B3.2.7 — Transport of water from roots to leaves during transpiration

Xylem -> Specialized plant tissue that transports water from roots to leaves

↳ Roots to shoots!

↳ Relies on 2 water properties:

1. Cohesion (water-water)
2. Adhesion (water-xylem wall)

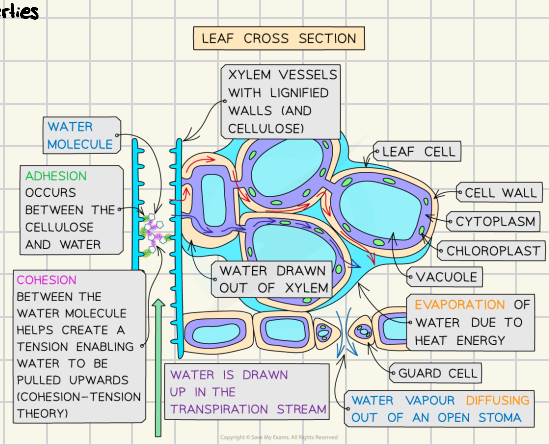
↳ The continuous evaporation of water from the stomata creates a negative pressure (tension) within the leaf

- The pressure pulls water molecules upwards
  - This process is known as ~~transpirational pull~~
    - => It is completely passive, as it relies on water's properties

Transpiration
_water will evaporate out of the stomata... _ bc. of its cohesive property, it will pull the other water molecules with it in a single column_

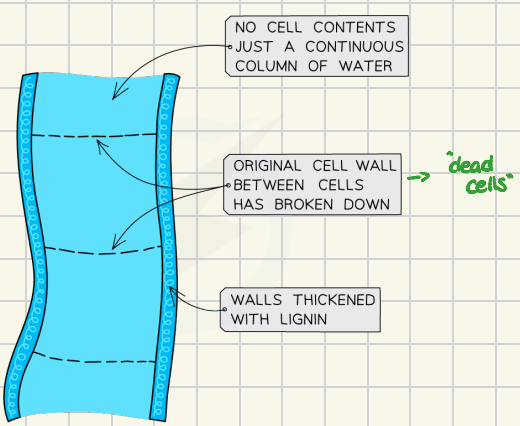
adhesion helps w/ gravity! } demonstrated via cellulose's hydrophillic nature (as it ligns the xylem)

"transpirational pull puts the xylem under tension. Bc. of H_2O's cohesive nature, a stream is generated"

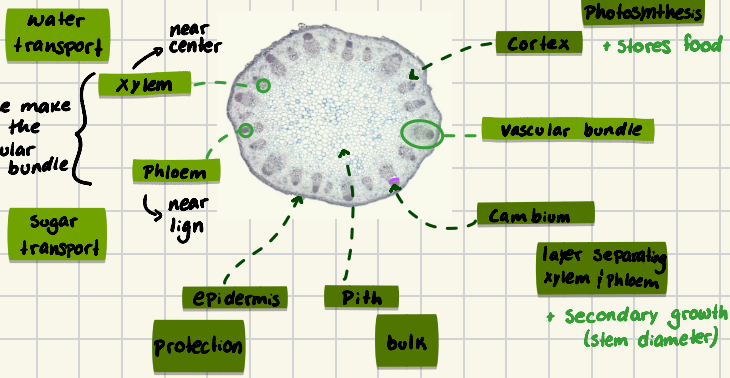


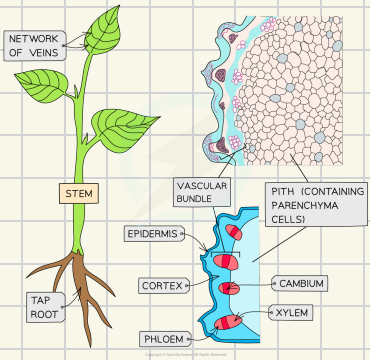
D3.2.8 — Adaptations of xylem vessels

Structure	Function
Dead, hollow cells	Maintenance of continuous water stream
Lignin (polysaccharide)	prevents collapse against pressure
Pits	water can pass through dif. vessels

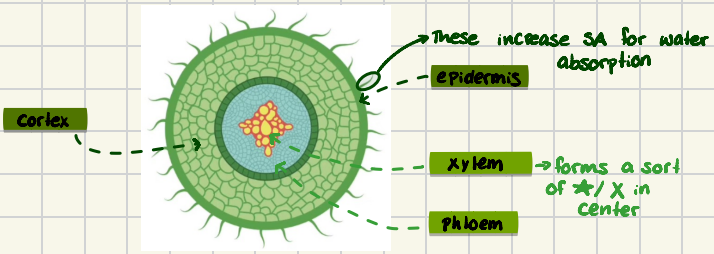


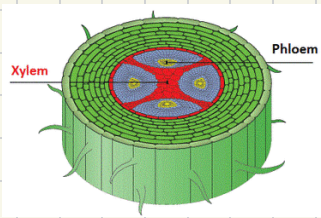
B3.2.9 — Distribution of tissues in dicotyledonous plant (stem)

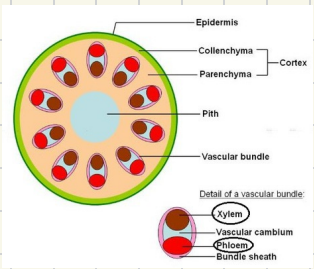


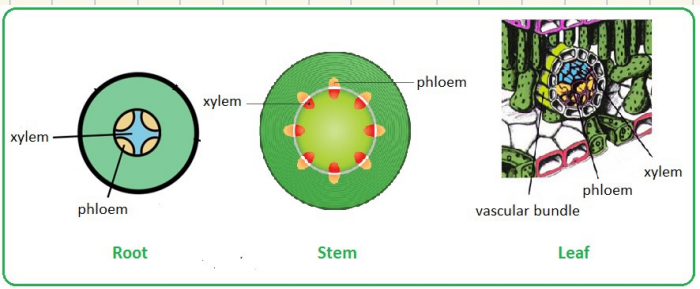


B3.2.10 — Distribution of tissues in dicotyledonous plant (root)









B3.2.17 — Root pressure in xylem by transport of mineral ions

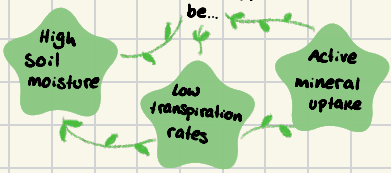
↳ Transpiration is not always possible:

a) The outside air might be too humid
b) The stomata might be closed
c) The plant might have lost some leaves

In any of these conditions, transpirational pull is no longer an option ; the movement of H_2O has to start from bottom

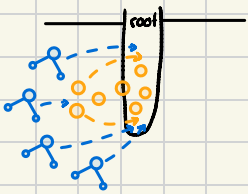
pressure must be applied from roots

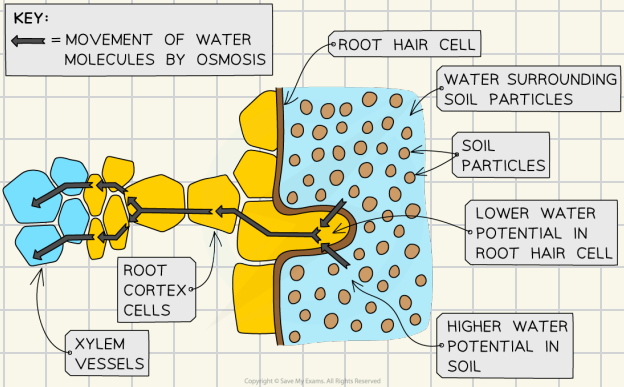
↳ for this to happen there must be...



↳ So, plant must:

1. Actively transport mineral ions from the soil into the root
2. This causes osmosis to ensue
   a) Water follows a high solute concentration
3. This increases pressure inside the root (↑ pressure)
   a) Pushing water up through xylem





B3.2.18 — Adaptations of phloem sieve tubes

↳ Phloem transports carbon compounds (sucrose) from source to sink

carbon compounds = CC

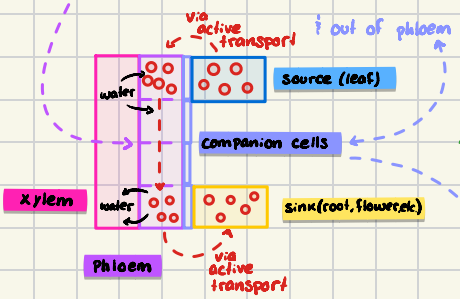
Source => where carbon compounds are made (leaf)

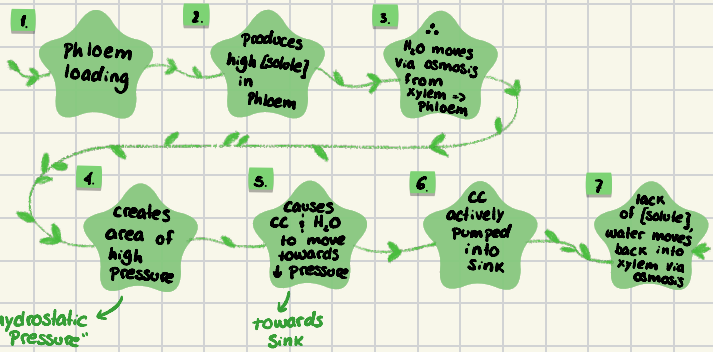
Sink => where carbon compounds are stored / used (root, shoot, flower, fruit)

↳ Phloem = bidirectional

holes (pits) on phloem sieve tubes allow for CC transport

help out actively transport CC into ↑ out of phloem





They:

- Contain many mitochondria
- Involved in the metabolic processes of sieve-tube elements

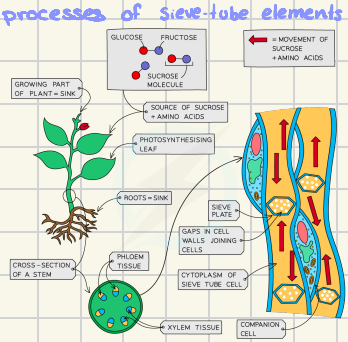
Phloem Sieve tubes

↳ Adjoining cells connect, but have large holes in the walls (sieve plates)

↳ Rest of the cell breaks down (nucleus + other organelles)

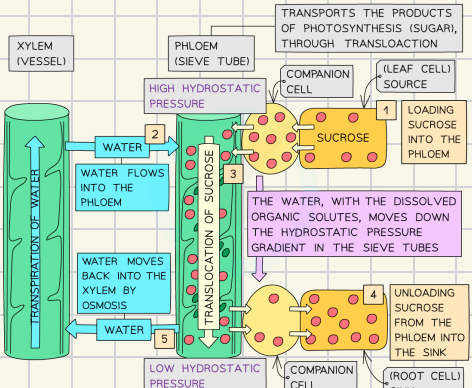
↳ They have a rigid cell wall

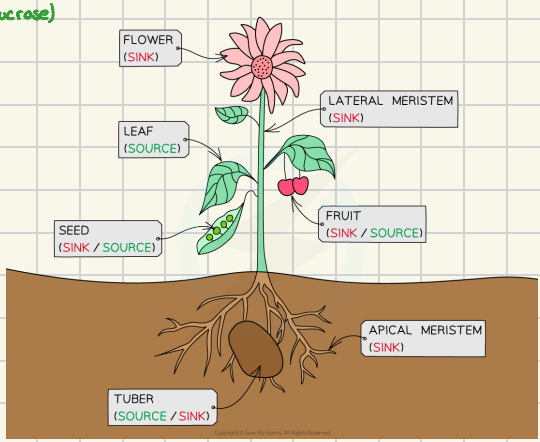
- This is why they rely on companion cells for things like active transport
  - i) Phloem loading
  - ii) Sink loading



Translocation => the movement of dissolved substances within a plant

Phloem sap => The fluid transported within the phloem (primarily sucrose)





Companion cell structure and function table

Structure	Function
Nucleus and other organelles	Provides metabolic support to sieve tube elements
Transport proteins in plasma membrane	Moves assimilates into and out of the sieve tube elements
Many mitochondria	Provide ATP for the active transport of assimilates into or out of the companion cells
Plasmodesmata	Link with sieve tube elements to allow assimilates to move from the companion cells into the sieve tubes

Sieve tube structure and function table

Structure	Function
Sieve plates	Allows for the continuous movement of the organic compounds between cells
Cellulose cell wall	Strengthens the wall to withstand the hydrostatic pressures that move the assimilates
No nucleus, vacuole or ribosomes in mature cells	Maximises the space for the translocation of assimilates
Thin cytoplasm	Reduces friction to facilitate the movement of assimilates