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CANDIDATE NAME

CENTRE NUMBER

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BIOLOGY **0610/41**

Paper 4 Theory (Extended) **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 80.
- 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 Substances travel across cell membranes.

(a) State the name of the type of movement across membranes that uses protein carriers.

..... [1]

(b) A student investigated the effect of surface area to volume ratio on the time taken for hydrochloric acid to move through cubes of agar jelly.

The student used four differently sized cubes of agar jelly, **A**, **B**, **C** and **D**.

The cubes contained universal indicator that changed colour from green to red at low pH values.

The cubes were immersed in hydrochloric acid.

The student recorded the time taken for each cube to become completely red.

Table 1.1 shows the results.

Table 1.1

cube	surface area : volume ratio	time taken for the cube to become completely red / s
A	6 : 1	15.2
B	3 : 1	28.5
C	2 : 1	43.0
D	1.5 : 1	57.8

(i) Describe **and** explain the results shown in Table 1.1.

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..... [3]

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(ii) The investigation was repeated at a higher temperature.

Predict **and** explain the effect of this on the results.

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..... [3]

(c) A sample of plant tissue was immersed in a highly concentrated salt solution. Another sample of plant tissue was immersed in distilled water.

Describe **and** explain the expected appearance of the cells in the two samples of plant tissue after 60 minutes of immersion.

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..... [6]

[Total: 13]

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2 **(a)** A student investigated the effect of two enzymes, amylase and pepsin, on starch.

(i) State where amylase and pepsin act in the human body.

amylase .....

pepsin .....

[2]

(ii) Two test-tubes were set up and left for 10 minutes.

- Test-tube **1** contained a mixture of starch suspension and amylase solution.
- Test-tube **2** contained a mixture of starch suspension and pepsin solution.

After 10 minutes, Benedict's solution was added to both test-tubes and they were heated.

Predict **and** explain the expected results for test-tube **1** and test-tube **2**.

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(b) Starch is a carbohydrate.

State the elements that are in all carbohydrates.

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(c) Table 2.1 shows some information about large molecules and the smaller molecules they are made from.

Complete Table 2.1.

Table 2.1

large molecule	small molecules
glycogen	
cellulose	
	amino acids
	fatty acids and glycerol

[2]

(d) Compare the process of assimilation with the process of absorption.

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[Total: 12]

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3 Ringing involves removing a circle of the outer tissues from a plant stem. This removes the phloem but not the xylem.

(a) A scientist investigated the effect of ringing in one species of plant.

Plant **A** was ringed and plant **B** was **not** ringed.

Most of the leaves were removed from the plants.

Plastic bags filled with carbon dioxide containing radioactive carbon (^{14}C) were tied around the remaining leaves.

After a set time, radioactive carbon (^{14}C) was detected in different parts of the plants.

Figure 3.1 is a diagram of the investigation and shows the results.

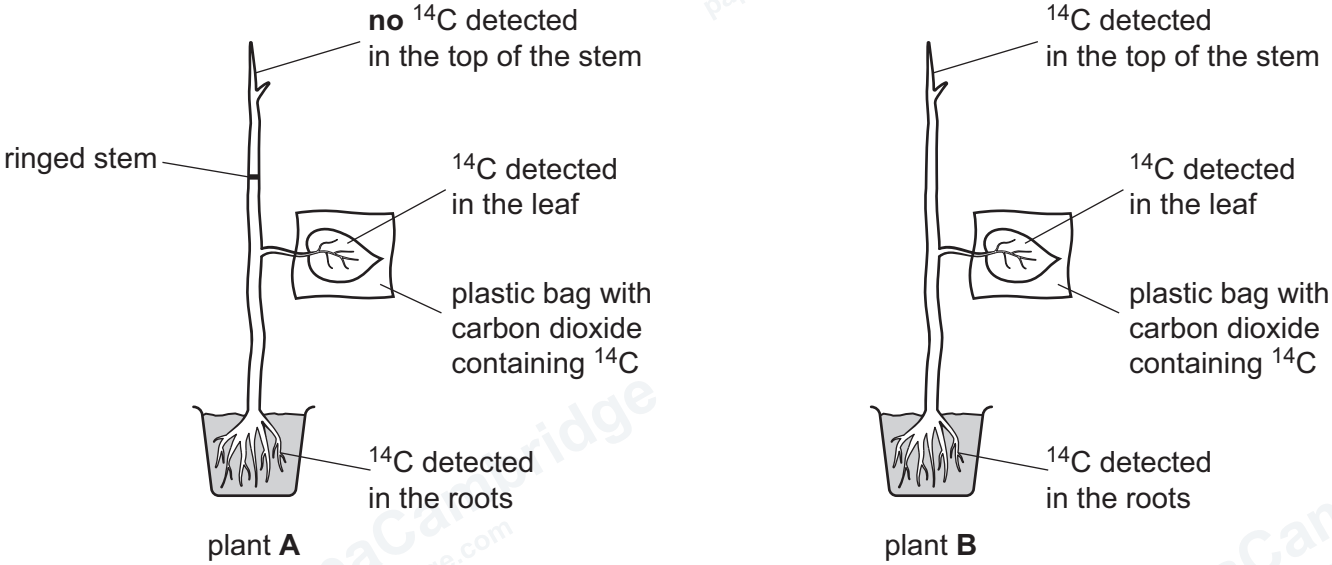

Figure 3.1

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(i) Explain why radioactive carbon (^{14}C) was found in the roots but **not** in the top of the stem in plant **A**.

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(ii) Explain the purpose of plant **B** in Figure 3.1.

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(b) Explain the effect on the rate of transpiration of removing leaves from a plant.

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..... [2]

(c) Suggest the effect on the rate of transpiration of ringing a plant.

Give a reason for your suggestion.

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..... [2]

(d) State the name of the structures in a leaf that contain phloem.

..... [1]

(e) State the name of a plant structure that contains lignin and cellulose.

..... [1]

[Total: 13]

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4 Horses are mammals that have similar breathing and circulatory systems to humans.

The heart rate of a horse was monitored before, during and after a race.

Figure 4.1 shows the results.

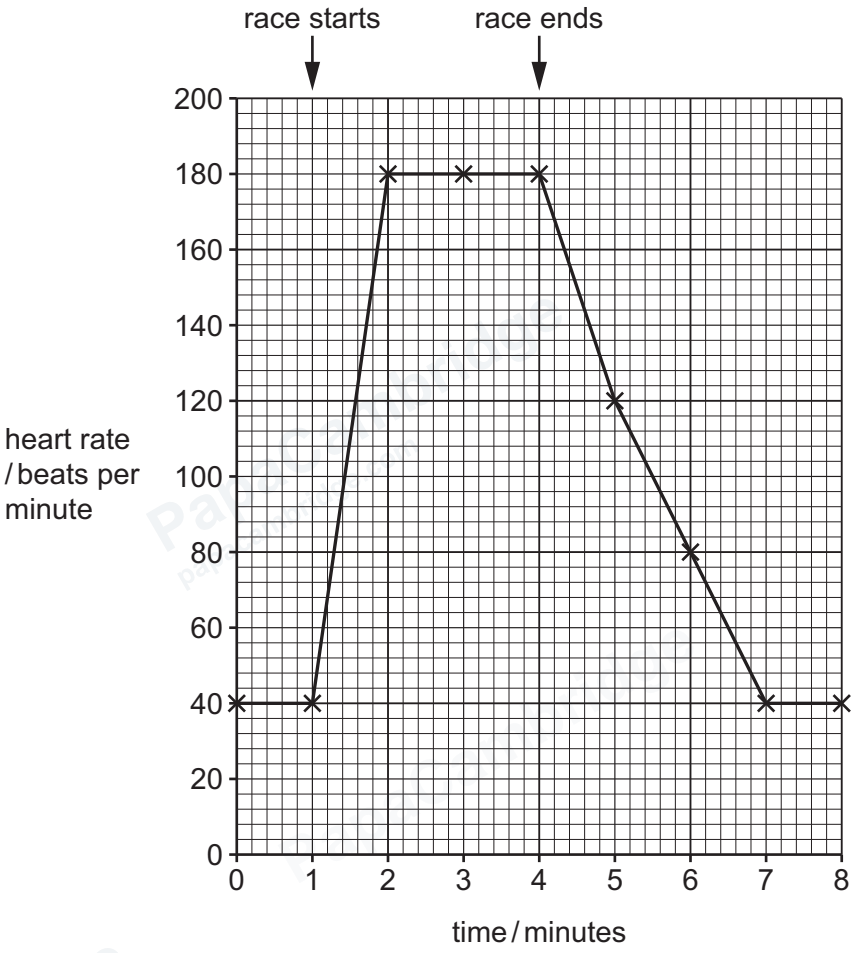

Figure 4.1

(a) Describe the results shown in Figure 4.1.

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..... [3]

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(b) During the race the rate of respiration changes.

(i) State the balanced equation for aerobic respiration.

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(ii) Explain why the rate of aerobic respiration increases at the start of the race.

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..... [2]

(iii) State where aerobic respiration occurs in cells.

..... [1]

(c) Explain why the heart rate does **not** immediately return to its resting value after the race ends in Figure 4.1.

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(d) Adrenaline is also released during the race and increases heart rate.

Describe **two other** effects of adrenaline that enable efficient respiration.

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2 .....

[2]

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(e) Blood is transported to the heart in veins.

Explain the structural adaptations of veins.

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[Total: 16]

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5 **(a)** A polyculture is a farming system which involves planting several different types of crop plants in the same area.

The numbers of different species of pollinator were counted in a polyculture and in a monoculture.

Table 5.1 shows the results.

Table 5.1

type of crop plant farming system	number of crop plant species	number of different species of pollinator
polyculture	3	90
monoculture	1	57

(i) Describe what is meant by the term species.

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..... [2]

(ii) Using the information in Table. 5.1, suggest the advantages to the environment of polyculture farming compared to monoculture farming.

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(b) Crop plants have been bred to increase yield.

(i) Complete the sentences by writing words or phrases in the spaces provided to describe this process.

Humans select crop plants that have the largest yield.

The pollen from these plants is taken and rubbed onto the .....

of other plants of the same species.

The ..... of these plants are then observed and the ones with

the highest yields are then selected and bred together.

This is repeated for many ....., until all the plants produced

have a high yield.

This process is called ..... .

[4]

(ii) Describe how herbicides can increase the yield of crop plants.

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..... [1]

(c) One consequence of farming can be deforestation.

Explain how deforestation can contribute to climate change.

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..... [4]

[Total: 14]

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6 **(a)** Figure 6.1 shows a diagram of a cross-section of human skin.

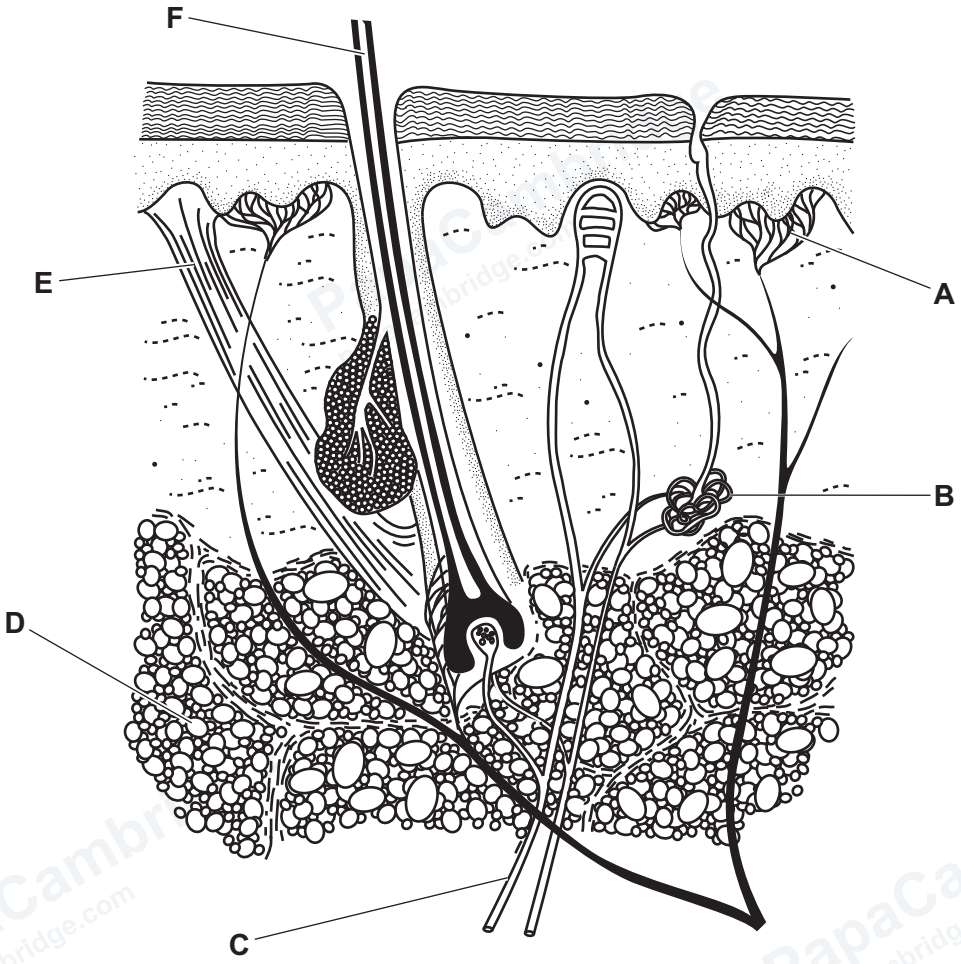

Figure 6.1

State the letters in Figure 6.1 that identify the part that:

contracts to raise the hair .....

produces liquid that cools the skin .....

shows a cell type that provides insulation. .....

[3]

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(b) A scientist monitored the skin temperature of a person, on two different parts of the body, in a warm environment and then in a cold environment.

Table 6.1 shows the results.

Table 6.1

part of the body	skin temperature / K		percentage decrease in temperature
	warm environment	cold environment	
chest	307.7	303.3	1.4
finger	306.4	294.2	

(i) Using the information in Table 6.1, calculate the percentage decrease in the skin temperature of the finger between a warm environment and a cold environment.

Give your answer to the appropriate number of decimal places.

.....% [3]

(ii) One of the roles of the skin is to help to control the internal temperature of the body.

Describe how a change in the internal body temperature is detected.

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(iii) Explain the changes that occur in the blood vessels in the skin in a cold environment.

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(c) The control of internal body temperature is an example of homeostatic control by negative feedback.

State the name of **one other** example of homeostatic control.

..... [1]

[Total: 12]

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