Important Terms

The process by which green plants make **glucose** or food with the help of **Carbon dioxide and water** in presence of **sunlight** and chlorophyll is called Photosynthesis

$6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

NADP- **Nicotinamide Adenine Dinucleotide Phosphate**

Chlorophyll is the green pigment found in plants.

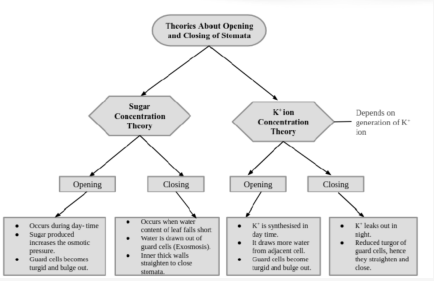
Chloroplasts are **minute oval bodies** bounded by a double membrane, and their interior contains closely packed flattened sacks (***thylakoids***) arranged in piles (***grana***) lying in a colourless ground substance called **stroma**.

The Carbon Cycle is a **series of chemical reactions** in which carbon as a chemical element is **removed** from the air, used by **living organisms in their body processes** and is finally returned to air.

Photolysis of water: Chemical decomposition of water induced by light or other radiant energy. Photolysis plays an important role in photosynthesis, during which it produces energy by splitting water molecules into gaseous oxygen and hydrogen ions.

In the process of photosynthesis, the phosphorylation of ADP to form ATP using the energy of sunlight is called **photophosphorylation.**

Stomatal Opening and Closing



Adaptations in Leaf For Photosynthesis

Large Surface Area - for maximum light absorption

Leaf Arrangement - at the right angle to the light source to obtain maximum light

Cuticle and Upper Epidermis - are transparent and waterproof to allow light to enter freely

Numerous Stomata - allow rapid exchange of gases

Thinness of Leaves - reduces distance between cells facilitating rapid transport

Chloroplasts - concentrated in the upper layers of leaf to obtain light energy quickly

Extensive Vein System - for rapid transport to and from the mesophyll cells.

Stomatal Transpiration

The following steps are involved in stomatal transpiration:

Osmotic diffusion transports water from the leaf's xylem to the intercellular space above the stomata.

The stomata open and close.

Through stomata, water is transported from the intercellular space to the external environment.

Factors Affecting Photosynthesis

Light Intensity

Carbon Dioxide Concentration

Temperature

Water Content

Chlorophyll

Protoplasm

Structure Of Leaf

Importance Of Photosynthesis

Provides Food

Provides Oxygen

Stages in Photosynthesis:

Light Reaction: Light reaction occurs in the thylakoids during daytime in the presence of sunlight. Since it results in the formation of chemical energy from radiant energy, it is called a photochemical reaction and it is divided into 4 stages.

Dark Reaction: This reaction occurs in the stroma. Since this reaction results in the formation of biomolecules, it is called a biosynthetic phase. There are three stages identified in the Calvin cycle.

Absorption of light energy: Chlorophyll pigments present in Photosynthetic units in the thylakoids absorb a photon of energy. This results in electrons being excited into a higher energy level.

Carboxylation: CO2 is covalently linked to a 5 carbon sugar (RuBP) and converted to 2 three carbon compounds.

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Stages in Photosynthesis: (cont)

Photolysis of water: The excess energy is used to split a molecule of water into H+ and OH– ions. Oxygen is formed as a byproduct and is released into the atmosphere. $4H_2O \rightarrow 4H^+ + 4(OH)^-$ (i) $4(OH)^- \rightarrow 2H_2O + O_2 + 4e^-$ (ii) $2H_2O \rightarrow 4H^+ + O_2 + 4e^-$ (adding i + ii)

Reduction: In the presence of the energy stored in the $NADPH_2$ and ATP, the two 3-carbon molecules combine to form a six carbon glucose molecule. NADP is got back from $NADPH_2$ and ADP is obtained from ATP. These are used in the next cycle of the light reaction. (The hydrogen released is used to reduce carbon dioxide into sugar molecule).

Reduction of NADP: $2NADP + 4e^- + 4H^+ \rightarrow NADPH$

Regeneration: The CO2 acceptor RuBP reforms at the expense of ATP.

Photophosphorylation: In the presence of sunlight, ADP binds with inorganic phosphate to form ATP. (ADP + Pià ATP)

The ATP and NADPH formed in the reaction are used to reduce CO_2 to carbohydrates in the dark reaction.

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