

CAIE Biology A-level

Topic 7 - Transport in Plants

Definitions and Concepts

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Adhesion (water movement) - The formation of hydrogen bonds between carbohydrates in the xylem vessel walls and water molecules. This contributes to the capillarity of water and transpiration pull.

Apoplastic pathway - One of two pathways by which water and minerals move across the root. Water moves through intercellular spaces between cellulose molecules in the cell wall.

Casparian strip - A waterproof strip surrounding the endodermal cells of the root that blocks the apoplast pathway, forcing water through the symplast route.

Cohesion (water movement) - The formation of hydrogen bonds between water molecules. This contributes to the capillarity of water and transpiration pull.

Cohesion-tension theory - The model that explains the movement of water from the soil to the leaves in a continuous stream.

Companion cells - Active cells of the phloem located adjacent to the sieve tube elements which produce ATP for metabolic processes in both themselves and the sieve tube elements. They retain their nucleus and organelles.

Cotransport - A form of secondary active transport. The movement of one substance down its concentration or electrochemical gradient is coupled to the transport of another substance via transmembrane proteins.

Dicotyledonous plants - Plants that produce seeds that contain two cotyledons. They have two primary leaves.

Endodermis - The innermost layer of the cortex of a dicotyledon root. It is impregnated with suberin which forms the Casparian strip. Endodermal cells actively transport mineral ions into the xylem.

Evaporation - A transition from the liquid state to the gaseous state which requires heat energy.

Eyepiece graticule - A scale bar inside the eyepiece of a light microscope which can be calibrated against a ruler to measure structures.

Herbaceous plants - Plants which do not have woody stems.

Hydrostatic pressure - The force which fluid molecules exert on the walls of a vessel.

Lignin - An organic polymer that has a role in the support and impermeability of vascular tissues.

Mass flow - Sugars flow passively from the source to the sink down a hydrostatic pressure gradient.

Phloem - A living plant transport vessel responsible for the transfer of assimilates to all parts of the plant. The phloem consists of sieve tube elements and companion cells.



Potometer - An apparatus used to measure water uptake from a cut shoot.

Root hair cells - Specialised cells responsible for the uptake of water and minerals from the soil. They have long hair-like extensions known as root hairs, which are adapted as exchange surfaces.

Sieve plates - The perforated end walls of sieve tube elements that allow plant assimilates to flow between cells unimpeded.

Sieve tube elements - The main cells of the phloem. They are elongated cells laid end-to-end with sieve plates between. They contain few organelles.

Sinks (plants) - The regions of a plant that remove assimilates e.g. roots, meristem, fruits.

Sources (plants) - The regions of a plant that produce assimilates e.g. leaves, storage organs.

Suberin - A waterproof, waxy material that forms the Casparian strip in the endodermis.

Symplastic pathway - One of two pathways by which water and minerals move across the root. Water enters the cytoplasm through the plasma membrane and moves between adjacent cells via plasmodesmata. Water diffuses down its water potential gradient by osmosis.

Translocation - The bulk movement of organic compounds in plants from sources to sinks via the phloem.

Transpiration - Water loss from plant leaves and stems via diffusion and evaporation. The rate of transpiration is affected by light, temperature, humidity, air movement and soil-water availability.

Water potential - A measure of the tendency of water molecules to move from one area to another measured in kilopascals (kPa) and given the symbol Ψ .

Xerophytes - Plants that are adapted to live and reproduce in dry habitats where water availability is low, e.g. cacti and marram grass.

Xylem - A non-living, heavily lignified plant transport vessel responsible for the transfer of water and minerals from the roots to the shoots and leaves.

