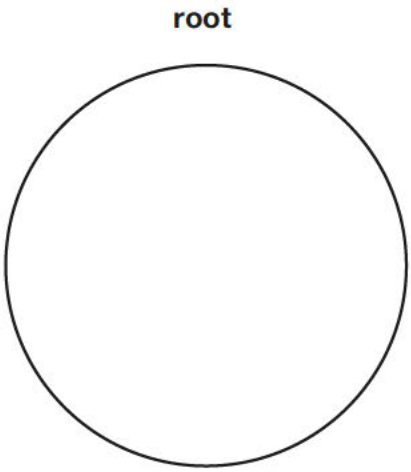
1 Translocation is the movement of the products of photosynthesis within a plant.

Translocation occurs in the phloem and involves sources and sinks.

(a) Using the outline below, draw in the position of the phloem in the root of a dicotyledonous plant.



[1]

(b) Research using carbon dioxide containing a radioactive label, C^{14}, has revealed the following evidence about the mechanism of translocation:

A labelled carbon can be observed in the phloem soon after being supplied to a well-lit plant;

B the rate of movement of sugars in the phloem is many times faster than could be achieved by diffusion alone.

Different research has revealed that:

C an insect such as an aphid feeds by inserting its proboscis (mouth parts) into the phloem;

D the pH of the phloem companion cells is lower than surrounding cells;

E the phloem companion cells contain many mitochondria.

Using the letters **A**, **B**, **C**, **D** and **E**, select **two** pieces of evidence from the list above which support the theory that translocation occurs in the phloem.

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.....

[2]

(c) State what is meant by the terms *source* and *sink*.

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..... **[2]**

(d) When the bark is removed from a tree, the phloem is also removed. If a complete ring of bark is removed, the tree trunk can be seen to swell above the cut.

Suggest **two** reasons why the trunk swells above the cut.

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..... **[2]**

[Total: 7]

2 In an experiment to measure the rate of diffusion, a student placed cubes of agar jelly containing an indicator into dilute hydrochloric acid. The indicator changes from pink to colourless in acidic conditions.

The student used cubes of different sizes and recorded the time taken for the pink colour of each cube to disappear completely.

The student's results are recorded in Table 2.1.

Length of side of cube (mm)	**Surface area of cube (mm^2)**	**Volume of cube (mm^3)**	**Surface area to volume ratio**	**Time taken for pink colour to disappear (s)**	**Rate of diffusion ($mm\,s^{-1}$)**
2	24	8	3.0:1	50	0.020
5	150	125	1.2:1	120	0.021
10	600	1 000		300	0.017
20	2 400	8 000	0.3:1	700	0.014
30	5 400	27 000	0.2:1	1 200	0.013

Table 2.1

(a) (i) Calculate the surface area to volume ratio of the cube with 10 mm sides.

Show your working.

Answer = ... **[2]**

(ii) **Using the data in Table 2.1**, describe the relationship between the rate of diffusion and the surface area to volume ratio.

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..... **[2]**

(iii) Explain the significance of the relationship between rate of diffusion and the surface area to volume ratio for large plants.

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..... **[2]**

(b) Another student used the same raw data obtained in the experiment but calculated a different rate of diffusion for each cube. This student's results are shown in Table 2.2.

Length of side of cube (mm)	Time taken for pink colour to disappear (s)	Rate of diffusion ($mm\,s^{-1}$)
2	50	0.040
5	120	0.042
10	300	0.033
20	700	0.029
30	1200	0.025

Table 2.2

In this student's table, the calculation of the rate of diffusion is incorrect.

(i) Suggest the method used to calculate the rate of diffusion in Table 2.2.

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..... **[1]**

(ii) State why the method in **(b)(i)** is **not** correct.

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..... **[1]**

(c) In mammals, the lungs are adapted to enable efficient gaseous exchange.

The table below lists some of the adaptations of the lungs.

Complete the table explaining how each adaptation improves efficiency of gaseous exchange.

Adaptation	How this adaptation improves efficiency of gaseous exchange
squamous epithelium	....
large number of alveoli	....
good blood supply	....
good ventilation	....

[4]

[Total: 12]

3 **(a)** The lignin in the xylem vessel walls of plants and the C-rings of cartilage in the mammalian trachea perform an important role.

(i) Explain why lignin is essential in the wall of a xylem vessel.

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..... **[3]**

(ii) Explain why cartilage is essential in the trachea.

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..... **[3]**

(b) All living organisms exchange substances with their external environment.

The following data apply to an average person:

- the surface area of the body is approximately 1.8 m^2
- the volume of the body is approximately 0.07 m^3
- the surface area of the lungs is approximately 70 m^2.

Comment on the significance of this information for gas exchange.

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..... **[3]**

[Total: 9]

4 **(a)** Complete the following paragraph about cells by using the most appropriate term(s).

Cells that are not specialised but still have the ability to divide are called ..... cells. Such cells can be found in the ..... of the long bones of mammals. These cells can ..... into other types of cell, such as erythrocytes that carry oxygen in the blood. In plants, ... tissue also contains cells that are not specialised. **[4]**

(b) Sponges are simple eukaryotic multicellular organisms that live underwater on the surface of rocks.

Sponges have a cellular level of organisation. This means that they have no tissues.

Each cell type is specialised to perform a particular function.

One type of cell found in a sponge is a collar cell. Collar cells are held in position on the inner surface of the body of the sponge.

Fig. 2.1 is a diagram showing a vertical section through the body of a sponge and an enlarged drawing of a collar cell.

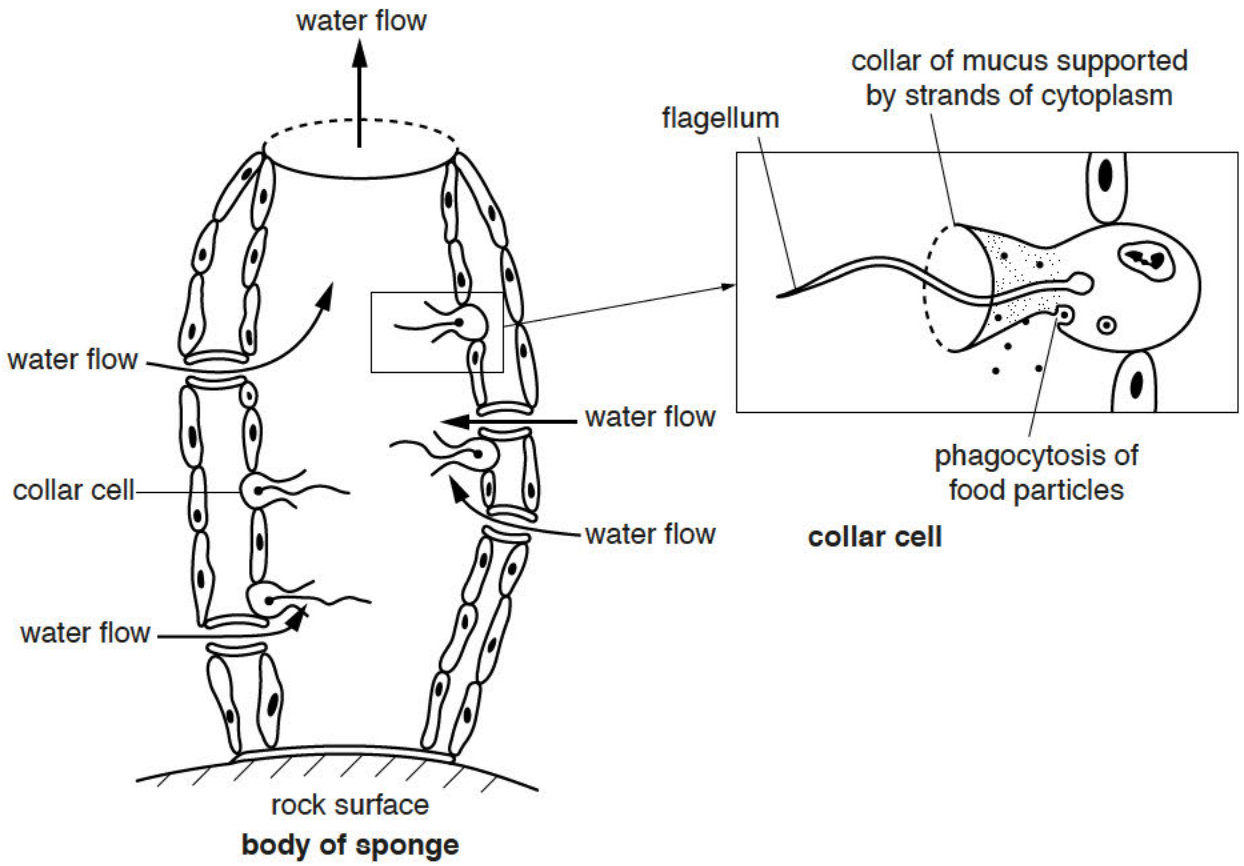


Fig. 2.1

(i) Suggest **one** function of the flagellum in the collar cell.

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..... **[1]**

(ii) Suggest **one** possible role for the collar of mucus in the cell.

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..... **[1]**

(c) In more advanced organisms, cells are organised into tissues consisting of one or more types of specialised cells.

Describe how cells are organised into tissues, using **xylem** and **phloem** as examples.

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..... **[4]**

[Total: 10]

5 a **(a)** State the maximum magnification that can be achieved by a light microscope and transmission electron microscope.

Select your answers from the list below.

10x **40x** 100x

light microscope x

transmission electron microscope ..... x **[2]**

(b) Describe what is meant by the term *resolution*.

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..... **[2]**

(c) Fig. 1.1 is an electron micrograph of xylem tissue in the stem of a plant.

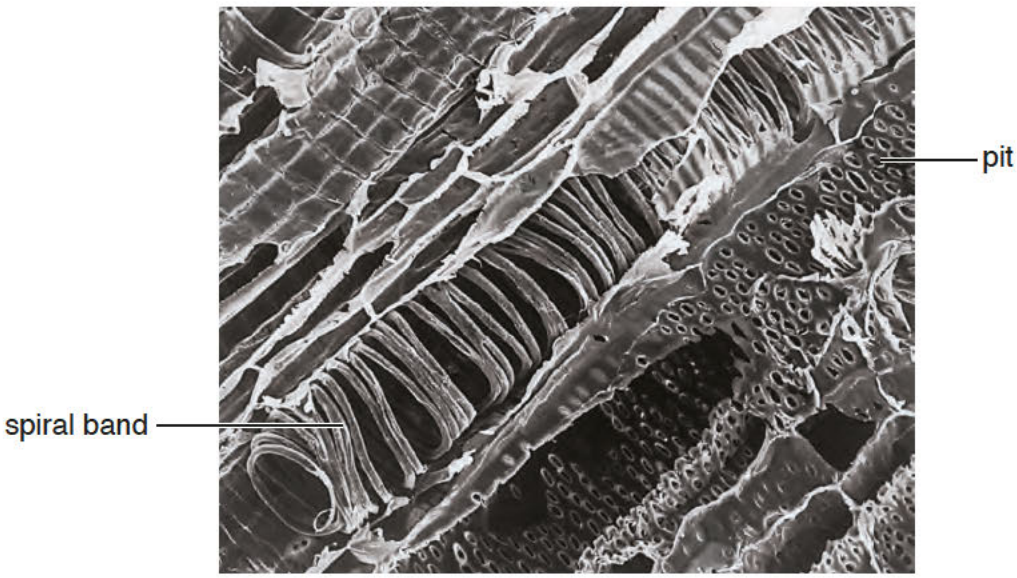


Fig. 1.1

(i) State **one** function of xylem tissue.

.....

..... **[1]**

(ii) The spiral band in the xylem vessel shown in Fig. 1.1 contains a substance called lignin.

State the function of this spiral band of lignin **and** explain why it is important that the xylem vessel becomes lignified in this way.

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..... **[3]**

(iii) Explain the function of the pits seen in Fig. 1.1.

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..... **[2]**

[Total: 10]