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Cambridge Assessment International Education

# Cambridge IGCSE™

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*8461003287*

**BIOLOGY** **0610/42**

Paper 4 Theory (Extended) **February/March 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 **20** pages. Any blank pages are indicated.

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**1** **(a)** Fig. 1.1 is a simplified diagram of the circulatory system in humans.

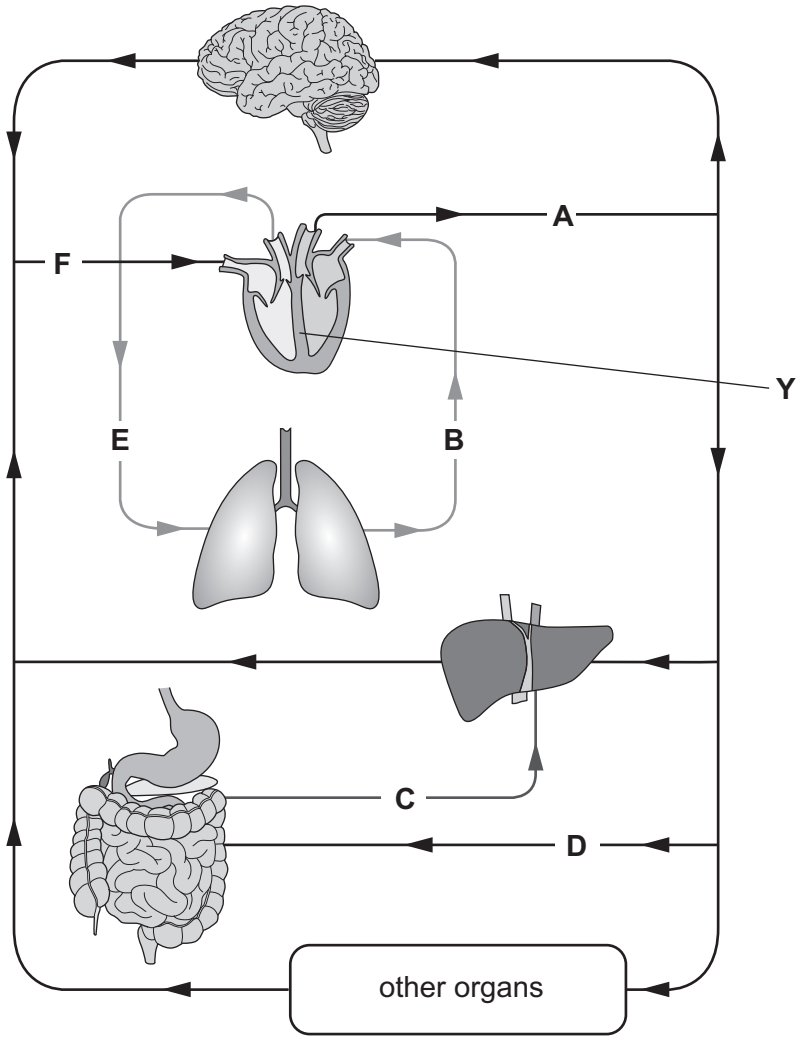


**Fig. 1.1**

**(i)** State the letter from Fig. 1.1 that represents the blood vessel that contains blood with the highest concentration of oxygen.

..... [1]

**(ii)** State the letter from Fig. 1.1 that represents the hepatic portal vein.

..... [1]

**(iii)** State all the letters from Fig. 1.1 that represent arteries.

..... [1]

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**(iv)** Explain the importance of the part labelled **Y** in Fig. 1.1.

.....

.....

.....

.....

..... [2]

**(v)** State the evidence from Fig. 1.1 that the diagram shows a double circulation system.

.....

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.....

.....

..... [2]

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**[Turn over**

**(b)** Fig. 1.2 shows the pressure of blood flowing through different blood vessels as it travels around the body. (Venules are narrow vessels that connect capillaries to veins.)

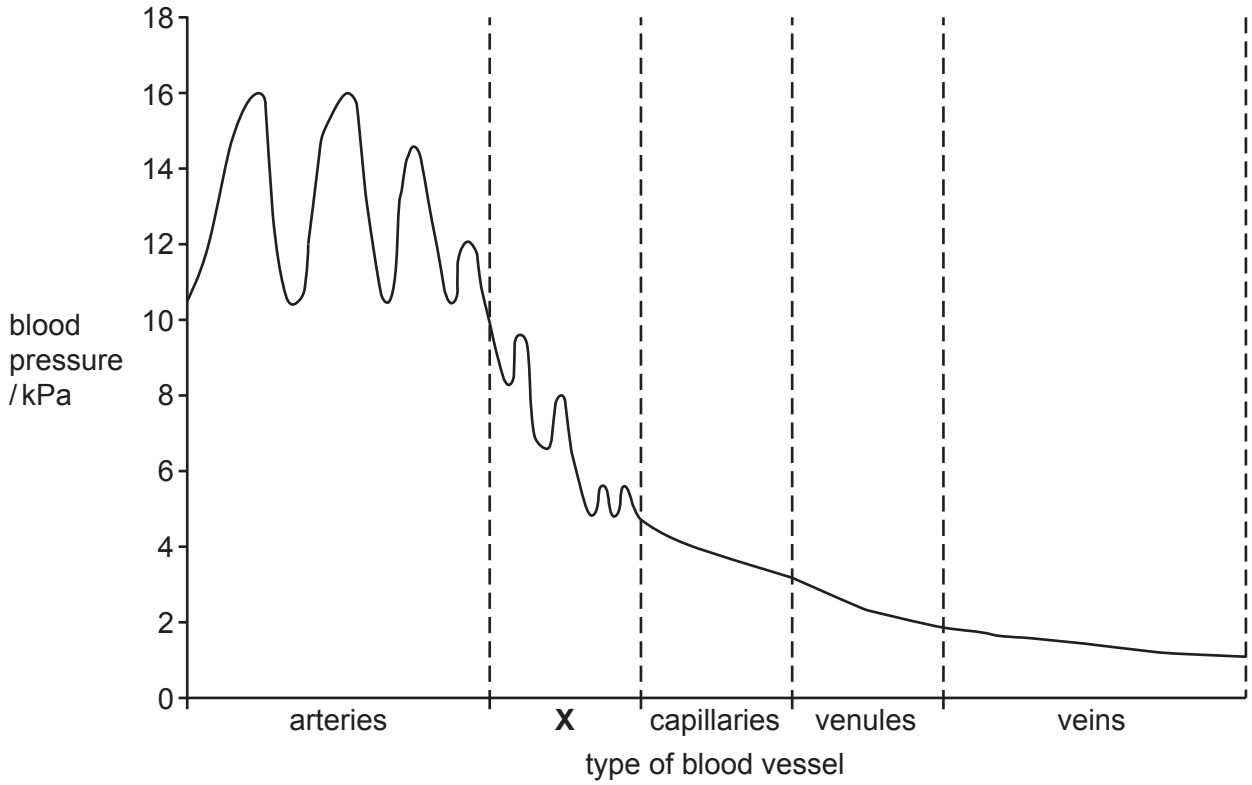


**Fig. 1.2**

**(i)** Blood vessels **X** in Fig. 1.2 supply blood to skin-surface capillaries and have a role in maintaining a constant internal temperature.

State the name of the blood vessels that are represented by the letter **X** in Fig. 1.2.

..... [1]

**(ii)** Explain reasons for the changes in pressure seen in the **arteries** in Fig. 1.2.

.....

.....

.....

.....

..... [2]

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**(iii)** Using the information in Fig. 1.2, explain the structural adaptations of arteries **and** veins.

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.....

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.....

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..... [4]

[Total: 14]

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**[Turn over**

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**2** A student investigated the digestion of starch.

Fig. 2.1 shows the apparatus she used.

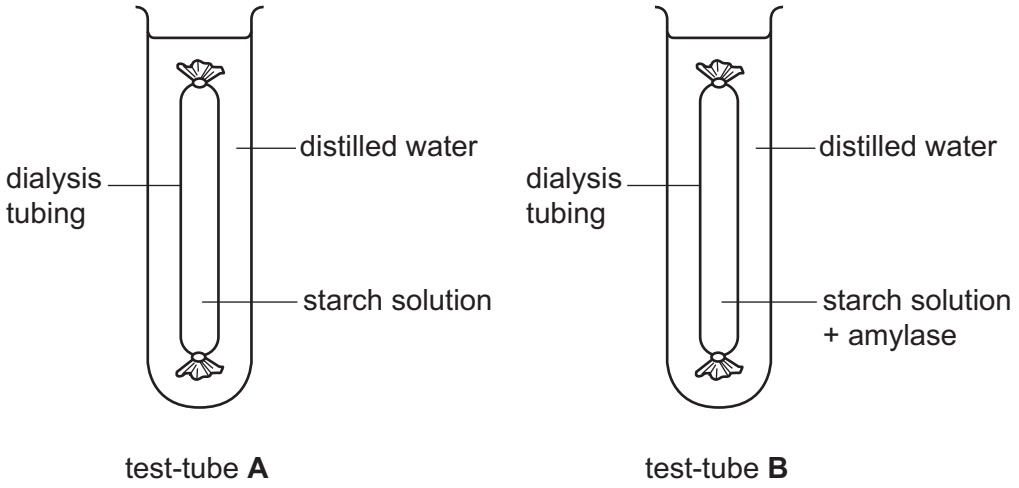


**Fig. 2.1**

Dialysis tubing is used to represent a cell membrane.

The dialysis tubing material allows small molecules to move across it, but not larger molecules.

Test-tubes **A** and **B** were set up as shown in Fig. 2.1 and placed in a water-bath at 37 °C for 30 minutes.

The liquid outside the dialysis tubing in test-tubes **A** and **B** was tested with Benedict's solution at 0 minutes and after 30 minutes.

Table 2.1 shows the results.

**Table 2.1**

| test-tube | colour with Benedict's solution at 0 minutes | colour with Benedict's solution at 30 minutes |
|---|---|---|
| **A** | blue | blue |
| **B** | blue | red |

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**(a)** Using the information in Fig. 2.1 and Table 2.1, explain the reasons for the difference in the results for test-tubes **A** and **B** in Table 2.1.

.....

.....

.....

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.....

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..... [6]

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**(b)** Complete Table 2.2 by writing in the names of the missing enzymes, substrates and products.

**Table 2.2**

| enzyme | substrate | product or products |
|---|---|---|
| pepsin | | |
| | | fatty acids and glycerol |
| trypsin | | |
| | | glucose |

[4]

**(c)** State the name of the structures that increase the surface area for absorption in the small intestine.

..... [1]

[Total: 11]

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**3** **(a)** Fig. 3.1 shows part of a classification diagram for plants.

**(i)** Complete Fig. 3.1.

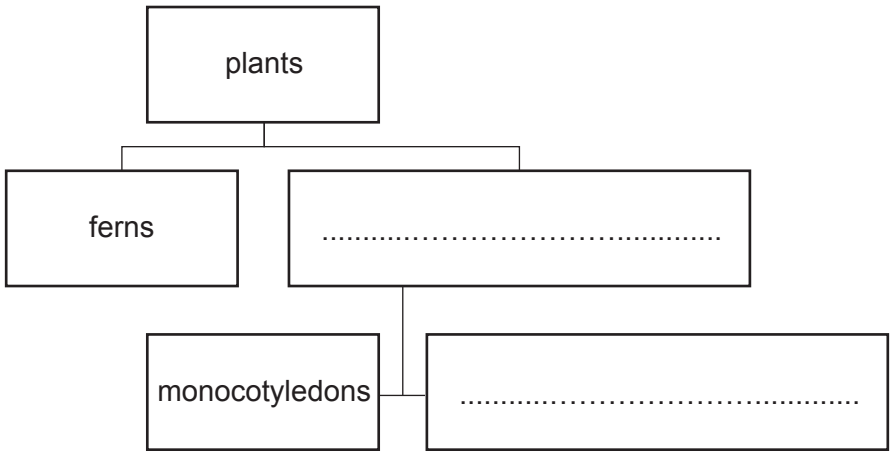


**Fig. 3.1**

[2]

**(ii)** Describe **two** identifying features of monocotyledons.

1 .....

2 .....

[2]

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**(b)** Fig. 3.2 shows the life cycle of a fern. The life cycle of a fern has some similarities and some differences compared with the life cycles of other plants.

The letters represent processes that occur during the life cycle.

The haploid stages of the life cycle are represented by (n).

The diploid stages of the life cycle are represented by (2n).

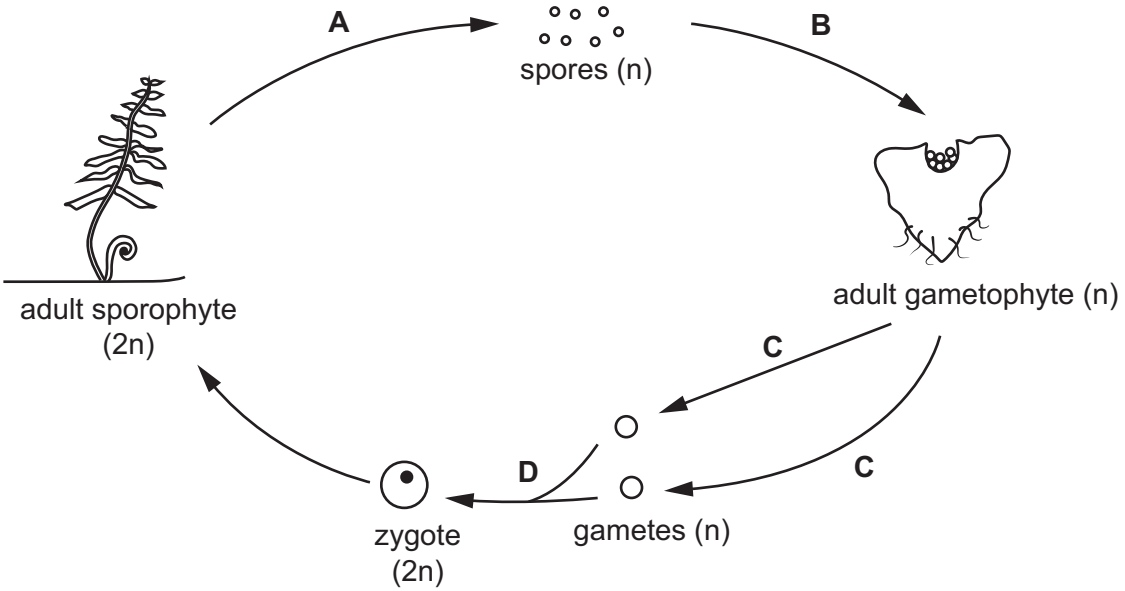


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**Fig. 3.2**

**(i)** The adult sporophyte has 1200 chromosomes in its body cells.

State the number of chromosomes in the body cells of the gametophyte.

..... [1]

**(ii)** Identify and describe process **A** in Fig. 3.2.

.....

.....

.....

.....

.....

.....

..... [3]

**(iii)** State the name of process **D** in Fig. 3.2.

..... [1]

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**(c)** Fig. 3.3 shows the parts of two flowers from two different plants of the same species.

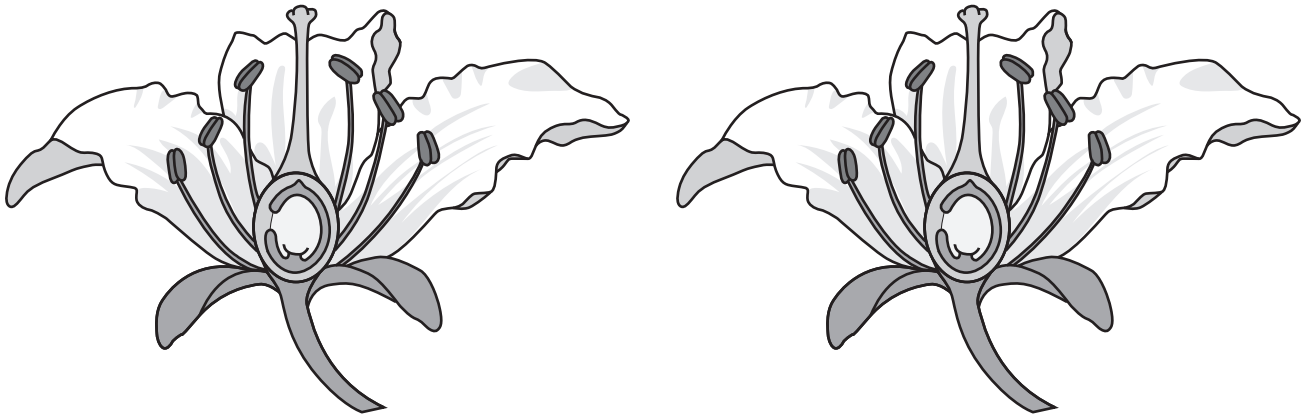

**Fig. 3.3**

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

.....

.....

.....

.....

..... [2]

**(ii)** Annotate Fig. 3.3 to show the mechanism of cross-pollination by:

- labelling the structures involved
- drawing an arrow to show the pathway of pollen.

[3]

**(iii)** Draw an **X** on Fig. 3.3 to show where fertilisation occurs. [1]

**(iv)** Explain the disadvantages of cross-pollination compared with self-pollination.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 18]

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**[Turn over**

**4** **(a)** Fig. 4.1 is a photograph of a tree that has been girdled.

Girdling involves removing a complete circle of bark and phloem from around the tree.



**Fig. 4.1**

**(i)** Explain why the area above the girdle in Fig. 4.1 will become swollen.

Use the terms source and sink in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

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**(ii)** Explain why the leaves in girdled trees are still able to receive mineral ions from the roots.

.....

.....

.....

.....

..... [2]

**(b)** Explain why glucose made during photosynthesis is required for the absorption of mineral ions by the roots.

.....

.....

.....

.....

.....

.....

..... [3]

**(c)** State the balanced symbol equation for photosynthesis.

..... [2]

[Total: 11]

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**[Turn over**

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**5** The eye is a sense organ that is part of the nervous system.

**(a)** Explain why the eye can be described as a sense organ.

.....

.....

.....

.....

..... [2]

**(b)** State the **two** parts of the central nervous system.

1 .....

2 .....

[2]

**(c)** Fig. 5.1 is a diagram of a section through the human eye.

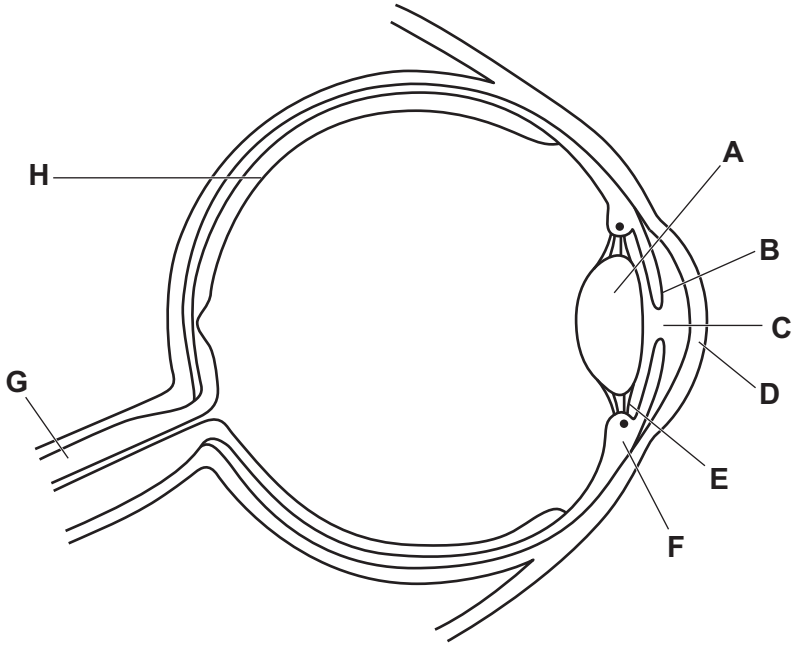


**Fig. 5.1**

**(i)** Draw an **X** on Fig. 5.1 to identify the blind spot. [1]

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**(ii)** Table 5.1 shows some of the parts labelled in Fig. 5.1, their names and their functions.

Complete Table 5.1.

**Table 5.1**

| name of the part | letter in Fig. 5.1 | function |
|---|---|---|
| | **H** | |
| | | transmits impulses to the central nervous system |
| cornea | | |

[3]

**(d)** State the names of the **two** effectors that contract and relax during the pupil reflex.

..... and ..... [1]

**(e)** Explain why a person is unable to focus on distant objects if the suspensory ligaments become permanently overstretched.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 12]

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**6** Golden rice is a type of rice that has been genetically modified to contain a nutrient called beta-carotene.

Fig. 6.1 shows the genetic modification process used to produce golden rice.

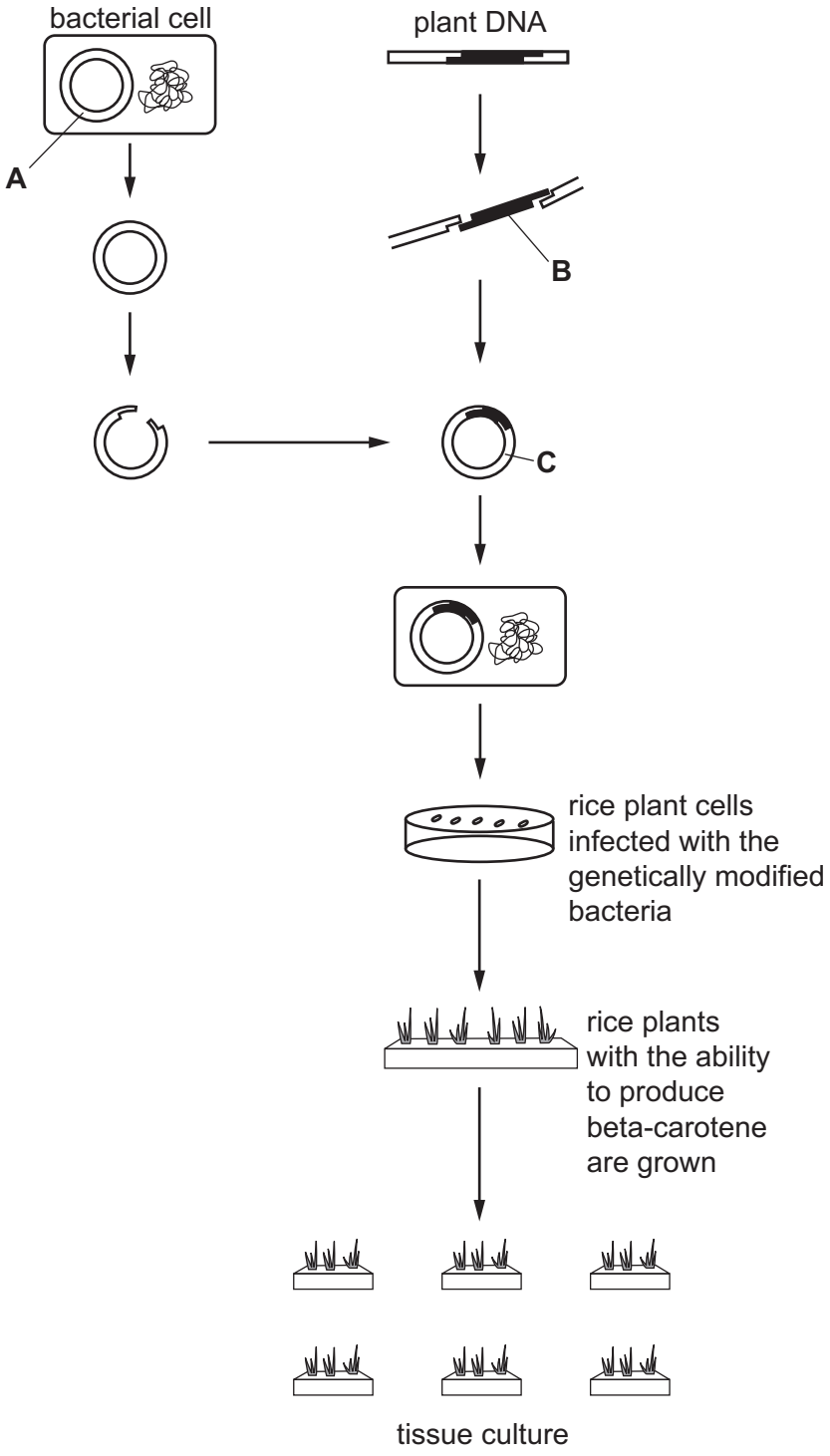


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**Fig. 6.1**

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**(a)** Using the information in Fig. 6.1, complete the sentences to describe how rice is genetically modified to contain beta-carotene.

The part labelled **A** in the bacterial cell is a ..... .

Part **A** is extracted and cut using a ..... enzyme forming ..... ends.

The part labelled **B** is the ..... that codes for the production of beta-carotene.

The enzyme used to cut part **A** is also used to cut part **B** from the plant DNA.

Part **B** is inserted into the part labelled **A** using the enzyme ..... .

This forms the part labelled **C**, which is called a ..... .

Part **C** is put into a bacterium. The bacterium is taken up by rice plant cells, giving them the ability to produce beta-carotene.

Tissue culture is a form of ..... reproduction that is used to produce many identical rice plants producing beta-carotene for commercial use.

[7]

**(b)** Apart from structural features, state **two** reasons why bacteria are useful for genetic modification.

1 .....

2 .....

[2]

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**[Turn over**

**(c)** Discuss the disadvantages of genetically modifying rice plants to produce beta-carotene.

.....

.....

.....

.....

.....

.....

..... [3]

**(d)** Beta-carotene is required to produce vitamin A, which is essential for eye function.

State the nutrient required to prevent:

scurvy .....

rickets. .....
[2]

[Total: 14]

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