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* 0000800000001 * DFD

CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 7 3 5 4 4 4 6 9 8 7 *

BIOLOGY **9700/23**

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 The different structures in the human gas exchange system vary in the tissues and types of cell that are present.

Figure 1.1 is a photomicrograph showing a section of one of the structures in the human gas exchange system.

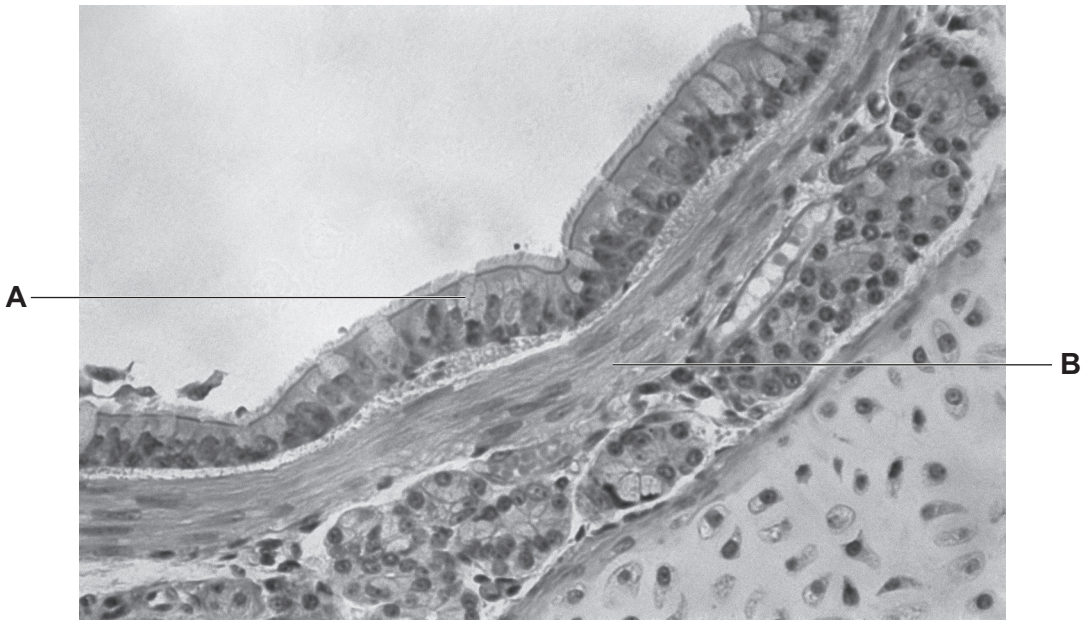


Figure 1.1

(a) (i) Name the cell labelled **A** in Figure 1.1.

..... [1]

(ii) Name the tissue labelled **B** in Figure 1.1.

..... [1]

(iii) Explain why the structure in the human gas exchange system shown in Figure 1.1 is **not** a bronchiole.

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..... [2]

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(b) Several different types of epithelial cell are present in the human gas exchange system.

These cells have different surface area to volume ratios (SA : V).

(i) A diagram of a columnar epithelial cell is shown in Figure 1.2.

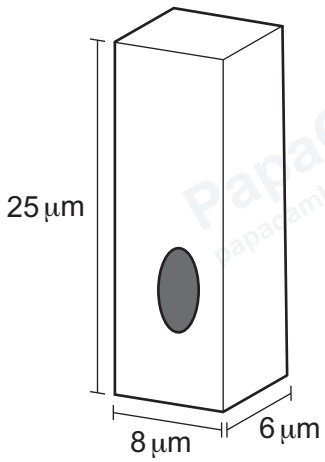


Figure 1.2

The cell in Figure 1.2 has a volume of 1200 μm^3.

Calculate the SA : V of the cell shown in Figure 1.2.

Show your working **and** give the value of SA to **one** significant figure.

The value of V is 1.

SA : V ..... : 1 [2]

(ii) A squamous epithelial cell has a typical SA : V of 10 : 1.

Explain why the high SA : V of a squamous epithelial cell is beneficial for gas exchange.

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..... [2]

[Total: 8]

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2 *Parakaryon myojinensis* is a single-celled organism. The species was discovered in 2012.

P. myojinensis is unusual because it has features of prokaryotes and eukaryotes. It also has features that are **not** present in prokaryotes or in eukaryotes.

Figure 2.1 shows a diagram of *P. myojinensis*.

The endosymbionts present in the cell of *P. myojinensis* are organisms that can be present inside some prokaryotic cells and some eukaryotic cells.

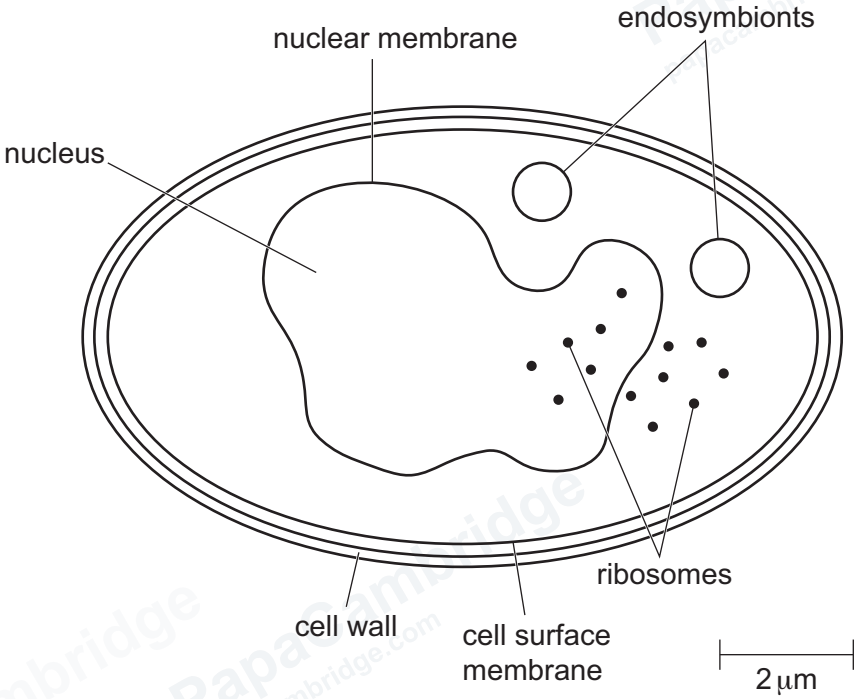


Figure 2.1

(a) (i) State **one** difference, **other than** the presence of a nucleus and endosymbionts, between the *P. myojinensis* cell shown in Figure 2.1 and a typical prokaryotic cell.

.....

..... [1]

(ii) State the differences between the *P. myojinensis* cell in Figure 2.1 and a typical eukaryotic cell.

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..... [2]

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(iii) Chemical analysis of the cell wall of *P. myojinensis* could provide information about how this organism compares with prokaryotes and with eukaryotes.

Suggest how the results of this chemical analysis may show how this organism compares with prokaryotes and with eukaryotes.

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..... [2]

(b) Outline how the actual length of a cell of *P. myojinensis* can be determined using a light microscope, a stage micrometer and an eyepiece graticule.

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..... [2]

[Total: 7]

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3 Hydrogen bonding has many important roles in organisms.

(a) State **and** explain the importance of hydrogen bonding for the specific heat capacity of water **and** for the latent heat of vaporisation of water.

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..... [3]

(b) Describe **and** explain the role of hydrogen bonding in the movement of water in xylem vessels in plants.

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(c) Figure 3.1 shows part of a DNA molecule.

The four bases in Figure 3.1 are labelled **W**, **X**, **Y** and **Z**.

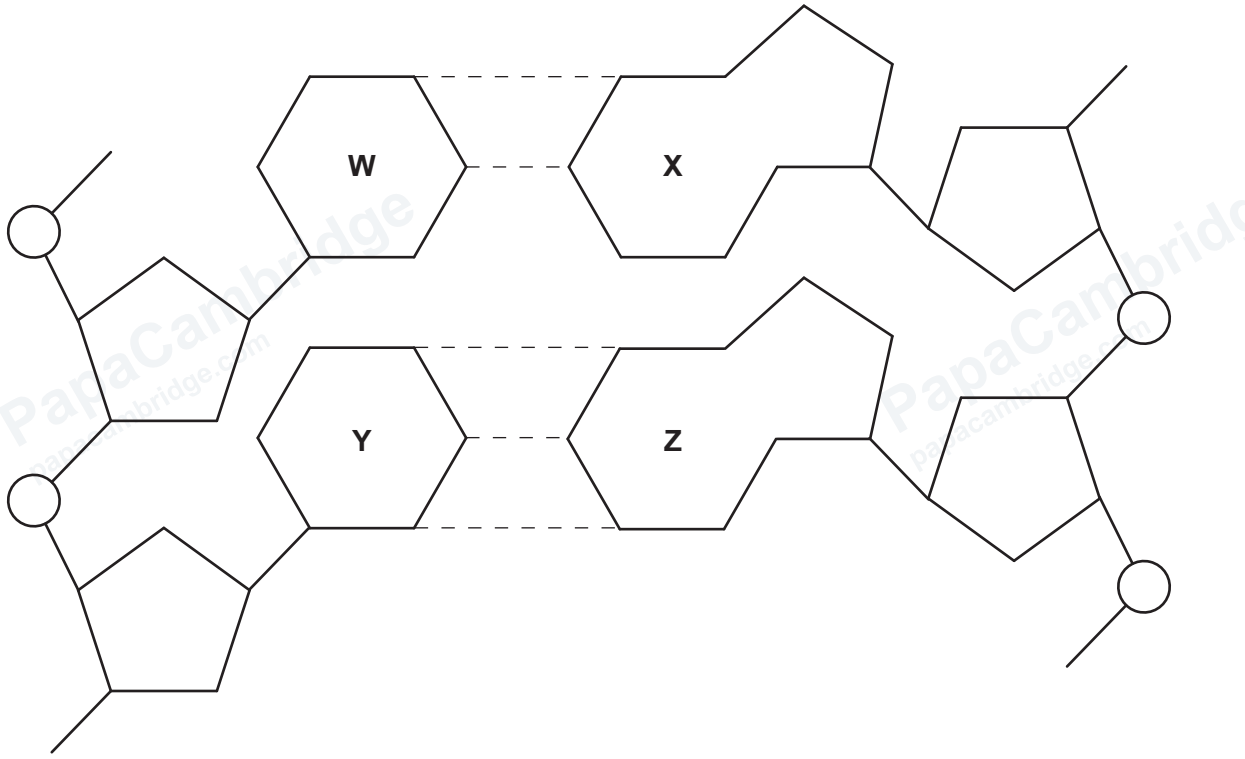


Figure 3.1

State the **names** of bases **W**, **X**, **Y** and **Z** in Figure 3.1.

W .....

X .....

Y .....

Z .....

[3]

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(d) Table 3.1 lists three types of interaction that maintain the shape of protein molecules.

Complete Table 3.1 by placing a tick (✓) in the box if the type of interaction can affect the primary structure, secondary structure or tertiary structure of a protein.

Table 3.1

interaction	primary structure	secondary structure	tertiary structure
hydrogen bonds			
hydrophobic interactions			
ionic bonds			

[3]

[Total: 12]

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4 Tetanus is a disease caused by infection with the bacterium *Clostridium tetani*.

A vaccine is available to provide protection against tetanus.

(a) The passage outlines some information about tetanus and *C. tetani*.

Complete the passage by using the most appropriate scientific terms.

Tetanus is unlike other diseases for which vaccines are available because it cannot be passed from an infected person to another person. Tetanus is therefore **not** considered to be a ..... disease. However, the bacterium *C. tetani* can be described as a ..... because it causes a disease when it infects an individual. *C. tetani* can enter the human body when a person has a wound that makes contact with substances that contain *C. tetani*, such as soil or dust.

[2]

(b) *C. tetani* releases a toxin, which produces the symptoms of tetanus in an infected person. The tetanus toxin is a protein, with part of its structure functioning as an enzyme.

Figure 4.1 shows the simplified structure of the tetanus toxin.

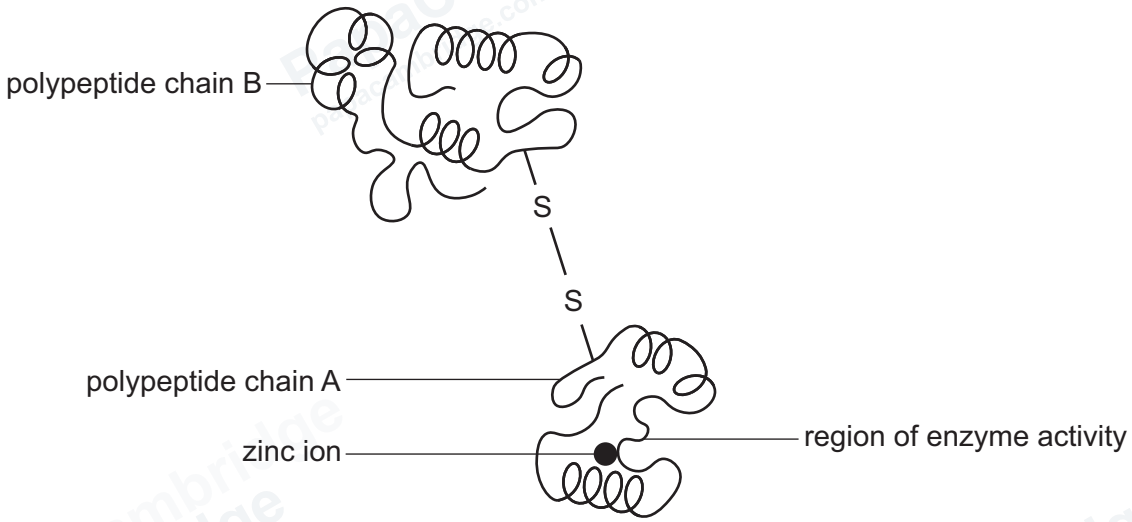


Figure 4.1

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Describe the structure of the tetanus toxin shown in Figure 4.1.

In your answer, you should link the descriptions to the different levels of protein structure shown in Figure 4.1.

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..... [4]

(c) The tetanus toxin enters nerve cells (neurones), where it causes the symptoms of the disease.

Figure 4.2 shows the entry of the tetanus toxin into a neurone.

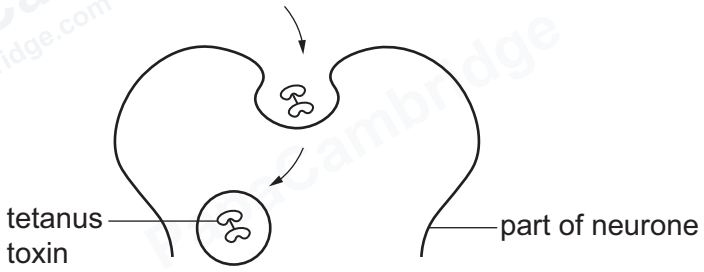


Figure 4.2

State the name of the process by which the toxin enters the neurone, as shown in Figure 4.2.

..... [1]

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(d) The symptoms of tetanus can develop in a person very quickly after infection by *C. tetani*.

People can gain immunity to infection by *C. tetani* in a number of different ways.

Table 4.1 describes three ways in which immunity to infection by *C. tetani* can develop in a person.

Complete Table 4.1 by naming the types of immunity that are described.

Table 4.1

description	types of immunity
Antibodies against tetanus toxin are passed from the mother to the fetus during pregnancy.	..... and .....
Inactivated tetanus toxin is injected into a person.	..... and .....
Anti-tetanus antibodies are injected into a person who has been exposed to *C. tetani*.	..... and .....

[3]

(e) Table 4.2 lists some events that occur during a primary immune response to infection by *C. tetani*.

Each event is represented by a letter.

Table 4.2

letter	event
A	antibodies are released into the circulation
B	antigens are presented on the surface of a macrophage
C	B-lymphocytes differentiate into plasma cells
D	T-helper cells produce cytokines that stimulate B-lymphocytes
E	T-helper cells are activated and divide by mitosis
F	pathogen enters macrophage by phagocytosis

State the sequence of letters that shows a correct order of events that occur during an immune response.

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[3]

[Total: 13]

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5 **(a)** The diagrams in Figure 5.1 represent three types of circulatory system, **G**, **H** and **J**, found in animals.

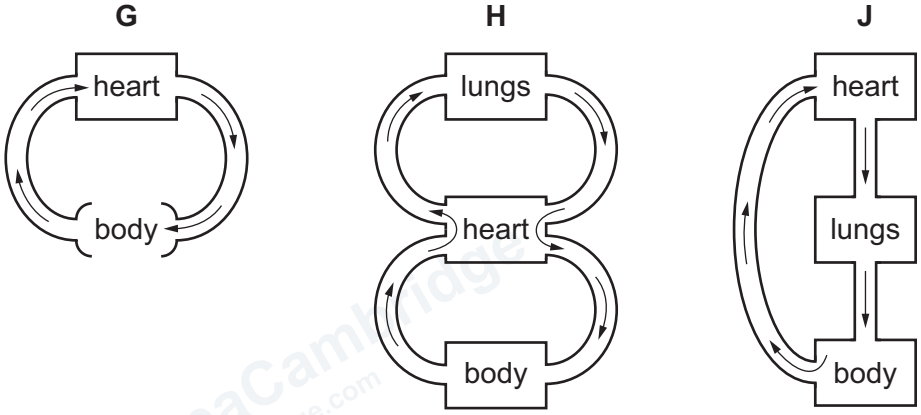


Figure 5.1

State which of the letters, **G**, **H** or **J**, in Figure 5.1 represents the circulatory system found in mammals. Give **two** reasons for your choice.

letter .....

reason 1 .....

.....

reason 2 .....

.....

[2]

(b) In mammals, water and some dissolved substances move from the blood in capillaries into tissue fluid.

Describe **and** explain the formation of tissue fluid in a capillary network.

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..... [4]

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(c) Water takes different pathways from the soil to the xylem in plants.

Describe the different pathways taken by water from the soil to the xylem.

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..... [5]

[Total: 11]

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6 DNA replication occurs in interphase during the cell cycle.

(a) DNA ligase is involved in DNA replication.

Figure 6.1 shows a diagram of DNA ligase.

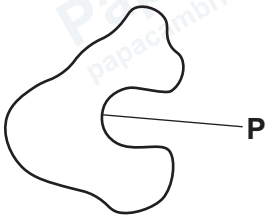


Figure 6.1

The site labelled **P** in Figure 6.1 is where the substrate binds.

With reference to the mode of action of enzymes, explain how DNA ligase allows successful DNA replication to occur.

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..... [3]

(b) State the phases that occur in interphase **and** outline the events that occur in each phase.

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..... [4]

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(c) Mitosis occurs after interphase in the cell cycle.

Figure 6.2 shows plant cells in stages of mitosis.

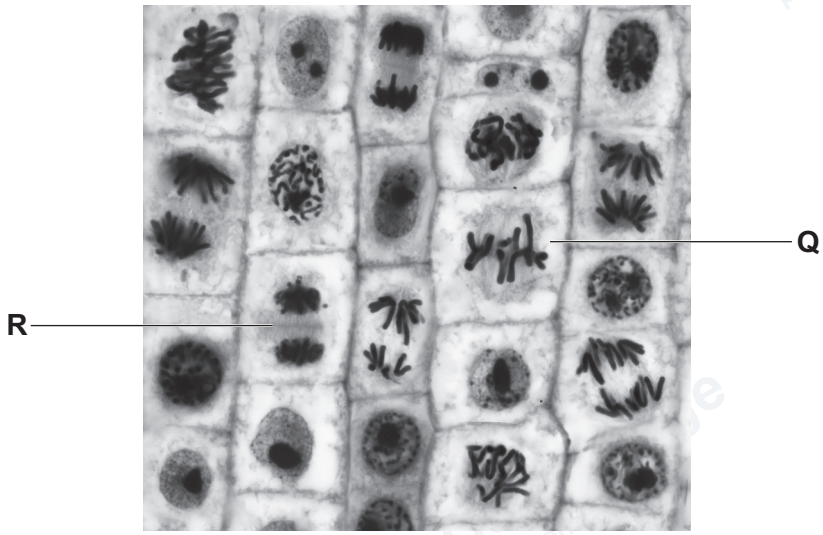


Figure 6.2

(i) Name the stage of mitosis that is occurring in the cell labelled **Q** in Figure 6.2.

..... [1]

(ii) State the process that is happening at the region labelled **R** in Figure 6.2.

..... [1]

[Total: 9]

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