Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

1593731686

BIOLOGY **0610/43**

Paper 4 Theory (Extended) **October/November 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 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

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1 **(a)** Fig. 1.1 is a diagram of an insect-pollinated flower.

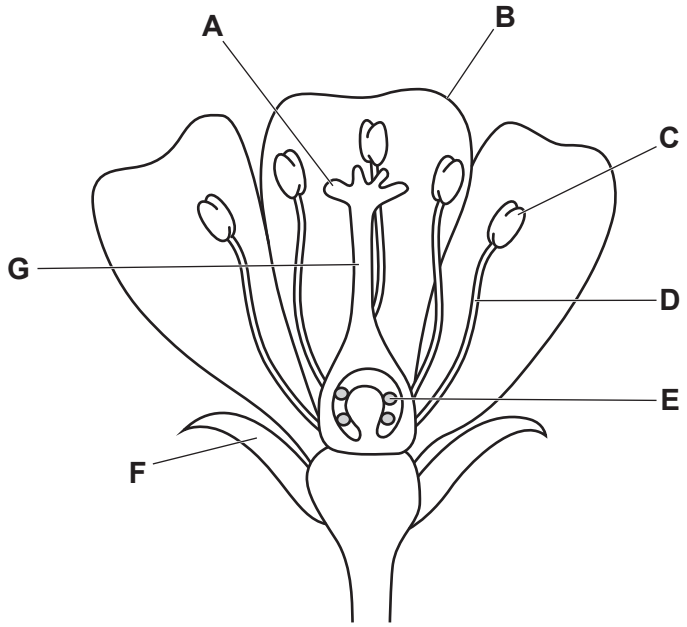

Fig. 1.1

(i) Using the information in Fig. 1.1, complete Table 1.1.

Table 1.1

structure in Fig. 1.1	name	function
A		
B		
F		

[3]

(ii) State the names of the **two** structures that form the stamen in a flowering plant.

1 .....

2 .....

[1]

(b) **(i)** Describe the stages in the reproduction of a flowering plant, from self-pollination to fertilisation.

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..... [5]

(ii) Outline the advantages and disadvantages of self-pollination compared with cross-pollination.

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..... [4]

[Total: 13]

2 **(a)** Fig. 2.1 is a diagram of a cross-section of part of a leaf.

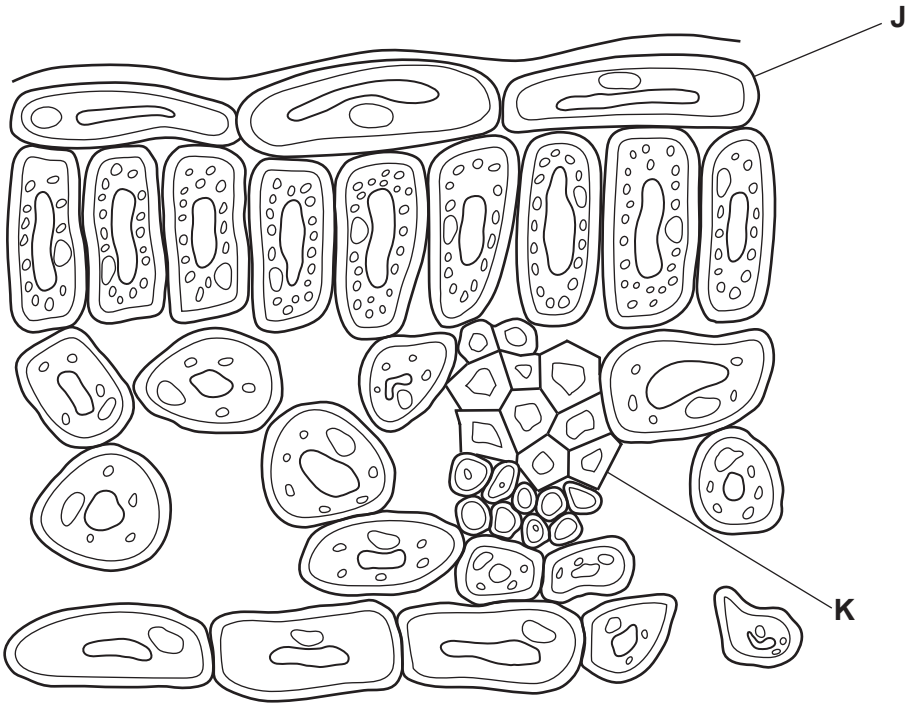

Fig. 2.1

Identify and explain how the structures labelled **J** and **K** are adapted for photosynthesis.

J .....

.....

.....

.....

K .....

.....

.....

.....

[4]

(b) In an experiment, thale cress plants (*Arabidopsis thaliana*) were grown in normal atmospheric and high carbon dioxide concentrations. The transpiration rate, the mean number of chloroplasts per cell and the concentrations of starch and magnesium ions were measured.

The results are shown in Table 2.1.

Table 2.1

factor measured	normal carbon dioxide concentration	high carbon dioxide concentration
transpiration rate / AU	8.1	5.6
mean number of chloroplasts per cell	8	11
concentration of starch / μg per mg of leaf	38	67
concentration of magnesium ions / mg per g of leaf	2.7	2.3

Complete the sentences about the data shown in Table 2.1.

Table 2.1 shows that increasing the carbon dioxide concentration caused more starch to be produced in the leaves. This shows that, at a normal carbon dioxide concentration, carbon dioxide is a ..... for photosynthesis.

During photosynthesis, ... molecules of carbon dioxide are required to make one molecule of glucose.

The greater quantity of starch stored in the leaves grown in a high carbon dioxide concentration means, when needed, more sucrose can be produced for transport in the phloem, so the leaves act as a ..... .

The greater number of chloroplasts per cell in the leaves grown in the higher carbon dioxide concentration means that more energy can be absorbed from ..... and transferred to ..... energy.

The transpiration rate is lower when the carbon dioxide concentration is higher. This means reduced loss of ..... from the leaves.

Magnesium ion concentration is lower in these leaves because they have used the magnesium ions to make ..... .

[7]

[Total: 11]

3 **(a)** **(i)** Complete Table 3.1 by writing in the percentages of carbon dioxide and oxygen in inspired air and in expired air.

Table 3.1

component	percentage in inspired air	percentage in expired air
carbon dioxide		
oxygen		

[2]

(ii) A scientist measured the number of dust particles in inspired air and in expired air.

They found fewer dust particles in expired air.

Suggest a reason for their observation.

.....

.....

..... [1]

(b) Fig. 3.1 is a diagram of alveoli and associated blood vessels.

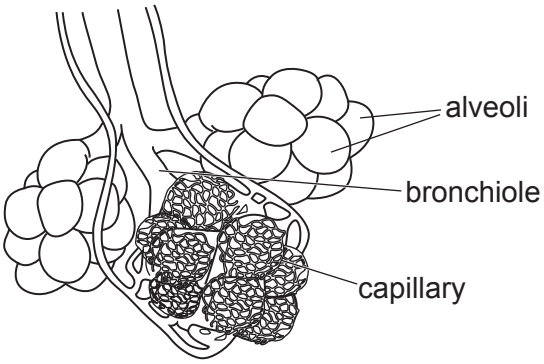

Fig. 3.1

(i) Explain how the structure of a capillary is related to its function.

.....

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.....

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.....

.....

..... [3]

(ii) State the name of the component of blood that transports oxygen.

..... [1]

(iii) State the name of the blood vessel that transports blood from the heart towards the capillaries in the lungs.

..... [1]

(iv) State the location and function of cartilage in the breathing system.

location .....

function .....

.....

.....
[2]

(c) A student measured the rate and depth of breathing of an athlete for 30 seconds at rest.

The data are shown in Fig. 3.2.

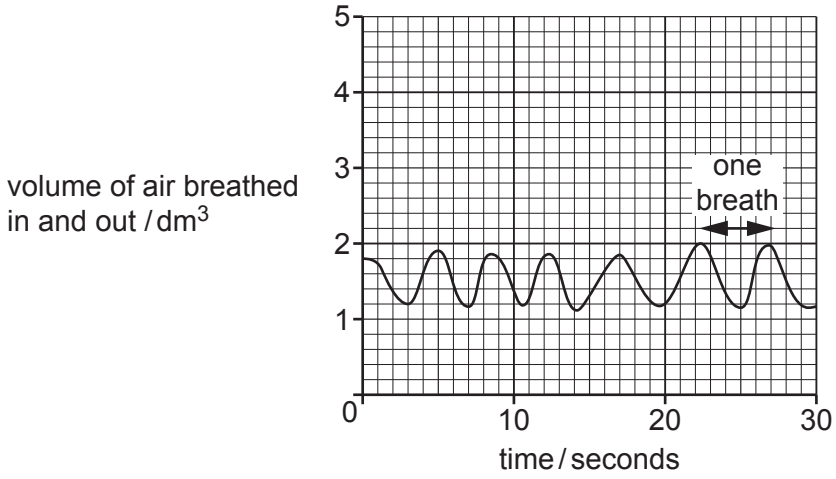

Fig. 3.2

(i) Using the information in Fig. 3.2, calculate the rate of breathing at rest.

..... breaths per minute [1]

The measurements were repeated while the athlete was running on a treadmill.

The data are shown in Fig. 3.3.

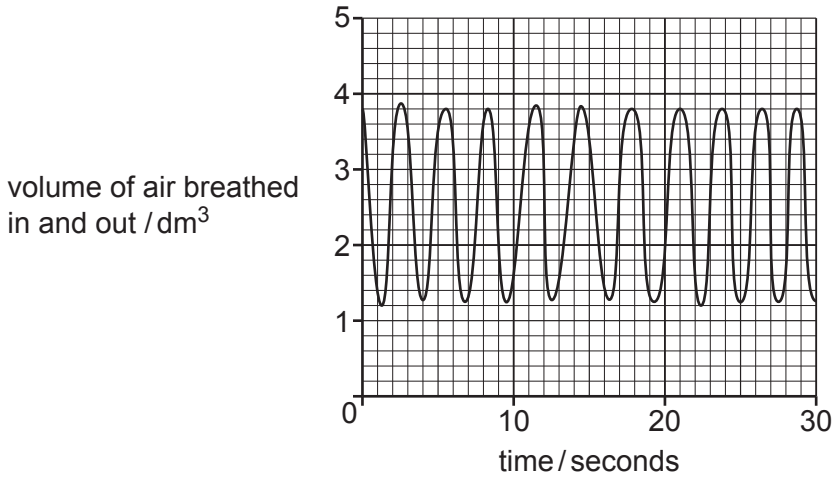

Fig. 3.3

(ii) Using the information in Fig. 3.3, calculate the volume of air inspired in **one** breath from 25 seconds.

..... dm^3 [1]

(iii) Explain the effect of exercise on the rate and depth of breathing shown in Fig. 3.2 and Fig. 3.3.

.....

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..... [4]

[Total: 16]

4 **(a)** Complete the sentences about the control of body temperature.

The human body maintains a constant internal temperature. This is an example of ..... . When the temperature moves away from the set point, the mechanism of ..... returns the temperature to the set point.

[2]

(b) Fig. 4.1 is a diagram of a section of human skin.

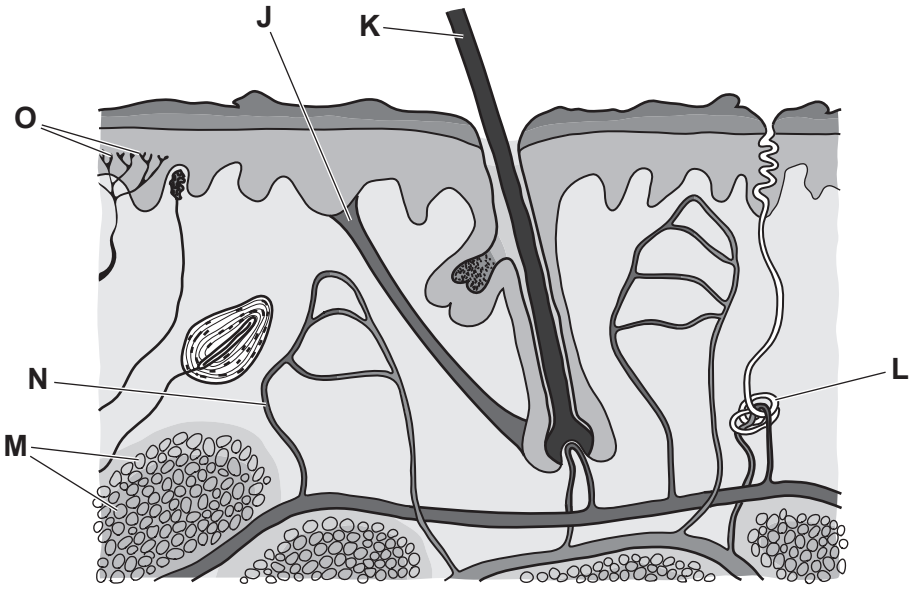

Fig. 4.1

(i) State the names of the structures labelled **L**, **O** and **J** in Fig. 4.1.

L .....

O .....

J .....

[3]

(ii) Describe how humans maintain a constant body temperature when the external temperature decreases.

Use the structures labelled in Fig. 4.1 in your answer.

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..... [6]

(c) Blood glucose concentration is maintained at a constant set point using the hormones glucagon and insulin.

(i) State the organ that secretes glucagon.

..... [1]

(ii) Describe the effect of glucagon on the body.

.....

.....

..... [1]

[Total: 13]

5 **(a)** State **two** cell structures found in both animal and bacterial cells.

1 .....

2 ..... [2]

(b) State why bacteria are useful in biotechnology.

.....

.....

.....

.....

.....

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..... [3]

(c) Genetically modified bacteria were grown in a fermenter. The number of bacteria was measured, and the data are shown in Fig. 5.1.

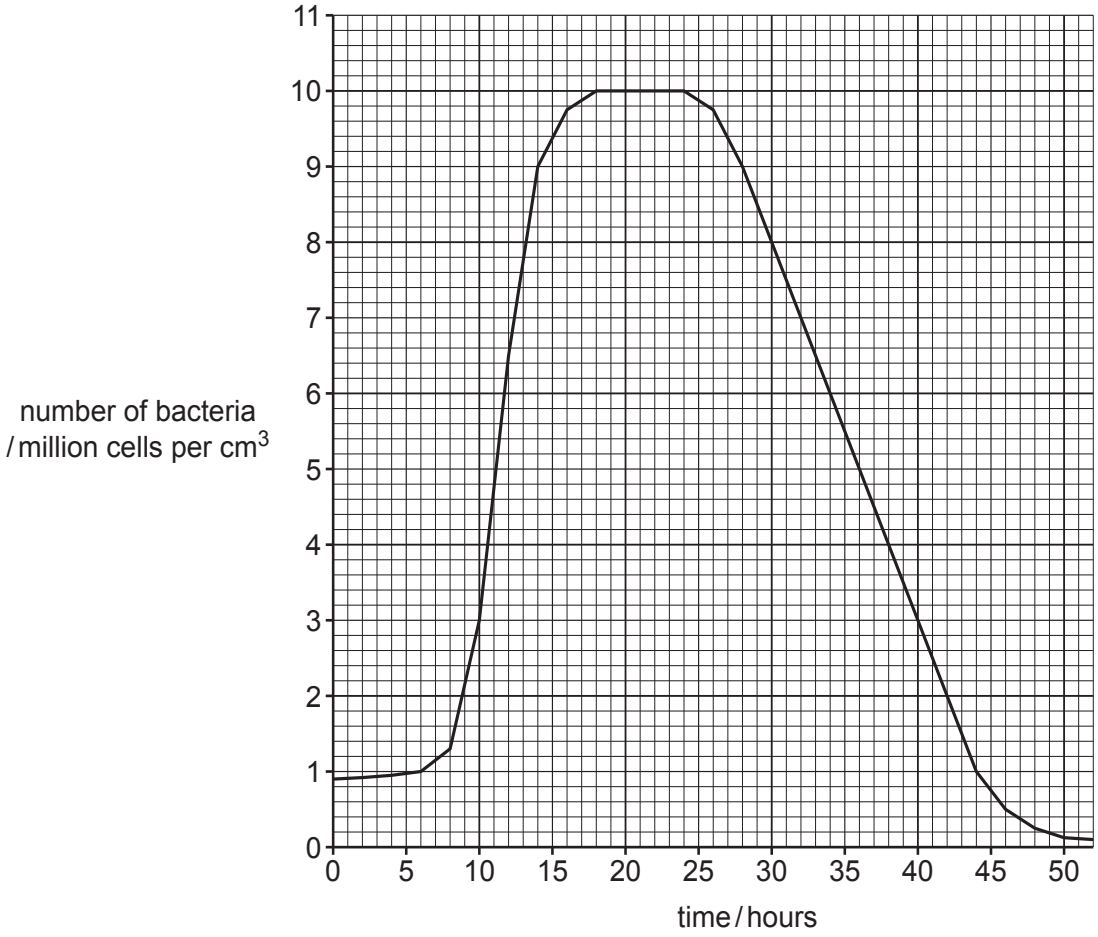

Fig. 5.1

(i) On Fig. 5.1, draw an **X** to identify the lag phase. [1]

(ii) On Fig. 5.1, draw a **Y** to show where the birth rate is equal to the death rate. [1]

(iii) Calculate how long it takes for the number of bacteria to reduce by half after the bacteria have been in the fermenter for 24 hours.

..... hours [1]

(iv) Describe **and** explain the change in bacterial population size from 24 hours to 50 hours shown in Fig. 5.1.

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..... [3]

(v) The fermenter is kept at the optimum temperature for the bacteria.

Explain why this is important for enzyme function.

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..... [3]

(vi) State why the bacteria are grown in a liquid that contains amino acids.

.....

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..... [1]

[Total: 15]

6 **(a)** Xerophytes are plants that are adapted for an environment which has very little available water.

Describe the meaning of adaptation.

.....

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..... [3]

(b) Fig. 6.1 is a photograph of a saguaro cactus, *Carnegiea gigantea*, which lives in a desert.

The climate in a desert has very low rainfall and very high daytime temperatures.

Fig. 6.1

Describe **two** visible adaptive features shown in Fig. 6.1 and explain how each feature is beneficial for living in a desert.

feature 1 .....

explanation .....

.....

.....

feature 2 .....

explanation .....

.....

.....
[4]

(c) Table 6.1 shows some data about stomatal density in the leaves of one plant that is **not** a xerophyte and three xerophyte plants.

Table 6.1

species	plant type	number of stomata per mm^2	
		upper leaf surface	lower leaf surface
oak tree	**not** a xerophyte	94	503
tongue leaf plant	xerophyte	0	18
lace aloe	xerophyte	2	15
ice plant	xerophyte	0	42

(i) Using the information in Table 6.1, estimate the total number of stomata in an ice plant leaf with a lower leaf surface area of $8\,cm^2$.

..... stomata [1]

(ii) Explain the data shown in Table 6.1.

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..... [2]

(d) There are xerophytic forests which are threatened by human overexploitation.

Suggest reasons why it is important to conserve xerophytic ecosystems.

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..... [2]

[Total: 12]

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