

Solutions

Each answer shows the steps, then the **result**.

2.1

- apoplast — water moves through the cell walls and spaces; symplast — water moves through the cytoplasm from cell to cell via plasmodesmata

2.2

- source — where the assimilate is made/released (e.g. a leaf); sink — where it is used or stored (e.g. a root)

3.1 B

- The Casparian strip blocks the apoplast, forcing water through the cell membranes

3.2 B

- Cohesion between water molecules holds the column together under tension

3.3

(a)

- volume = $60 \text{ mm} \times 2.0 \text{ mm}^2 = 120 \text{ mm}^3$

(b)

- rate = $120/10 = 12 \text{ mm}^3 \text{ min}^{-1}$

3.4

- companion cells use proton pumps to pump H^+ out, then cotransporters bring sucrose in with H^+ — active transport; this lowers the water potential in the sieve tube so water enters by osmosis, raising the hydrostatic pressure; sap then flows down the pressure gradient to the sink (mass flow)