4 Fig. 4.1 is a photograph of a bee on a flower. One of the bee's legs is covered with pollen.

Fig. 4.1

(a) (i) State **three** features of flowers that attract pollinating insects such as bees.

1 .....

2 .....

3 .....

[3]

(ii) State **one** way that pollen grains are adapted for pollination by bees.

.....

.....

..... [1]

(b) Describe **two** ways the structure of a monocotyledonous plant differs from the structure of a dicotyledonous plant.

1 .....

.....

2 .....

.....

[2]

(c) Fig. 4.2 is a diagram of a cross-section of an insect-pollinated flower.

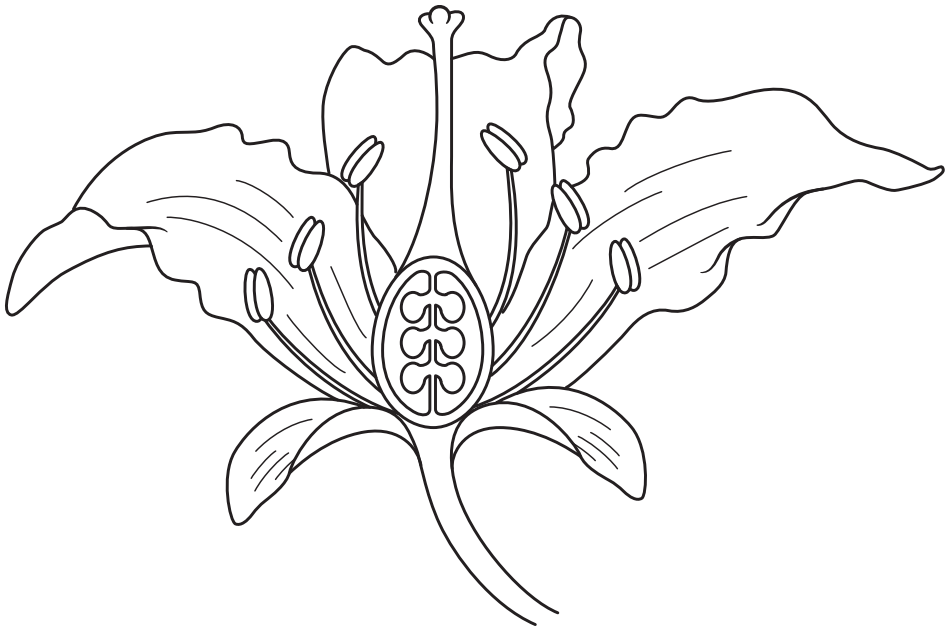

Fig. 4.2

On Fig. 4.2, name and draw label lines to:

- the structure that supports an anther
- a structure that protects the flower bud
- an ovule.

[3]

(d) Describe sexual reproduction in a flower, from the release of pollen to the formation of a zygote.

.....

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.....

(e) Sexual reproduction also occurs in humans.

(i) State the name of the male gamete in a human.

..... [1]

(ii) State where gametes are formed in the human male reproductive system.

..... [1]

(iii) Human male gametes are haploid.

State the name of the process that produces haploid male gametes.

..... [1]

(iv) Describe the function of the prostate gland in the male reproductive system.

.....

.....

..... [1]

[Total: 18]

2 **(a)** Dicotyledons and monocotyledons belong to the plant kingdom.

(i) State **two** main features of plants.

1 .....

2 .....
[2]

(ii) State the names of **two** other kingdoms.

1 .....

2 .....
[2]

(b) Fig. 2.1 is a diagram of a cross-section of a monocotyledonous stem.

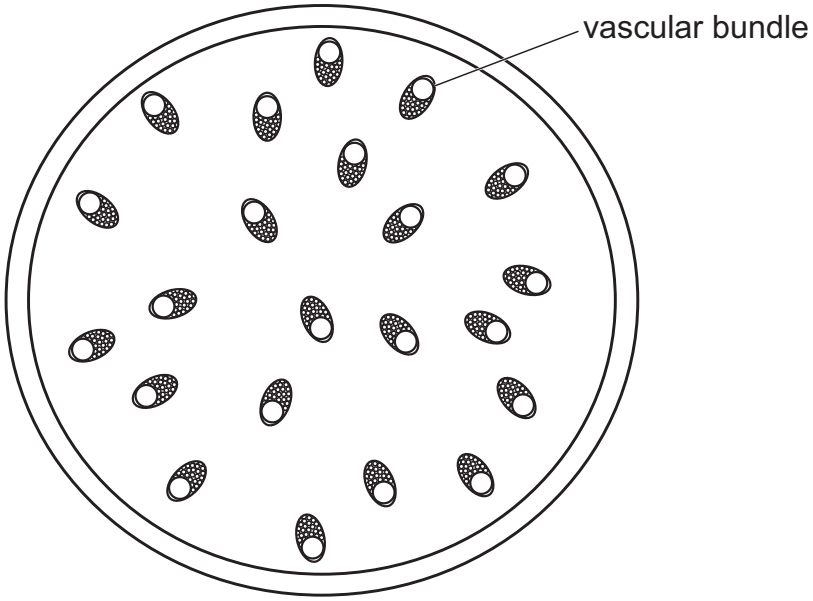


Fig. 2.1

Describe how the distribution of vascular bundles in a dicotyledonous stem would differ from the monocotyledonous stem shown in Fig. 2.1.

.....

.....

..... [1]

(c) Fig. 2.2 is an incomplete drawing of a cross-section of a dicotyledonous root.

Complete Fig. 2.2 by:

- sketching the distribution of phloem and xylem
- labelling the phloem, xylem and a root hair.

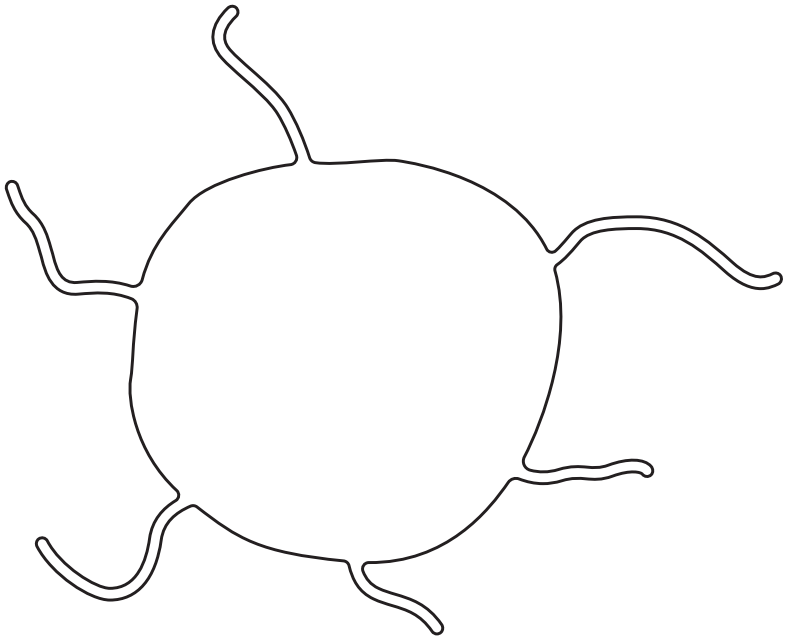


Fig. 2.2

[3]

(d) State **two** functions of xylem.

1 .....

2 .....

[2]

(e) A farmer investigated the effect of girdling on the mass of apple fruit produced by apple trees.

The farmer removed a 3 mm strip of bark and phloem tissue from the branches that produce the fruit, as shown in Fig. 2.3.

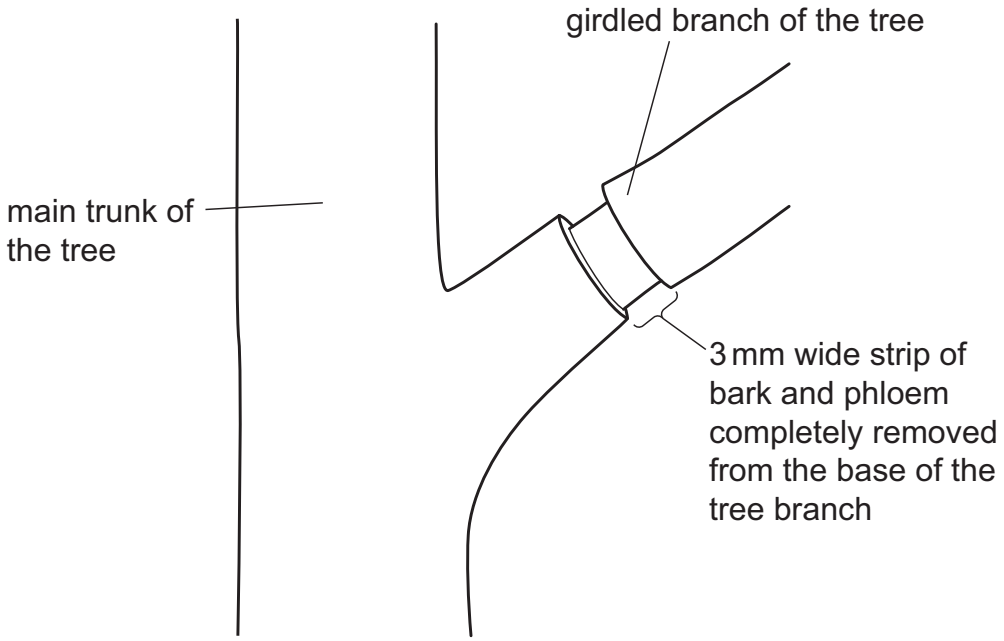


Fig. 2.3

The farmer girdled nine apple trees and left nine apple trees ungirdled.

The mass of ten fruits from the girdled trees and the mass of ten fruits from the ungirdled trees were compared.

Table 2.1 shows the results.

Table 2.1

treatment of trees	mass of ten fruits / g
girdled	1796
ungirdled	958

Describe the results shown in Table 2.1 **and** suggest an explanation for them.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(f) Apples are used to make apple juice.

State **one** enzyme used in fruit juice production.

..... [1]

[Total: 16]

3 **(a)** Fig. 3.1 is a photograph of a necklace starfish, *Fromia monilis*.

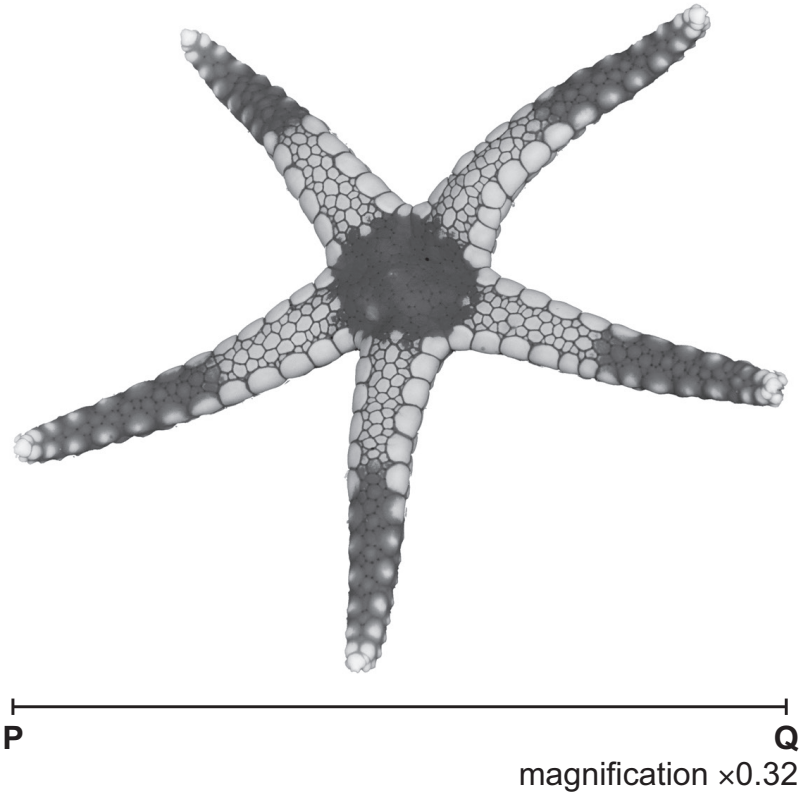


Fig. 3.1

(i) Draw a large diagram of the necklace starfish shown in Fig. 3.1.

[4]

(ii) Line **PQ** in Fig. 3.1 represents the diameter of the necklace starfish.

Measure the length of line **PQ** in Fig. 3.1.

length of line **PQ** ..... mm

Calculate the actual diameter of the necklace starfish using the formula and your measurement.

$$\text{magnification} = \frac{\text{length of line } \mathbf{PQ} \text{ in Fig. 3.1}}{\text{actual diameter of the necklace starfish}}$$

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

Space for working.

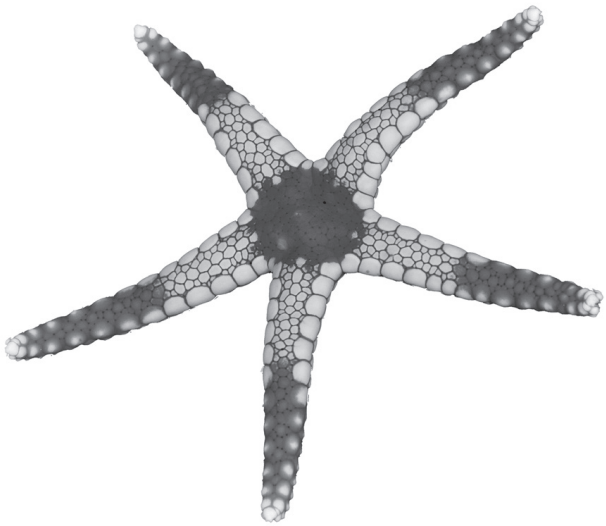
..... mm
[3]

(iii) Fig. 3.2 is a photograph of a spiny starfish, *Marthasterias glacialis*. Fig. 3.3 is a photograph of a necklace starfish.

The magnifications of the photographs are **not** the same.

spiny starfish

Fig. 3.2



necklace starfish

Fig. 3.3

State **two** ways the spiny starfish in Fig. 3.2 differs from the necklace starfish in Fig. 3.3, and **one** way it is similar.

Do **not** include references to size in your answer.

difference 1 .....

.....

difference 2 .....

.....

similarity 1 .....

.....

[3]

(b) Seven-armed starfish live in the sea.

Scientists investigated the distribution of seven-armed starfish, *Luidia ciliaris*, in one region.

- Photographs of 20 m^2 areas of seabed were taken at different depths.
- The depth of the water in each area was measured when the water was at its highest level (high tide).
- The numbers of seven-armed starfish in each photograph were counted.
- All photographs were taken on the same day in July.

(i) State **two** ways that the method used by the scientists ensured that the numbers of seven-armed starfish counted at different depths could be compared.

1 .....

.....

2 .....

.....

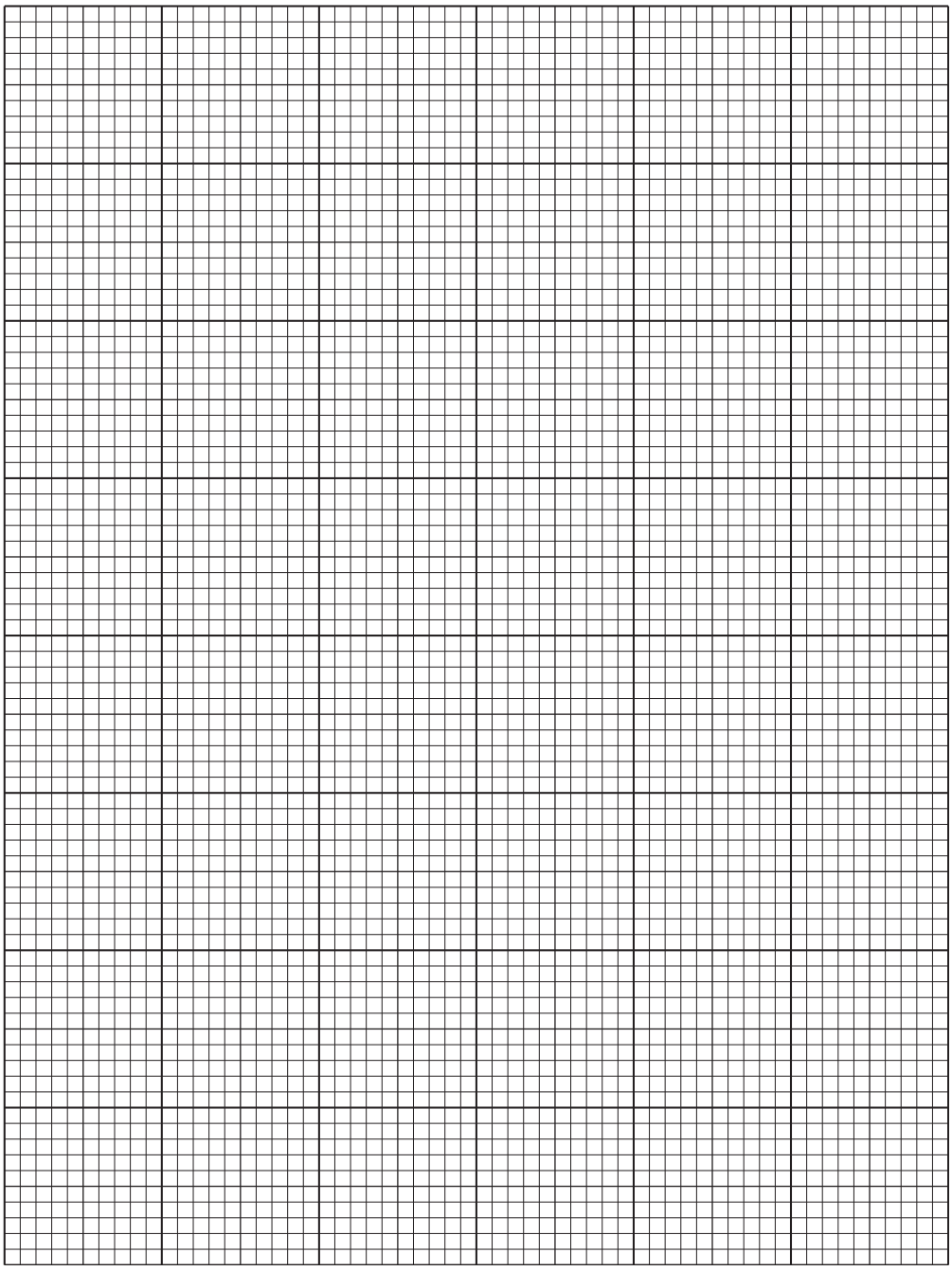
[2]

The results of the investigation are shown in Table 3.1.

Table 3.1

depth / m	number of seven-armed starfish counted
0.0–9.9	337
10.0–19.9	1486
20.0–29.9	1243
30.0–39.9	241
40.0–49.9	121

(ii) Plot a histogram on the grid of the data in Table 3.1.



[4]

(iii) State the depth range in Table 3.1 at which most seven-armed starfish were found.

.....m [1]

(iv) Using the information in Table 3.1, calculate the total number of seven-armed starfish that were photographed at all depths, and use this value to calculate the percentage of starfish that were photographed in the 0.0–9.9 m range.

Express the percentage as a whole number.

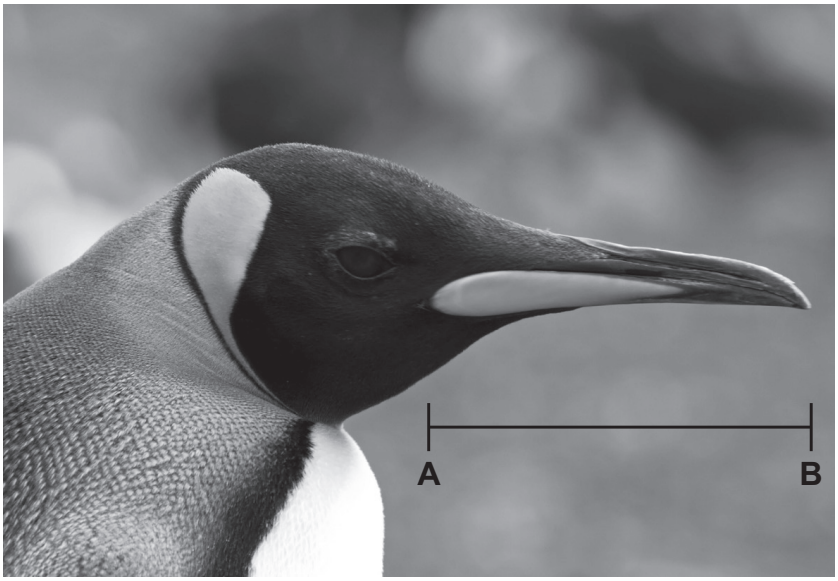
Space for working.

total number of seven-armed starfish photographed .....

percentage of seven-armed starfish photographed at 0.0–9.9 m .....%
[3]

[Total: 20]

3 **(a)** Fig. 3.1 is a photograph of the head of a king penguin.



magnification ×0.42

Fig. 3.1

(i) Make a large drawing of the head of the king penguin shown in Fig. 3.1.

[4]

(ii) The length of line **AB** represents the length of the penguin's beak.

Measure the length of line **AB** in Fig. 3.1.

length of line **AB** ..... mm

Use your measurement and the formula to calculate the actual length of the penguin's beak.

$$\text{magnification} = \frac{\text{length of line } \mathbf{AB} \text{ in Fig. 3.1}}{\text{actual length of the penguin's beak}}$$

Give your answer to **one** decimal place.

Space for working.

..... mm
[3]

(b) Fig. 3.2 shows the heads of a gentoo penguin and a black-footed penguin.

gentoo black-footed

not to scale

Fig. 3.2

Other than size, state **two** ways the gentoo penguin differs from the black-footed penguin in Fig. 3.2.

1 .....

.....

2 .....

.....

[2]

(c) Penguins are covered in feathers. The feathers reduce heat loss by insulating the birds from the cold.

A beaker of hot water can be used to represent a penguin.

Plan an investigation to determine the effect of the thickness of an insulating material on heat loss in a beaker of hot water.

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..... [6]

[Total: 15]

2 Which set of features is characteristic only of birds?

A hair and wings

B hard-shelled eggs and feathers

C scales and soft-shelled eggs

D wings and soft-shelled eggs

3 A single-celled organism has chloroplasts, a cell wall and a nucleus.

Which kingdom is this organism placed in?

A fungus

B plant

C prokaryote

D protoctist

4 Fig. 4.1 is a photograph of a water lily, *Nymphaea alba*, in a lake.

Fig. 4.1

Fig. 4.2 is a photomicrograph of a cross-section of part of a water lily leaf.

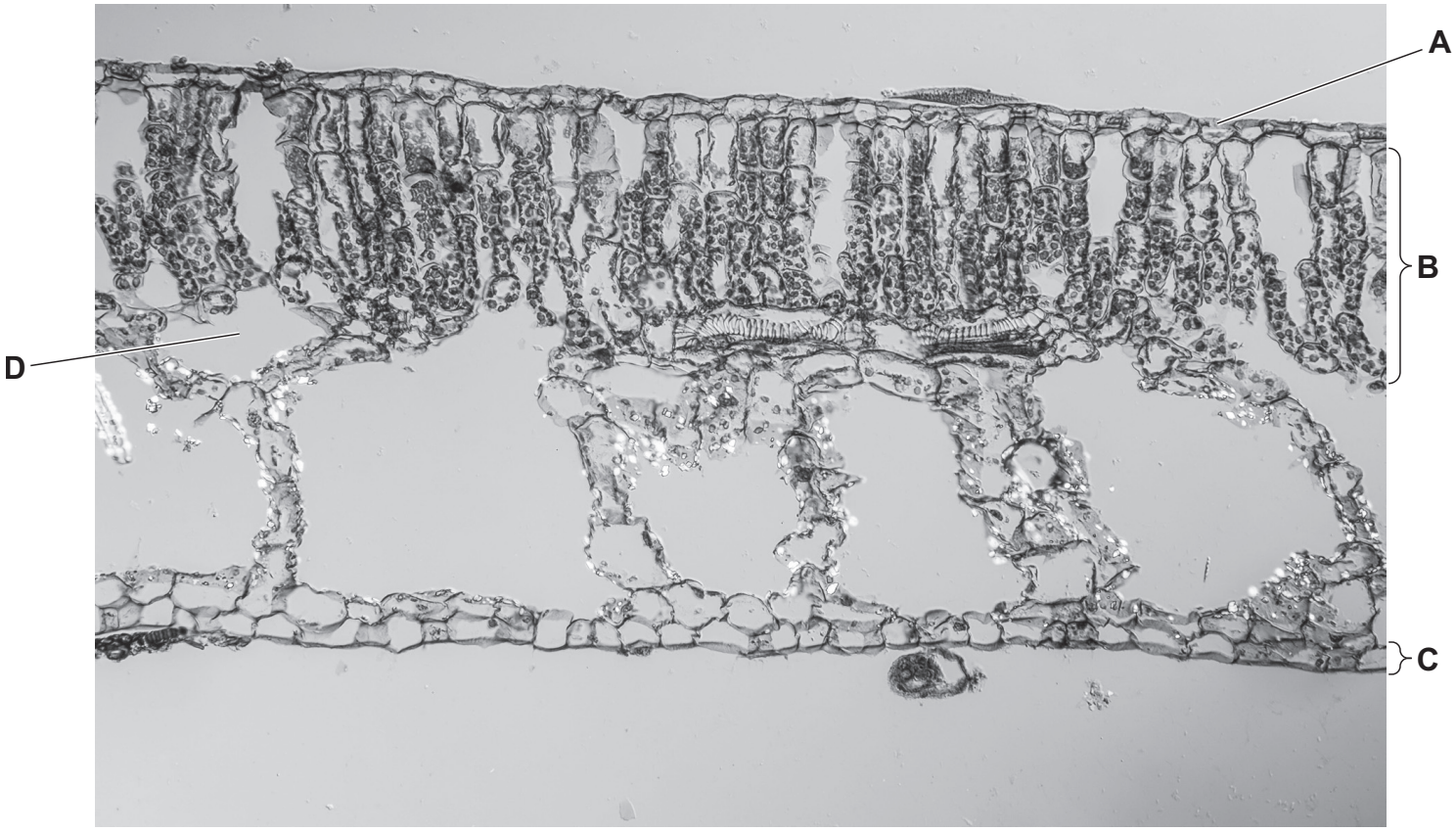

Fig. 4.2

(a) (i) Identify tissue **B** and tissue **C** labelled in Fig. 4.2.

B .....

C .....

[2]

(ii) Describe **two** functions in water lilies of the area labelled **D** in Fig. 4.2.

1 .....

.....

2 .....

.....

[2]

(iii) A green pigment is found in tissue **B** in Fig. 4.2.

Describe the function of this pigment.

.....

.....

.....

.....

..... [2]

(iv) Water lilies have a very thin cuticle compared to a plant growing on land.

Explain how this is an adaptation for water lilies.

.....

.....

.....

.....

..... [2]

(b) Table 4.1 shows the stomatal density and habitat of two different hydrophytes.

Table 4.1

type of plant	habitat	stomatal density on upper leaf surface / stomata per mm^2	stomatal density on lower leaf surface / stomata per mm^2
pondweed	under the water	0	0
water lily	leaves on the surface of the water	573	0

(i) Convert the stomatal density of the upper leaf surface of the water lily to stomata per cm^2.

..... stomata per cm^2 [1]

(ii) Using the data in Table 4.1, explain the stomatal density found in the two different hydrophytes.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Fig. 4.3 is a photograph of rice, *Oryza sativa*, a monocotyledonous crop plant grown in flooded fields in waterlogged soils.

Fig. 4.3

(i) Identify a characteristic visible in Fig. 4.3 that can be used to classify rice as a monocotyledonous plant.

.....

[1]

(ii) Waterlogged soil contains very low concentrations of oxygen.

Suggest how this limits the amount of proteins a plant can make.

.....

.....

.....

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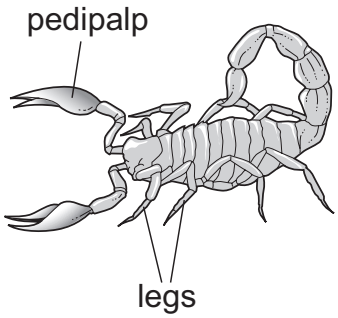
.....

.....

..... [3]

[Total: 17]

2 The diagram shows an arthropod.



To which group does it belong?

A arachnids

B crustaceans

C insects

D myriapods