1 *Rhabdostyla* is a single-celled organism that has no cell wall and no chlorophyll.

(a) Gases are exchanged across the cell membrane of *Rhabdostyla*.

Name:

the gas produced by *Rhabdostyla* .....

the process that produces the gas .....

the method of removal of the gas .....

[3]

Rhabdostyla lives in freshwater habitats, such as ponds, lakes and rivers.

Freshwater has a very low concentration of solutes.

Rhabdostyla has a contractile vacuole that fills with water and empties at intervals as shown in Fig. 4.1. The contractile vacuole removes excess water.

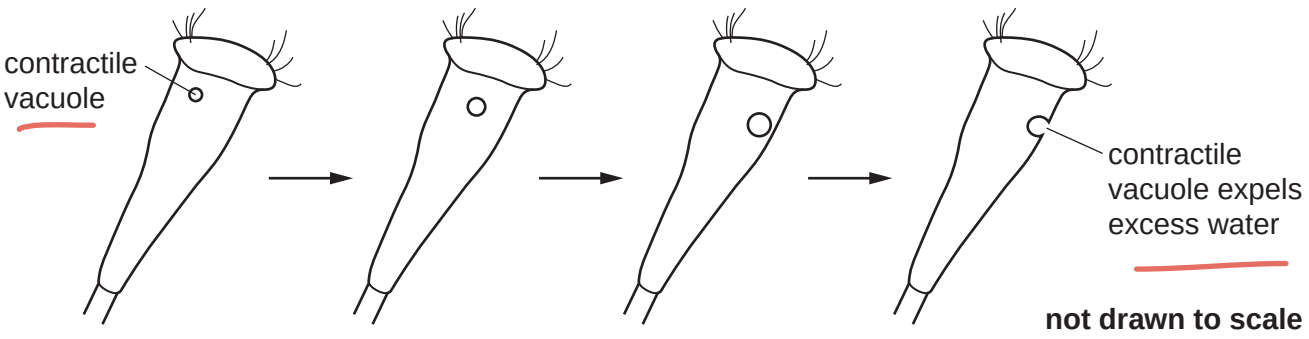


Fig. 4.1

(b) Explain, using the term **water potential**, why *Rhabdostyla* needs to remove excess water.

.....

.....

.....

.....

.....

.....

.....

[3]

In an investigation, individual *Rhabdostyla* were placed into different concentrations of sea water. The rate of water excreted by the contractile vacuole of each organism was determined. The results are shown in Fig. 4.2.

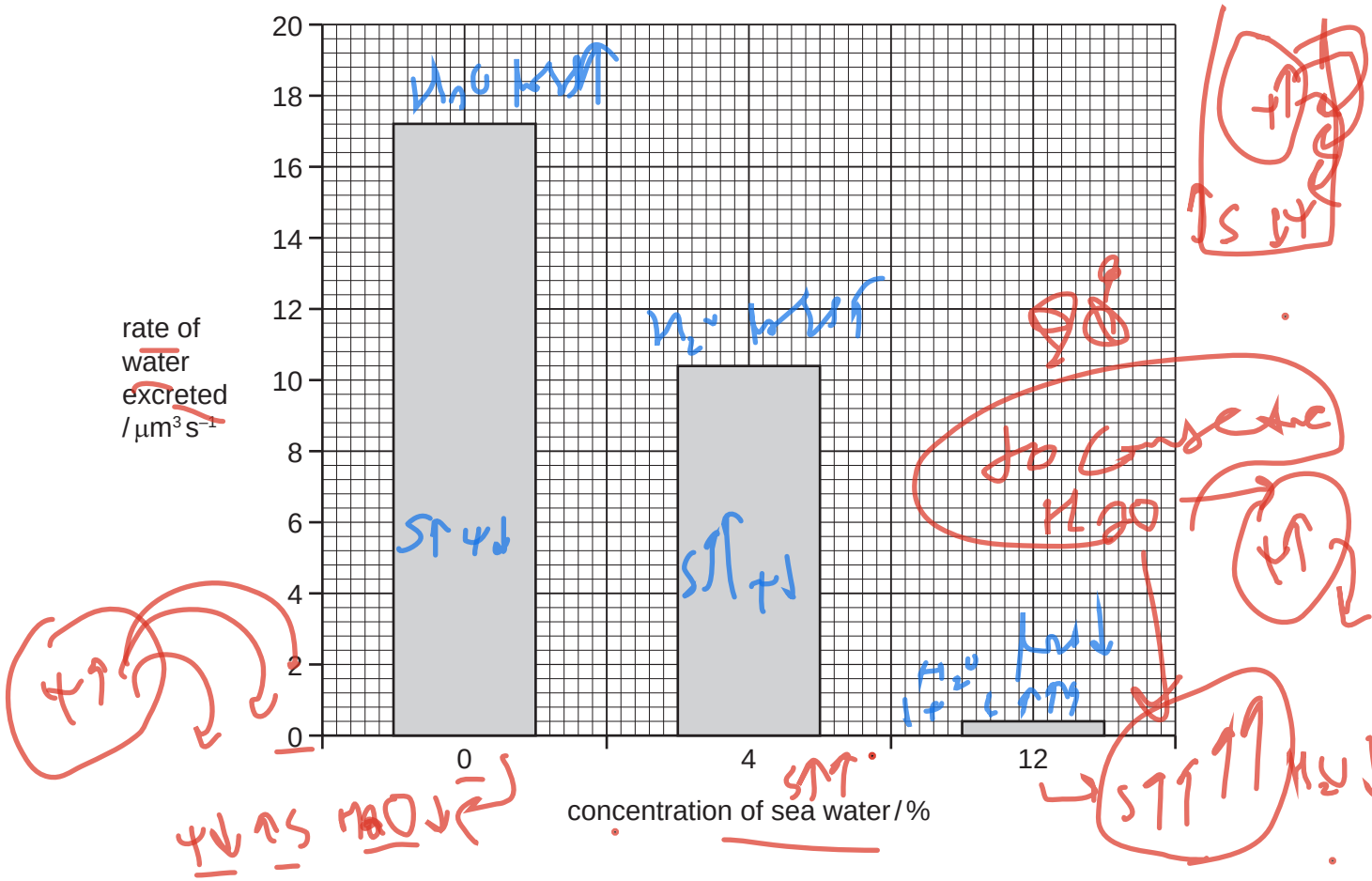


Fig. 4.2

(c) Explain the results shown in Fig. 4.2.

.....

.....

.....

.....

.....

.....

.....

[3]

(d) Single-celled organisms with cell walls do not have contractile vacuoles. Suggest why.

Cell wall → inelastic, dont stretch, rigid, inflexible
keep shape of cell
cell → turgid, high turgor pressure
Resist any increase in volume / pressure
cells do not absorb excess H2O
Not burst

[3]

[Total: 12]

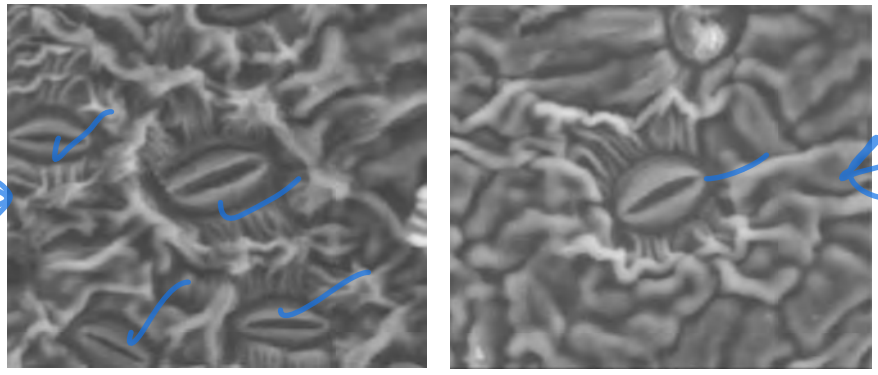
2 Water moves into plants from the soil and exits through the leaves.

(a) Explain how water moves from the soil into the root.

Soil → Root → down ↑ → high ↑ → low ↑ by osmosis
down concentration gradient
through partially permeable membrane
through protein pores in membrane

.....[4]

Water reaches the leaves from the roots through the xylem. Fig. 4.1 shows images of stomata on the lower surfaces of leaves of two varieties of olive plant, **A** and **B**. Both are shown at the same magnification.



A **B**

Fig. 4.1

(b) **(i)** Describe the function of stomata.

Movement of gas O2 / CO2 into / out of leaves
for photosynthesis / respiration
transpiration
ends to H2O to pull up the plants

.....[2]

(ii) Compare the density of stomata between the two varieties of olive plant, **A** and **B**, shown in Fig. 4.1.

Greater density / more stomata in variety A

4 times more

.....[2]

(iii) Under identical environmental conditions the rate of water uptake in plant **A** is higher than plant **B**.

Explain why.

* more stomata in Var A, more transpiration in Var A
* Greater opportunity for loss of H_2O vapour through stomata in Var A
* by evaporation from surface of mesophyll into air spaces in leaf
* loss of H_2O from leaf → lowers H_2O potential → pull

.....[3]

(c) The density of stomata is an example of a leaf adaptation to the environmental conditions.

State **two** other adaptations of leaves for survival in a **dry** environment.

collection of H_2O

1- Sunken stomata
2- hairs
3- Rolling / shrivelled leaves
4- thick cuticle
5- small surface area
6- few stomata / leaves
7- Rolling of leaves / reflecting surfaces

.....[2]

(d) Water lost from the leaves enters the atmosphere.

Describe how water is recycled from the atmosphere back to the roots.

H_2O vapour – condense to form cloud - fog - dew

precipitation

rain H_2O drains into River

Seeps into soil / form ground H_2O

.....[2]

[Total: 15]

3 Ecologists study plants and animals in their natural environment.
Some ecologists inserted probes into the water-conducting tissue in trees, as shown in Fig. 4.1.
The ecologists measured the time taken for water to move up from probe 1 to probe 2.

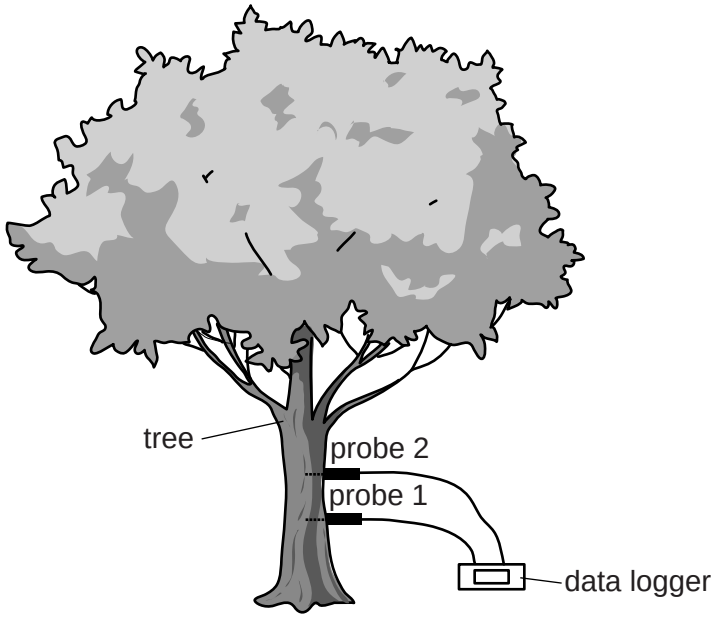


Fig. 4.1

(a) **(i)** Name the water-conducting tissue into which the two probes were inserted.

..... [1]

(ii) Describe how the structure of this water-conducting tissue is adapted to its function.

..... [2]

(b) Explain the mechanism of water movement from the roots up the tree to the leaves.

- transpiration pull → creates negative pressure
- H_2O potential gradient → osmosis into le
- continuous column of H_2O → cohesion of H_2
- adhesion of H_2O to cell wall
- H_2O evaporates into air spaces in mesophyll
- H_2O vapour diffuses out through stom
- lost by pressure

[4]

(c) Fig. 4.2 shows the rate of water conduction up three different trees in a forest over 24 hours.

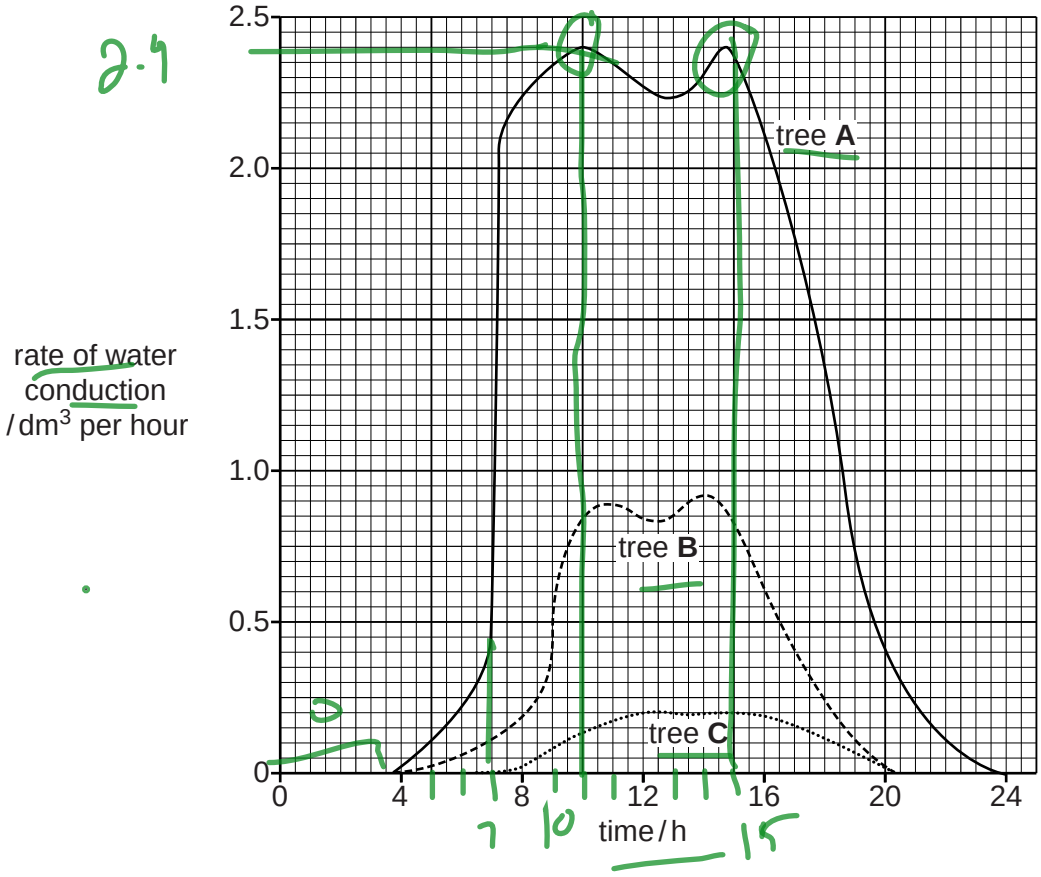


Fig. 4.2

(i) Describe the rate of water conduction in tree **A**, during this 24 hour period.

You will gain credit for using the data in Fig. 4.2 to support your answer.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Suggest how the ecologists used the data in Fig. 4.2 to calculate the total volume of water used by a tree in 24 hours.

[1]

(iii) In Fig. 4.2, tree **A** is a tall tree, tree **B** is a medium-height tree and tree **C** is a short tree.

Suggest reasons for the different rates of water conduction in the three trees.

[3]

(d) Loggers often cut down the tall trees in a forest.

Describe the effects on the forest ecosystem of cutting down trees.

[4]

[Total: 18]