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* 0000800000001 * DFD

CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 3 8 7 5 6 0 6 9 3 1 *

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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 [ ].

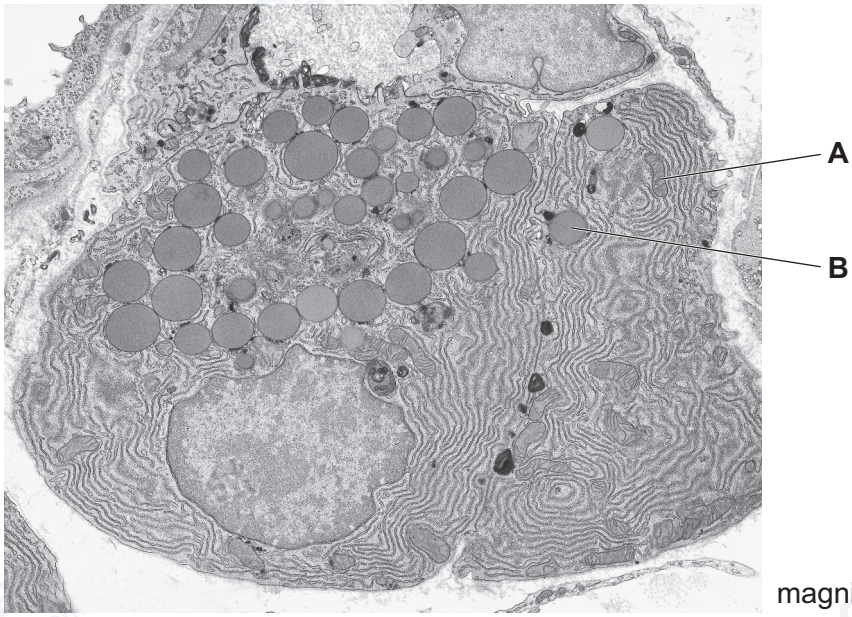
This document has **20** pages. Any blank pages are indicated.

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1 Figure 1.1 is a transmission electron micrograph of a section through part of the pancreas of a mammal.



magnification ×5000

Figure 1.1

(a) (i) Describe the steps to determine the actual length in micrometres (μm) of the organelle labelled **A** in Figure 1.1.

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..... [2]

(ii) The structures labelled **A** and **B** are visible when the cells in Figure 1.1 are viewed using a light microscope.

State **two other** structures in the cells shown in Figure 1.1 that are visible when using a light microscope.

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..... [1]

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(iii) Explain why some of the cell structures that are visible with the transmission electron microscope are **not** visible when using the light microscope.

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..... [2]

(b) The main function of the cells shown in Figure 1.1 is to synthesise and release enzymes that digest proteins, lipids and carbohydrates in the digestive system.

State the cell structures visible in Figure 1.1 that are involved with the synthesis and release of enzymes **and** outline the role of each structure in these processes.

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2 **(a)** Cholera, malaria and tuberculosis are infectious diseases. Vaccines are available for these three diseases.

(i) State why these three diseases are described as infectious diseases.

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..... [2]

(ii) There is no vaccine to provide protection from infection by HIV.

Suggest why it has been difficult to develop a vaccine to provide protection from infection by HIV.

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(b) Figure 2.1 shows how the number of new cases of HIV across the world changed between 1990 and 2022.

In 2015, the United Nations set a target to reduce the number of new cases of HIV as part of the programme to control HIV infection. This target is 0.18 million by 2030.

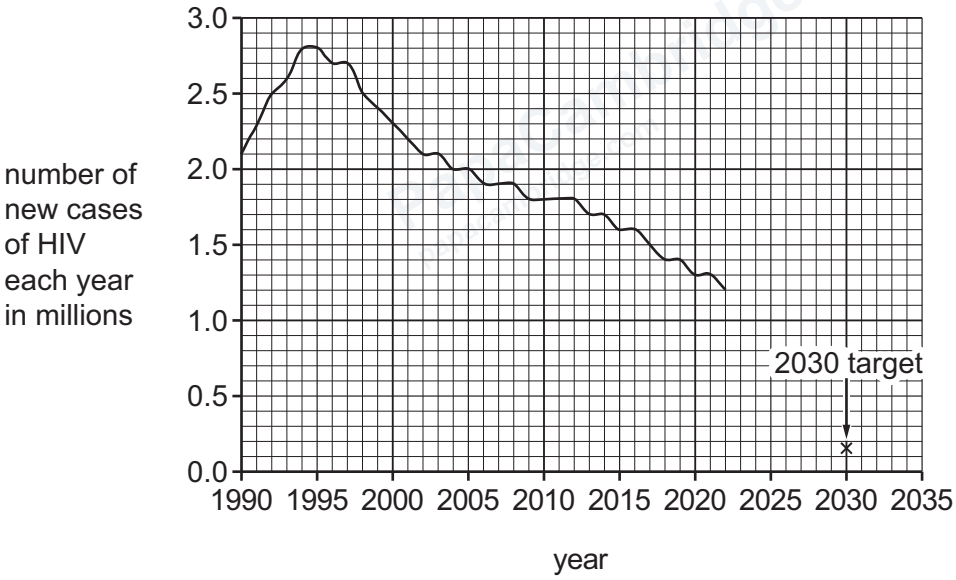


Figure 2.1

(i) Calculate the percentage decrease in the number of new cases of HIV from 2022 that will be needed to reach the target for 2030.

Space for working.

.....% [1]

(ii) Table 2.1 lists two of the aims set by health authorities to reduce the number of new cases of HIV.

Complete Table 2.1 by suggesting ways in which health authorities can achieve these aims.

Table 2.1

aim	way to achieve aim
to reduce the risk of HIV infection during blood transfusions	
to reduce the risk of new-born babies being infected with HIV	

[2]

[Total: 7]

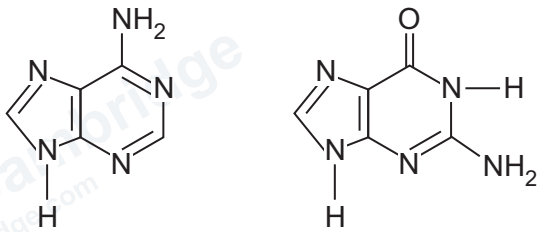
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3 **(a)** DNA and RNA are nucleic acids.

Figure 3.1 shows the five nitrogenous bases that are components of nucleic acids.

row 1



row 2

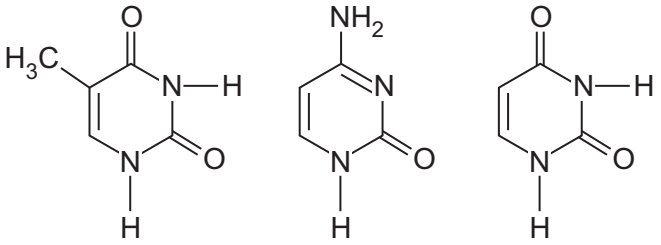


Figure 3.1

(i) A student made two correct statements about the nitrogenous bases shown in Figure 3.1:

- DNA and RNA have the nitrogenous bases in row 1
- DNA and RNA each have two of the nitrogenous bases in row 2, but **not** all three.

Explain how the structure of DNA and the structure of RNA support these two statements.

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(ii) Outline what happens to each nitrogenous base before it can form part of the structure of a nucleic acid.

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..... [2]

(iii) Describe the features of the genetic code that explain how a sequence of nitrogenous bases in messenger RNA (mRNA) can determine the sequence of amino acids in a polypeptide.

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..... [4]

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(b) Figure 3.2 shows the mitotic cell cycle of a mammalian stem cell.

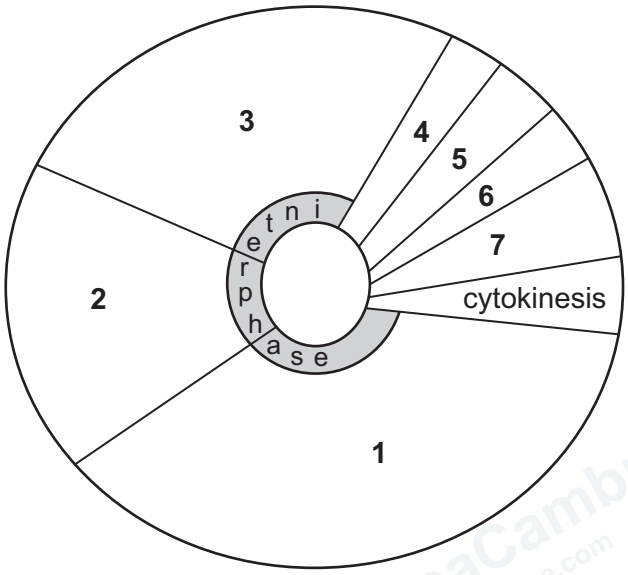


Figure 3.2

(i) There are various processes involving DNA in the nucleus that occur during the cell cycle.

Complete Table 3.1 to identify the process involving DNA in the nucleus in each of the stages of the cell cycle, identified by the numbers on Figure 3.2. The process for stage 3 has been done for you.

Table 3.1

stage	process involving DNA in the nucleus
1	
2	
3	error checking
4	

[3]

(ii) Describe how cytokinesis results in the formation of two separate cells.

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..... [2]

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(iii) State the function of DNA polymerase **and** the function of DNA ligase in the cell cycle.

DNA polymerase .....

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DNA ligase .....

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[3]

[Total: 17]

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4 A student investigated the structure of muscular arteries.

Figure 4.1 is a photomicrograph of a transverse section (TS) of a muscular artery and surrounding tissue.

Figure 4.2 is a photomicrograph of part of a TS of the muscular artery as indicated in Figure 4.1.

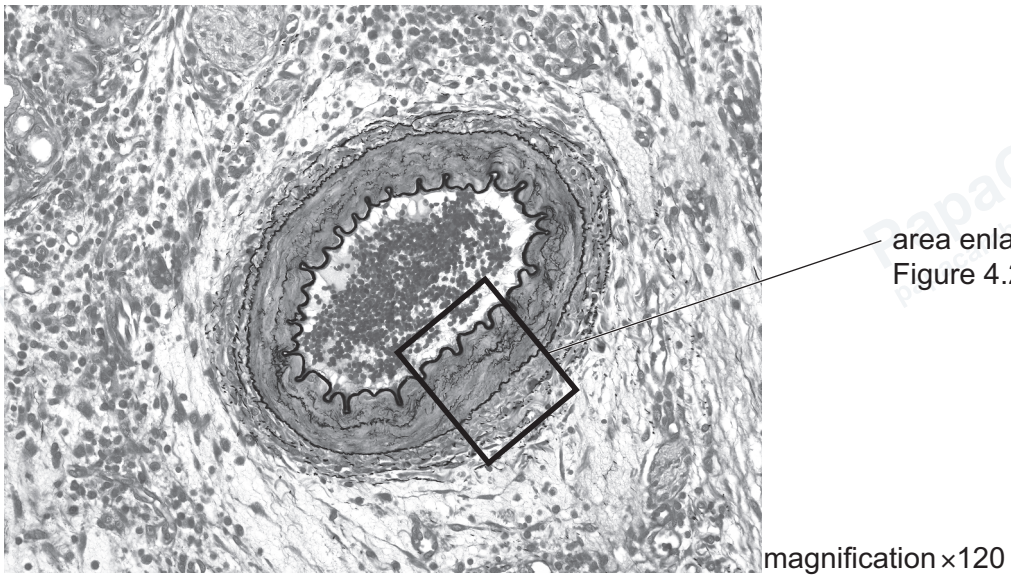


Figure 4.1

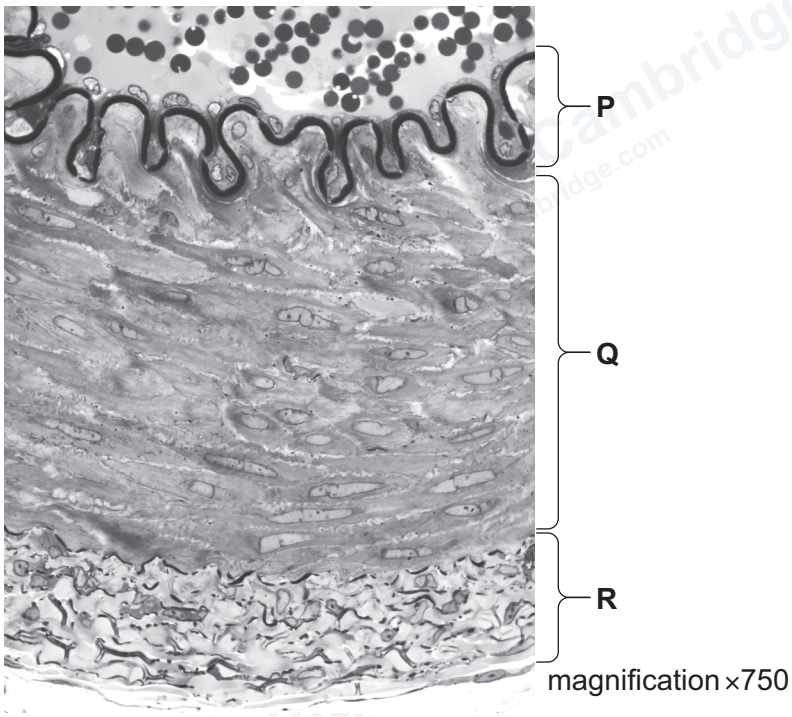


Figure 4.2

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(a) (i) Identify the main component of each of the regions **P**, **Q** and **R** shown in Figure 4.2.

P .....

Q .....

R .....

[3]

(ii) Explain how the structure of the muscular artery shown in Figure 4.1 and Figure 4.2 is related to its function.

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..... [3]

(iii) Describe how the appearance of a TS through the aorta of a mammal differs from the appearance of the TS of the muscular artery shown in Figure 4.1.

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(b) The student did not observe any neutrophils or lymphocytes in the blood in the centre of the section shown in Figure 4.1.

Draw a neutrophil and a lymphocyte, as seen in a sample of mammalian blood that has been stained to show nuclei.

Do **not** add any labels.

neutrophil lymphocyte

[2]

(c) The student also investigated transverse sections of lung tissue.

State **one** feature of the wall of a bronchus that is **not** found in the wall of an artery in lung tissue.

..... [1]

[Total: 11]

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5 Mesophyll cells in plant leaves synthesise sucrose from the products of photosynthesis. The enzyme sucrose synthase catalyses the final reaction in the synthesis of sucrose.

(a) Name the **two** monosaccharides that are used to make sucrose.

..... [1]

(b) Scientists studying a species of flowering plant investigated the movement of sucrose from mesophyll cells through phloem parenchyma cells and companion cells into sieve tubes.

Figure 5.1 shows the movement of sucrose from a mesophyll cell to a phloem sieve tube element in the vein of a leaf.

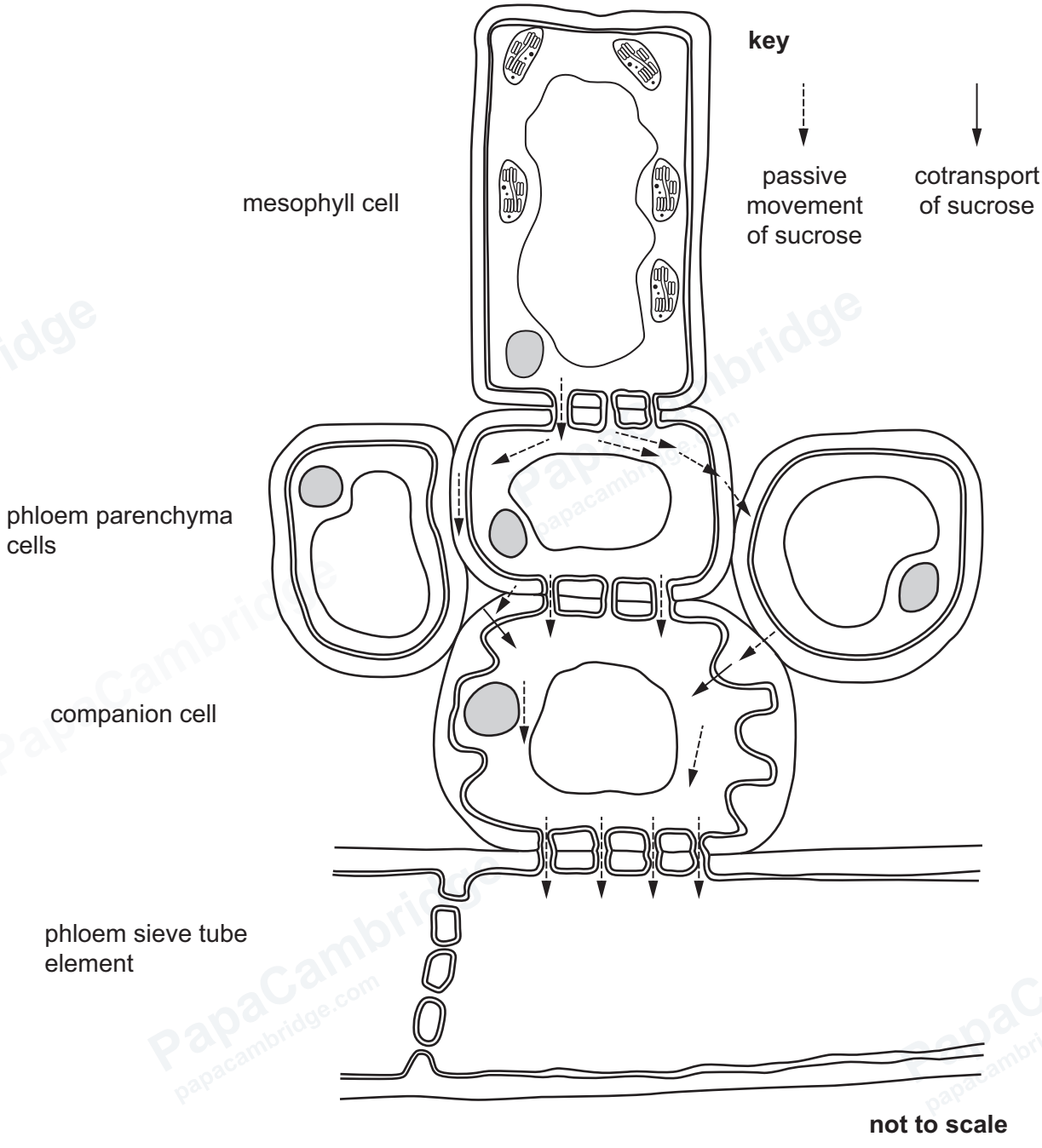


Figure 5.1

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Explain how sucrose moves from the mesophyll cell to the phloem sieve tube element, as shown in Figure 5.1.

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..... [5]

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(c) The scientists discovered a protein in the cell surface membrane of phloem parenchyma cells that transports sucrose out of the cells.

Figure 5.2 shows the structure of the membrane protein, known as SWEET, in the cell surface membrane.

Figure 5.3 shows the membrane protein viewed from the surface of the cell.

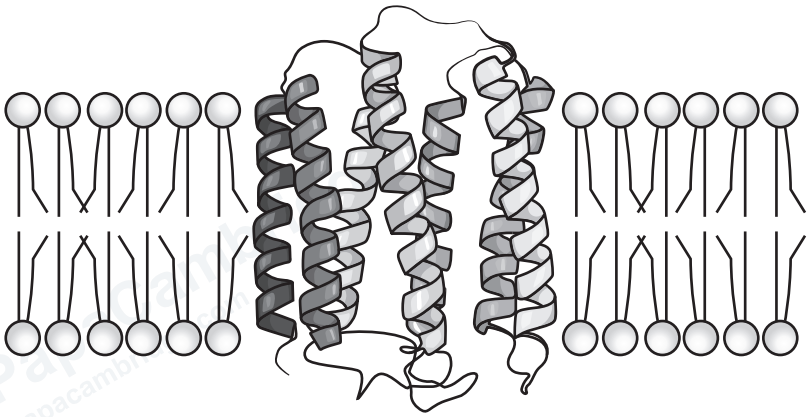


Figure 5.2

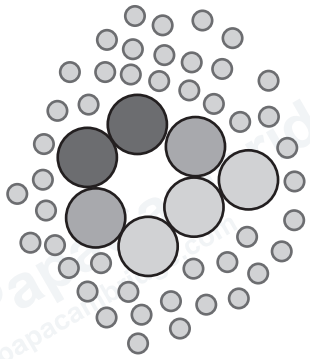


Figure 5.3

(i) Describe the structure **and** arrangement of the SWEET protein as shown in Figure 5.2.

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..... [3]

(ii) Explain why SWEET proteins are needed for the movement of sucrose out of the phloem parenchyma cell shown in Figure 5.1.

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[Total: 11]

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6 Monoclonal antibodies are used in many diagnostic tests.

Figure 6.1 shows stages in the production of a monoclonal antibody.

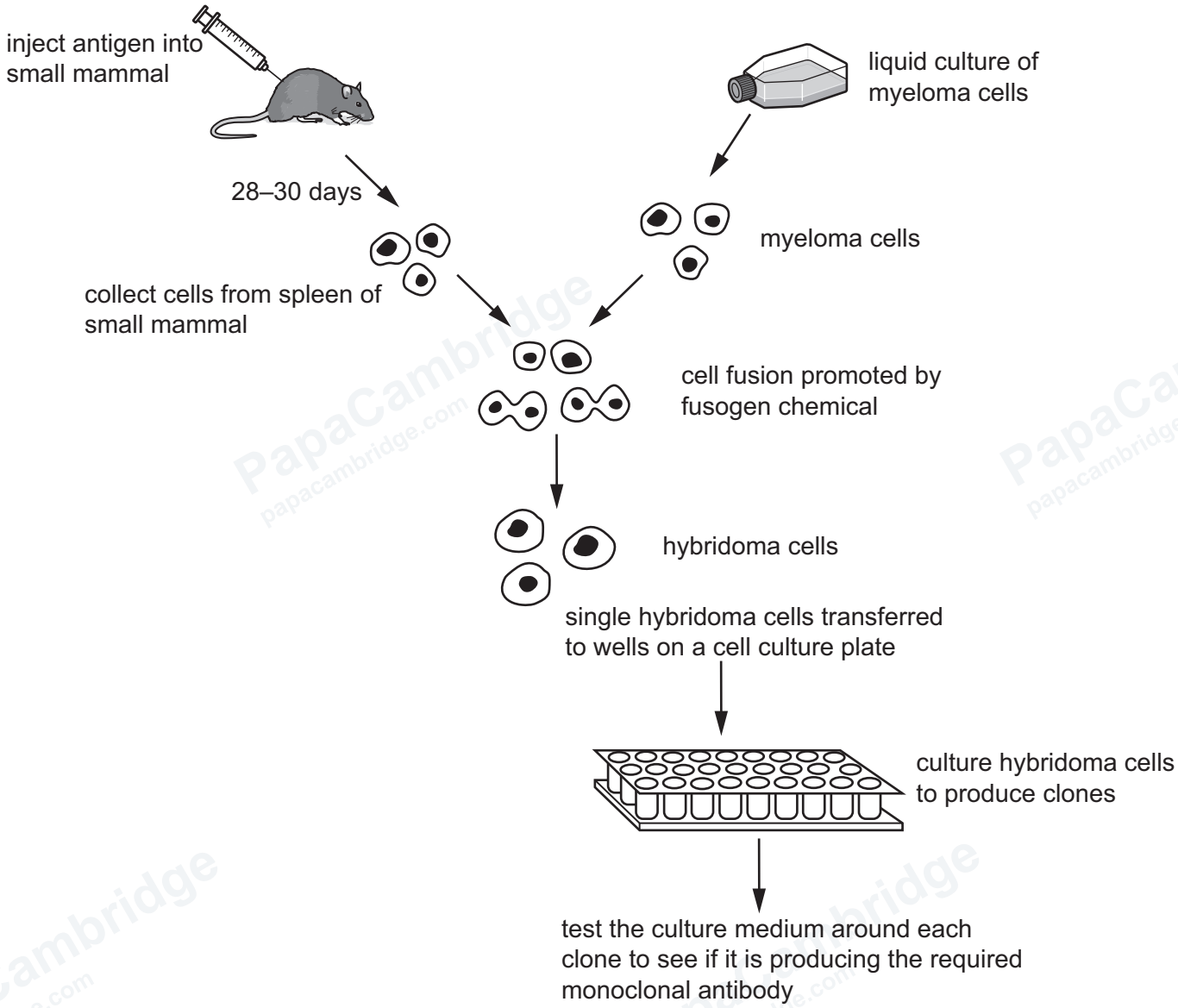


Figure 6.1

(a) State the name of the type of cell that is collected from the spleen of the small mammal.

..... [1]

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(b) Explain why myeloma cells are used in the production of monoclonal antibodies.

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..... [2]

(c) Mpox is a viral disease. Scientists used the procedure shown in Figure 6.1 to develop a monoclonal antibody for use in diagnostic test strips.

The culture medium around each of the clones shown in Figure 6.1 was tested to find a suitable monoclonal antibody to detect the mpox virus in blood samples of people who might have been exposed to the disease.

Suggest how the culture medium around each of the clones can be tested to find a monoclonal antibody suitable for the diagnostic test strips.

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..... [1]

(d) Monoclonal antibodies that are produced in the way shown in Figure 6.1 are not suitable for the long-term treatment of human diseases.

Scientists have solved this problem by producing monoclonal antibodies using small mammals in which the gene coding for the heavy polypeptides of their antibodies is replaced by the gene from humans.

Explain the advantage of using these modified small mammals in the production of monoclonal antibodies for use in the long-term treatment of human diseases.

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[Total: 6]

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