

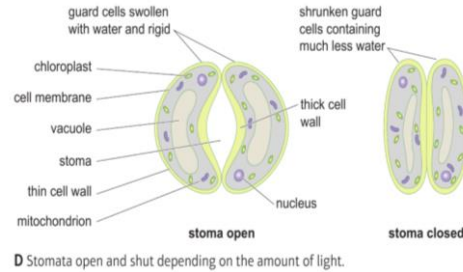
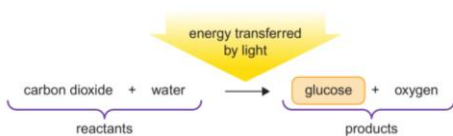
B6: Plants

Lesson sequence

1. Photosynthesis
2. Leaves
3. Factors affecting photosynthesis
4. Core practical – effect of light intensity on photosynthesis
5. Roots
6. Transpiration and translocation

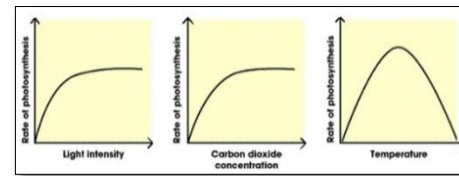
1. Photosynthesis

Photosynthesis	How plants produce glucose using the energy from light.
Photosynthesis equation	Carbon dioxide + water → glucose + oxygen
Chloroplast	Part of a plant cell where photosynthesis happens.
Chlorophyll	A green pigment that enables photosynthesis by trapping the energy in light.
Forming starch	As soon as they are made, glucose molecules are joined together into long chains to form starch.
At night	Starch is converted into a sugar called sucrose which is easy to move around the plant.
Uses of sucrose	Sucrose is converted into: - Glucose for respiration - Starch for storage - Other molecules for growth
Biomass	The total mass of materials in an organism (except water). Photosynthesis is the main source of biomass.



2. Leaves

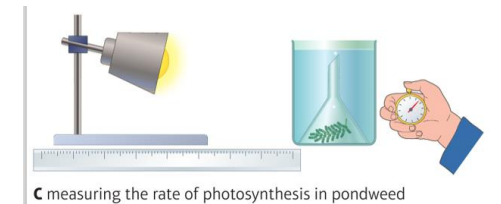
Job of leaves	To conduct as much photosynthesis as possible as quickly as possible.
Leaf adaptations	To do more photosynthesis, leaves have: a large surface area, a waxy cuticle, palisade cells, a spongy layer, stomata.
Large surface area	Allows the leaf to absorb more light.
Waxy cuticle	A waxy coating that stops water evaporating from the leaf.
Palisade cells	Tall cells in a leaf with many chloroplasts for lots of photosynthesis.
Spongy layer	A layer of cells with lots of gaps that allows gases to move around inside the leaf.
Stomata (singular = stoma)	Holes in the bottom of the leaf that allow carbon dioxide in and oxygen and water vapour out.
Stomata structure	Each stoma is surrounded by two cells called guard cells that can swell to open it or shrink to close it.
How stomata work	During the day, the stomata open to allow gas exchange. At night the stomata close. Stomata also close during dry spells to stop water loss.



3. Factors affecting photosynthesis

Limiting factor	A factor that holds back the rate of photosynthesis when in short supply.
The limiting factors	Carbon dioxide concentration, light intensity, temperature.
Limiting factor graphs	The line slopes up when the factor is limiting, the line levels out when the factor is not limiting.

Carbon dioxide and light intensity	To start with, increasing them will increase the rate of photosynthesis because they are limiting. Eventually increasing them further has no effect as they are no longer limiting.
Temperature and photosynthesis	Increasing temperature towards the optimum increases the rate as particles move faster and collide more. Increasing past the optimum decreases rate as enzymes denature.
Inverse square law	$I_{new} = \frac{I_{orig} \times d_{orig}^2}{d_{new}^2}$



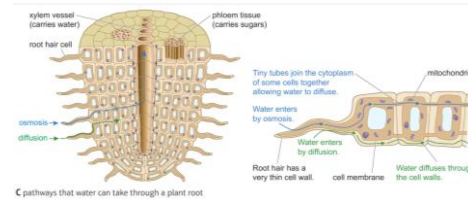
4. Core practical – effect of light intensity on photosynthesis (CP4)

CP4 – Key question	How does light intensity affect the rate of photosynthesis?
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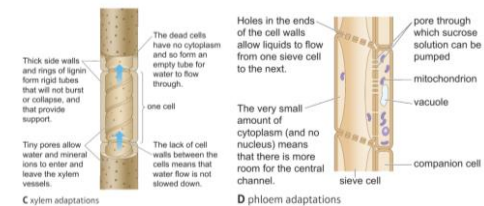
CP4 - Set up equipment	Place some pondweed in a beaker of water with a glass funnel over it and place it 10 cm away from a lamp and wait three minutes for it to settle.
CP4 - Recording results	Count the number of bubbles produced in a minute.
CP4 - Vary the light intensity	Repeat the experiment lowering the light intensity by moving the lamp 10 cm further away each time until it is 50 cm away.
CP4 - Results	As the light intensity decreases, the number of bubbles per minute decreases because the rate of photosynthesis decreases.

5. Roots	
Role of roots	To absorb water and nutrients from the soil.
Root hair cells	Role: To quickly absorb water and minerals from soil Adaptations: A long hair which increases their surface area, thins cell walls to ease water absorption.
Movement of water	Water enters roots by diffusion and osmosis and travels to the xylem in the centre.
Diffusion in roots	Water diffuses along the cell walls around the outside of each cell until it reaches the xylem.
Osmosis in roots	Water travels from cell to cell across cell membranes by osmosis until it reaches the xylem.
Minerals in the soil	Plants absorb minerals from soil such as nitrates, phosphates and potassium.
Absorbing minerals	Plants absorb minerals by active transport because their concentration is low.

Xylem cells	Role: To carry water from the roots to the leaves. Adaptations: Hollow to let water pass, no walls between neighbours to allow water through, rings of lignin to make them strong.
Factors increasing transpiration	Air movement (wind), dryer air (low humidity), higher temperatures
Translocation	The movement of sucrose (sugar) around a plant through the phloem.
Phloem	Tissue that transports sucrose around plants, made of sieve tubes and companion cells.
Sieve tubes	Cells in phloem with a large channel running through them to carry sucrose solution.
Companion cells	Cells in phloem that sit next to the sieve tubes and pump sucrose into the sieve tubes.

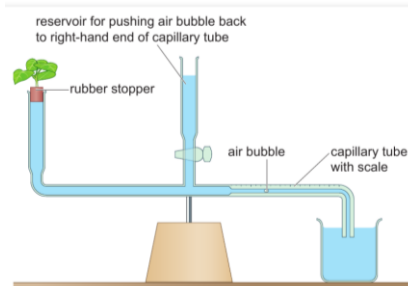
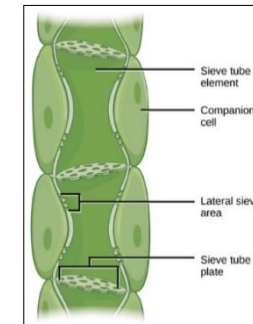


C pathways that water can take through a plant root.



C xylem adaptations

D phloem adaptations



B We can investigate the factors affecting transpiration using a **potometer**. The air bubble moves along the tube as the plant loses water. The speed of the bubble gives a measure of the rate of transpiration (e.g. in mm/min).

6. Transpiration and translocation	
Transpiration	The movement of water into a plant's roots, up its stem and evaporating out of the leaves.
Xylem	Hollow tubes that carry water from the roots, up the stem to the leaves.