

This is the **Higher Combined** version — includes Higher Tier content. Some Separate-only details are omitted.

Plants have their own tissues and transport systems. Understanding their structure explains how plants survive and grow.

- **Epidermis:** outer protective layer of leaves. Often covered in a waxy cuticle to reduce water loss.
  - **Palisade mesophyll:** column-shaped cells packed with chloroplasts. Located near top of leaf. Main site of photosynthesis.
  - **Spongy mesophyll:** irregularly arranged cells with large air spaces. Allows CO<sub>2</sub> to diffuse to palisade cells.
  - **Stomata:** pores in the lower epidermis (mainly) that allow gas exchange (CO<sub>2</sub> in, O<sub>2</sub> and water vapour out). Controlled by guard cells.
  - **Guard cells:** become turgid (in light/water-rich conditions) → open stomata. Become flaccid (in drought/dark) → close stomata.
  - **Xylem vessels:** dead hollow cells with lignified walls. Transport water and minerals from roots to leaves (transpiration stream). One-way flow.
  - **Phloem:** living cells with sieve plates. Transport dissolved sugars (sucrose) from leaves (source) to all parts of plant (translocation). Bidirectional.
  - **Root hair cells:** long extensions, large surface area. Absorb water by osmosis, mineral ions by active transport.
- ★ **HT Meristem cells at root and shoot tips:** undifferentiated, actively dividing — the plant equivalent of stem cells.

### Key Terms

<b>Transpiration</b>	Evaporation of water vapour from leaf cells through stomata — driven by concentration gradient
<b>Translocation</b>	Movement of dissolved sugars (sucrose) in phloem from leaves to rest of plant
<b>Xylem</b>	Dead hollow vessels carrying water and minerals upwards from roots — lignified walls
<b>Phloem</b>	Living cells transporting dissolved sugars throughout the plant — bidirectional
<b>Guard cells</b>	Cells surrounding stomata — control opening and closing to regulate gas exchange and water loss

■ **Exam Tip:** Know the difference between **TRANSPIRATION** (water in xylem, upward) and **TRANSLOCATION** (sucrose in phloem, any direction). These are often confused in exams.