Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 2025**

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.

[Turn over

1 *Ranunculus* is a group (genus) of dicotyledonous plants that includes more than 1600 species.

(a) Fig. 1.1 is a photomicrograph of a transverse section through part of a root of a *Ranunculus* species.

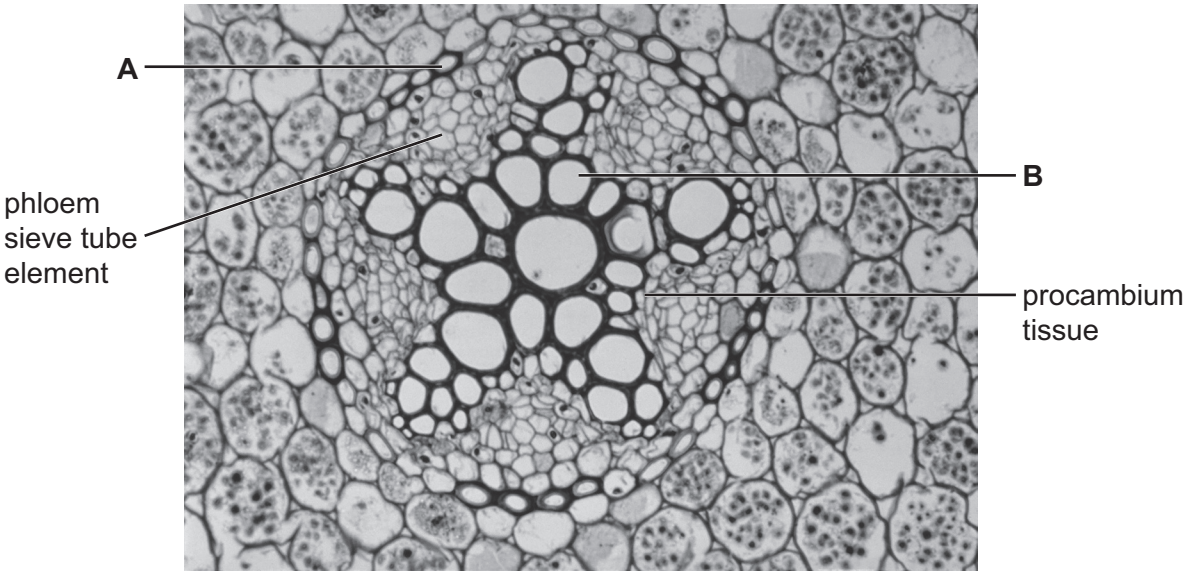

Fig. 1.1

(i) Name the cells labelled **A** and **B** in Fig. 1.1.

A .....

B .....

[2]

(ii) The procambium tissue shown in Fig. 1.1 consists of stem cells.

Suggest a role of the procambium tissue in the roots of this plant.

.....

.....

..... [1]

(b) Some species in the *Ranunculus* genus are xerophytes.

State **and** explain **two** adaptations of the leaves of xerophytic plants that reduce water loss.

adaptation .....

.....

explanation .....

.....

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adaptation .....

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explanation .....

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[4]

[Total: 7]

2 Bees are insects that produce venom as a means of self-defence.

Melittin is a polypeptide present in the venom of bees.

(a) Lysine is one of the amino acids present in melittin.

Fig. 2.1 shows an incomplete diagram of the structure of lysine.

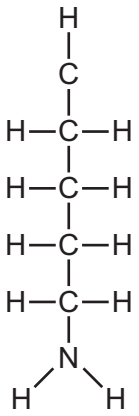

Fig. 2.1

(i) State the number of carbon atoms in the R group of lysine.

..... [1]

(ii) Complete the diagram of the structure of lysine in Fig. 2.1. [2]

(b) Descriptions of the structure of melittin are shown in Table 2.1.

Complete Table 2.1 by writing the level of protein structure that applies to each description.

Table 2.1

description	level of protein structure
in some conditions, four melittin polypeptides can bind to each other	
a melittin polypeptide consists of a sequence of 26 amino acids	
alpha helices are formed at each end of a melittin polypeptide	

[3]

(c) When a bee stings a person, venom enters the body.

Melittin in the venom interacts with cell surface membranes of body cells, as shown in Fig. 2.2.

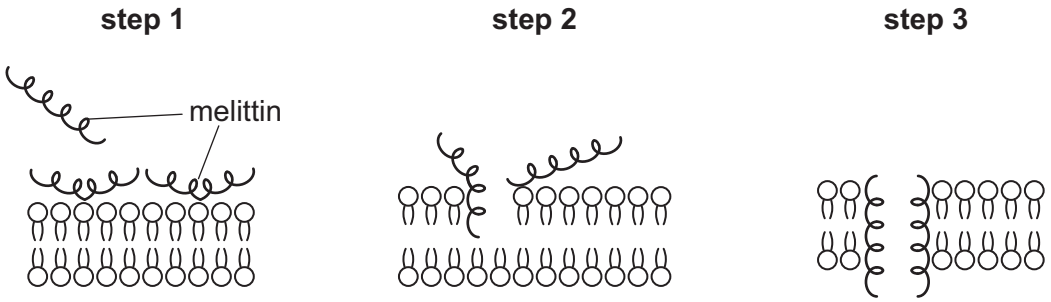

Fig. 2.2

Outline how melittin affects the structure of a cell surface membrane, as shown in Fig. 2.2.

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.....

.....

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..... [2]

(d) Cells that have been affected by melittin break down into cell fragments.

These cell fragments are taken in by phagocytes for further breakdown.

Describe the process by which phagocytes take in and break down these cell fragments.

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.....

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.....

..... [4]

[Total: 12]

3 *Staphylococcus epidermidis* is a species of bacterium that lives on human skin.

Staphylococcus aureus is a pathogenic bacterium that can infect humans.

(a) *S. epidermidis* and *S. aureus* are prokaryotes.

Table 3.1 shows some cell features that could apply to typical prokaryotic cells or to typical eukaryotic cells or to both types of cell.

Complete Table 3.1 by using a tick (✓) if the feature applies to the type of cell or a cross (✗) if the feature does not apply to the type of cell.

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

Table 3.1

feature	prokaryotic cell	eukaryotic cell
circular DNA		
80S ribosomes		
a cell diameter of 20 μm		

[3]

(b) One way that *S. aureus* can infect humans is through wounds (breaks) in the skin.

Populations of *S. aureus* develop on human skin as part of a biofilm. The biofilm contains cells of *S. aureus* within a mixture of polymers that have been secreted by the cells.

S. epidermidis produces a protease enzyme that prevents the growth of *S. aureus* populations on human skin. Proteases catalyse the breakdown of proteins.

Fig. 3.1 is a diagram showing populations of *S. epidermidis* and *S. aureus* on human skin cells.

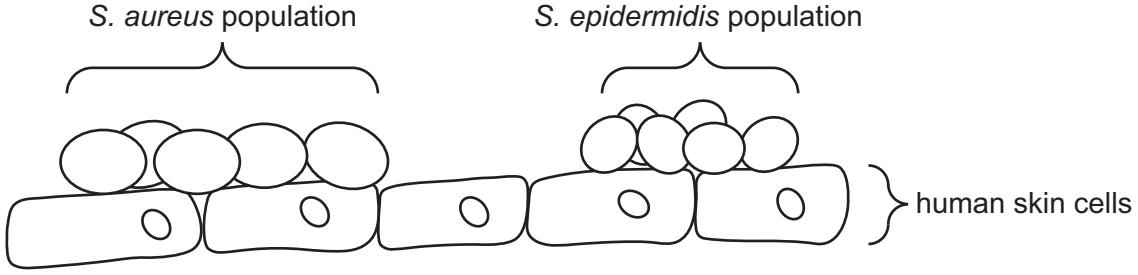

Fig. 3.1

Suggest **and** explain how the protease produced by *S. epidermidis* cells prevents the growth of an *S. aureus* population on human skin.

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.....

.....

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.....

.....

..... [3]

(c) *S. aureus* can infect many tissues in the human body, including tissues in the gas exchange system.

(i) Describe the role of goblet cells in the protection of tissues in the trachea from infection by *S. aureus*.

.....

.....

.....

..... [2]

(ii) *S. aureus* cells can infect tissues by passing in between cells that line the lumen of the trachea.

State the name of a cell type, **other than** goblet cells, that lines the lumen of the trachea.

..... [1]

(d) Vancomycin and penicillin are antibiotics that are used to treat infectious diseases caused by *S. aureus*.

Fig. 3.2 shows the mechanism of action of vancomycin.

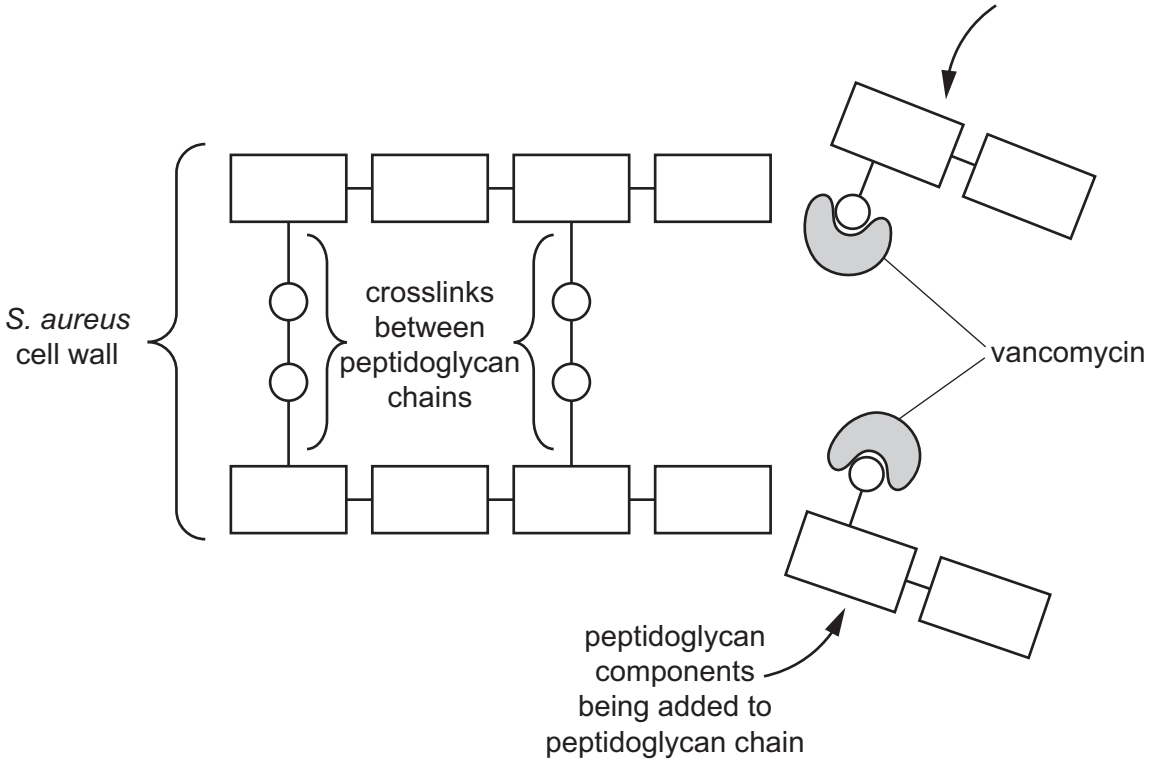

Fig. 3.2

(i) Vancomycin and penicillin act on the cell wall of bacterial cells.

With reference to Fig. 3.2, describe the similarities **and** differences between the mechanism of action of vancomycin and the mechanism of action of penicillin.

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..... [3]

(ii) Some strains of *S. aureus* are resistant to vancomycin and penicillin.

Describe the steps that can be taken to reduce the impact of antibiotic resistance.

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..... [3]

[Total: 15]

4 Lysosomes are membrane-bound organelles found in mammalian cells.

(a) Scientists measured the concentration of cholesterol in the membranes of lysosomes in a mammalian cell.

The concentration of cholesterol in the lysosome membranes was found to be lower than the concentration in other membranes inside mammalian cells.

(i) State how a lower concentration of cholesterol would make the properties of lysosome membranes different from other membranes in mammalian cells.

.....

.....

..... [1]

(ii) Suggest why the lower concentration of cholesterol in lysosome membranes would help lysosomes carry out their function.

.....

.....

..... [1]

(b) The enzyme α-galactosidase is present in lysosomes.

Students investigated the effect of substrate concentration on the rate of reaction catalysed by α-galactosidase at pH 4.5 and at pH 5.9.

The results are shown in Fig. 4.1.

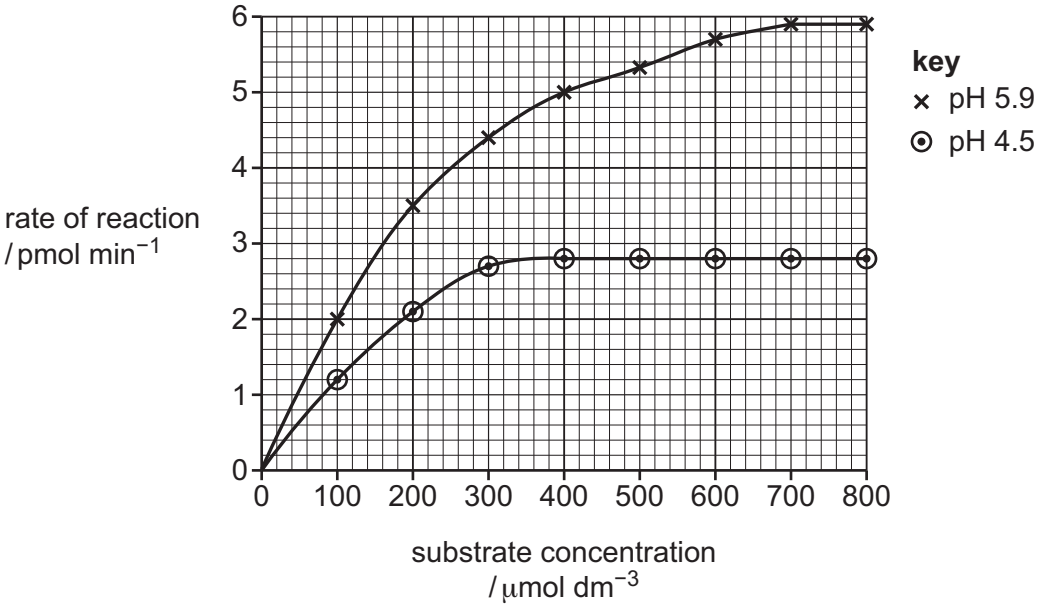

Fig. 4.1

(i) Determine the Michaelis–Menten constant, K_m, for α-galactosidase at pH 4.5 using the data in Fig. 4.1.

State the unit for the K_m value in your answer.

K_m = ... unit ..... [2]

(ii) With reference to Fig. 4.1, describe the differences in the results at pH 4.5 and pH 5.9 **and** suggest explanations for the differences.

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..... [4]

[Total: 8]

5 Telomeres are lengths of DNA that consist of repetitive nucleotide sequences. Telomeres are present in eukaryotic chromosomes.

(a) Outline the role of telomeres in eukaryotic chromosomes.

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..... [3]

(b) Fig. 5.1 shows part of the telomere nucleotide sequence in one of the DNA strands.

A A T C C C A A T C C C A A T C C C

Fig. 5.1

Scientists have found that the DNA in telomeres can be transcribed to produce RNA known as TERRA.

(i) TERRA is transcribed from the DNA nucleotide sequence shown in Fig. 5.1.

Complete Fig. 5.2 to show the six bases in the RNA sequence of TERRA.

DNA sequence:	**A**	**A**	**T**	**C**	**C**	**C**
RNA sequence:	……	……	……	……	……	……

Fig. 5.2

[1]

(ii) Fig. 5.3 is a diagram showing DNA triplet codes on the non-transcribed strand of a gene and the amino acids coded by the triplets.

The bases in the centre of the diagram represent the first base in a triplet.

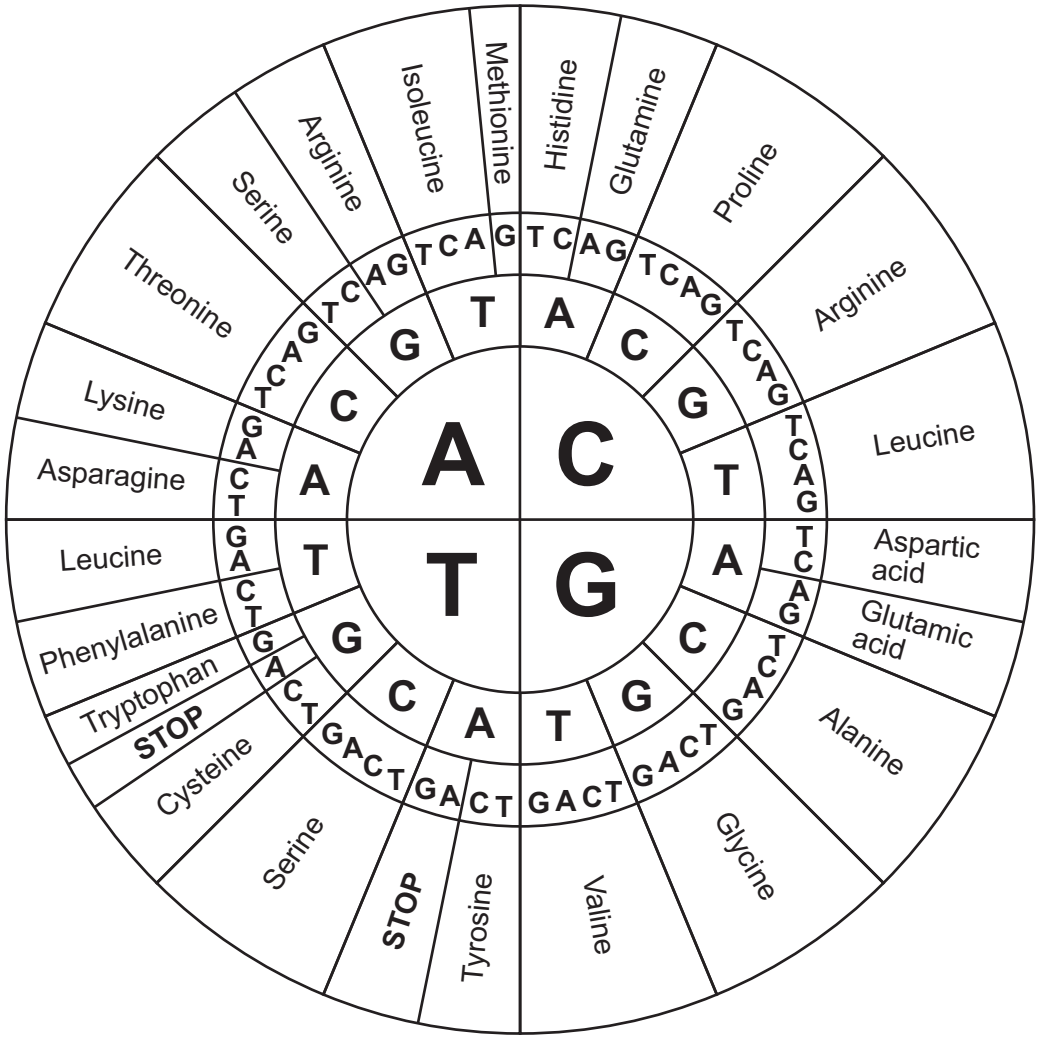

Fig. 5.3

Dipeptides are sometimes translated from TERRA RNA.

Use Fig. 5.3 to state the **two** amino acids in the dipeptide translated from TERRA RNA.

1 .....

2 .....

[2]

(iii) Scientists have discovered that TERRA interacts with genes in stem cells.

Increased concentrations of TERRA in stem cells result in a large increase in the number of genes that are transcribed.

Suggest the result of the large increase in the number of genes that are transcribed in stem cells.

.....

..... [1]

[Total: 7]

6 Monoclonal antibodies can be used in the treatment of disease.

(a) Describe how monoclonal antibodies are produced using the hybridoma method.

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..... [5]

(b) Abciximab is a drug developed from a monoclonal antibody. Abciximab is used to prevent blood clotting in the coronary arteries in people with coronary heart disease.

Abciximab prevents blood clotting by stopping structures called platelets from binding together.

Fig. 6.1 shows platelets and abciximab in a coronary artery.

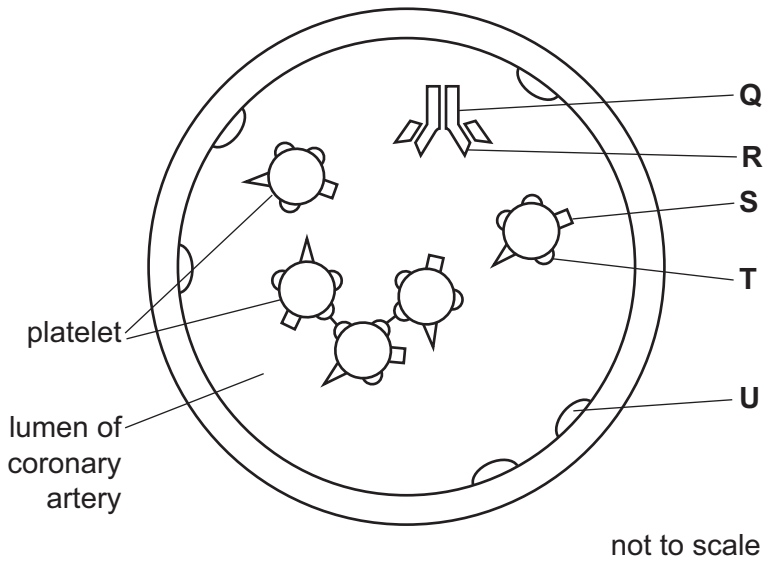

Fig. 6.1

State the letter in Fig. 6.1 that represents:

- the target antigen for abciximab ……..
- the constant region of abciximab ……..
- one of the antigen binding sites of abciximab …….. .

[3]

(c) Coronary arteries supply oxygenated blood to the cells of the heart.

The passage outlines the cardiac cycle of the heart and the structures in the heart that control the cycle.

Complete the passage by using the most appropriate scientific terms.

The sinoatrial node is located in the wall of the ……..., one of four chambers of the mammalian heart. Electrical impulses from the sinoatrial node reach the atrioventricular node, which transmits impulses towards the apex of the heart along a series of specialised muscle fibres called ……. Pressure increases in the ventricles when they contract in the stage of the cardiac cycle known as ……..

[3]

[Total: 11]

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