

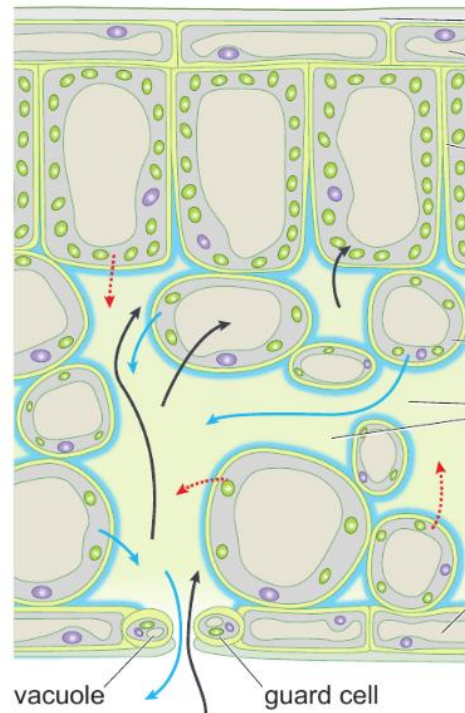
### B6: Plants Structures and their Functions

#### Lesson sequence

1. Photosynthesis and leaves
2. Factors affecting photosynthesis
3. Core practical – effect of light intensity on photosynthesis
4. Absorbing water and mineral ions (roots)
5. Transpiration and translocation
6. Plant adaptations
7. Plant hormones
8. Uses of plant hormones

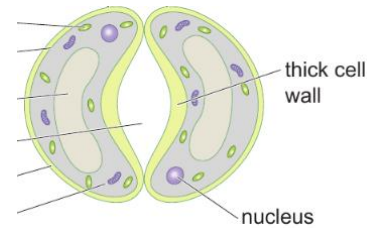
#### 1. Photosynthesis

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



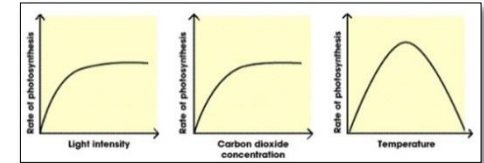
Leaves	
<b>Job of leaves</b>	To conduct as much photosynthesis as possible as quickly as possible.
<b>Leaf adaptations</b>	To do more photosynthesis, leaves have: a large surface area, a waxy cuticle, palisade cells, a spongy layer, stomata.
<b>Large surface area</b>	Allows the leaf to absorb more light.
<b>Waxy cuticle</b>	A waxy coating that stops water evaporating from the leaf.
<b>Palisade cells</b>	Tall cells in a leaf with many chloroplasts for lots of photosynthesis.
<b>Spongy layer</b>	A layer of cells with lots of gaps that allows gases to move around inside the leaf.

<b>Stomata (singular = stoma)</b>	Holes in the bottom of the leaf that allow carbon dioxide in and oxygen and water vapour out.
<b>Stomata structure</b>	Each stoma is surrounded by two cells called guard cells that can swell to open it or shrink to close it.
<b>How stomata work</b>	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.



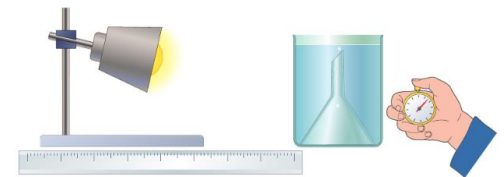
#### 2. Factors affecting photosynthesis

<b>Limiting factor</b>	A factor that holds back the rate of photosynthesis when in short supply.
<b>The limiting factors</b>	Carbon dioxide concentration, light intensity, temperature.
<b>Limiting factor graphs</b>	The line slopes up when the factor is limiting, the line levels out when the factor is not limiting.
<b>Carbon dioxide and light intensity</b>	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.
<b>Temperature and photosynthesis</b>	Increasing temperature towards the optimum increases the rate as particles move faster and collide more. Increasing past the optimum decreases rate as enzymes denature.
<b>Inverse square law</b>	$I_{new} = \frac{I_{orig} \times d_{orig}^2}{d_{new}^2}$



#### 3. Core practical – effect of light intensity on photosynthesis (CP6)

<b>CP6 – Key question</b>	How does light intensity affect the rate of photosynthesis?
<b>CP6 - Set up equipment</b>	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.
<b>CP6 - Recording results</b>	Count the number of bubbles produced in a minute.
<b>CP6 - Vary the light intensity</b>	Repeat the experiment lowering the light intensity by moving the lamp 10 cm further away each time until it is 50 cm away.
<b>CP6 - Results</b>	As the light intensity decreases, the number of bubbles per minute decreases because the rate of photosynthesis decreases.



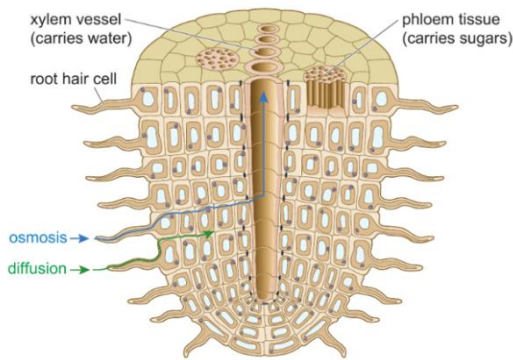
#### 4. Absorbing water and mineral ions (roots)

<b>Role of roots</b>	To absorb water and nutrients from the soil.
<b>Root hair cells</b>	<b>Role:</b> To quickly absorb water and minerals from soil. <b>Adaptations:</b> A long hair which increases their surface area, thin cell walls to ease water absorption.

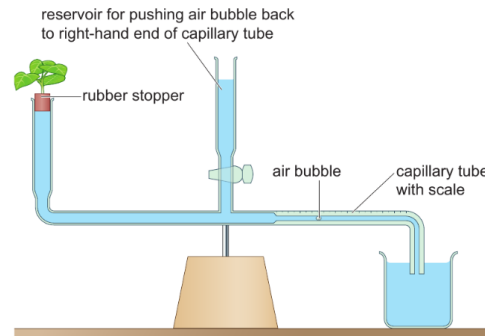
#### Exam-style question

Explain how palisade cells are adapted for photosynthesis. (2 marks)

<b>Movement of water</b>	Water enters roots by diffusion and osmosis and travels to the xylem in the centre.
<b>Diffusion in roots</b>	Water diffuses along the cell walls around the outside of each cell until it reaches the xylem.
<b>Osmosis in roots</b>	Water travels from cell to cell across cell membranes by osmosis until it reaches the xylem.
<b>Minerals in the soil</b>	Plants absorb minerals from soil such as nitrates, phosphates and potassium.
<b>Absorbing minerals</b>	Plants absorb minerals by active transport because their concentration is low.
<b>Active transport</b>	The movement of ions or molecules through a membrane from a low concentration to high concentration (energy is required).



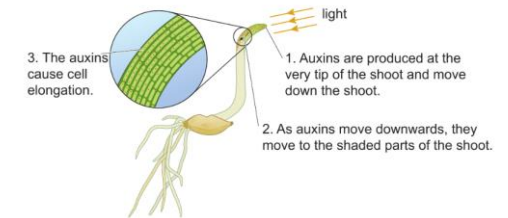
<b>Xylem cells</b>	<b>Role:</b> To carry water from the roots to the leaves. <b>Adaptations:</b> Hollow to let water pass, no walls between neighbours to allow water through, rings of lignin to make them strong.
<b>Factors increasing transpiration</b>	Air movement (wind), dryer air (low humidity), higher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



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

6. Plant adaptations	
<b>Deciduous plants</b>	Trees and shrubs that shed their leaves usually in autumn.
<b>Epidermis cells</b>	A single layer of cells that covers the leaves, flowers, roots and stems of plants. It forms a boundary between the plant and the external environment.

<b>chloroplasts</b>	The place in a plant cell where photosynthesis happens.
<b>Cacti adaptations</b>	Have spines (the prickly thorn like things) in which replace leaves. These spines minimise the surface area of the cactus reducing water loss. The cacti's stem is also thick and fleshy allowing it to store a lot of water. The stem also has a waxy waterproof kind of coating to help retain more water.



7. Plant hormones	
<b>Stimulus</b>	Something that can elicit or evoke a physiological response in a cell, a tissue, or an organism.
<b>Tropism</b>	A growth toward or away from a stimulus.
<b>Phototropism</b>	A plants growth in response to a light source.
<b>Gravitropism</b>	A plants growth in response to gravity.
<b>Plant hormones</b>	Are chemicals plants use for communication, coordination, and development between plant cells.
<b>Auxins</b>	A plant hormone produced in the stem tip that promotes cell elongation.

8. Uses of plant hormones	
<b>Rooting powder</b>	Uses a plant hormone to aid in the transplant of fresh cuttings by promoting quick root development.
<b>Photoperiodism</b>	The response of an organism to seasonal changes in day length.
<b>Selective weedkillers</b>	Contains a growth hormone that causes the weeds to grow too quickly and die.
<b>Gibberellins</b>	Growth hormones that stimulate cell elongation and cause plants to grow taller. Gibberellins also have a role in other plant processes, such as stem elongation, germination, flowering, and fruit ripening.
<b>Ethene</b>	A hormone that affects the ripening and flowering of many plants.

