Plant Transport

Transpiration - Xylem

The evaporation of water from a plant which pulls water up the stem due to cohesion-tension. Passive process controlled by stomata and in only one direction (up).

- heat from sun causes mesophyll cells to lose water via evaporation to air spaces
- cells have a lower water potential - water moves in via osmosis from neighbouring cells - now have a lower water potential etc. etc.
- water potential gradient established - pulls water from xylem across mesophyll

- heat from sun causes evaporation from mesophyll cells and transpiration occurs
- water molecules form hydrogen bonds and stick together - cohesion - forming a continuous unbroken column
- as water evaporates from mesophyll, more molecules are drawn up due to cohesion
- **transpiration pull** - column of water pulled up xylem as a result of transpiration
- transpiration pull puts xylem under tension (negative pressure) therefore this is the cohesion-tension theory

Apoplast - water moves between root cells along cell walls

Vacuolar - water moves from vacuole to vacuole

Symplast - water moves through cell membranes, cytoplasm or plasmodesmata

Translocation - Phloem

Organic molecules and some mineral ions are transported from one part of a plant to another, an active process from source to sink and in any direction.

- sucrose is manufactured from products of photosynthesis in chloroplast containing cells
- sucrose moves down a concentration gradient into companion cells via facilitated diffusion
- hydrogen ions actively transported from companion cells into spaces within cell walls using ATP
- hydrogen ions diffuse down concentration gradient through carrier proteins into sieve tube elements
- sucrose molecules transported via co-transport through protein carriers (CTP)

- sucrose actively transported into sieve tubes
- lowers the water potential of sieve tubes, so water moves in via osmosis form the xylem, creating a hydrostatic pressure in the sieve tubes
- sucrose used at respiring cells (sink) = low sucrose concentration so sucrose actively transported into them from sieve tubes. Sucrose lowers their water potential so therefore water moves in via osmosis too.
- Hydrostatic pressure of sieve tubes is low in this region and therefore mass flow of sucrose solution down hydrostatic gradient in sieve tubes.

high hydrostatic pressure at a source, low hydrostatic pressure at a sink.