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BIOLOGY **0610/43**

Paper 4 Theory (Extended) **October/November 2024**

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 shows part of the human digestive system.

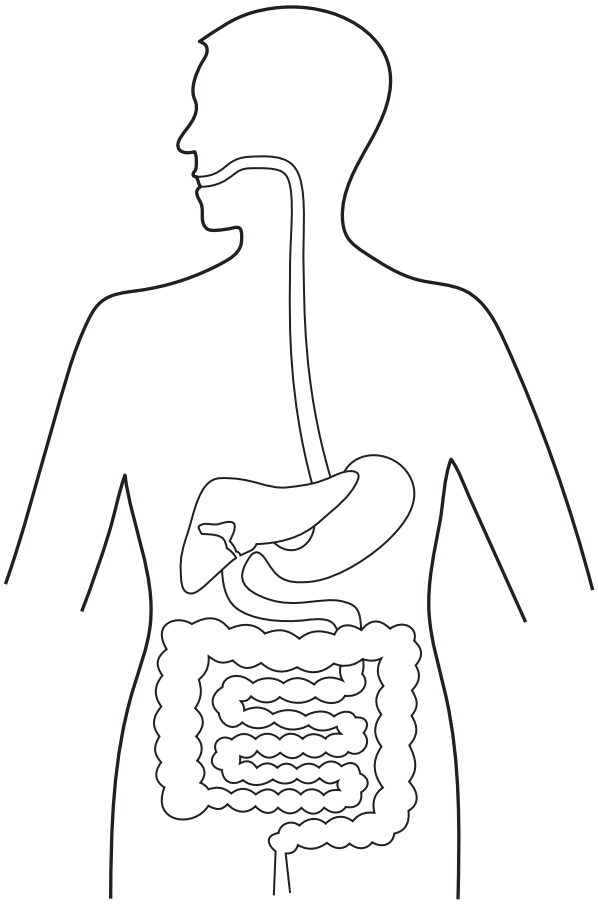

Fig. 1.1

(i) Using label lines and the letters shown, identify **on Fig. 1.1**:

- the organ that produces bile and label it **A**
- the organ that stores bile and label it **B**.

[2]

(ii) Describe physical digestion.

.....

.....

.....

.....

..... [2]

(iii) State the names of **two** places where physical digestion occurs in the body.

1 .....

2 .....

[2]

DO NOT WRITE IN THIS MARGIN

(b) Bile is involved in fat digestion.

(i) Complete the sentences about fat digestion.

Bile is released into the ..... in the digestive system. Bile increases the surface area of fats and oils. This is called ..... . This increase in surface area increases the rate of ..... digestion using the enzyme ..... .

[4]

(ii) State the names of the products of fat digestion.

.....

..... [1]

(c) Explain the role of bile in the breakdown of protein by trypsin.

.....

.....

.....

.....

..... [2]

[Total: 13]

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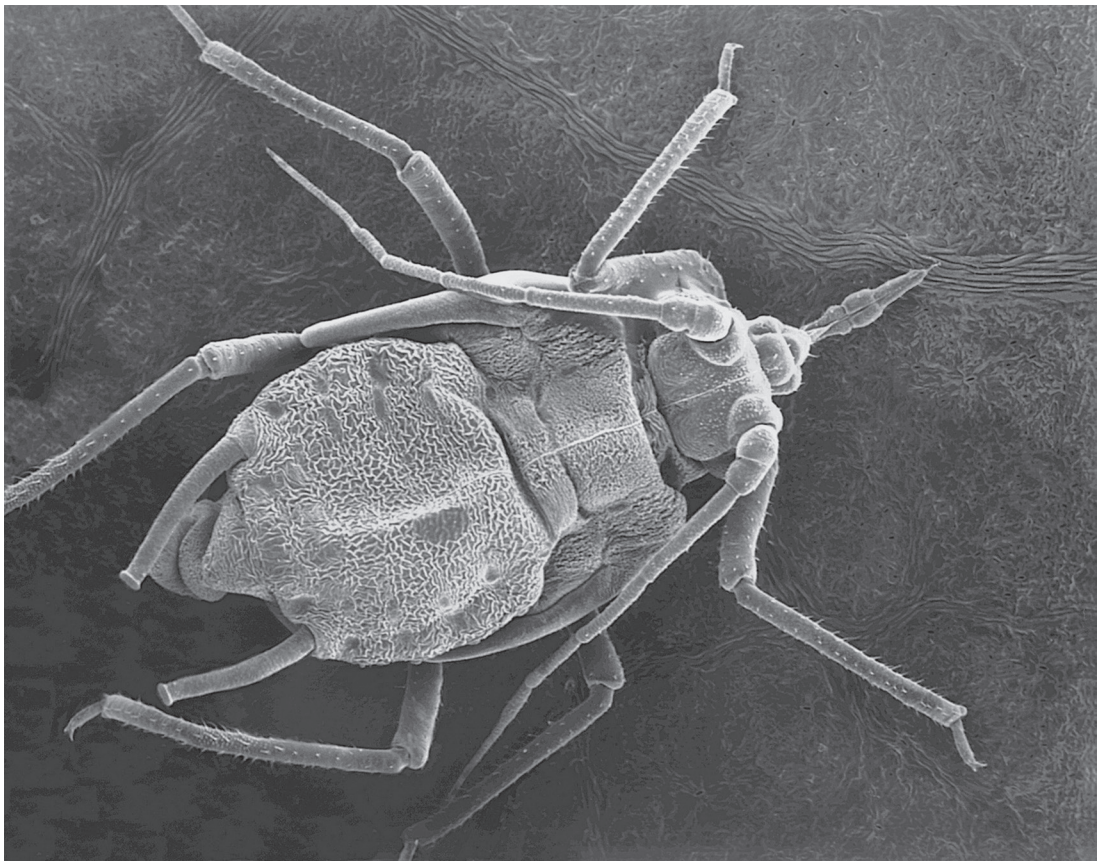
2 Aphids are arthropods.

Aphids insert their mouthpieces into the phloem in the stem of a plant to feed.

An aphid is shown in Fig. 2.1.



magnification ×22

Fig. 2.1

(a) **(i)** Identify **two** features visible in Fig. 2.1 that can be used to classify an aphid as an insect.

1 .....

2 .....

[2]

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Fig. 2.2 is a diagram of a cross-section of a dicotyledonous stem.

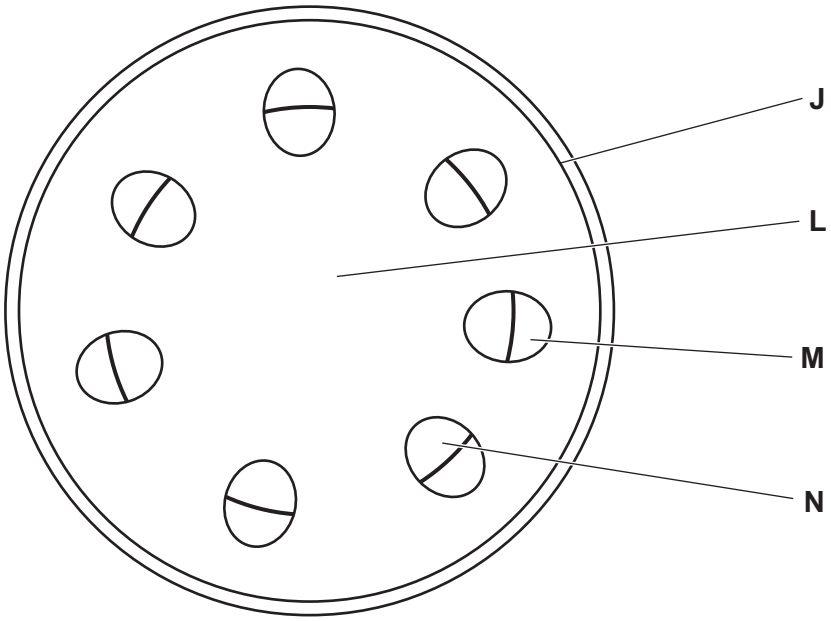

Fig. 2.2

(ii) State the letter in Fig. 2.2 that identifies the structure from which aphids feed.

..... [1]

(iii) State the names of **two** nutrients transported in the phloem.

1 .....

2 .....
[1]

DO NOT WRITE IN THIS MARGIN

(b) Scientists investigated the effect of temperature on the rate of translocation.

The data are shown in Table 2.1.

Table 2.1

temperature / °C	rate of translocation / cm per hour
15	7.3
20	13.8
25	16.7
30	17.1

Calculate the percentage change in rate of translocation between 15 °C and 30 °C.

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

Space for working.

..... % [3]

(c) Fig. 2.3 shows a potato plant growing in the spring and then in the summer.

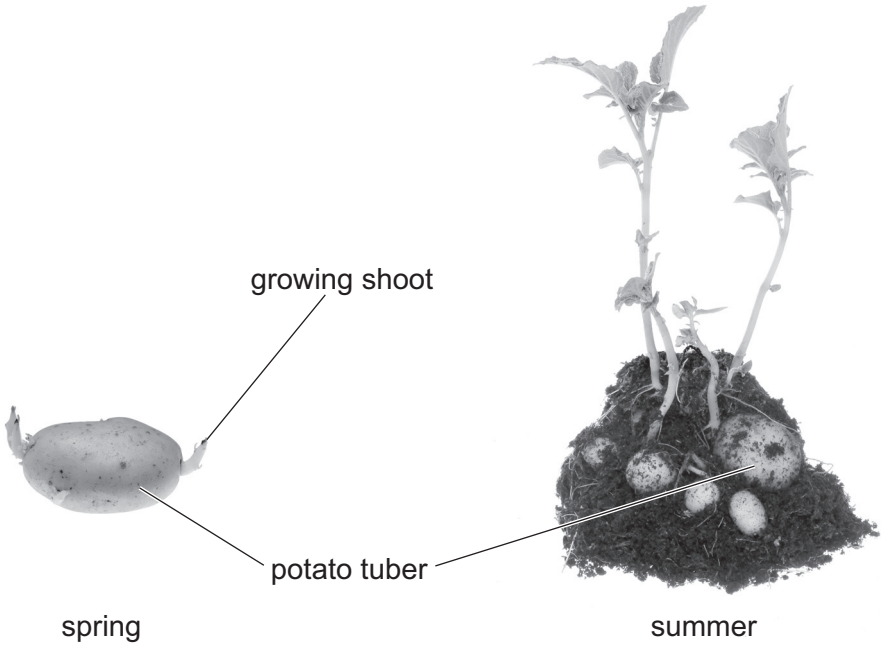

Fig. 2.3

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(i) Explain how translocation changes between spring and summer in the potato plant shown in Fig. 2.3.

Use the terms source and sink in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) New tubers form on the potato plant in the summer. These tubers are genetically identical.

Identify the type of reproduction that the potato plant is using to form the tubers.

..... [1]

[Total: 12]

DO NOT WRITE IN THIS MARGIN

3 **(a)** HIV can be transmitted from mother to infant.

Describe how the risk of a mother transmitting HIV to their infant can be reduced.

.....

.....

.....

.....

..... [2]

(b) **(i)** Scientists investigated the effect of breastfeeding on the chance of infants getting an infection.

They studied two groups of 100 infants. One group was breastfed and one group was **not** breastfed.

Table 3.1 shows the data.

Table 3.1

type of infection	number of infections in infants that were breastfed	number of infections in infants that were **not** breastfed
gastroenteritis	4	8
influenza	5	4
bronchitis	7	9
conjunctivitis	12	10

Using the data in Table 3.1, describe the effect of breastfeeding on the chance of getting an infection.

.....

.....

.....

.....

..... [2]

DO NOT WRITE IN THIS MARGIN

(ii) State the name of a blood cell involved in the immune response.

..... [1]

(iii) Describe how infants can gain passive immunity.

.....

.....

.....

.....

.....

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.....

.....

..... [4]

(iv) Describe how immunity gained by vaccination differs from passive immunity.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 12]

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4 Human muscle cells use anaerobic respiration during vigorous exercise.

(a) **(i)** State the word equation for anaerobic respiration in humans.

..... [1]

(ii) Compare the process of anaerobic respiration to aerobic respiration in human muscle cells.

.....

.....

.....

.....

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.....

..... [3]

(b) An athlete runs a race which lasts 60 seconds.

Fig. 4.1 shows the heart rate and breathing rate of the athlete during the race and as he recovers after the race.

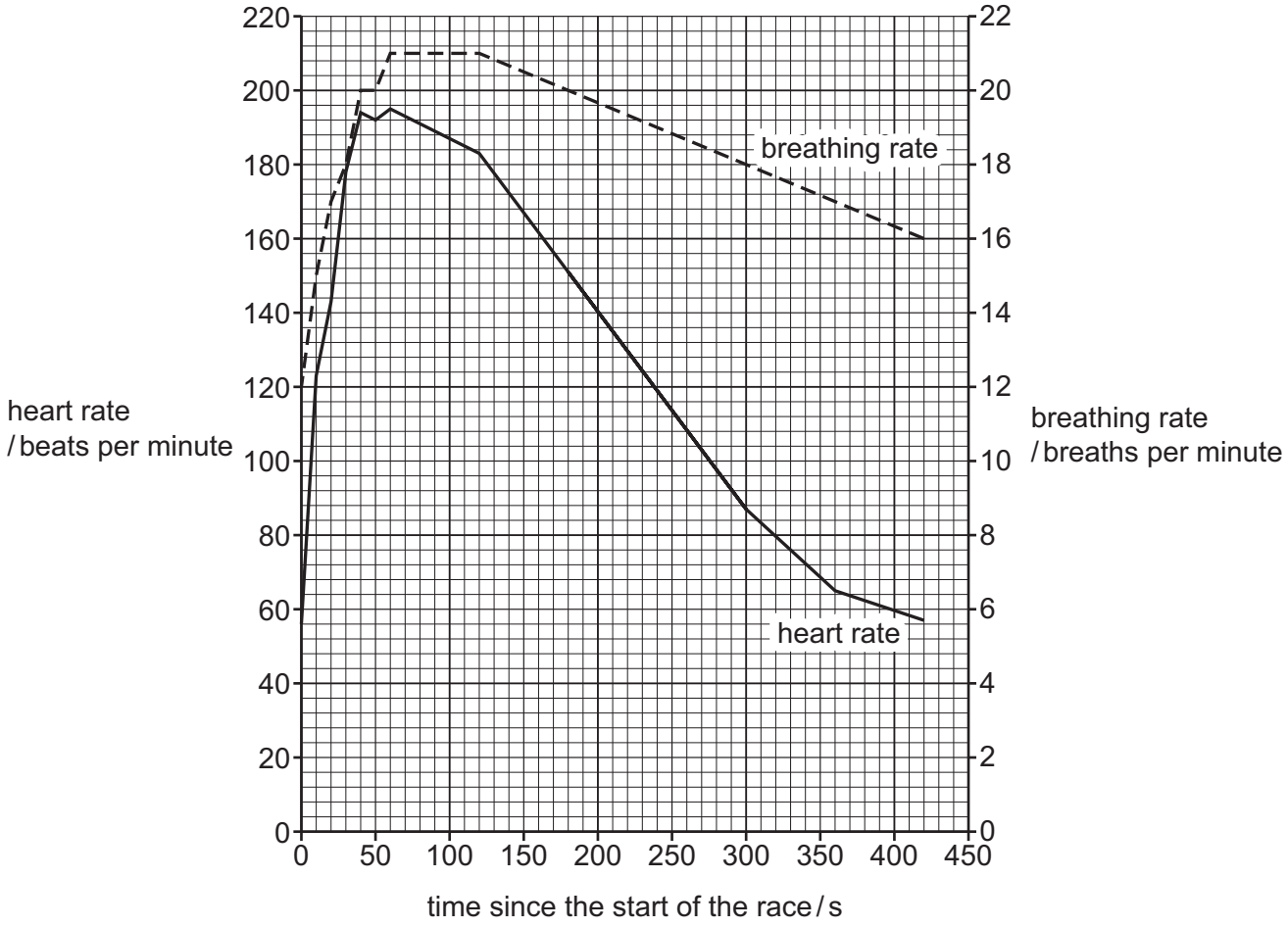

Fig. 4.1

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(i) The rate of breathing increases during the race in response to a change detected by the body.

Identify the stimulus in this response **and** state the organ that detects the stimulus.

stimulus .....

organ .....
[2]

(ii) Using the information in Fig. 4.1, calculate the rate of decrease in heart rate from 125 seconds to 260 seconds as the athlete recovers.

Space for working.

..... beats per minute per second [2]

(iii) Explain the results shown in Fig. 4.1 from 60 seconds until 420 seconds.

.....

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.....

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..... [6]

[Total: 14]

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5 Feather colour in some breeds of chicken is an example of codominance in birds.

In this example, a chicken with white feathers and a chicken with black feathers can breed to produce offspring that have white feathers and black feathers.

The allele for black feathers is $\mathbf{F^B}$ and the allele for white feathers is $\mathbf{F^W}$.

Fig. 5.1 is a pedigree diagram of a family of chickens.

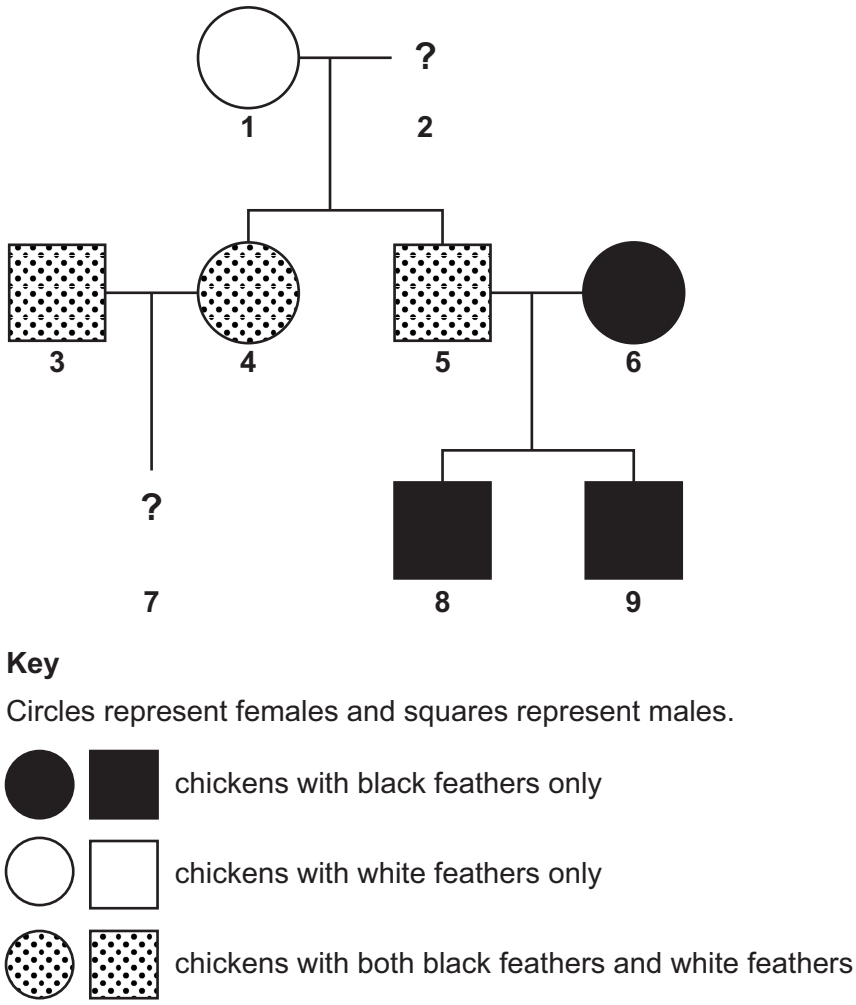

Fig. 5.1

(a) State the type of variation that is caused by genes only.

..... [1]

(b) State **all** the possible genotypes of chicken **2** and chicken **7** in Fig. 5.1.

chicken **2** .....

chicken **7** .....
[2]

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(c) Complete the genetic diagram to show the results of a cross between chicken **5** and chicken **6** in Fig. 5.1.

	chicken **5**		chicken **6**
parental phenotypes	.....	×	.....
parental genotypes	.....	×	.....
gametes	..... , ...		..... , ...

offspring genotypes .....

expected offspring phenotype percentage .....
[5]

(d) State **one** example of codominance in humans.

..... [1]

[Total: 9]

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6 Some blood-clotting disorders can be inherited.

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

.....

.....

..... [2]

(ii) Describe the process of blood-clotting.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

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(b) Genetic modification has been used to produce human proteins.

One protein made in this way is factor VIIa which is used to treat some blood clotting disorders.

Fig. 6.1 shows part of the process.

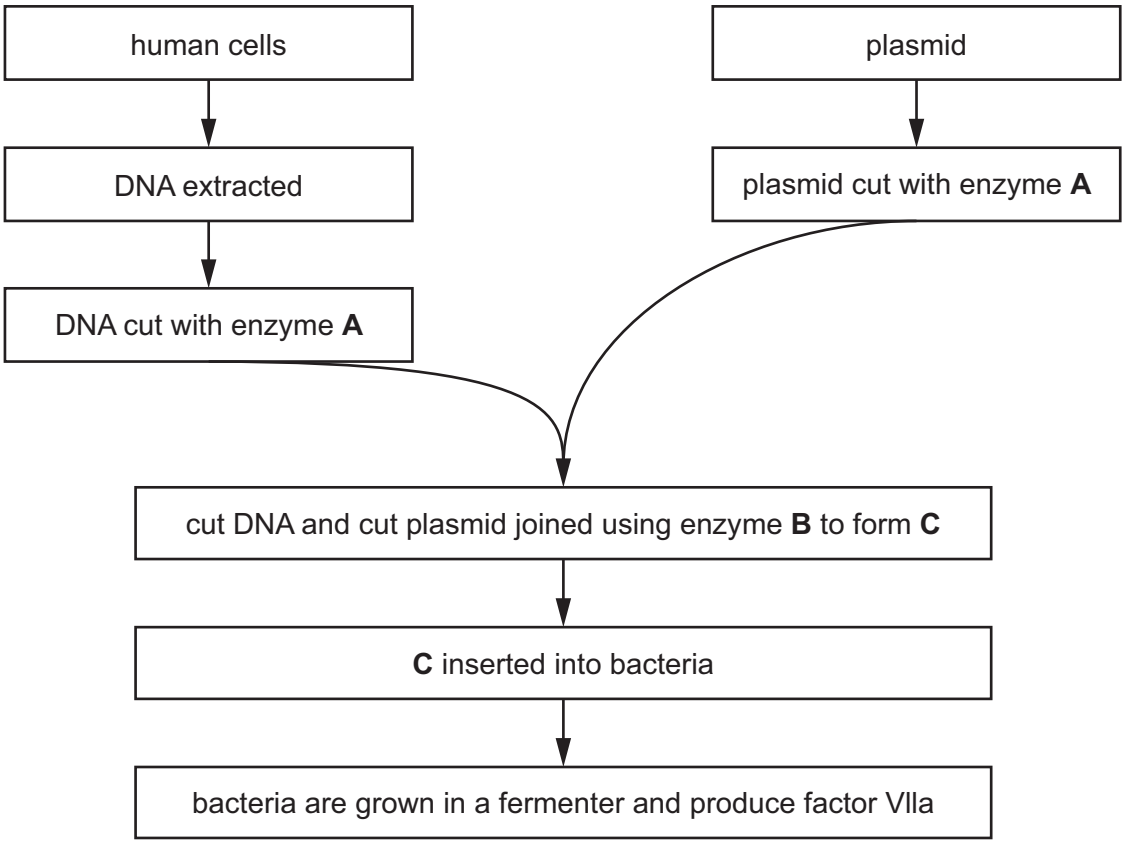

Fig. 6.1

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(i) State the names of enzyme **A** and enzyme **B** in Fig. 6.1.

A .....

B .....
[2]

(ii) Explain why it is important that enzyme **A** is used to cut both the human DNA and the plasmid.

.....

.....

..... [2]

(iii) State what the letter **C** in Fig. 6.1 represents.

..... [1]

(iv) Explain why the contents of the fermenter in Fig. 6.1 are stirred constantly.

.....

.....

..... [1]

(v) Bacteria can be used to make complex molecules.

Describe **two** other reasons why bacteria are useful in biotechnology.

1 .....

.....

2 .....

.....
[2]

(vi) Describe **two** ways animal cells differ from bacterial cells.

1 .....

2 .....
[2]

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(c) Crop plants such as soya can also be genetically modified.

Discuss the advantages and disadvantages of genetic modification of crop plants.

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..... [4]

[Total: 20]

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