Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8855766941

BIOLOGY **9700/23**

Paper 2 Structured Questions AS **October/November 2015**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **16** printed pages.

CAMBRIDGE International Examinations

Answer **all** the questions

1 Antibodies are secreted by activated B-lymphocytes known as plasma cells.

Fig. 1.1 is a diagram showing the cellular processes involved in the production of a polypeptide of an antibody molecule (not drawn to scale).

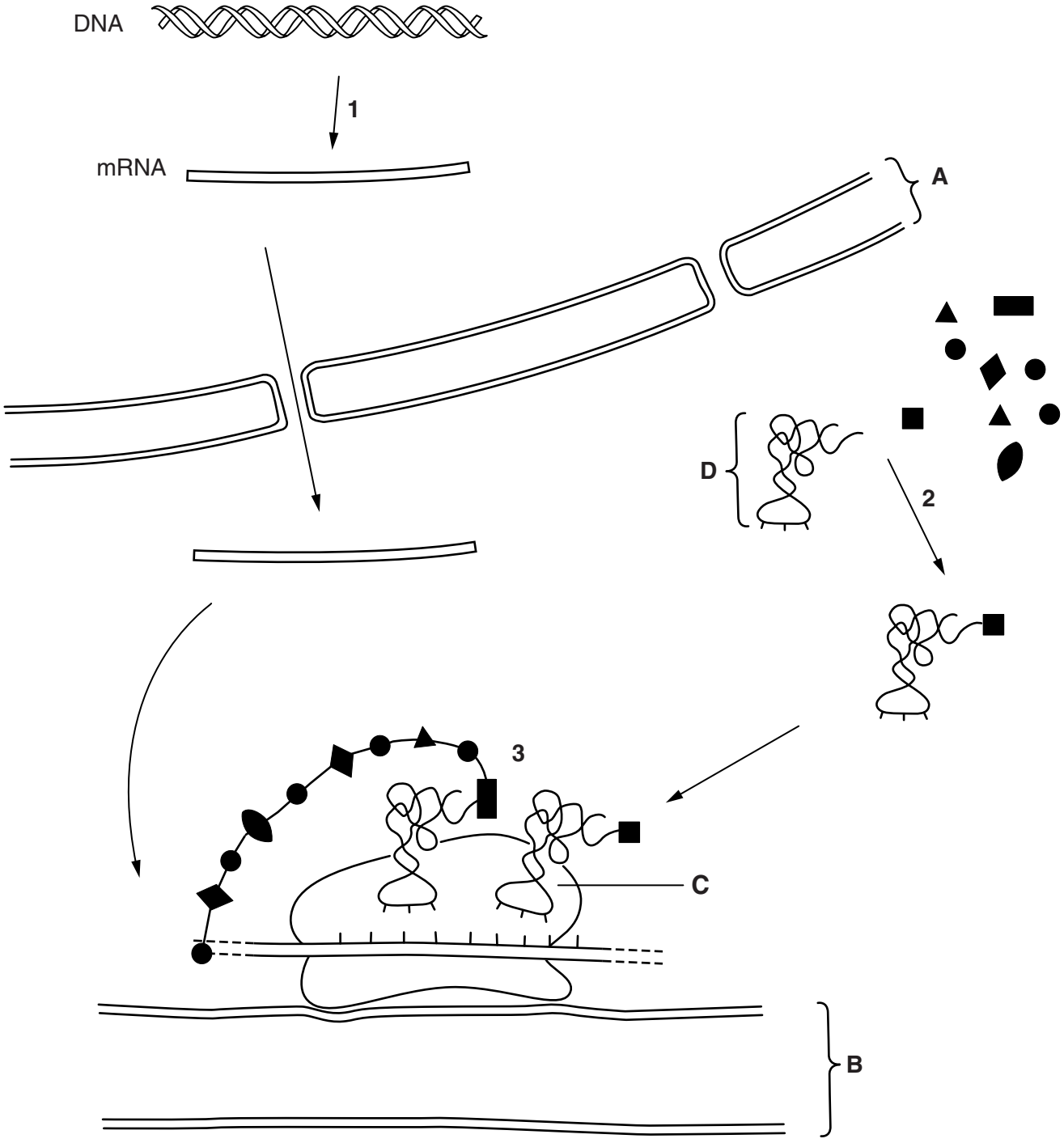

Fig. 1.1

(a) (i) Name structures **A**, **B** and **C**.

A .....

B .....

C ..... [3]

(ii) Name molecule **D**.

D ..... [1]

(iii) State what is occurring at **1**, **2** and **3**.

*at **1*** .....

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*at **2*** .....

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*at **3*** .....

..... [3]

(b) Antibodies are glycoproteins.

State what is meant by the term glycoprotein.

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..... [1]

(c) The genes responsible for antibody production are found on different chromosomes, such as chromosomes 2 and 14 in humans.

Explain how one antibody molecule is the product of more than one gene.

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..... [2]

(d) Describe **and** explain how the structure of an antibody molecule is related to its functions.

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..... [4]

[Total: 14]

Question 2 starts on page 6

2 Most of the water lost from plants passes out through the stomata of leaves.

The distance between open guard cells is known as the stomatal aperture, as shown in Fig. 2.1.

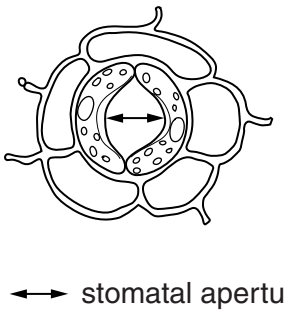

Fig. 2.1

Researchers investigated the effect of stomatal aperture on rates of transpiration in leaves of *Tradescantia zebrina* under two conditions:

- air kept moving by a fan (moving air)
- non-moving air.

The results are shown in Fig. 2.2.

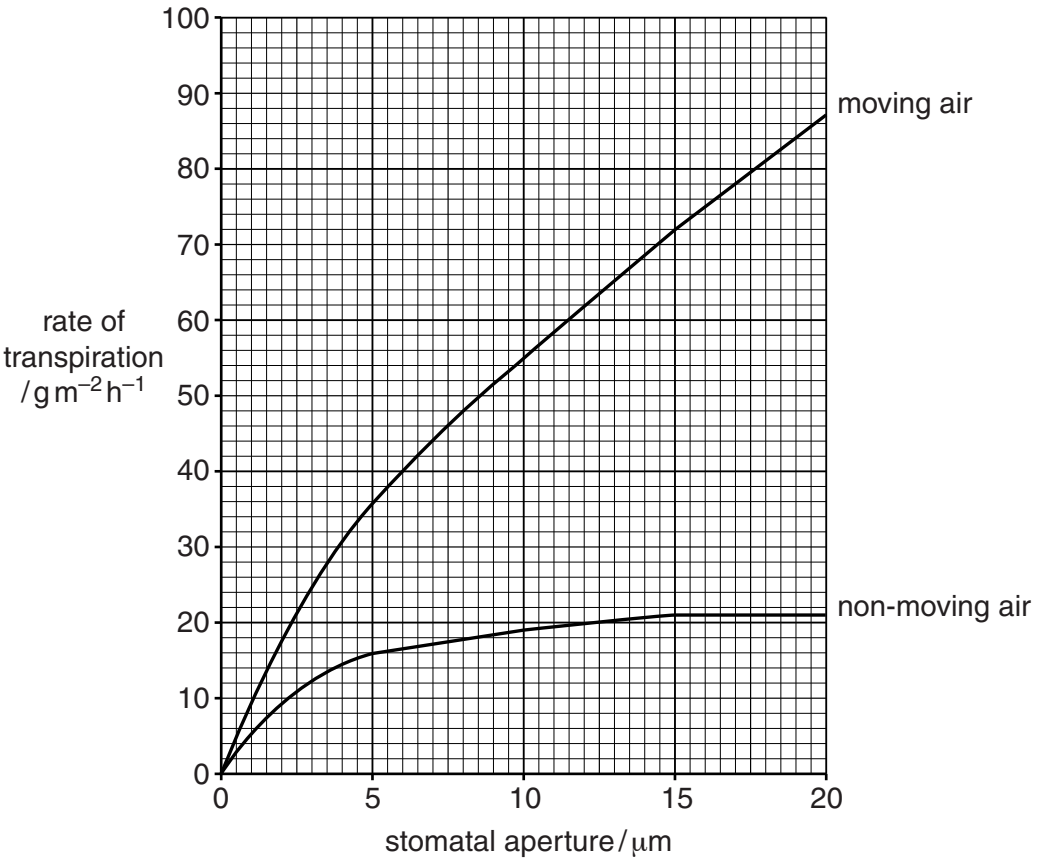

Fig. 2.2

(a) (i) Compare the effect of stomatal aperture on the rate of transpiration in *T. zebrina* in the two conditions.

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(ii) Explain the effect of stomatal aperture on rates of transpiration in non-moving and moving air.

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..... [3]

(b) Spruce trees and pine trees are adapted to dry conditions where water can be in limited supply.

Fig. 2.3 shows two stomata in a spruce leaf and Fig. 2.4 shows a vertical section through a stoma from a pine leaf.

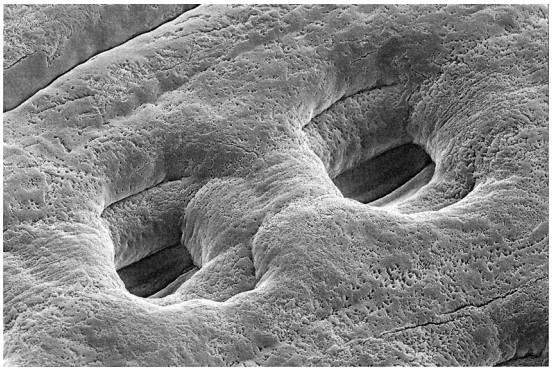

Fig. 2.3

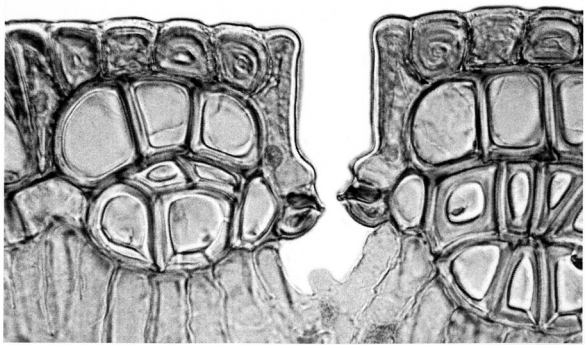

Fig. 2.4

(i) Explain how the stomatal features shown in Fig. 2.3 and Fig. 2.4 give an advantage to plants such as spruce and pine.

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..... [2]

(ii) Some plants that live in very dry conditions close their stomata during the day and open them at night.

State **one** disadvantage of this for these plants.

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..... [1]

(iii) State **and** explain two adaptations that plant leaves have for survival in dry conditions **other** than those involving number or structure of stomata.

1. .....

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2. .....

..... [2]

[Total: 11]

Question 3 starts on page 10

3 The enzyme catalase is found in many plant and animal tissues.
The enzyme catalyses the decomposition of hydrogen peroxide, which is a toxic product of metabolism. The reaction is:

$$2H_2O_2 \xrightarrow{\text{catalase}} O_2 + 2H_2O$$

A research team investigated the activity of two forms of catalase, **P** and **Q**, extracted from *Anopheles gambiae*, an important vector of malaria. The team investigated the effect of increasing concentrations of hydrogen peroxide on the activity of these two forms of catalase.

The results are shown in Fig. 3.1.

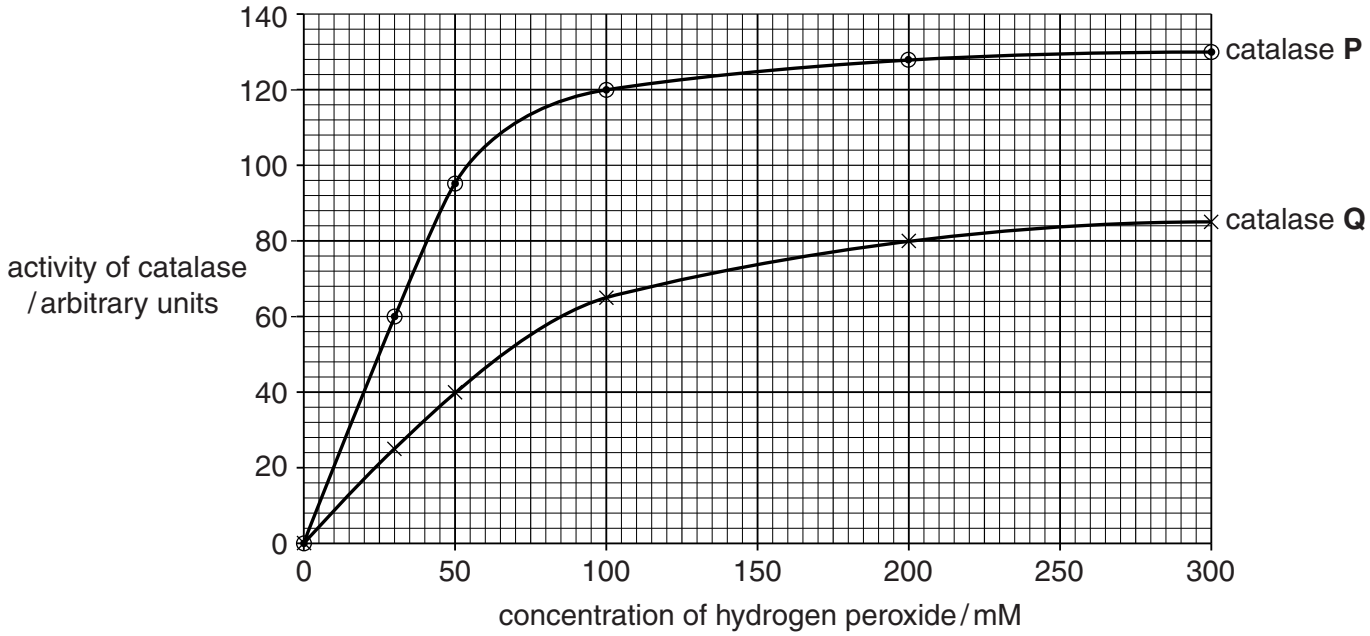

Fig. 3.1

(a) With reference to Fig. 3.1, describe **and** explain the effect of increasing the concentration of hydrogen peroxide on the activity of catalase **P**.

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..... [5]

(b) Each molecule of catalase consists of four identical polypeptides. The two forms of catalase in *A. gambiae* differ by only one amino acid at position 2 in the amino acid sequence. Catalase **P** has serine and catalase **Q** has tryptophan.

Suggest how the difference in one amino acid is responsible for the lower activity of catalase **Q** compared with catalase **P**.

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..... [2]

(c) Female mosquitoes feed on blood in order to produce their eggs. After feeding, the metabolic rate increases for egg production.

The researchers allowed female mosquitoes to feed on blood. They found that female mosquitoes with only catalase **P** produced more eggs than those with only catalase **Q**.

Suggest why there is a difference in egg production between the two types of *A. gambiae*.

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..... [2]

(d) Metal ions can act as a non-competitive inhibitor of catalase.

Explain how copper ions can act as a non-competitive inhibitor.

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..... [2]

(e) Enzyme inhibitors can also inhibit carrier proteins in cell surface membranes.

Explain why carrier proteins are required in cell surface membranes.

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..... [2]

(f) Describe three roles of cell surface membranes, **other than** the transport of substances into and out of cells.

1. .....

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2. .....

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3. .....

..... [3]

[Total: 16]

4 Glycogen is a highly branched polysaccharide molecule that is stored in the liver, kidney and muscles of mammals.

Fig. 4.1 shows a small part of a molecule of glycogen.

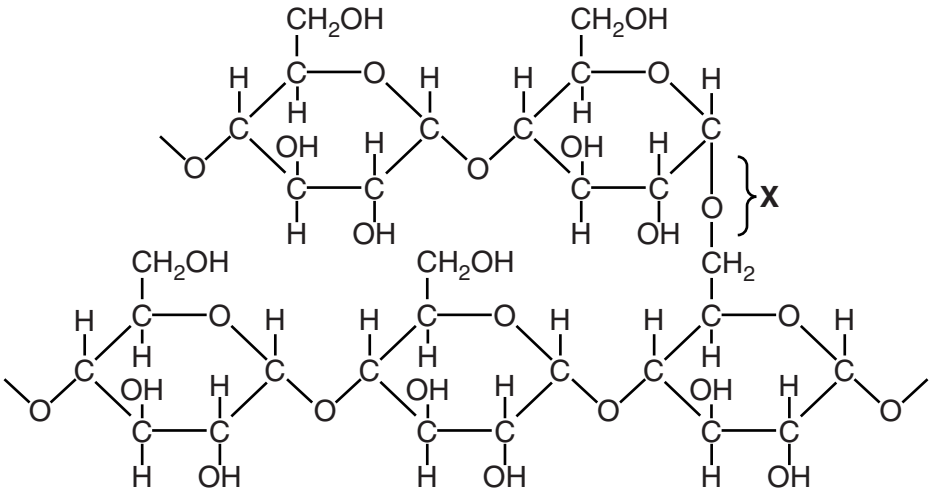

Fig. 4.1

(a) (i) Name the bond at **X**.

..... [1]

(ii) State the advantages for a mammal of having a storage molecule that is highly branched.

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..... [2]

(iii) State two ways in which the structure of cellulose differs from the structure of glycogen.

1. .....

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2. .....

..... [2]

(b) Glycogen from animals and starch from plants form a large part of the energy intake of humans.

Fig. 4.2 is a flow chart that shows the energy input, in one growing season, into a field of a cereal crop which is processed to provide animal feed.

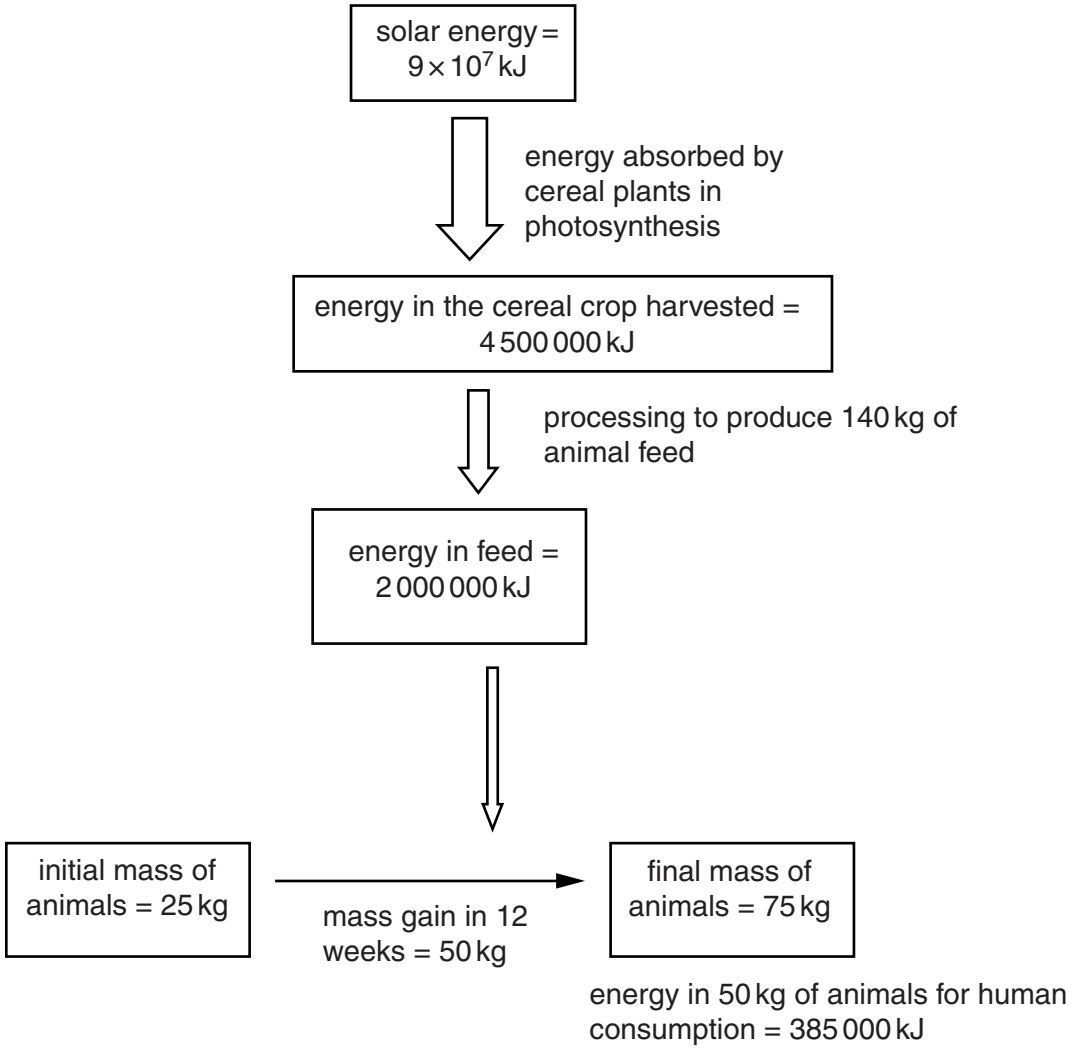

Fig. 4.2

(i) Calculate the percentage of the energy in animal feed that is converted into energy available for human consumption. Show your working.

answer ..... [2]

(ii) Explain why the energy available to humans from feeding on animal products is much less than if the energy came directly from crop plants, such as cereals.

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[Total: 10]

5 Nicotine and carbon monoxide in tobacco smoke contribute to damage to the cardiovascular system.

(a) Explain how nicotine and carbon monoxide contribute to damage to the coronary arteries.

nicotine .....

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carbon monoxide .....

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..... [3]

(b) One type of surgical treatment for coronary heart disease is to use arteries from the chest and veins from the leg to by-pass blockages as shown in Fig. 5.1.

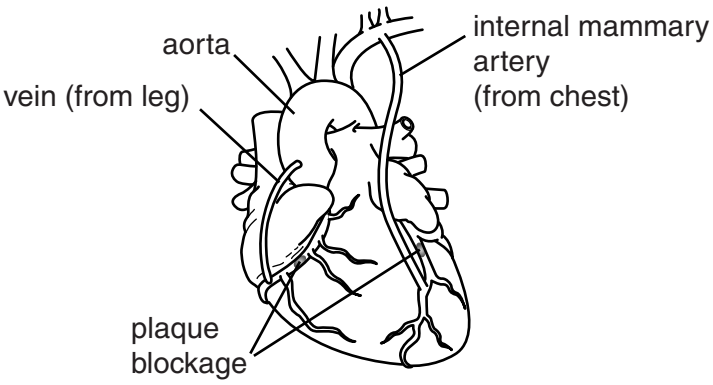

Fig. 5.1

(i) Explain how the two by-passes shown in Fig. 5.1 provide an effective treatment for coronary heart disease.

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(ii) The cost of treating heart disease is very high.

Suggest the steps that governments could take to reduce heart disease in the population.

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[Total: 9]