Your notes

GCSE Biology: revision notes

Plant tissues, transpiration and translocation

Contents

1. Start here: how a plant moves water and sugar
2. Plant tissues in a leaf
3. Stomata and guard cells
4. Xylem and transpiration
5. Factors affecting transpiration
6. Phloem and translocation
7. Exam tip
8. Common mistakes
9. Worked examples
10. Key terms
11. Quick questions
12. What to do next

Start here: how a plant moves water and sugar

- A plant takes in water through its roots and makes glucose in its leaves. Both have to get to the rest of the plant.
- Two kinds of tube do it: **xylem** carries water and mineral ions up from the roots, and **phloem** carries dissolved sugars to wherever they are needed.
- Water evaporates from the leaves through tiny holes called **stomata**. Losing it pulls more water up the **xylem**: this is **transpiration**.

Plant tissues in a leaf

- Epidermal tissue covers the leaf; the upper epidermis is transparent and covered by a **waxy cuticle** that reduces water loss.
- **Palisade mesophyll** has many chloroplasts and is near the top of the leaf, so it absorbs lots of light for photosynthesis.
- **Spongy mesophyll** has air spaces that let gases diffuse in and out of cells.
- **Xylem** and **phloem** transport substances around the plant. Meristem tissue at the growing tips makes new cells.

Stomata and guard cells

- **Stomata** are tiny pores, mostly on the underside of leaves, that let carbon dioxide in and oxygen and water vapour out.
- Each stoma is surrounded by two **guard cells** that open and close it, controlling gas exchange and water loss.

- **Stomata** usually close at night or when the plant is short of water.

Xylem and transpiration

- **Xylem** tissue is made of dead cells joined end to end, strengthened with **lignin**, forming hollow tubes.
- **Xylem** carries water and mineral ions from the roots to the stems and leaves.
- **Transpiration** is the loss of water vapour from the leaves, mostly through the **stomata**. It pulls a continuous stream of water up the **xylem**: the transpiration stream.
- Root hair cells absorb water by osmosis and mineral ions by active transport.

Factors affecting transpiration

- A higher temperature increases the rate: water evaporates and diffuses faster.
- Lower humidity increases the rate: there is a steeper concentration gradient of water vapour.
- More air flow (wind) increases the rate by blowing away water vapour near the leaf.
- Brighter light increases the rate because more **stomata** open.
- A **potometer** measures water uptake, which is used to estimate the rate of **transpiration**.

Phloem and translocation

- **Phloem** tissue is made of elongated living cells with pores in the end walls (sieve plates) that let cell sap move from one cell to the next.
- **Phloem** carries dissolved sugars from the leaves to the rest of the plant, for immediate use or storage. This is called **translocation**.
- Unlike **xylem**, **phloem** transports substances in both directions.

Exam tip

- Keep the two transport tissues apart: **xylem** carries water and minerals upwards and is made of dead cells with **lignin**; **phloem** carries dissolved sugars both ways, in living cells.
- When explaining **transpiration** rates, use evaporation and **stomata** in your answer.

Common mistakes

- Mixing up **xylem** and **phloem**.
- Saying higher humidity speeds up **transpiration**. It slows it down.

Your notes

Worked examples

In a potometer, the air bubble moves 30 mm in 5 minutes. Calculate the rate of water uptake.

Rate = distance moved ÷ time. **30 ÷ 5**

Answer: 6 mm per minute (the faster the bubble moves, the faster the plant is taking up water)

Key terms

Xylem	Tissue of dead, hollow cells strengthened with lignin that carries water and mineral ions up from the roots.
Phloem	Tissue of living cells with sieve plates that carries dissolved sugars around the plant.
Transpiration	The loss of water vapour from the leaves of a plant.
Translocation	The movement of dissolved sugars through the phloem.
Stomata	Tiny pores in a leaf that allow gases to diffuse in and out.
Guard cells	Pairs of cells that open and close stomata.
Palisade mesophyll	Leaf tissue with many chloroplasts where most photosynthesis happens.
Spongy mesophyll	Leaf tissue with air spaces that allow gases to diffuse.
Potometer	Apparatus used to measure water uptake by a plant shoot.
Waxy cuticle	A waterproof layer on the surface of a leaf that reduces water loss.
Lignin	A strong substance in the walls of xylem cells.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What does xylem transport?
2. What does phloem transport?
3. What is translocation?
4. What is transpiration?
5. Which tissue has lots of chloroplasts near the top of the leaf?
6. What controls the opening and closing of stomata?
7. Which change increases the rate of transpiration?
8. Why does high humidity slow down transpiration?

Answers

1. Water and mineral ions
2. Dissolved sugars

Your notes

3. The movement of sugars through the phloem
4. The loss of water vapour from leaves
5. Palisade mesophyll
6. Guard cells
7. Higher temperature
8. The concentration gradient of water vapour is smaller

What to do next

Practise 12 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

Your notes