

CIE Biology GCSE

8: Transport in plants

Notes

Plants have a transport system made up of **xylem and phloem vessels**. These transport nutrients from the roots of the plant to the stem and leaves, and vice versa. The **xylem** is used to transport **water** through plants from the roots in **transpiration**. The xylem is made from **hollowed-out dead cells** that have the ends removed to make a tube for water to pass through. The **phloem** is made of **living cells** and is used to **transport sugars and food nutrients** in **translocation**.

Water uptake:

Water is taken up by **root hair cells** via osmosis. The water then moves into the **root cortex cells** by osmosis (as the root hair cells now have a higher water potential than the cortex cells), before entering the **xylem vessel** where it is drawn up the **stem to the leaves**. At the leaf it diffuses into **mesophyll cells** where it is used in metabolic reactions such as **photosynthesis**.

Root hair cells are adapted for efficient water uptake by having a **large surface area**. This increases the rate of **osmosis** into the root, as well as increasing the rate of ion uptake by **active transport**. They also have a **thin wall**, so the diffusion distance is shortened.

Transpiration:

Transpiration is the **loss of water vapour** from the **mesophyll cell surface** due to **evaporation**. The water vapour then exits the plant via the **stomata**. Water helps maintain plant structure by keeping cells **turgid**. If the plant loses too much water which is not replaced, it begins to **wilt** as **water moves out of cells** and **turgor pressure decreases**. To limit water loss, the plant closes the stomata to prevent water vapour diffusing out.

Water molecules are drawn up the xylem by **transpiration pull** (not osmosis). Water molecules are **cohesive**, meaning they stick together. This means that as the water evaporates at the leaf and diffuses out of the stomata, more water is drawn up the plant from the roots.

The **rate of transpiration** depends on the **temperature and humidity**. On warm days the temperature is higher, so water evaporates more easily, therefore there is more diffusion of water vapour out of the plant, so the **rate of transpiration is high**. A high humidity, however, decreases the rate of transpiration as the **concentration gradient** of water vapour between the inside and outside of the plant is comparatively low, so diffusion out of the plant is slower.

Translocation:

Translocation occurs in the **phloem vessels** and involves the transport of **amino acids and sucrose**. Areas where amino acids and sucrose are produced are called **sources**. Regions where they are **stored** or used for **respiration and growth** are called **sinks**. Materials are always transported from **source to sink**.

Sucrose and amino acids are produced in the leaves, before being transported to the roots for **storage**. They are later transported to regions where they are used in **respiration and for growth**. Some parts of the plant, such as the leaves, can act as both source and sink within a plant's life as they synthesise molecules and use them in metabolic reactions.