Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **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 80.
- 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 **(a)** Fig. 1.1 shows part of the human gas exchange system.

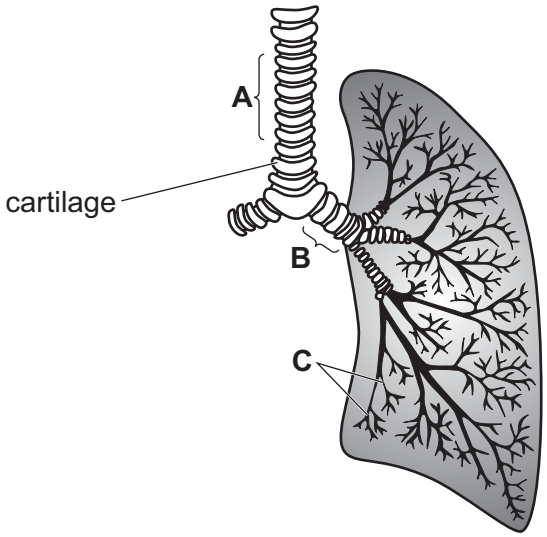

Fig. 1.1

(i) Identify structures **A**, **B** and **C** shown in Fig. 1.1.

A .....

B .....

C .....

[3]

(ii) State the function of the cartilage shown in Fig. 1.1.

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..... [1]

(iii) Explain how inspiration occurs.

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..... [4]

(b) Cystic fibrosis is a condition that affects the lungs. People with cystic fibrosis have mucus in the airways of their lungs that is thicker and stickier than usual.

(i) Two types of cells that line the airways protect the body against pathogens and particles.

State the names of these **two** types of cell **and** describe how they protect the body.

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..... [3]

(ii) Suggest how having thicker and stickier mucus in the airways affects the ability of a person to do exercise.

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..... [4]

(c) Cystic fibrosis is an inherited condition in humans caused by a recessive allele of a gene.

There are two alleles for this gene:
- the allele for no cystic fibrosis is represented by the letter **F**
- the allele for cystic fibrosis is represented by the letter **f**.

Two heterozygous parents wanted to have a child.

Complete the genetic diagram to predict the probability of these parents having a child with cystic fibrosis.

parental phenotypes no cystic fibrosis x no cystic fibrosis

parental genotypes ..... x .....

gametes ..... , ... x ..... , ...

offspring genotypes ....

offspring phenotypes ....

probability of having a child with cystic fibrosis .....

[5]

[Total: 20]

2 Fig. 2.1 is a photomicrograph of human blood.

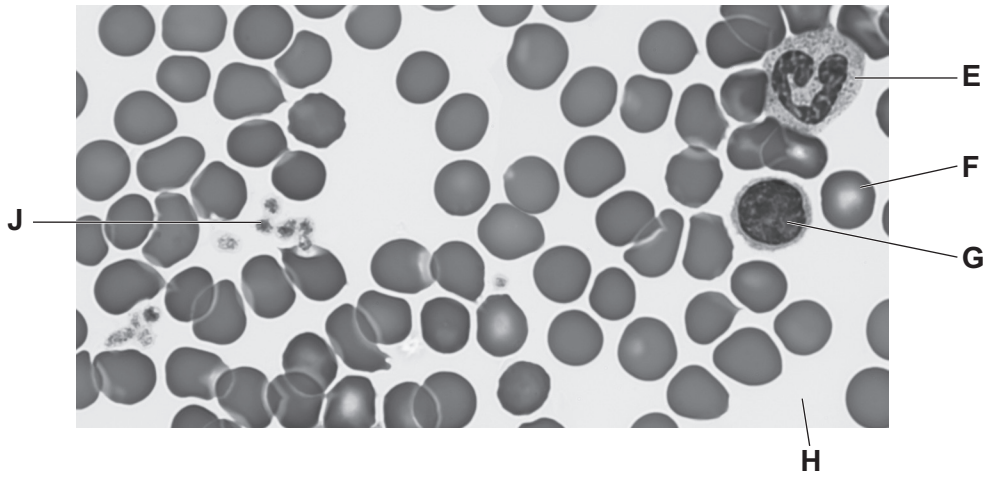

Fig. 2.1

(a) Use the information in Fig. 2.1 to complete Table 2.1.

Table. 2.1

component of blood	letter from Fig. 2.1	function
red blood cell		
		production of antibodies
	H	
		phagocytosis
platelet	**J**	

[5]

(b) Some diseases are transmissible.

(i) State the name of a pathogen that is transmitted by direct contact with blood.

..... [1]

(ii) State **two** ways that a pathogen can be transmitted **indirectly**.

1 .....

2 .....

[2]

(c) Describe the role of antibodies in the defence against pathogens.

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..... [3]

(d) Explain how active immunity differs from passive immunity.

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..... [3]

[Total: 14]

3 Scientists developed genetically modified (GM) maize.

Fig. 3.1 shows the mass of GM maize grown in one country from 2000 to 2015.

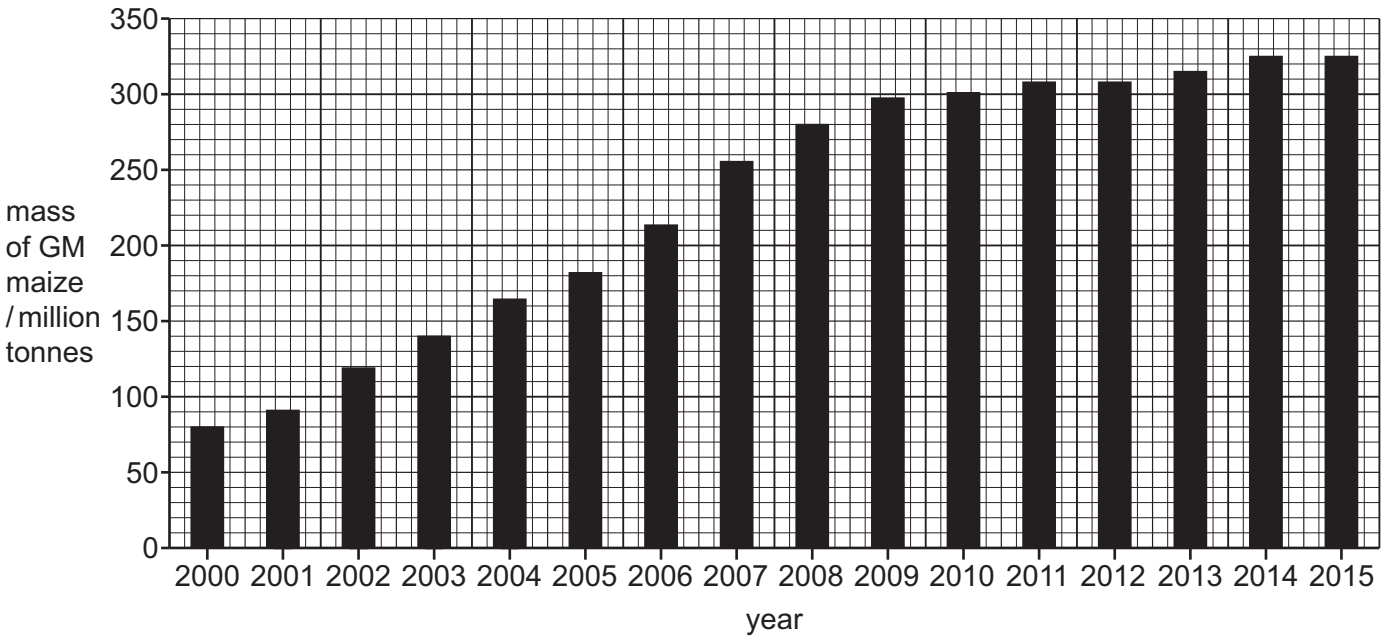

Fig. 3.1

(a) Calculate the percentage increase in the mass of GM maize grown between 2000 and 2015.

Give your answer to **two** significant figures.

Space for working.

..... % [3]

(b) To develop GM maize, a gene for producing a natural insecticide was taken from a bacterium and transferred into maize plant cells.

(i) Genes are found at specific positions on a biological molecule.

State the name of this biological molecule.

..... [1]

(ii) Scientists who develop GM crop plants breed them for many generations before allowing farmers to grow the crop plants.

Suggest why scientists breed the GM crop plants for many generations.

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..... [2]

(iii) Human proteins can also be made using bacteria that have been genetically modified.

Describe how a gene can be transferred from one organism to another using genetic modification.

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..... [6]

(c) Some people are worried that GM crops could pollinate wild plants.

(i) Suggest how pollination between GM crops and wild plants could be prevented.

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..... [1]

(ii) State **two** advantages of GM crops **other than** insect resistance.

1 .....

2 .....

[2]

[Total: 15]

4 Xerophytes are plants that show adaptive features for dry habitats.

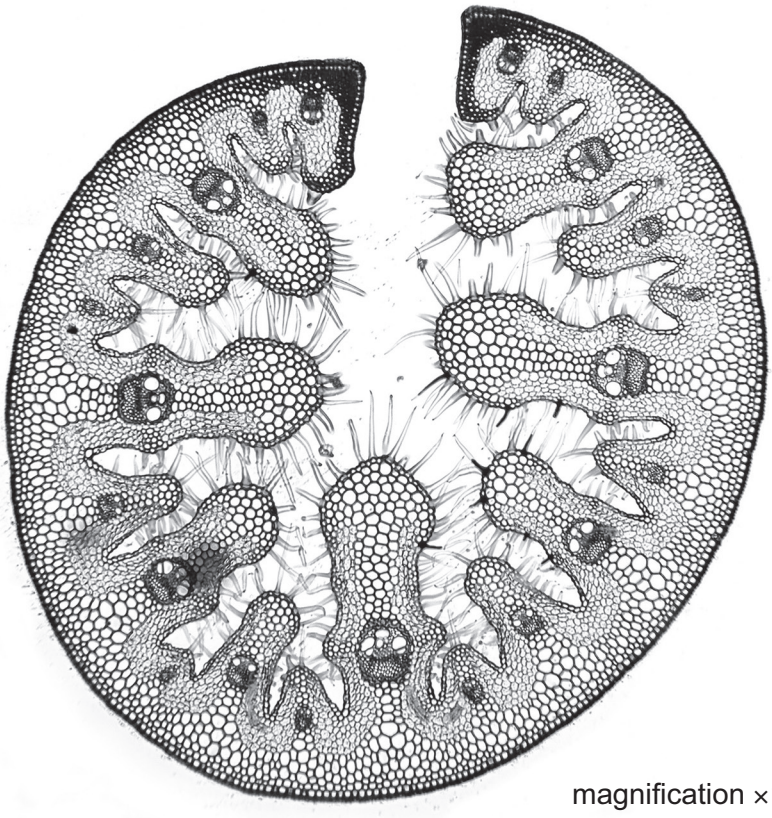
(a) Complete the sentence to define the term adaptive feature.

An adaptive feature is an ..... feature that helps an organism to ..... and ..... in its environment.

[2]

(b) Marram grass is a xerophytic plant.

Fig. 4.1 is a photomicrograph of a cross-section of a marram grass leaf.



magnification ×10

Fig. 4.1

Using Fig. 4.1, describe the visible features that identify this as a xerophyte leaf.

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..... [2]

(c) **(i)** The mean cell wall thickness of an epidermal cell from one species of xerophyte is 1.276 μm.

Convert 1.276 μm to mm.

..... mm [1]

(ii) State the name of the carbohydrate molecule used to build cell walls in xerophytes.

..... [1]

(iii) Suggest **one** way the stem of a xerophyte is adapted for dry habitats.

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..... [1]

(d) Fig. 4.2 is a diagram showing the root systems of two different species of xerophyte.

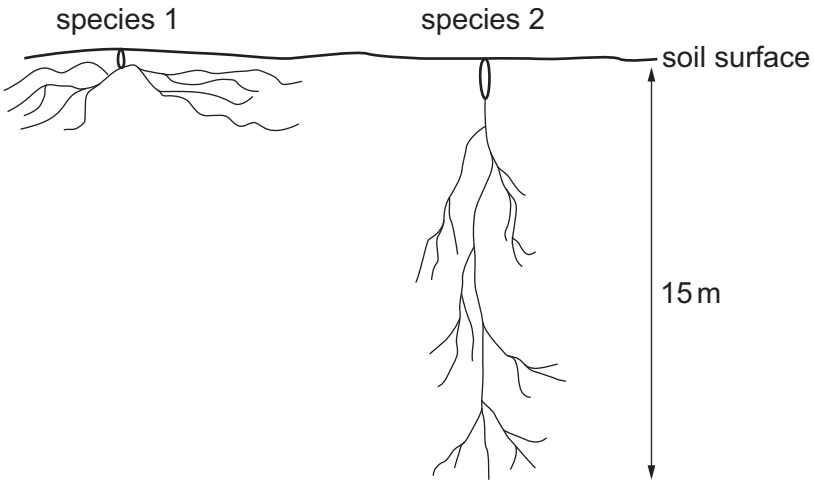

Fig. 4.2

Describe the **two** root systems shown in Fig. 4.2 **and** suggest how each one is an adaptation for living in a dry environment.

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..... [3]

[Total: 10]

5 Fig. 5.1 is a diagram of a plant root hair cell.

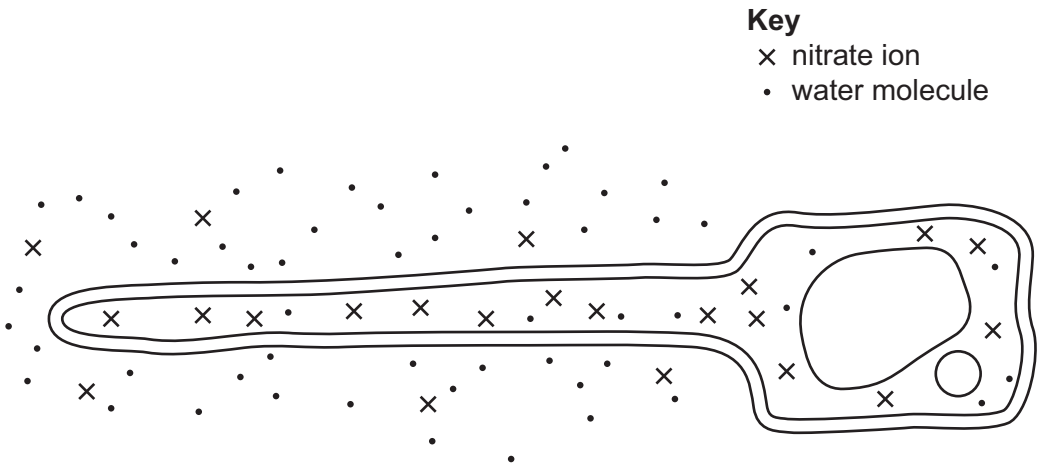

Fig. 5.1

(a) (i) Using the information in Fig. 5.1, explain how nitrate ions are transported into the root hair cell.

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..... [4]

(ii) State **two** ways that nitrogen fixation occurs.

1 .....

2 .....

[1]

(b) State the name of the process that moves water molecules into root hair cells.

..... [1]

(c) Describe differences **and** similarities between the structure of a plant root hair cell and a bacterial cell.

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..... [5]

[Total: 11]

6 A scientist investigated the effect of changes in pH on the activity of two different protease enzymes.

Each enzyme was placed in a hole in the centre of a jelly layer in a Petri dish. The jelly layer was made of protein. The investigation was carried out at a range of different pH values.

After 60 minutes, the area of the jelly layer that had been broken down by enzyme **L** or enzyme **M** was recorded at each pH value tested.

Fig. 6.1 is a diagram of the apparatus.

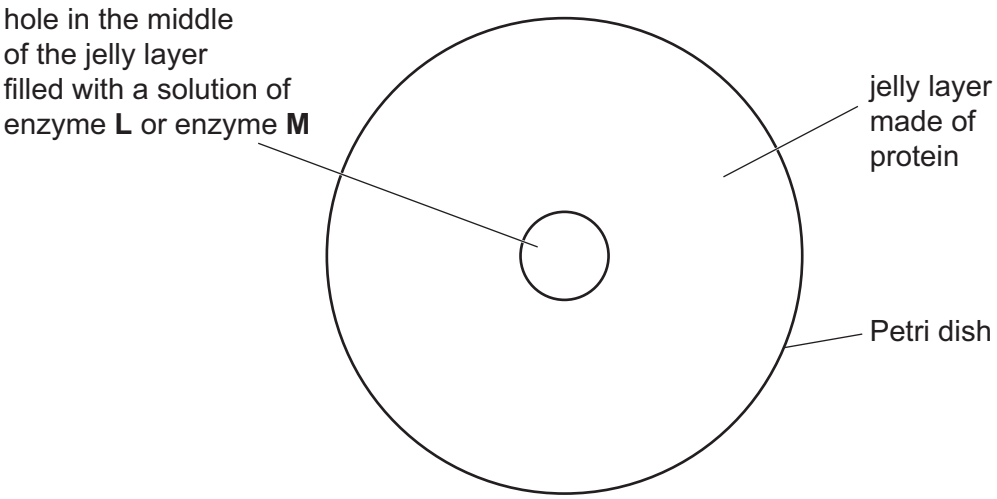

Fig. 6.1

Fig. 6.2 shows the results of the investigation.

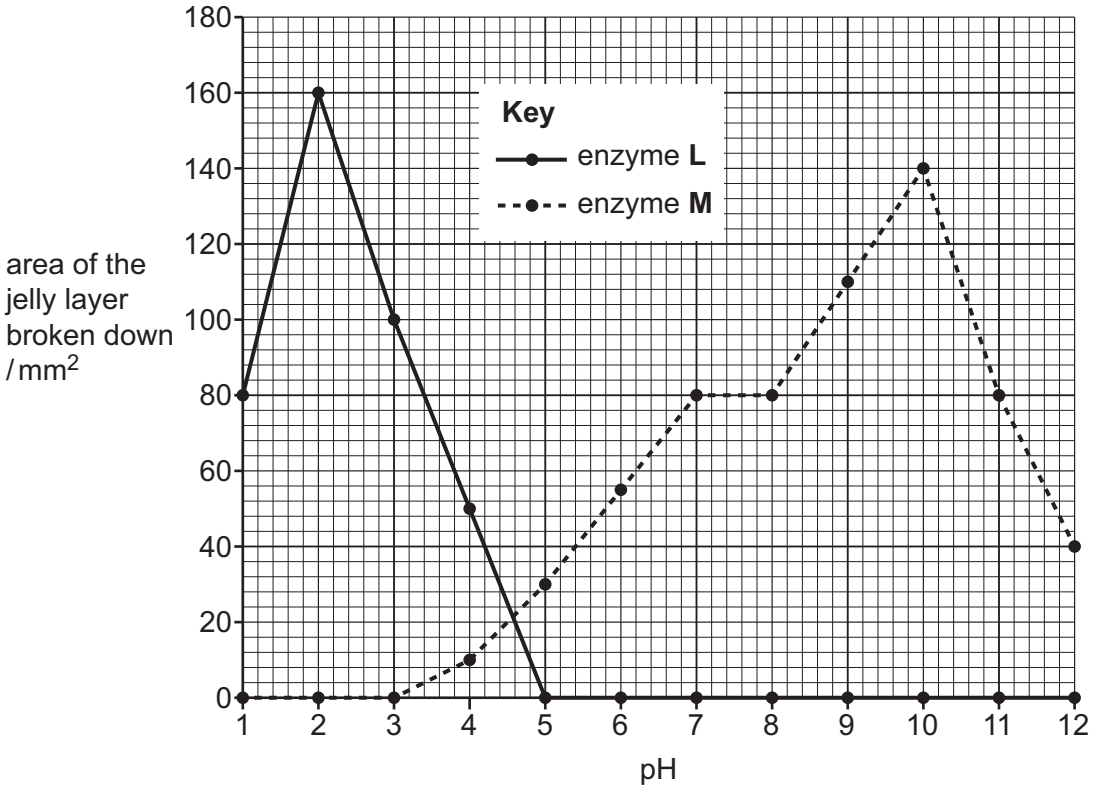

Fig. 6.2

(a) Using the information in Fig. 6.2, describe the results of this investigation.

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..... [5]

(b) Explain the result for enzyme **M** at pH 2 shown in Fig. 6.2.

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..... [3]

(c) Suggest the name of enzyme **L and** state its location in the human digestive system.

name of enzyme **L** .....

location .....

[2]

[Total: 10]

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