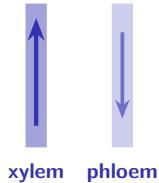


Transport in Plants

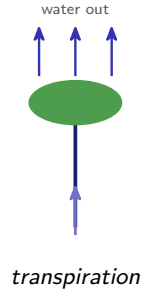
IGCSE Biology ■ Topic 8

IGCSE Biology



What we will cover

- 1 Xylem & phloem
- 2 Water uptake & pathway
- 3 Transpiration
- 4 How water rises
- 5 Translocation



1

Tissues and water

Xylem and phloem



xylem

dead, hollow cells;
thick **lignin** walls

carries water +
minerals **up** only

also **supports**
the plant



phloem

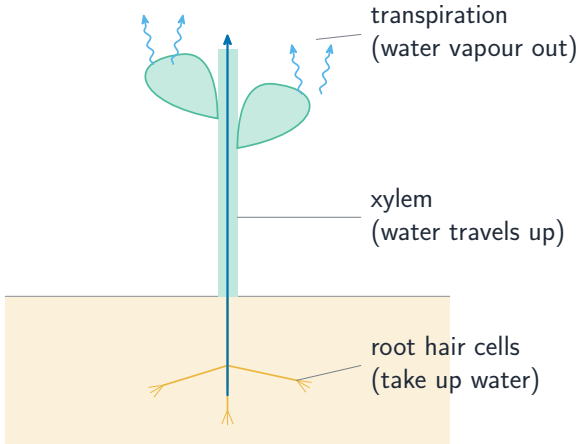
living cells;
sieve plates

carries sucrose +
amino acids

moves **both ways**

- **xylem** 木质部 – carries water and **mineral ions** 矿物质离子 up from the roots, and gives the plant **support** 支撑.
- **phloem** 韧皮部 – carries **sucrose** 蔗糖 and **amino acids** 氨基酸 to wherever they are needed.

Water uptake and pathway



- Water **evaporates** 蒸发 from the wet surfaces of the mesophyll cells into the **air spaces** 气腔 inside the leaf.
- The water vapour then **diffuses** 扩散 out of the leaf through the **stomata** 气孔.

How water gets in, and what happens when it runs out

root hair cells 根毛细胞

long thin extensions giving an enormous **surface area** 表面积 for absorption

the pathway

root hair → root cortex → xylem → stem → leaf → evaporation from the mesophyll

showing it

stand a plant or a **white flower** in water containing a coloured **stain** 染色剂; the stain travels up the xylem and shows the route

the xylem tube

cells joined end to end with **no walls across**, making one long continuous pipe

forces of attraction 吸引力

between water molecules pull the whole column up as water evaporates at the top

wilting 萎蔫

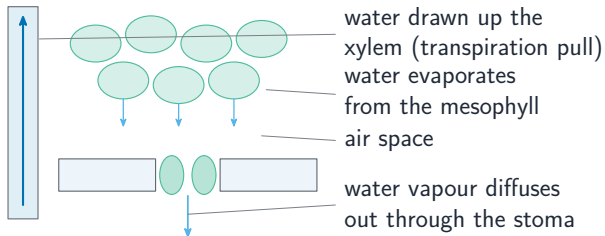
when water is lost faster than it is taken up, cells go soft and leaves and stems droop

Transpiration rate rises with **temperature**, **wind speed** 风速 and **light**, and falls with humidity. All four change how fast water leaves the leaf.

2

Transpiration

Transpiration



Transpiration 蒸腾作用 is water loss from leaves:

- water **evaporates** 蒸发 from the mesophyll
- vapour **diffuses** 扩散 out of the **stomata** 气孔

Faster when hotter, windier or drier.

How water rises

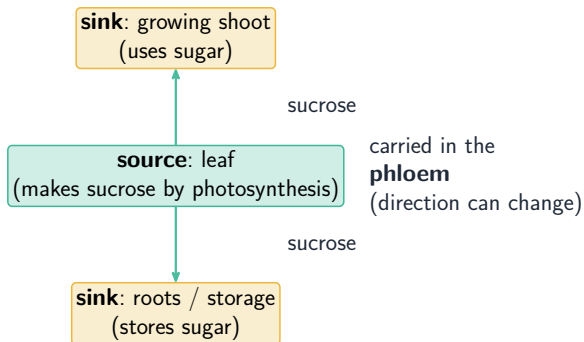
transpiration pull 蒸騰拉力

water leaving the leaf
pulls more up behind it

one water column

molecules stick together; losing
water too fast → **wilting** 萎蔫

Translocation

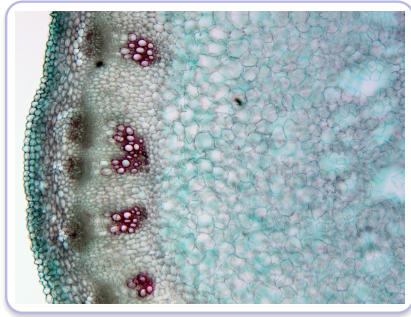


Translocation 转运 moves sucrose in the phloem from a **source** 源 to a **sink** 库.

- source – makes/stores sugar (leaves)
- sink – uses/stores it (roots)

The direction can change.

Xylem structure (Supplement)



A stem in cross-section: the red-stained xylem sits in vascular bundles near the edge

Xylem and phloem, continued



A tree moves water up from its roots through xylem vessels.

Exam tips

- Xylem: water and mineral ions, upward only, plus support – its cells are dead, with thick lignin walls. Phloem: sucrose and amino acids, in living cells.
- Learn the water pathway: root hair cell → cortex → xylem → mesophyll.
- Transpiration = evaporation from the mesophyll, then diffusion out of the stomata. It is faster when hotter, windier or drier.
- Water rises by the **transpiration pull**; the water molecules hold together as a column.
- Translocation goes from a **source** (where sugar is made or stored) to a **sink** (where it is used). The direction can change with the season.

3

Recap

Worked example – what changes transpiration?

A potometer bubble moves faster when a fan is switched on. Explain why.

- Transpiration is water **evaporating** from the leaves and diffusing out of the stomata.
- Still air lets water vapour **build up** just outside the leaf.
- The fan blows that vapour away, keeping the **concentration gradient steep**.
- Faster diffusion out $\Rightarrow$ faster water uptake $\Rightarrow$ **the bubble moves faster**.

Wind, heat and dry air all **speed up** transpiration; high humidity slows it. Each works by changing the **water-vapour gradient** outside the leaf.

Topic 8 – key takeaways

1

Xylem

water & minerals up; dead, lignified

2

Phloem

sucrose to sources & sinks; living

3

Transpiration

evaporate then diffuse out of stomata

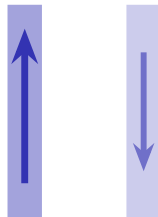
4

Pull

transpiration pull draws up a water column

Check yourself

- 1 Which tissue carries water up the plant?
- 2 Where does water evaporate in a leaf?
- 3 What drives water up the xylem?
- 4 What does translocation move?



Answers 1. xylem 2. the mesophyll cells 3. the transpiration pull 4. sucrose & amino acids