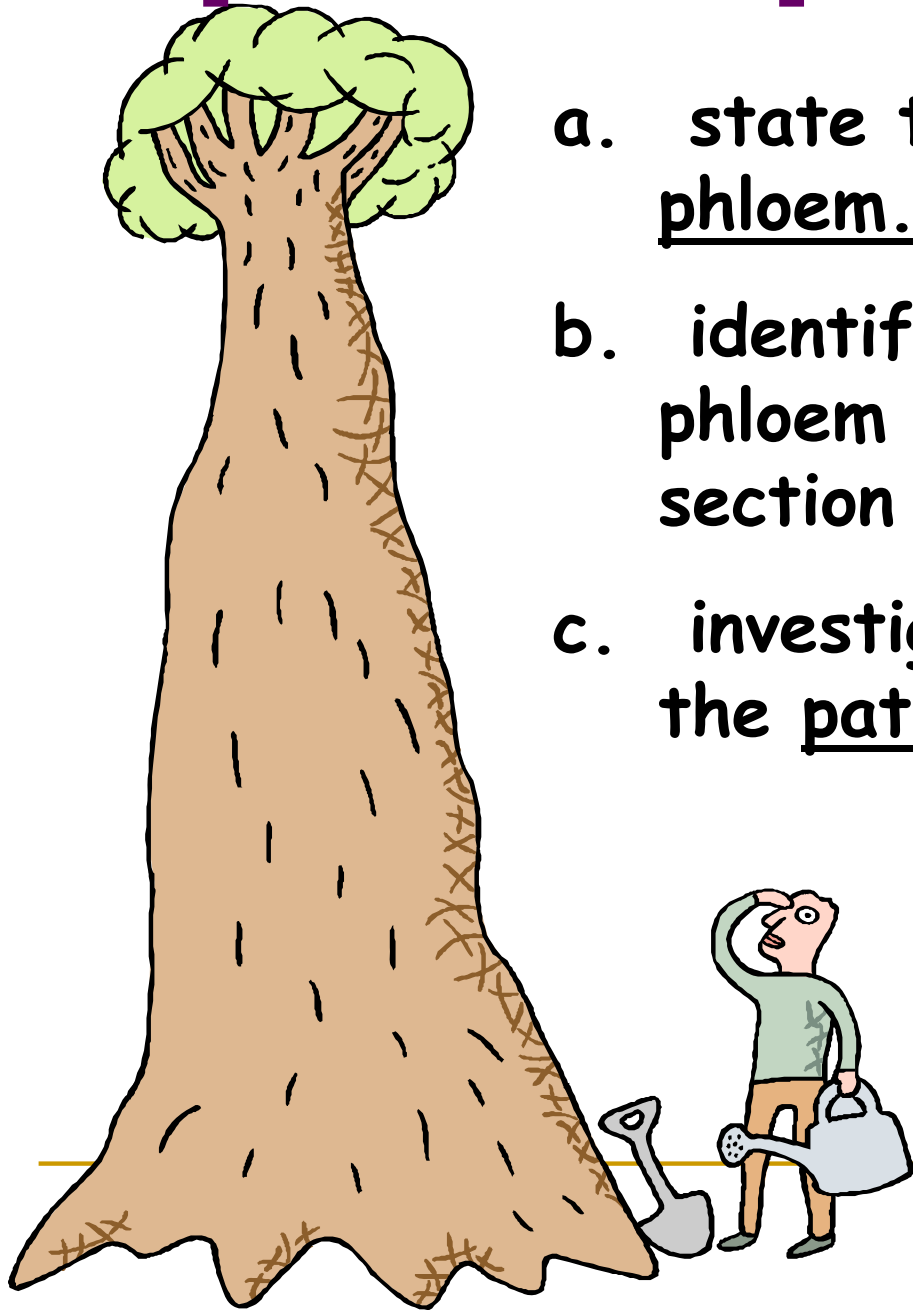
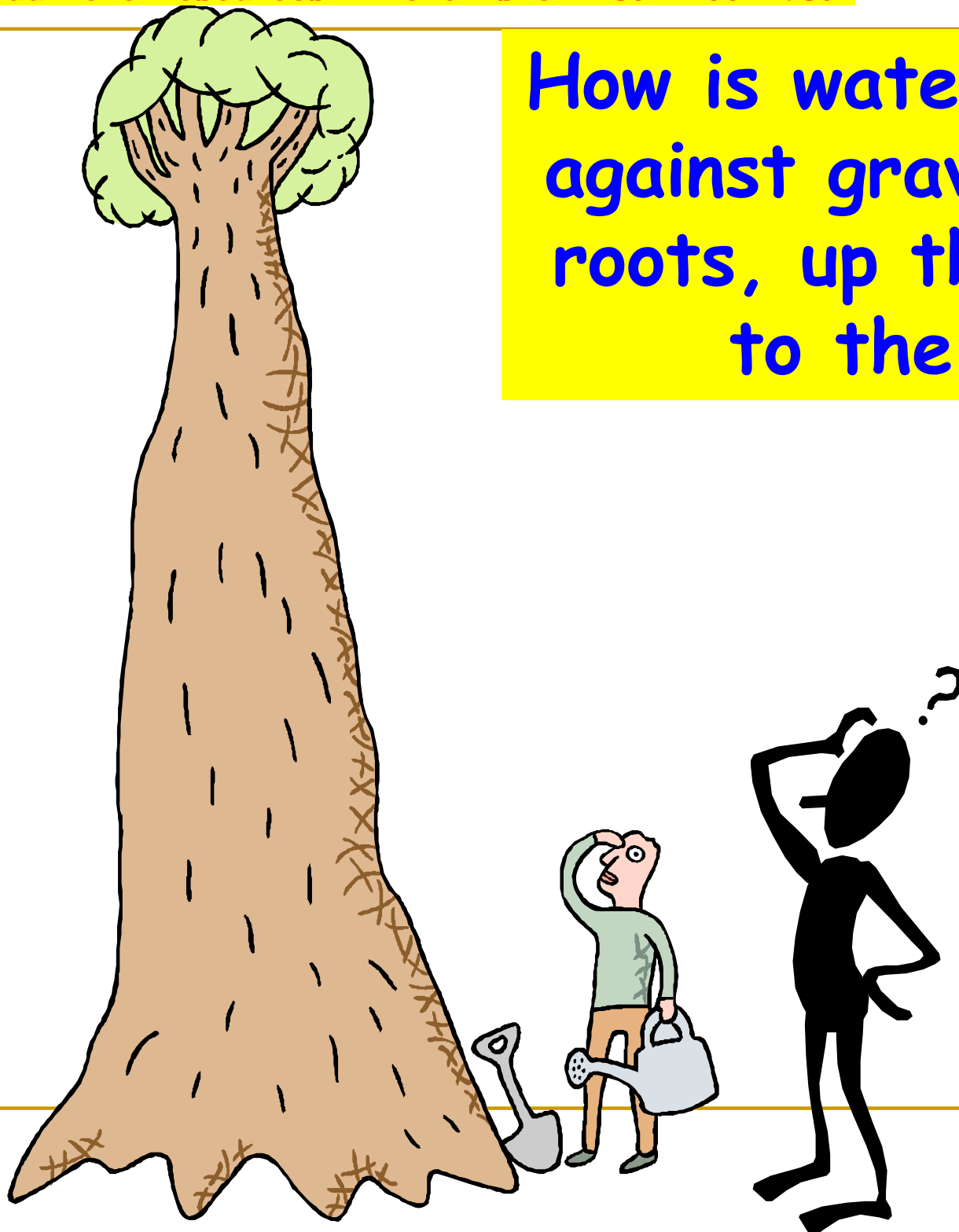


Chapter : Transport in Flowering Plants

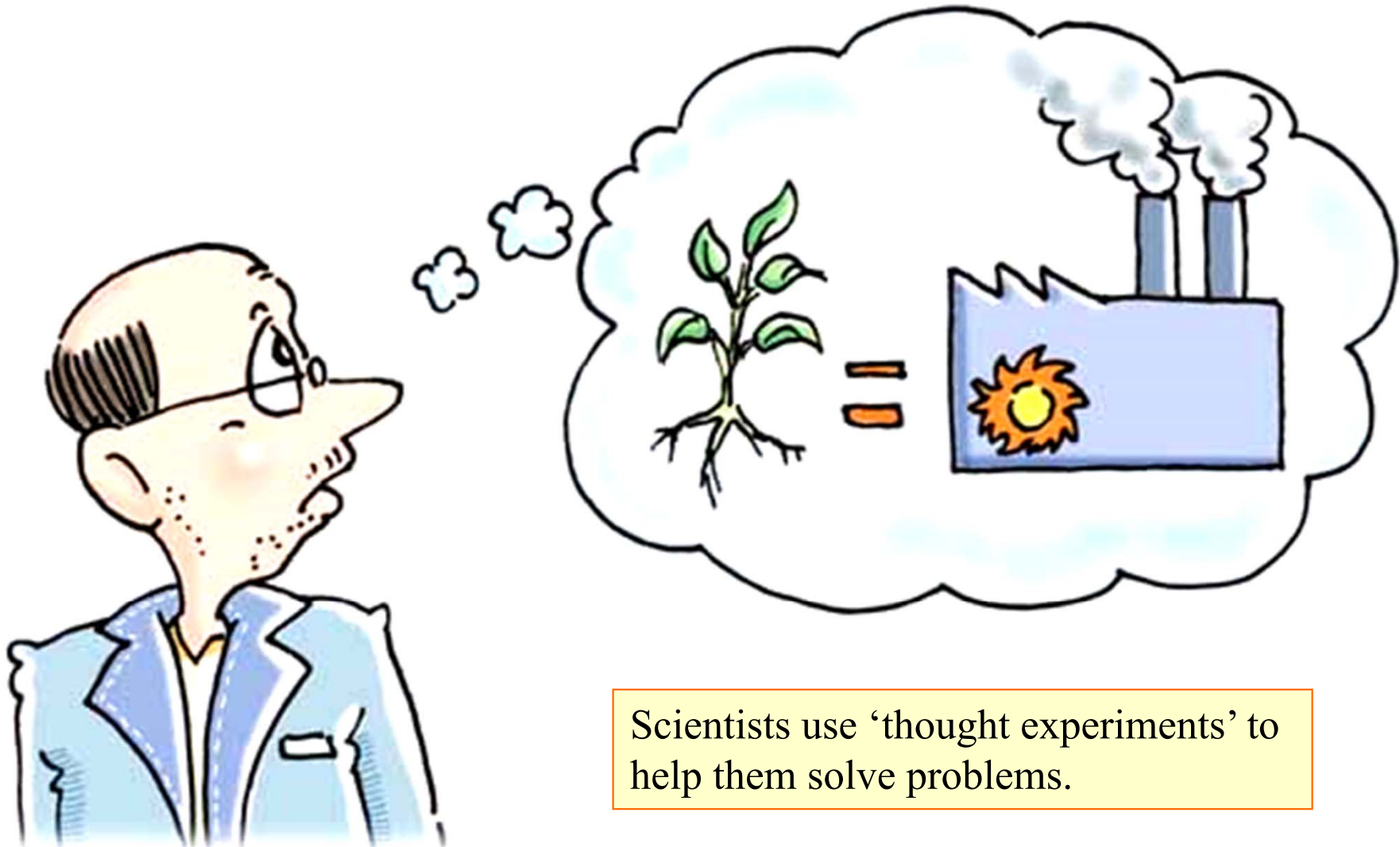


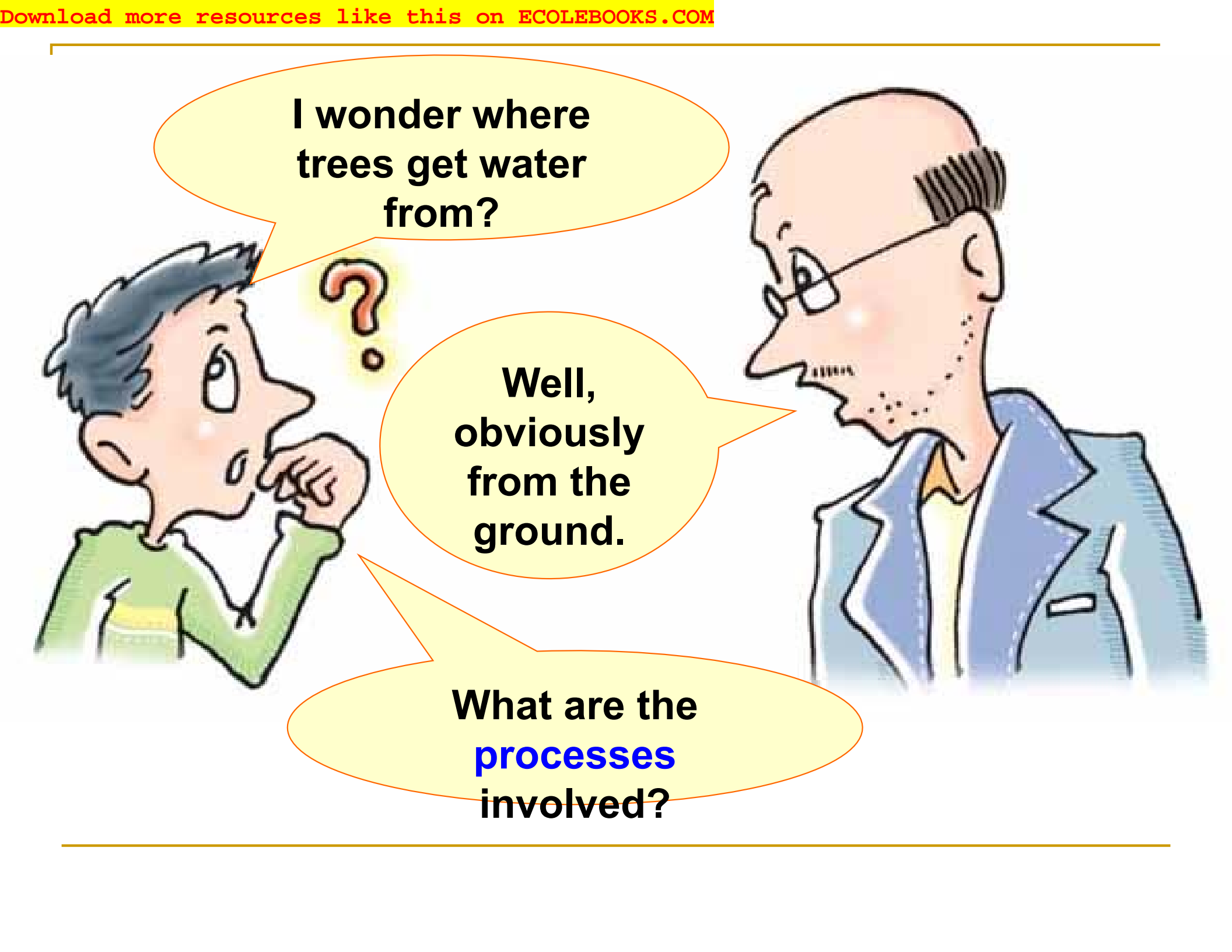
- state the functions of xylem and phloem.
- identify the positions of xylem and phloem tissues as seen in transverse section of *roots, stems and leaves*.
- investigate, using a suitable stain, the pathway of water in a cut stem.

How is water transported against gravity from the roots, up the xylem and to the leaves?



Think Like a Scientist





I wonder where trees get water from?

Well, obviously from the ground.

What are the **processes** involved?

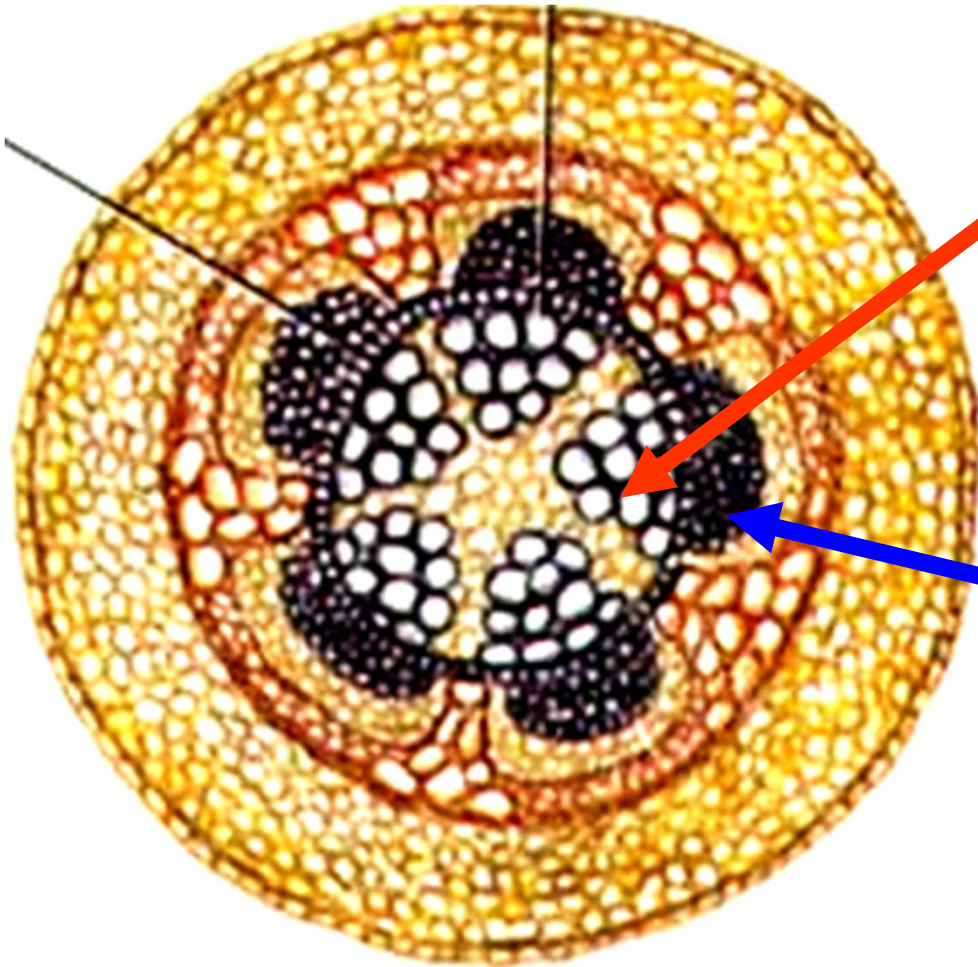
How does water move through the transport system of a plant IF it does not have a heart to act as a pump?

PAUSE to PONDER

- How is water lifted against gravity from the ground to the leaves through this transport system?
- Are the products of photosynthesis also carried in a set of vessels from the leaves to the roots?



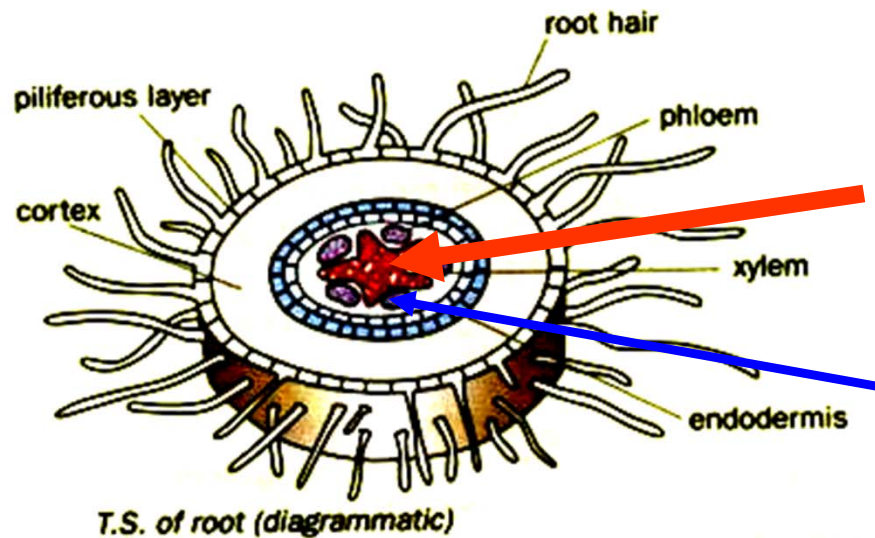
Vascular bundles: xylem & phloem



Xylem transports water & dissolved minerals from roots to leaves.

Phloem transports food (sugar) made in leaves to all other parts of the plant.

Figure 9.5 A young dicotyledonous root

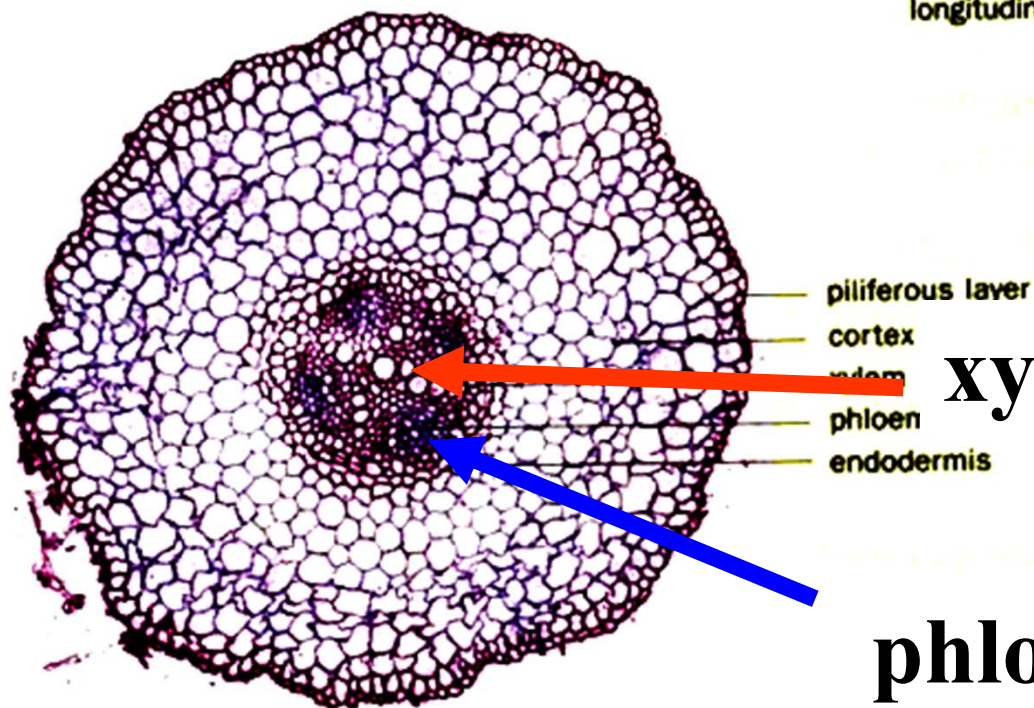


xylem

phloem

Root cut
longitudinal

Distribution of
vascular bundles in
roots

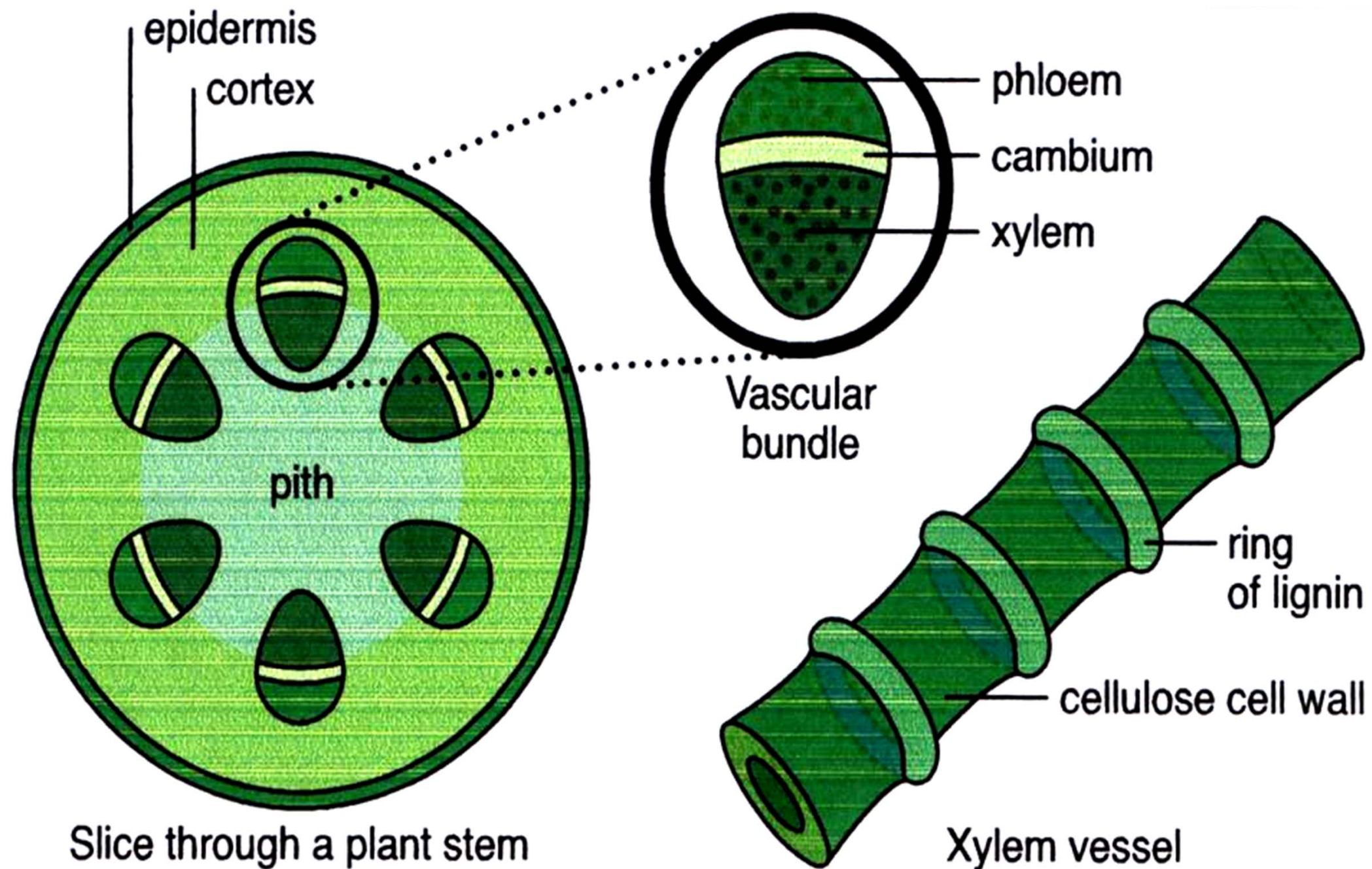


xylem

phloem

Photomicrograph of section of a young root

Xylem & phloem tissues in stems.



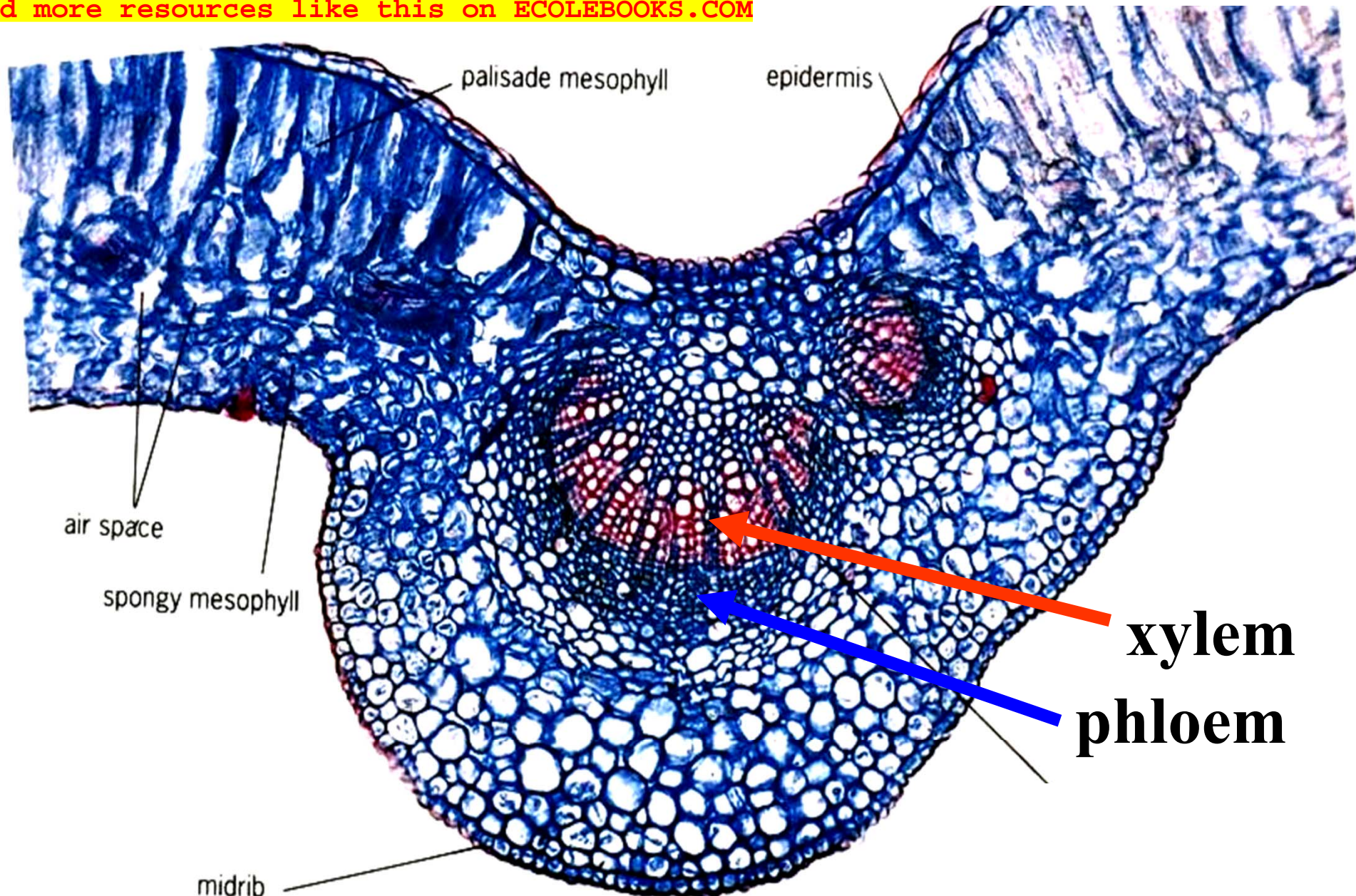


Figure 3 Transverse section through a leaf (x30)

Distribution of vascular bundles in leaves.

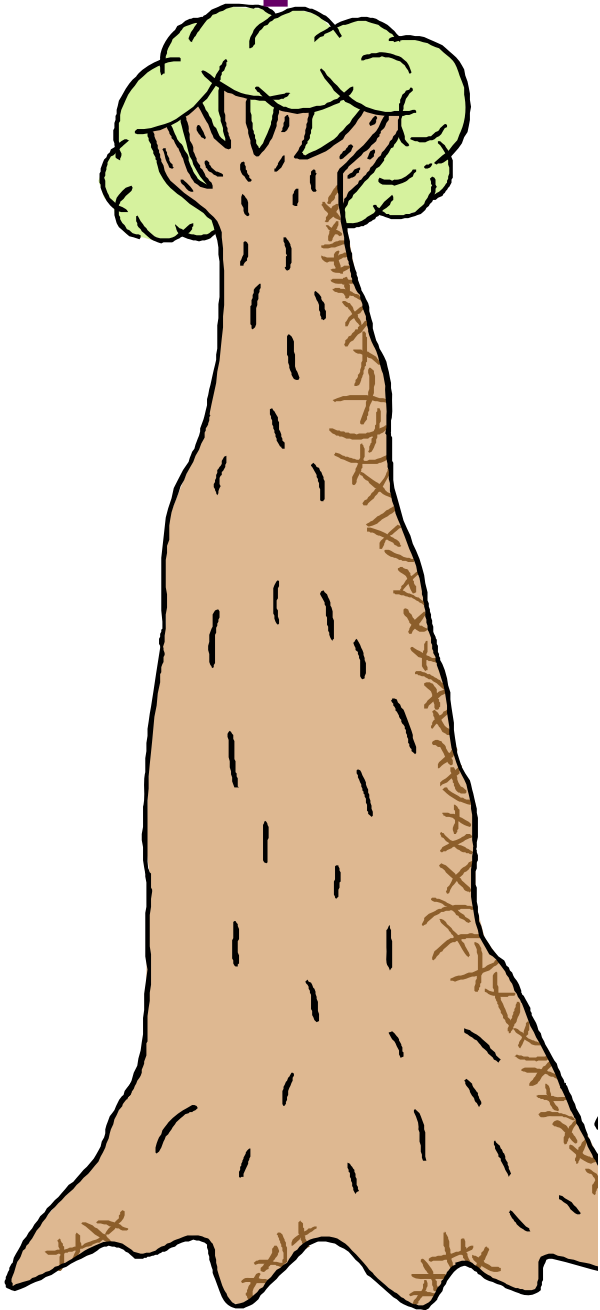


Diagram showing a section through a leaf.

xylem

phloem

Chapter 6: Transport in Flowering Plants



- d. describe the structure and functions of root hair cells in relation to their surface area, and to water and ion uptake.
- e. define transpiration.
- f. describe how factors (e.g. *humidity, temperature, light intensity*) affect the rate of transpiration.
- g. describe how wilting occurs.

Transport of water & minerals

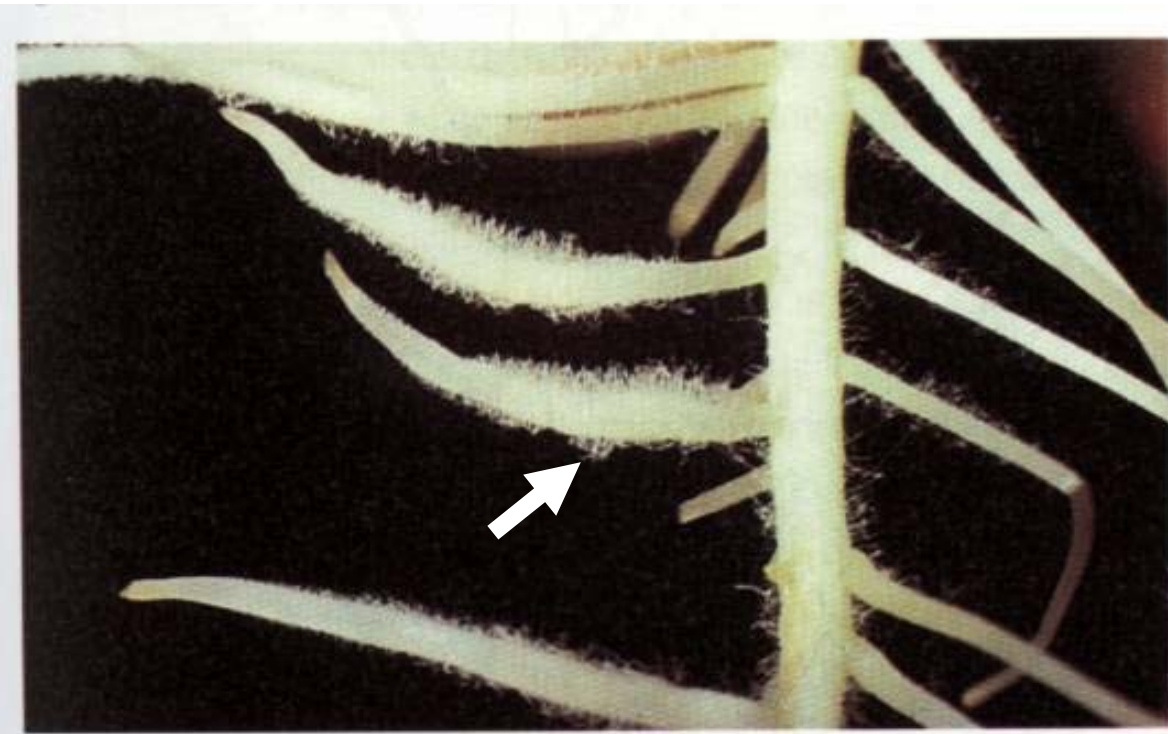


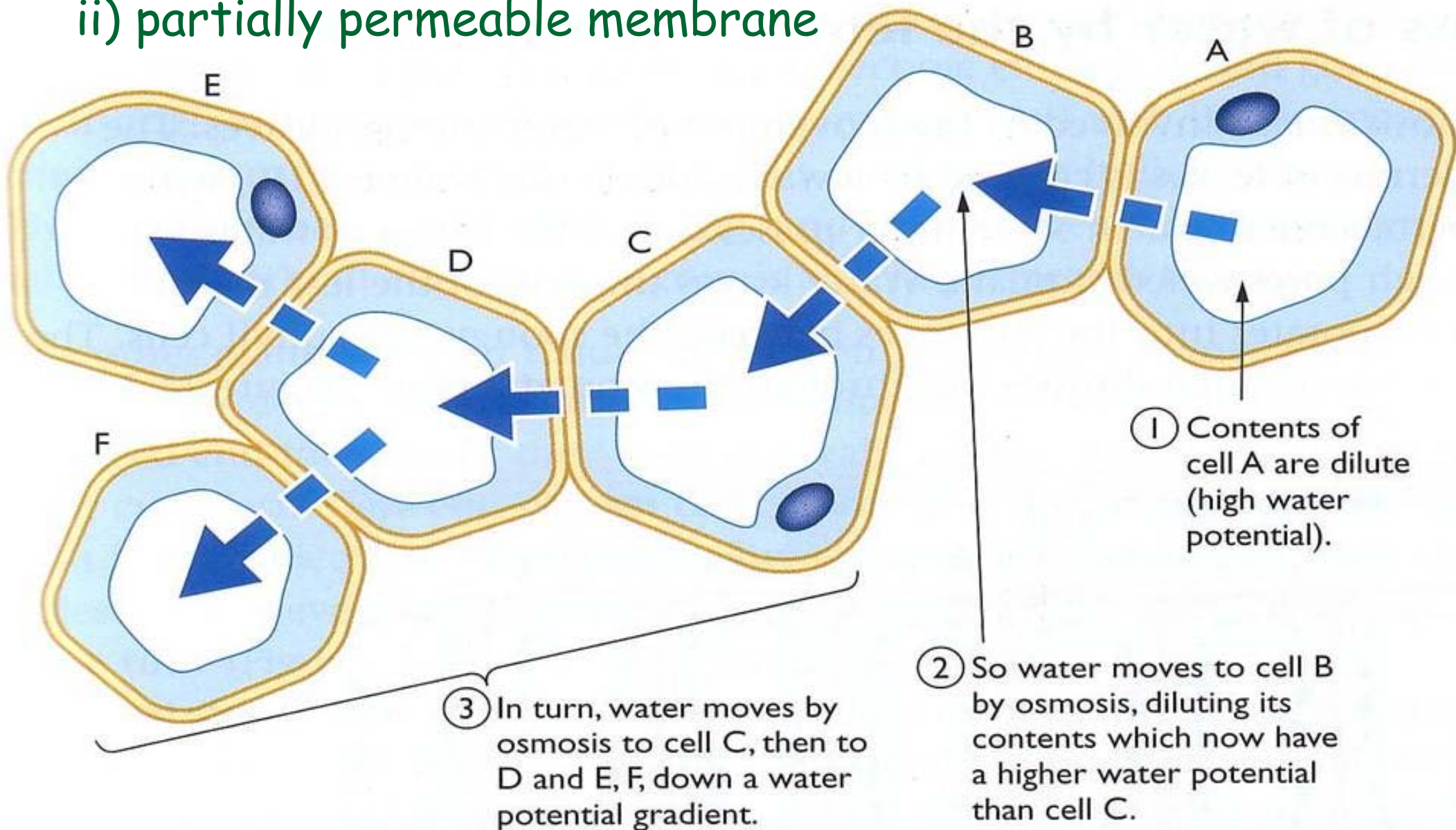
Figure 14 Root hairs (x5) as they appear on a root grown in moist air

Thousands of tiny root hairs on each root allows water to enter the plant very quickly.

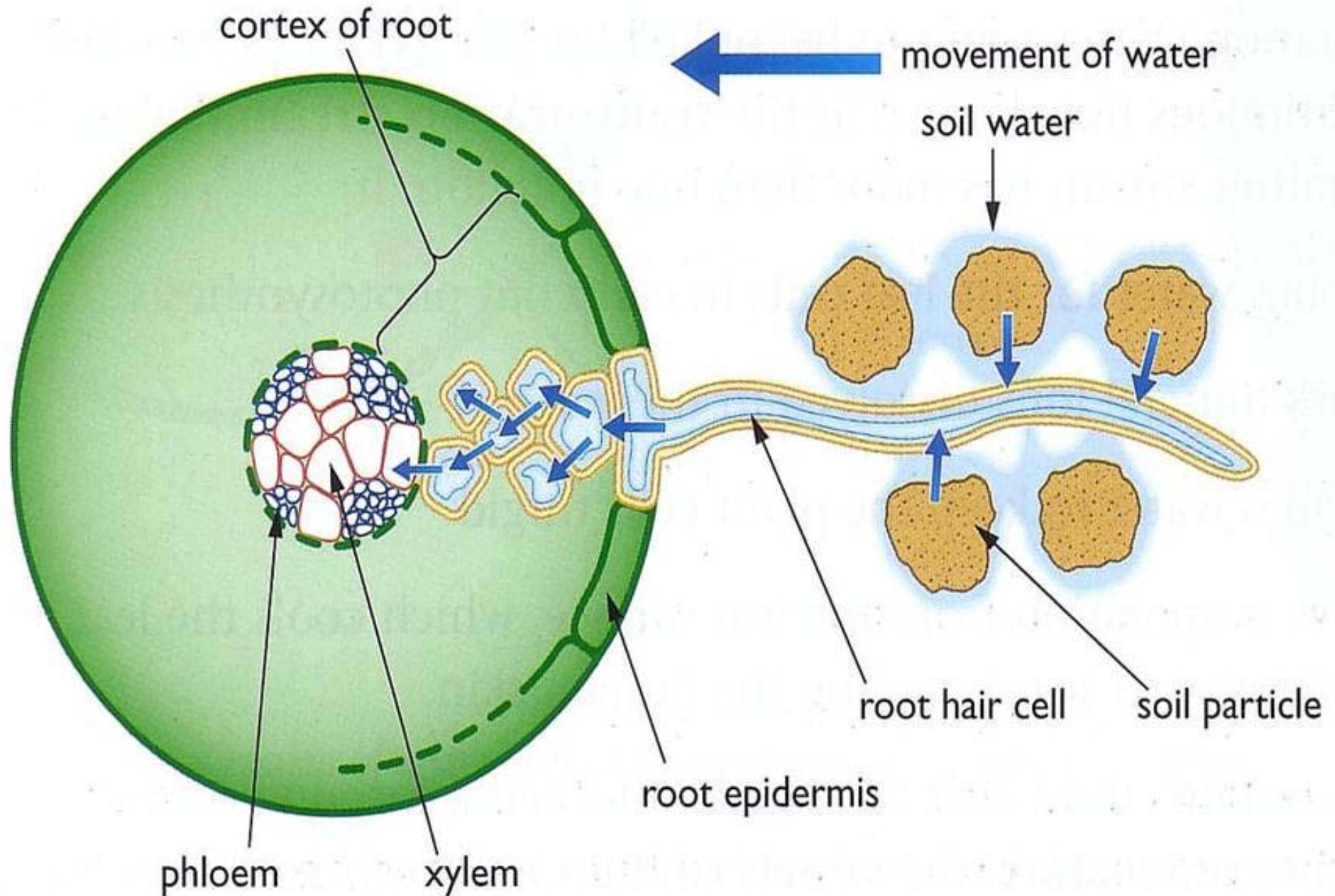
How do water & dissolved minerals move from the soil to the roots?

Osmosis occurs due to presence of :

- i) concentration gradient between the sap in a root hair cell and the soil water.
- ii) partially permeable membrane

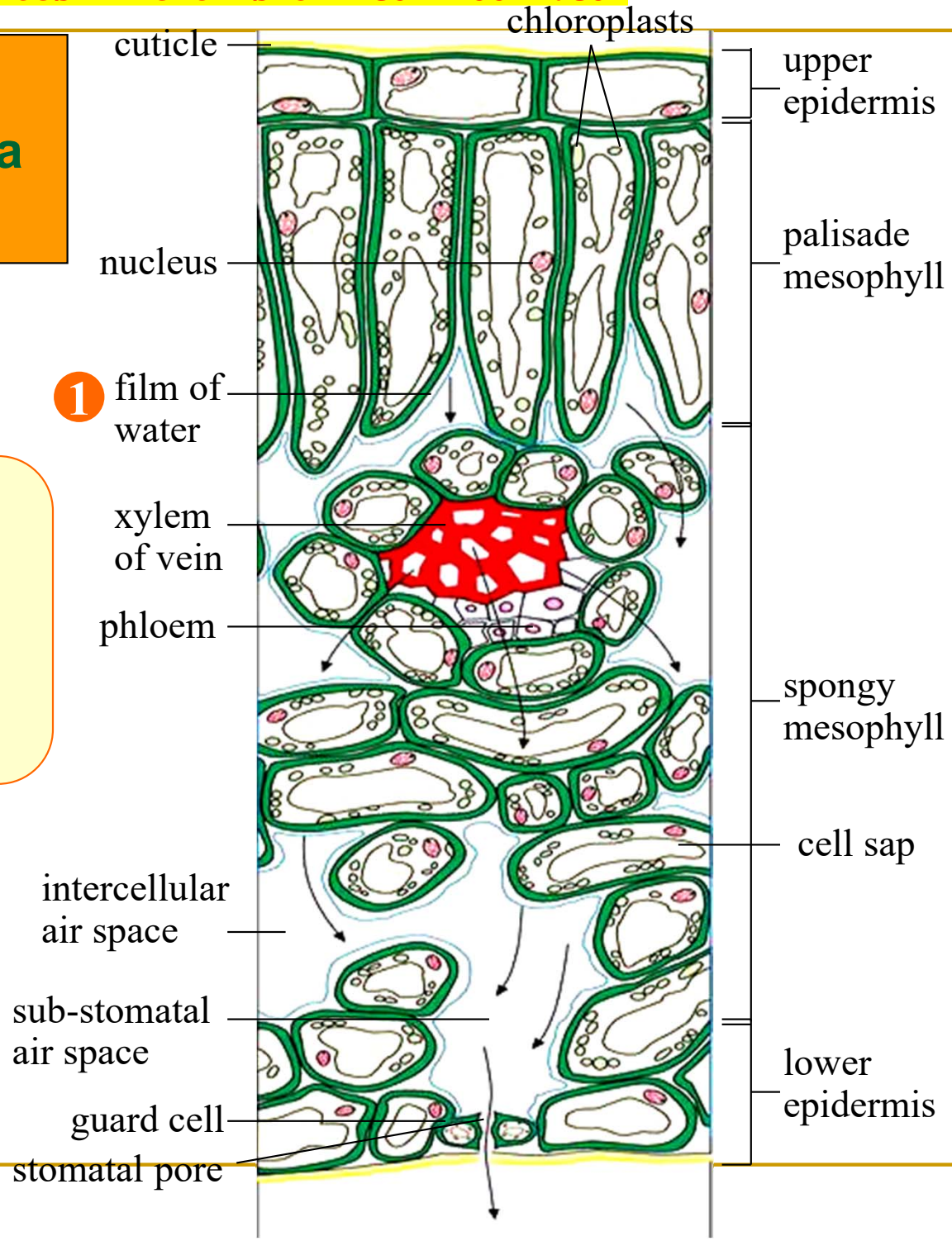


Water enters by osmosis from root hairs and continues until it reaches the xylem vessels.

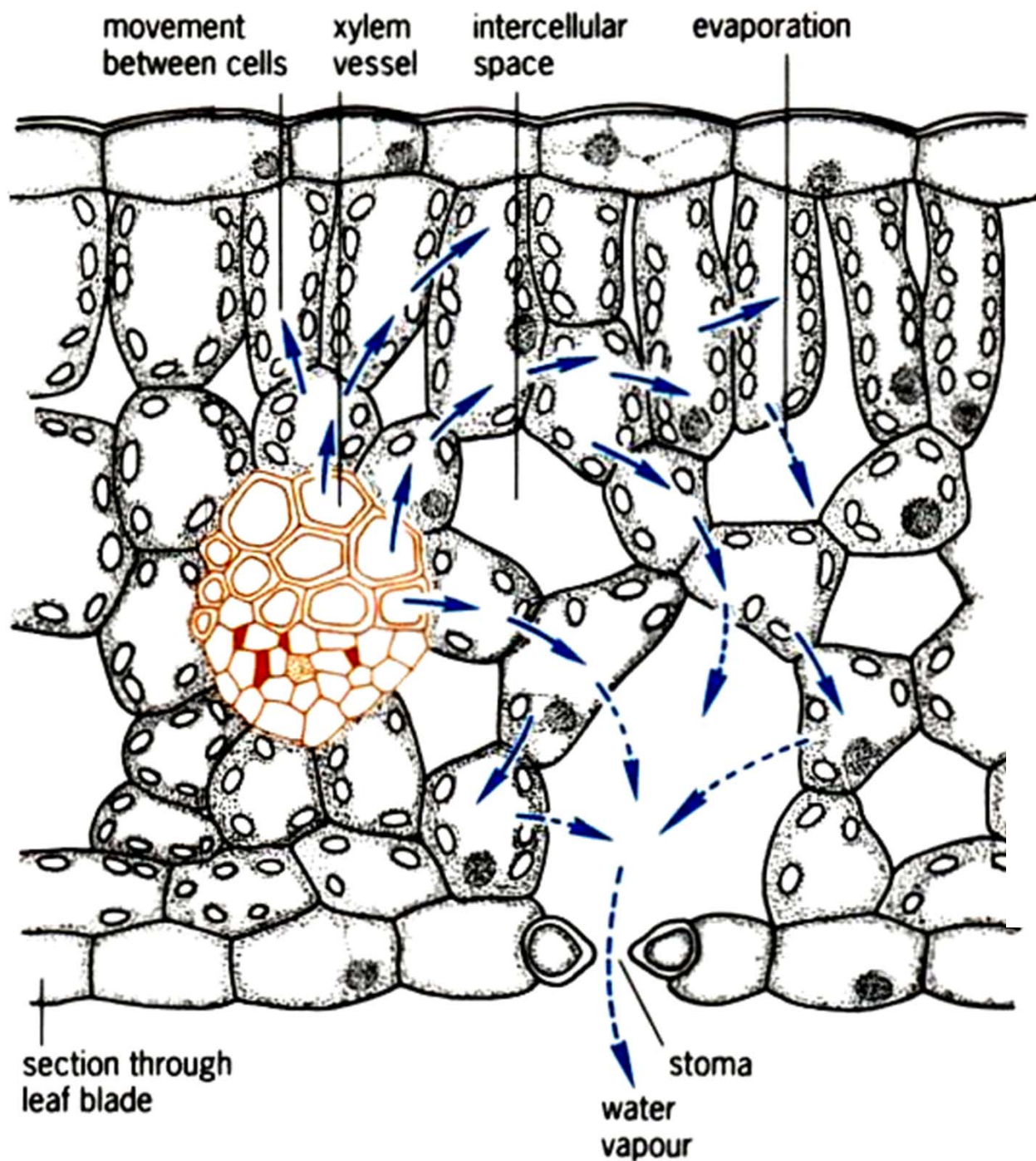


Movement of Water inside a Leaf

1 Water continuously moves out of the mesophyll cells to form a thin film of moisture over their surfaces.



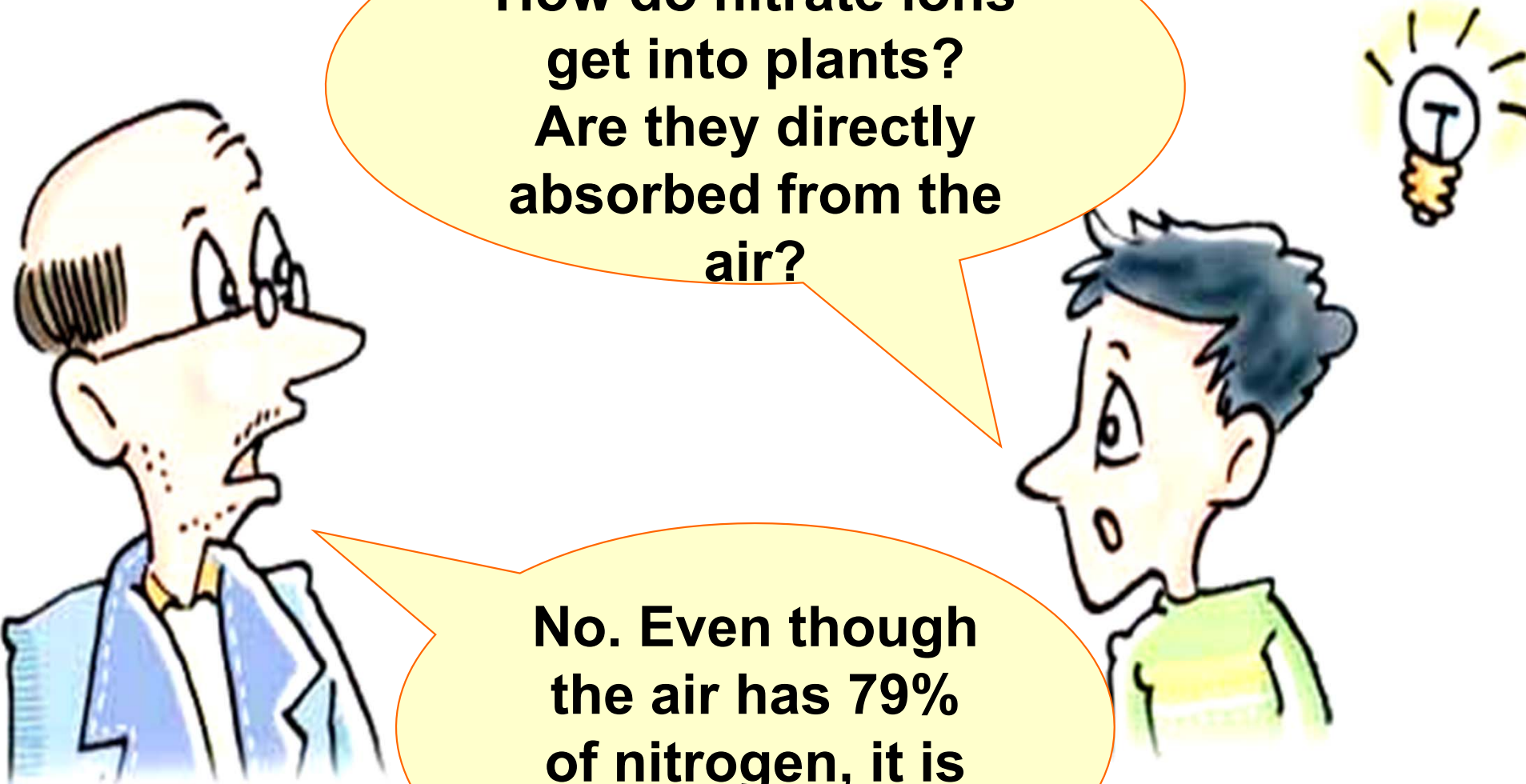
→ arrows show path of water vapour and water



Transpiration:

The loss of water vapour from the stomata.

Figure 2 Movement of water through a leaf

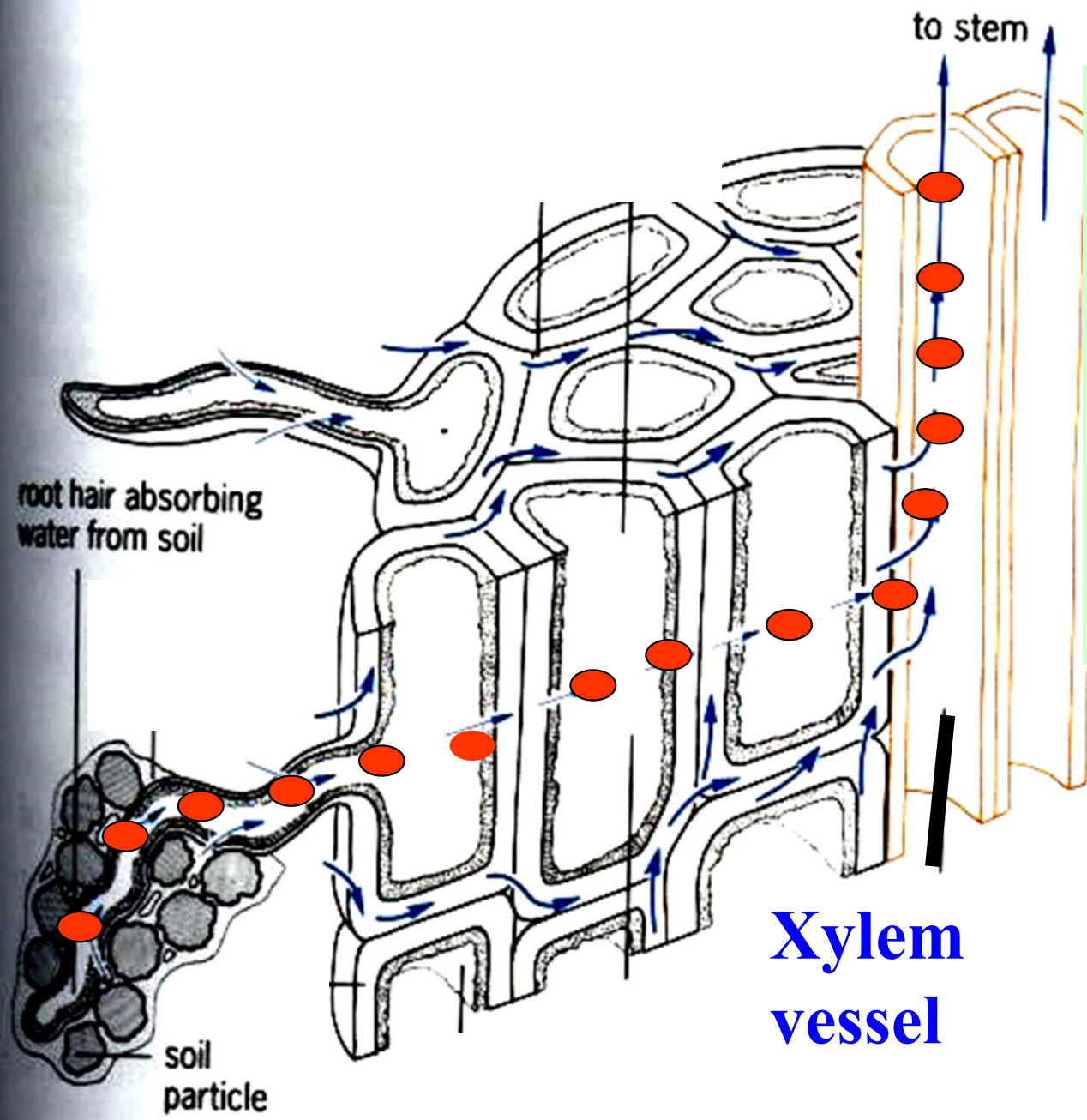


How do nitrate ions
get into plants?
Are they directly
absorbed from the
air?

No. Even though
the air has 79%
of nitrogen, it is
highly
unreactive.

**PAUSE to
PONDER**

•How are ions transported around in plants?



Diffusion and active transport are involved in the absorption of dissolved mineral salts.

Figure 6 The probable pathways of water through a root



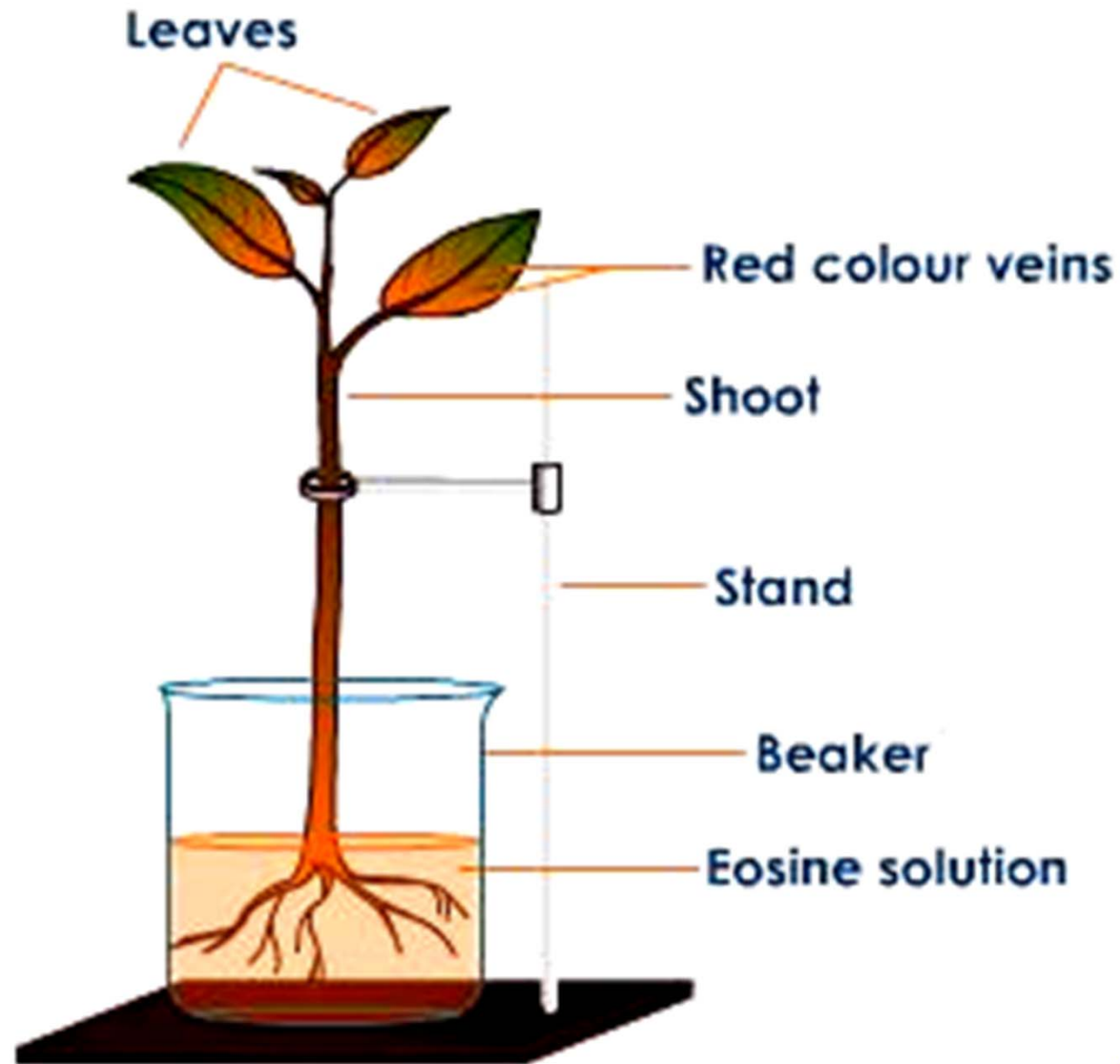
What happens when the concentration of dissolved sugars and mineral salts in the sap of root hair is higher than the surrounding soil water?



Concentration of dissolved sugars and mineral salts is **higher** in roots.

Concentration of dissolved sugars and mineral salts is **lower** in soil.

Inv. 8.2: Path of water through a plant (p105)



Inv. 8.3 : The ringing experiment (p107)



•In the ringing experiment, a ring of bark is scraped away that also removes the phloem.

A ring of bark with phloem removed.

Results:



twig A



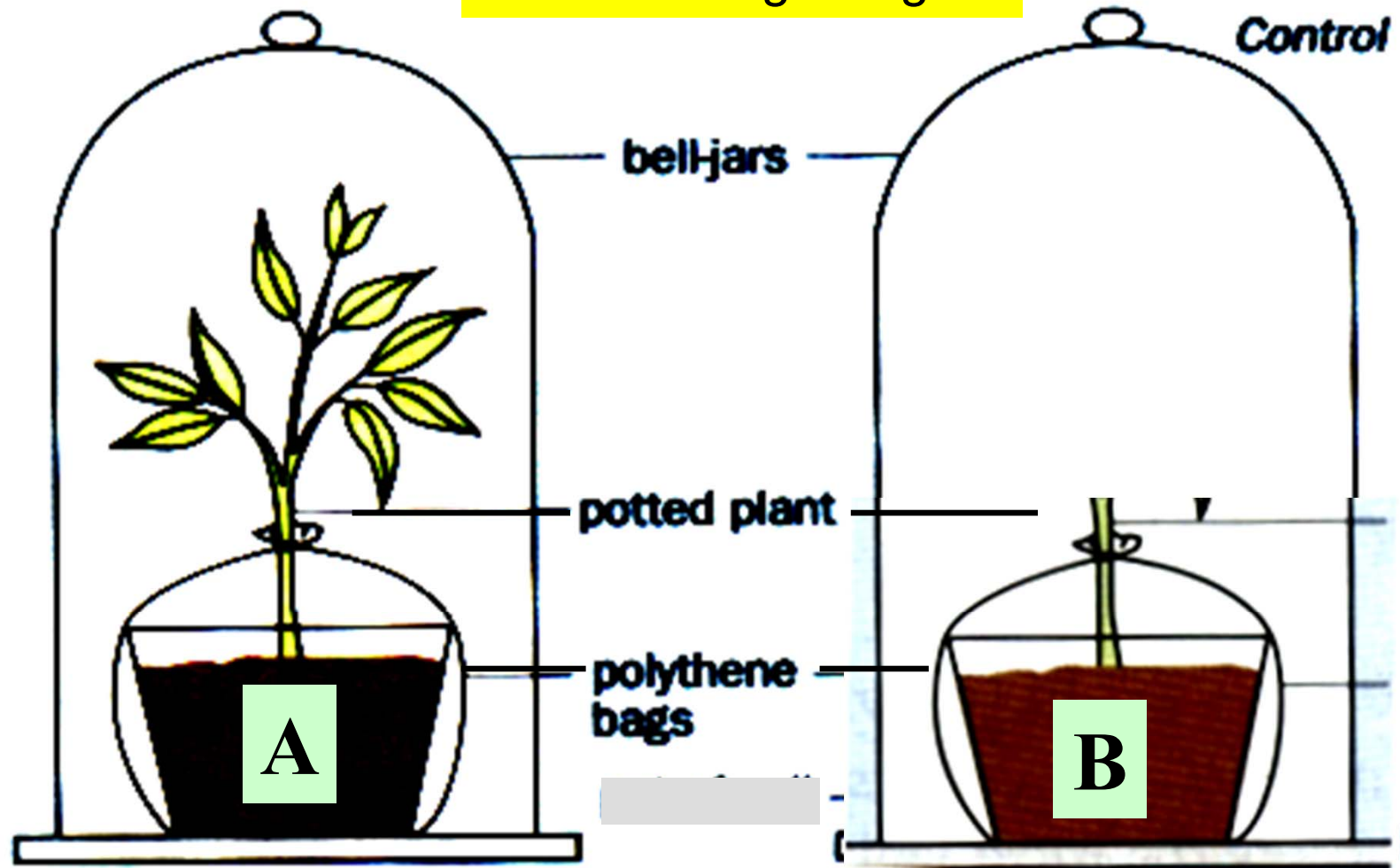
twig B



twig C

- The phloem tissues have been removed.
- Manufactured food substances (e.g [sugar and amino acid](#)) accumulate above the cut region and cause swelling in twigs A and C. However in twig B, manufactured food can pass through the phloem without any barrier.
- This suggests that food is made in the leaves and are transported through the phloem.

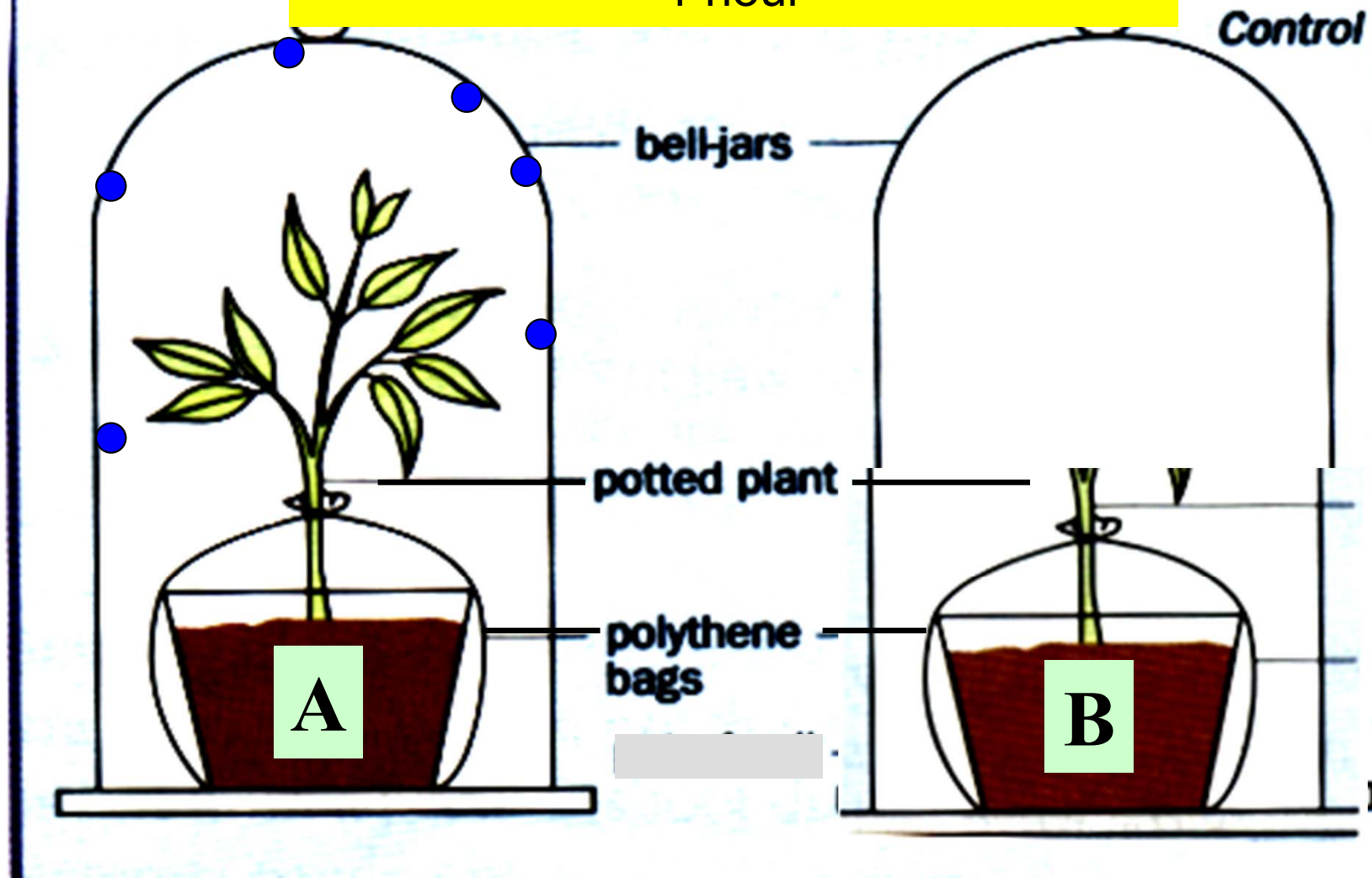
At the beginning



Inv. 8.6:

Investigating transpiration in leaves and stems

After placing the bell jars in sunlight for
1 hour



Results:

Drops of liquid are seen on the inner surface of the bell jar A.

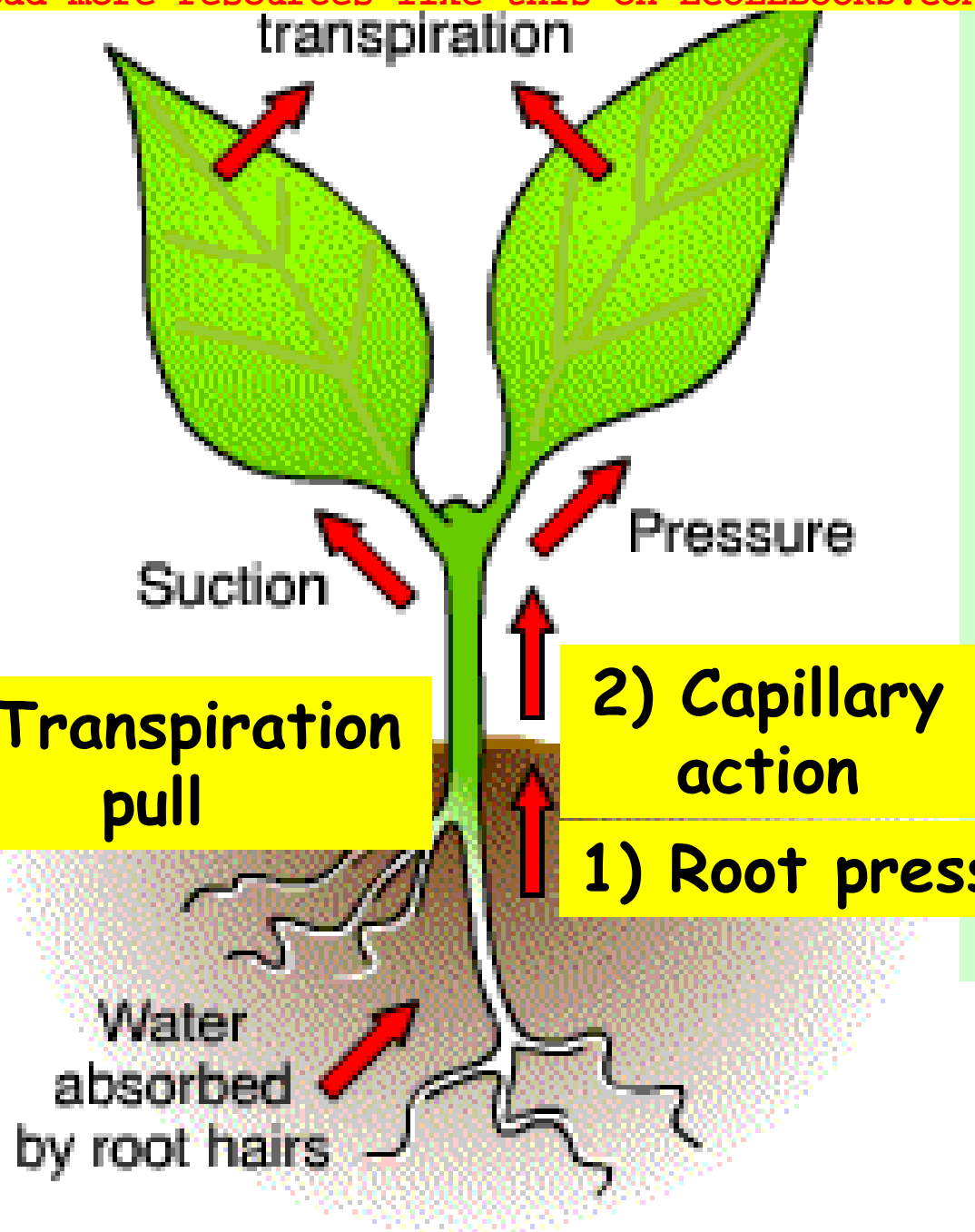
- 6) There is no change. No liquid droplets form on the inner surface of the bell jar.
- 7) The anhydrous copper sulphate turns **blue**.
- 8) Water

- Questions:

- 1) To prevent the water in the soil from evaporating.
- 2) Roots have absorbed water in the soil and transported it up
the plant. Water vapour given off by the plant
condenses on
the inner surface of the bell jar.

Investigation 8.6 : Comparing Transpiration in Leaves and Stems

- 6) Water condensed on the inner surface of the bell jar.
- 7) Some water condensed on the inner surface of the bell jar but not as much as in the bell jar with the leafy twig.
- 8) Transpiration has occurred in both jars. Transpiration occurs mainly through the leaves, so more water condensed on the inner surface of the bell jar with the leafy twig.



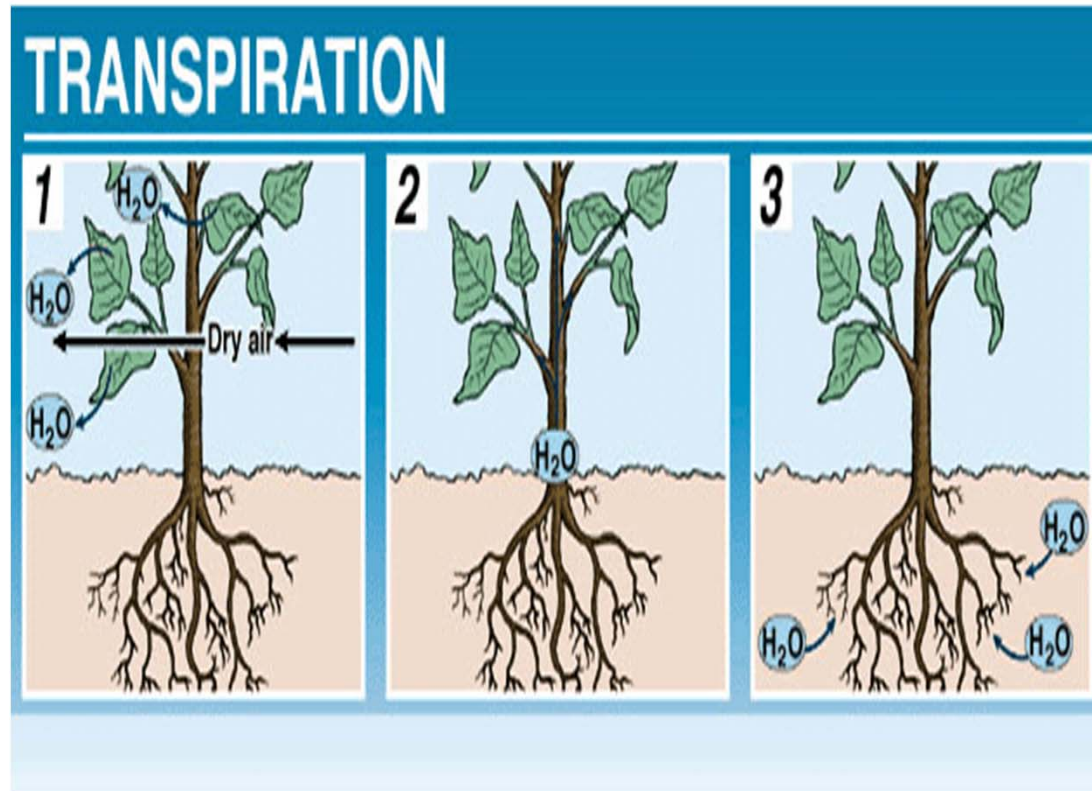
Water is drawn up the xylem in the **stem** by three factors:

- Root pressure
- Capillary action
- Transpiration pull

- **Root pressure** refers to the forces that draws water up to the xylem vessels by **osmosis** and **active transport**.
- **Capillary action** plays a part in upward movement of water in **small plants**.
- **Transpiration pull** refers to the **strongest force** that causes water to rise up to the leaves of tall trees. It is a result of loss of water vapour from the leaves (transpiration).

Factors affecting rate of transpiration:

- a) Humidity of the air
- b) Temperature of the air
- c) Strong wind
- d) Light



Which has a higher rate of transpiration?

Light affects the opening and closing of stomata.

Daylight:

Stomata open and become wider.

At night:

Stomata close.



Wilting

f the day.

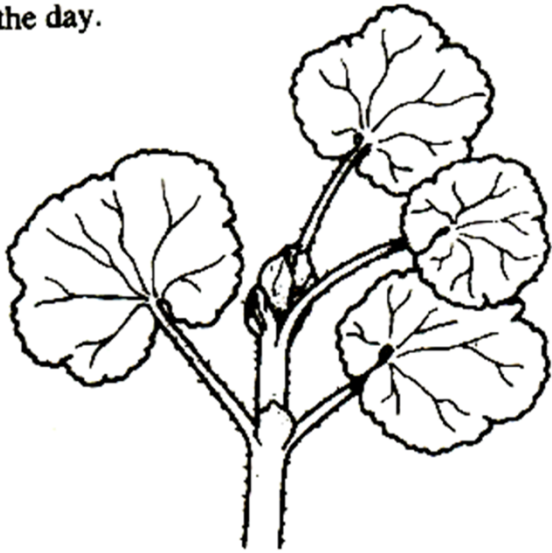


Fig. 1A

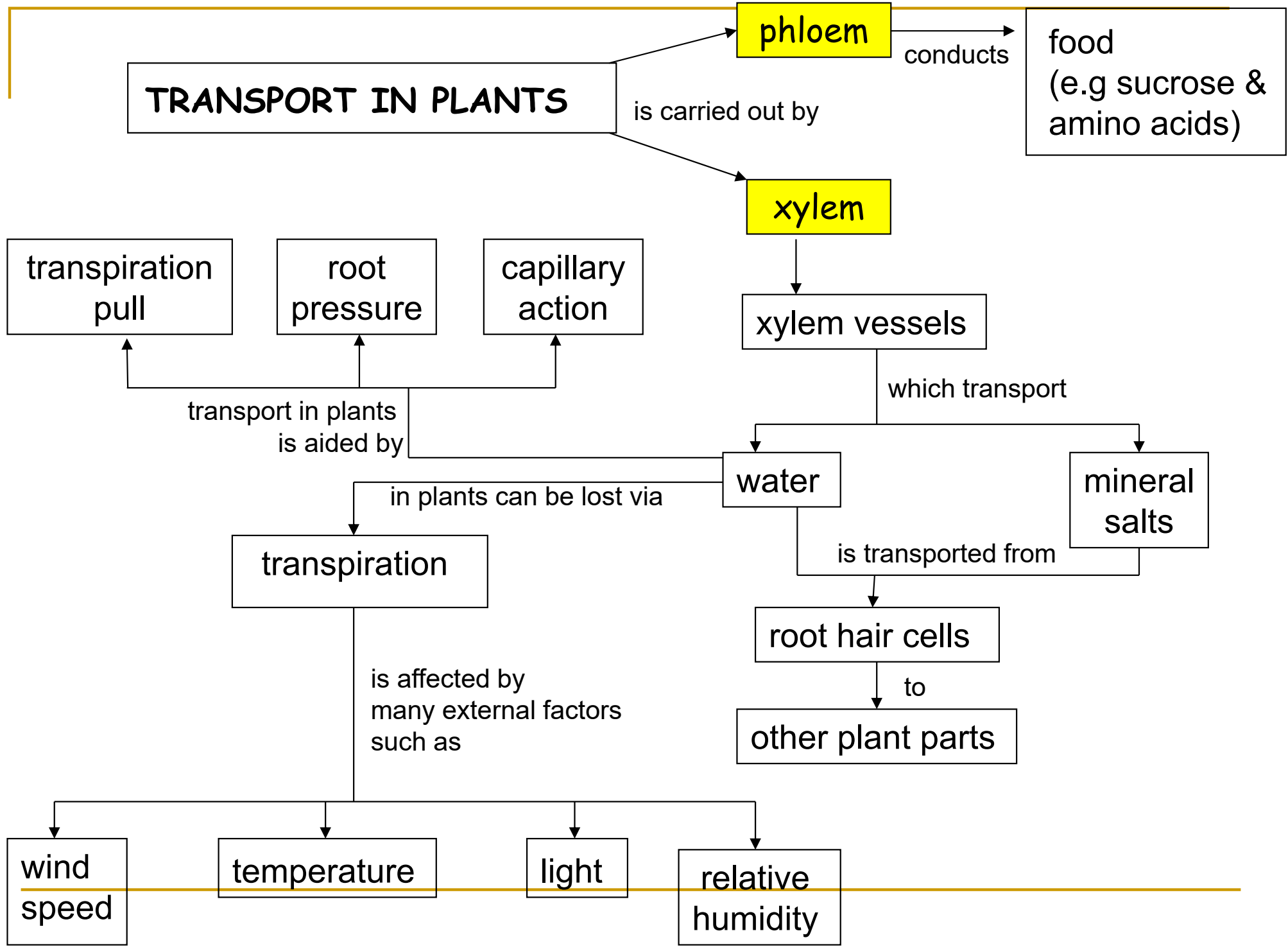
Excessive transpiration causes mesophyll cells to become flaccid.



wilting results



Fig. 1B



Online Resources:



• <http://www.purchon.com/biology/flash/leaf.swf>

• <http://scienceyear.digitalbrain.com/scienceyear/web/data/ks4/year10/practise/?backto=Gverb%3d>

• http://www.bbc.co.uk/education/gcse/bitesize/science_biology/plants/transpiration_rev.shtml#trans2