

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 CO_2

the process that produces the gas aerobic resp

the method of removal of the gas Diffusion
body \rightarrow env

[3]

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

Freshwater has a very low concentration of solutes.

$\downarrow H_2O \uparrow \uparrow$

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.

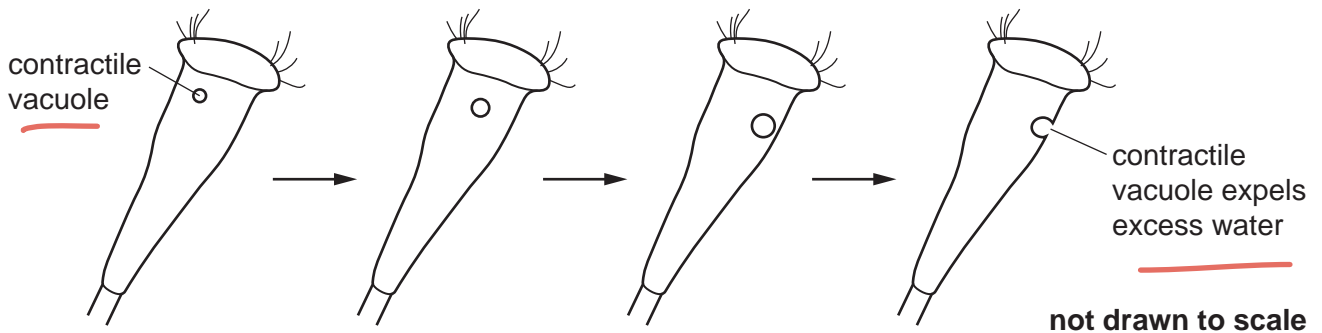


Fig. 4.1

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

H_2O enters by osmosis - down conc gradient -
high \rightarrow low conc
through partially permeable membrane
need to remove H_2O to prevent bursting

[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.

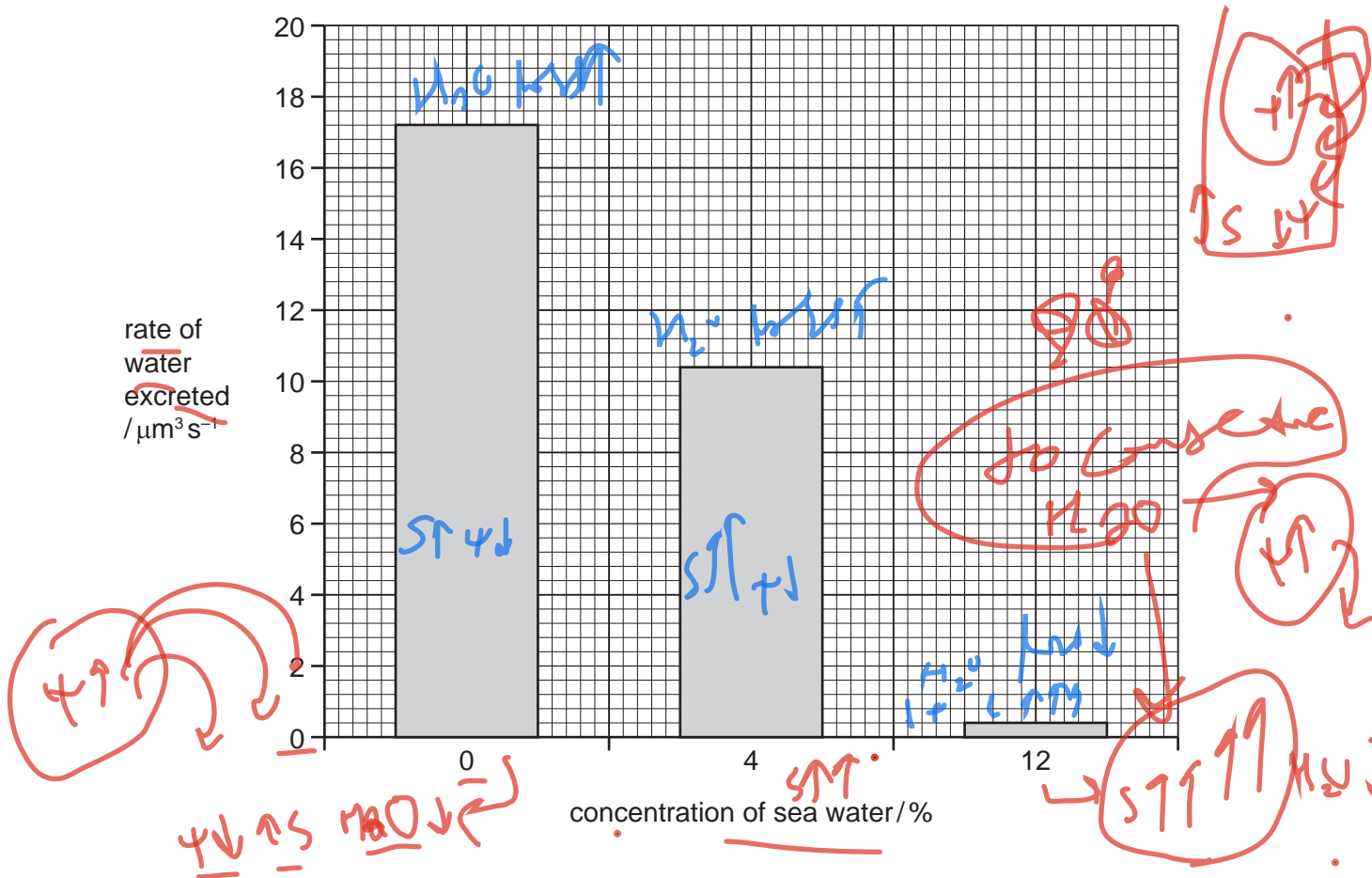


Fig. 4.2

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

As conc of sea H_2O \uparrow → Removal of H_2O \downarrow (hypertonic body)
 salts \uparrow H_2O \downarrow → \downarrow \rightarrow

Conc of sea H_2O \uparrow → \downarrow gradient \downarrow (difference) (S \uparrow +)

less H_2O enters → higher conc of sea H_2O
 less excrete H_2O

osmoregulation
 (loss of H_2O + gain of salts)

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

Cell wall \rightarrow inelastic, do not stretch, rigid, inflexible

Keep shape of cell

Cell \rightarrow turgid, high turgor pressure

Resist any increase in volume/pressure

Cells do not absorb excess H_2O

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 + up + → low + by osmosis
hair 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.

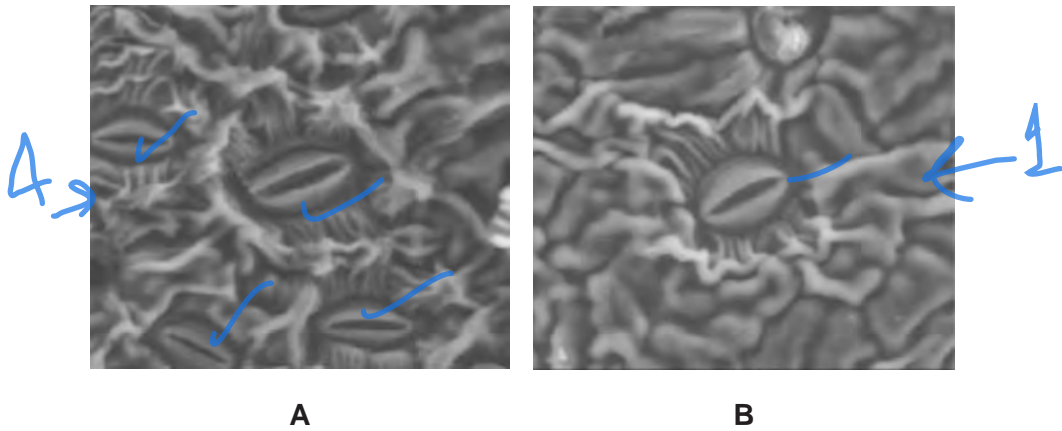


Fig. 4.1

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

Movement of gas O_2 / CO_2 into / out of leaves
for photosynthesis / respiration
transpiration → pull up the plant
enable H_2O

[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 \rightarrow lowers H_2O potential \rightarrow 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.

reduction of H_2O loss in water / in dry

1 - Sunken stomata

2 - hairs

3 - fleshy, succulent leaves

4 - thick cuticle

5 - small surface area

6 - few shedding of leaves

7 - Rolling of leaves / reflecting surface

[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 of ground H_2O

[2]

[Total: 15]

single stranded sequence of DNA/RNA

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.

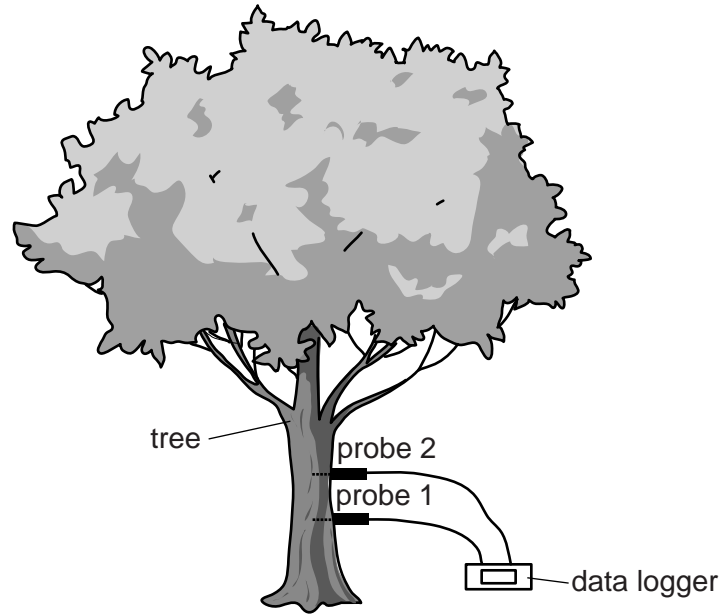


Fig. 4.1

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

..... xylem [1]

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

Thick lignified cell wall for support
 lignin cell walls are H₂O proof - no H₂O can
 long, hollow, no cytoplasm, no organelle, no end wall
 H₂O passes through easily, low
 resistance to flow
 pits for lateral movement

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

transpiration pull \rightarrow creates negative pressure
- H_2O potential gradient \rightarrow osmosis into leaf
continuous column of H_2O \rightarrow cohesion of H_2O
adhesion of H_2O to cell wall
 H_2O evaporates into air spaces in
mesophyll
- H_2O vapour diffuses out through stomata
- turgor pressure

[4]

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

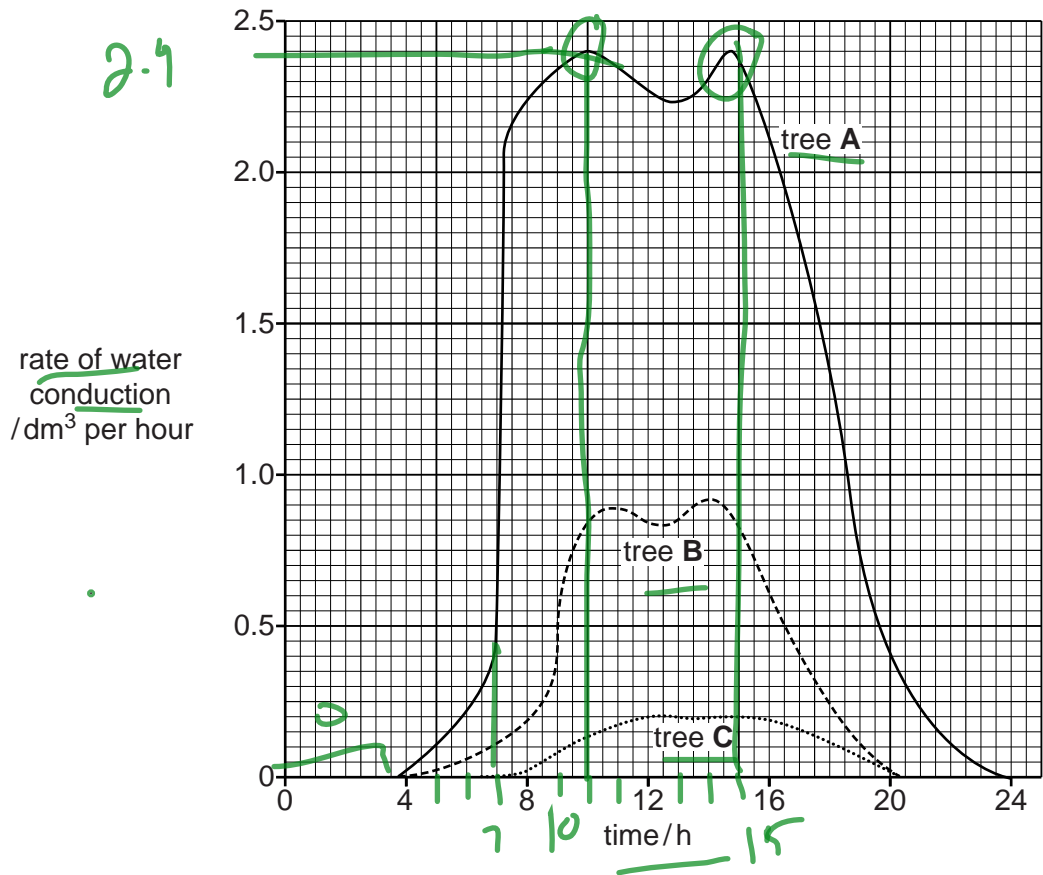


Fig. 4.2

(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.

- 2 peaks at 10h and 15h
 - No H₂O conduction before 4h
 - slow gradual increase from 4h to 6/7h
 - Max H₂O conduction rate of 2.4 dm³/h
 - Sharp increase in rate of H₂O conduction at 10h
 - decrease in rate of H₂O conduction after 15h
- [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.

Add volume of H_2O conducted per hour / calculate area under curve [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.

- Different rate of transpiration / evaporation
- Different n. of leaves - Different SA
Factors affecting transpiration → Temp - height - wind - humidity - light - density of stomata
Diff species → Different diameter of xylem
Feature of leaf → thickness of cuticle / stomatal density / hair [3]

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

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

who cut trees
→ Increase in CO_2 , decrease in O_2
→ increase soil erosion, decrease soil fertility
less soil H_2O , faster flow of H_2O from land
→ increase flooding, disrupts H_2O cycle
→ Habitat, ecosystem loss
→ destruction of food chains / food webs
→ less biodiversity
→ extinction
→ seeds germinate / seedlings grow / germinate [4]

[Total: 18]