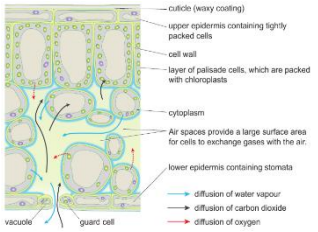
B6: Plant Structures and their Functions

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.
Glucose	Sugar formed by photosynthesis.
Starch	As soon as they are made, glucose molecules are joined together into long chains to form starch.
Sucrose	Starch is be broken down into sucrose to be transported around the plant.
Uses of sucrose	Sucrose is converted into: - Glucose for respiration - Starch for storage - Other molecules for growth
Endothermic	Reactions where the products have more energy than the reactants. Photosynthesis is an exothermic reaction.
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.

Stomata (singular = stoma)	Microscopic pores 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 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.
Leaf Structure	

2. Factors That Affect Photosynthesis

Limiting factor	A factor that holds back the rate of photosynthesis when in short supply. Carbon dioxide concentration, light intensity and temperature
Carbon Dioxide and Photosynthesis	To start with, increasing CO_2 levels will increase the rate of photosynthesis. Eventually further increases have no effect because they are no longer the limiting factor.
Light Intensity and Photosynthesis	To start with, increasing light intensity will increase the rate of photosynthesis because they. Eventually increasing it 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	$I_{new} = \frac{I_{orig} \times d_{orig}^2}{d_{new}^2}$
Linear Relationship	A relationship between two variables shown by a straight line on a graph.
Direct Proportion	A linear relationship in which a change in a variable occurs with an equal percentage change in another variable.

3. Core Practical

Key Question	How does light intensity affect the rate of photosynthesis?
Method	Measure the pH of solutions with algal balls in at different distances away from a light source.
Dependent Variable	Change in pH/hour (rate of photosynthesis)
Independent Variable	Distance of algal balls from light source.
Control Variables	Number/size of algal balls, volume of indicator solution, temperature (tank of water is placed between light source and jars with algal balls to absorb heat).
Results	The closer to the light source the greater the rate of photosynthesis (and greater final pH).
Explanation	The closer to the light source the algal balls are, the greater the light intensity and the greater the level of photosynthesis.

4. Absorbing Water and Mineral Ions

Water	In plants, used for carrying dissolved mineral ions, keeping cells rigid, cooling leaves and photosynthesis.
Root hair cells	**Role:** To quickly absorb water and minerals from soil **Adaptations:** A long hair which increases their surface area & thin cell wall for fast water absorption.
Diffusion	Movement from a high concentration to low until equilibrium is reached.
Osmosis	Movement of a solvent from high to low concentrations across as semi-permeable membrane.
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.

5. 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.
Xylem Adaptations	Hollow dead cells 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
Potometer	Equipment used to measure rate of transpiration.
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- lots of mitochondria for active transport