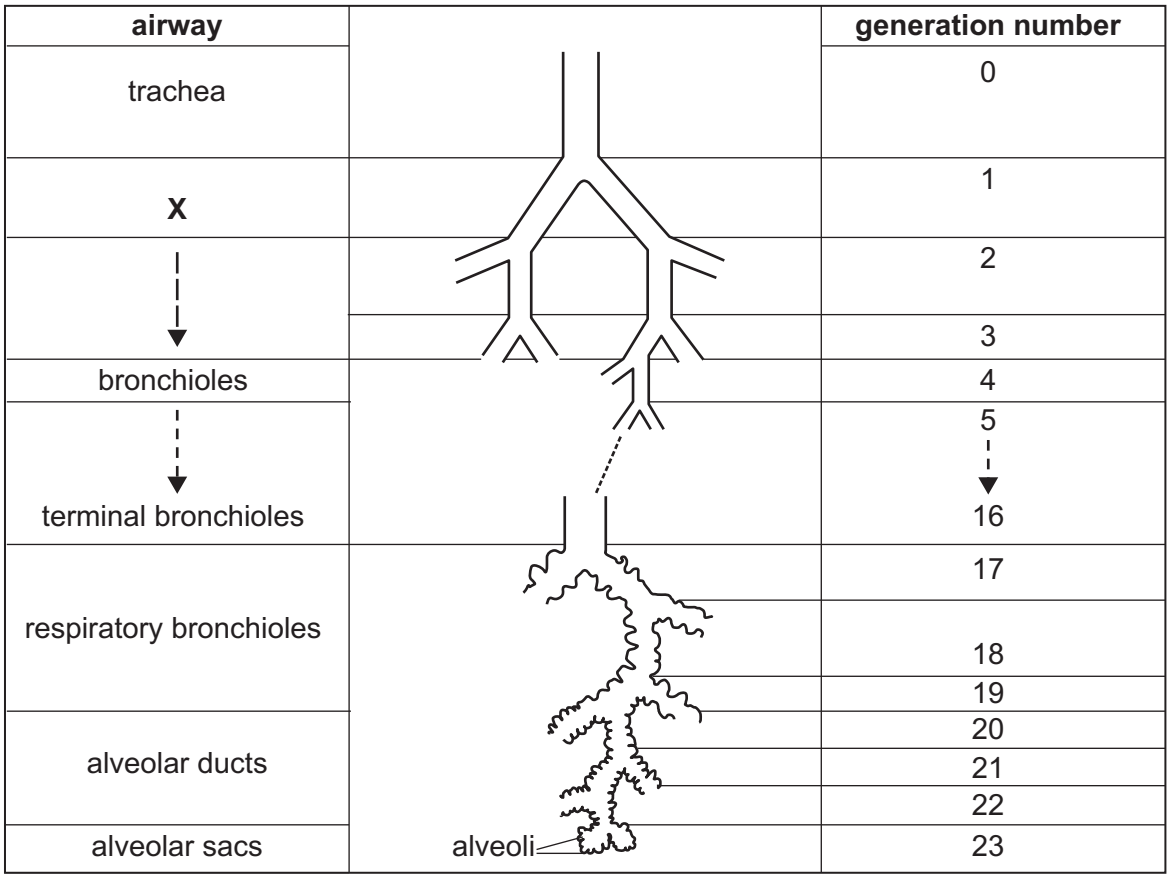


Fig. 6.1

(a) The Weibel Lung model describes how each airway divides into two.

Name the airways in generation 1, labelled **X** in Fig. 6.1, that branch from generation 0.

..... [1]

(b) The airways are well supplied with blood. However, the airways from generation 0 to generation 16, shown in Fig. 6.1, are **not** able to carry out gas exchange.

Suggest why the airways from generation 0 to generation 16 are **not** able to carry out gas exchange.

.....

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..... [2]

(c) High-resolution computed tomography (HRCT) is an imaging technique that is used to obtain measurements of airway diameters in people with a pulmonary (lung) disease. Regular, repeated imaging must be avoided because it involves exposure to harmful radiation.

Scientists researched the use of a different technique, HP gas MRI, that does **not** involve harmful radiation. Two types of MRI image, known as projection and multi-Slice, were used to obtain measurements of airway diameters.

Fig. 6.2 shows the results of the HP gas MRI study compared with the Weibel Lung model, for generations 0 to 5. The Weibel Lung model was used as a standard reference for airway diameters.

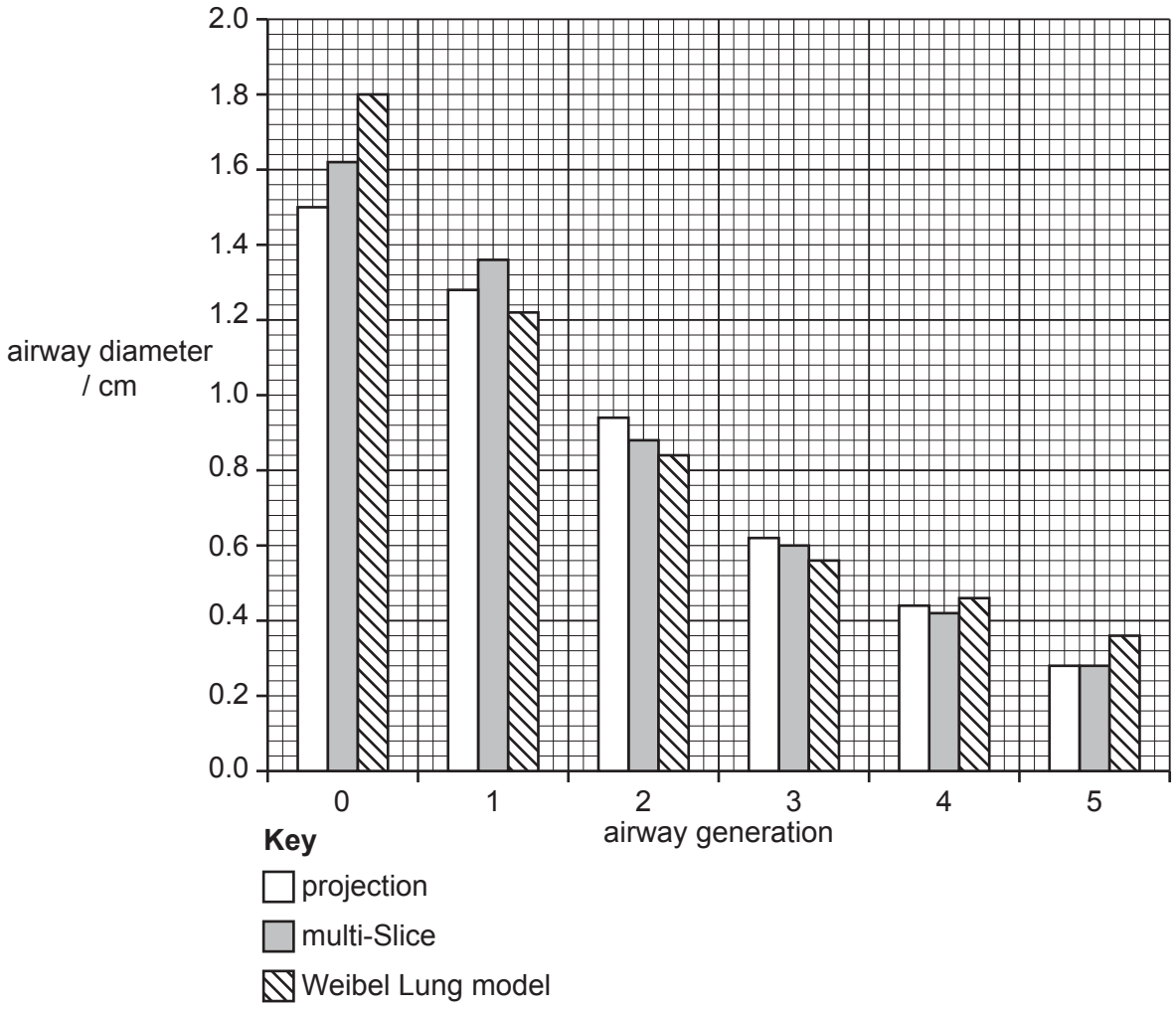


Fig. 6.2

(i) State the relationship shown in Fig. 6.2 between airway diameter and airway generation for the Weibel Lung model data.

.....

..... [1]

(ii) With reference to the data in Fig. 6.2, explain whether HP gas MRI could be a useful alternative to HRCT in obtaining airway diameter measurements.

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..... [3]

[Total: 7]

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BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 2023**

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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[Turn over

1 The cells in a tissue are often at different stages of the cell cycle.

(a) Fig. 1.1 shows cells at different stages of the cell cycle.

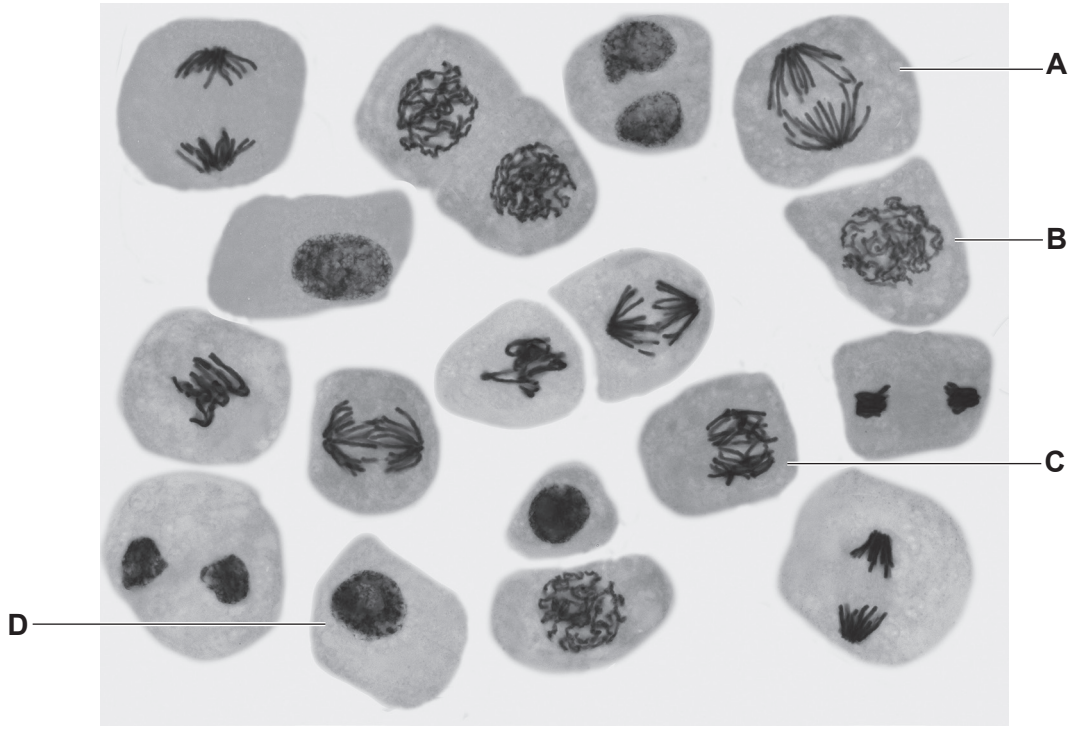


Fig. 1.1

(i) Identify the stages of mitosis occurring in the cells labelled **B** and **C** in Fig. 1.1.

B .....

C .....
[2]

(ii) Describe the behaviour of the chromosomes in the stage of mitosis shown in cell **A** in Fig. 1.1.

.....

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.....

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..... [3]

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(iii) Cell **D** in Fig. 1.1 is in interphase.

Describe the role of DNA ligase in interphase.

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..... [3]

(b) Telomerase is an enzyme that is active during interphase in some cells.

Telomerase helps to maintain telomeres present on chromosomes.

(i) State the location of telomeres on a chromosome.

.....

..... [1]

(ii) Some people with a long lifespan have cells showing a higher than normal activity of telomerase.

Suggest why a long lifespan could result from a higher telomerase activity.

.....

.....

.....

.....

..... [2]

[Total: 11]

2 The number of cases of tuberculosis (TB) is affected by many biological, social and economic factors.

(a) The number of reported cases of TB in the USA between 1980 and 2000 is shown in Fig. 2.1.

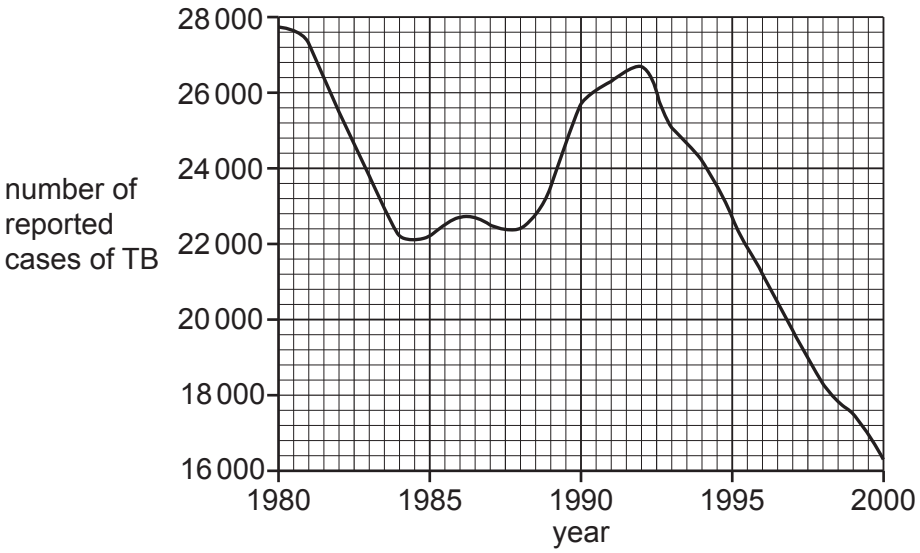


Fig. 2.1

(i) Describe the trends shown in Fig. 2.1 between 1980 and 2000.

.....

.....

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.....

..... [3]

(ii) The number of reported cases of TB between 1984 and 1992 in the USA may have been affected by an increase in the number of people infected with HIV.

Explain how an increase in the number of people infected with HIV could have affected the number of TB cases.

.....

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..... [2]

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(b) *Mycobacterium tuberculosis* is a species of bacterium that causes TB. Strains of *M. tuberculosis* have evolved resistance to some of the antibiotics used to treat the disease.

State **two** ways that the impact of antibiotic resistance can be reduced.

1 .....

.....

2 .....

.....

[2]

(c) TB can affect every part of the human gas exchange system, including the trachea, bronchi and alveoli.

(i) The cartilage in the bronchi can be damaged in some people with TB.

Suggest the effect that damage to cartilage may have on the bronchi.

.....

..... [1]

(ii) Table 2.1 shows four types of cell and three structures found in the gas exchange system.

Complete Table 2.1 to show the distribution of cell types in each structure of the gas exchange system.

Use a tick (✓) if the cell type is present in the structure and a cross (✗) if the cell type is **not** present.

Put a tick (✓) or a cross (✗) in every box.

Table 2.1

cell type	alveolus	bronchus	trachea
ciliated epithelial cell			
goblet cell			
smooth muscle cell			
squamous epithelial cell			

[3]

[Total: 11]

3 Blood contains white blood cells and red blood cells.

(a) Fig. 3.1 is a photomicrograph showing different types of blood cell.

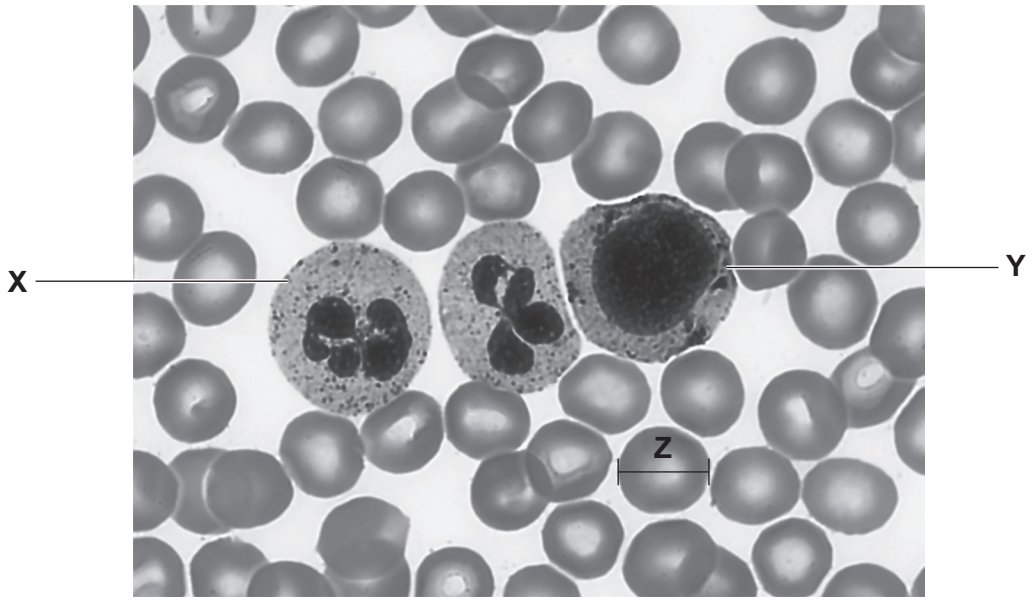


Fig. 3.1

(i) Identify cell **X** and cell **Y** in Fig. 3.1.

X .....

Y .....

[2]

(ii) The width of one of the cells in Fig. 3.1 is represented by the line **Z**.

The actual width of cell **Z** is 8 μm.

Calculate the magnification used to produce the image shown in Fig. 3.1.

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

formula

magnification = x ..... [2]

(b) Carbonic anhydrase is an enzyme found in red blood cells.

(i) Describe how carbonic anhydrase is involved in the release of oxygen from red blood cells at respiring tissues.

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..... [4]

(ii) Sulfonamide is a competitive inhibitor of carbonic anhydrase.

Fig. 3.2 shows the effect of increasing substrate concentration on the rate of the reaction catalysed by carbonic anhydrase.

Sketch a curve **on Fig. 3.2** to show the effect of sulfonamide on the rate of reaction catalysed by carbonic anhydrase.

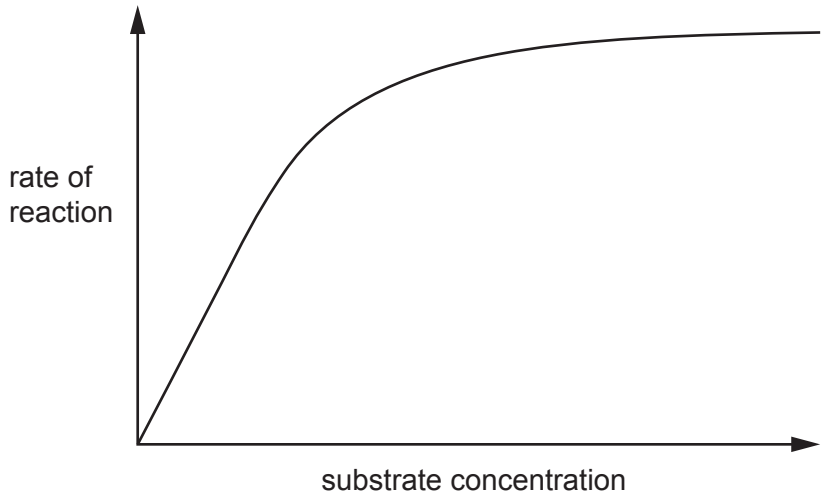


Fig. 3.2

[2]

[Total: 10]

4 Food crops such as barley and wheat contain gluten. Gluten contains two proteins, glutenin and gliadin.

(a) (i) Table 4.1 contains descriptions of the structures of glutenin and gliadin.

Complete Table 4.1 by writing the level of protein structure that applies to each description.

Table 4.1

description	level of protein structure
a gliadin protein is a single polypeptide that forms a compact structure	
20% of the amino acids in a glutenin molecule are glycine	
gliadin and glutenin molecules contain regions of β-pleated sheets	

[3]

(ii) Many genes in eukaryotic cells contain introns. The genes that code for gliadin do **not** contain introns.

Explain how a lack of introns in a gliadin gene affects the production of mRNA from the primary transcript.

.....

.....

..... [1]

(b) Coeliac disease is a condition in which the immune system of a person responds to gluten in their diet.

In coeliac disease, there is a response to the presence of peptides (short chains of amino acids) that are produced as a result of gliadin digestion.

(i) The gliadin peptides produced as result of digestion are often as large as 33 amino acids in length. Intestinal cells take up large numbers of these peptides at the same time.

Suggest **and** explain how gliadin peptides are transported into intestinal cells.

.....

.....

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..... [2]

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(ii) The presence of gliadin causes the immune system of a person with coeliac disease to respond by producing anti-gliadin antibodies.

Describe the sequence of events that results in the immune system producing anti-gliadin antibodies.

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..... [4]

[Total: 10]

5 Phloem and xylem are specialised tissues involved in the transport of water, ions and assimilates in plants.

(a) A photomicrograph of a transverse section of a dicotyledonous stem is shown in Fig. 5.1.



Fig. 5.1

Use label lines and labels to identify the phloem tissue **and** xylem tissue in Fig. 5.1. [2]

(b) **(i)** Describe how sucrose is transported in phloem sieve tubes from photosynthesising leaves to other parts of the plant.

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..... [4]

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(ii) Cyanide ions (CN^-) inhibit the activity of an enzyme involved in respiration.

Suggest why the treatment of photosynthesising leaves with CN^- results in less sucrose being transported into phloem sieve tubes.

.....

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..... [2]

(c) A student was asked to carry out semi-quantitative Benedict's tests on two solutions.

- Solution **A** was extracted from the cytoplasm of cells in the mesophyll tissue of photosynthesising leaves.
- Solution **B** was extracted from the phloem sap in phloem sieve tubes.

The solutions were taken from the same plant, and other variables were standardised.

For each solution, the student measured the time taken for the first colour change to appear.

Suggest which of the two solutions, **A** or **B**, would change colour in the shortest time.

Explain your answer.

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..... [2]

[Total: 10]

6 Polysaccharides, such as glycogen, are composed of thousands of monomers.

Oligosaccharides are carbohydrates that contain three to ten monomers in their chain.

(a) Nystose is one example of an oligosaccharide. The structure of nystose is shown in Fig. 6.1.

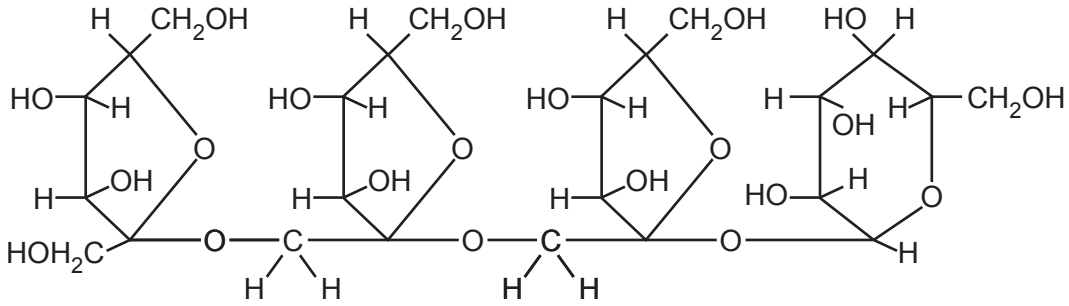


Fig. 6.1

State **three** differences between the structures of nystose and glycogen, **other** than the number of monomers in the molecules.

1 .....

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2 .....

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3 .....

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[3]

(b) Cells use oligosaccharides to synthesise glycoproteins, which are transported to cell surface membranes.

Describe the roles of the rough endoplasmic reticulum and the Golgi body in synthesising glycoproteins.

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..... [4]

(c) State **one** role of glycoproteins in the cell surface membrane.

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..... [1]

[Total: 8]

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