

1. **Photosynthesis:**

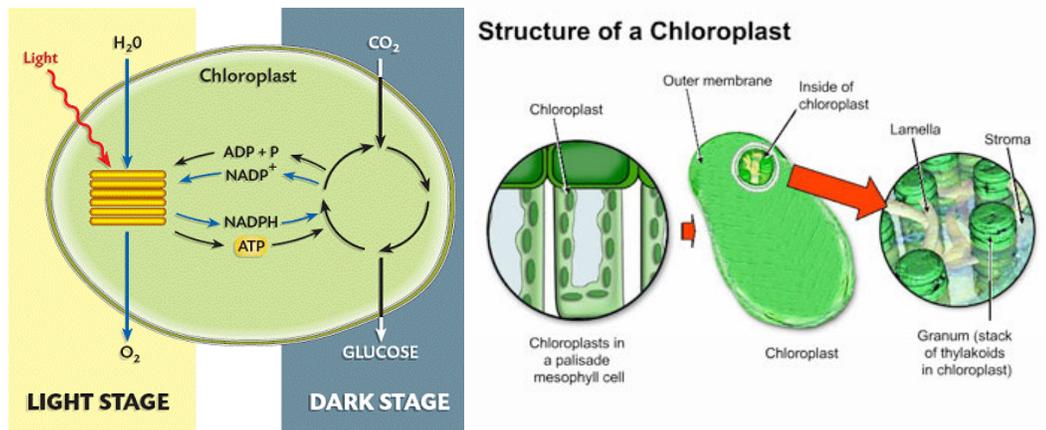
- a. **Photosynthesis** is the process in which light energy absorbed by Chlorophyll is transformed into chemical energy. The energy was used to synthesize carbohydrates from water and carbon dioxides. Oxygen was released during the process



- b. **Light dependent stage:** Sunlight absorbed by chlorophyll and converted into chemical energy. Light energy also used to split water molecules into oxygen and hydrogen atoms

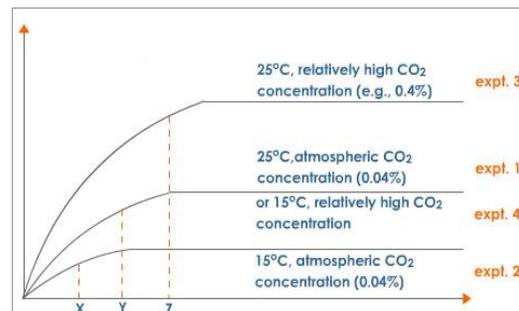
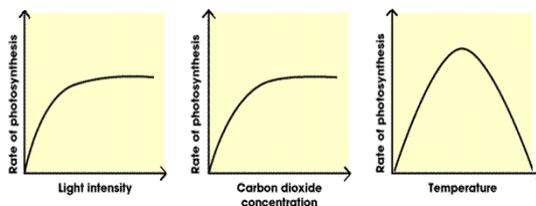


- c. **Light Independent stage:** Chemical energy and the hydrogen atoms from the light stage are used to convert CO<sub>2</sub> into glucose by **enzymes**.



2. **Factor affecting Rate of Photosynthesis:** by counting rate of O<sub>2</sub> bubble released

- Carbon dioxide concentration:** higher conc → Higher rate
- Amount of Sunlight** and wavelength: wavelength corresponding to green light is not useful. Higher intensity → higher rate
- Surrounding Temperature:** Higher temp → higher rate. Too high temperature may denature the enzymes and stop dark stage of photosynthesis.
- Water:** essential
- Chlorophyll:** essential

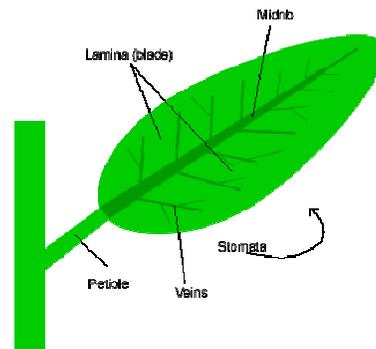
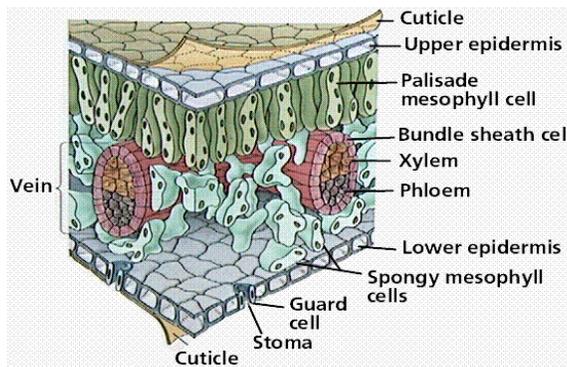


### 3. Important of photosynthesis

- Provide foods for other living organisms.
- Store energy from Sun as chemical energy.
- Maintain Oxygen and Carbon dioxide balance in the atmosphere.

### 4. Structure and Functions of Leaf

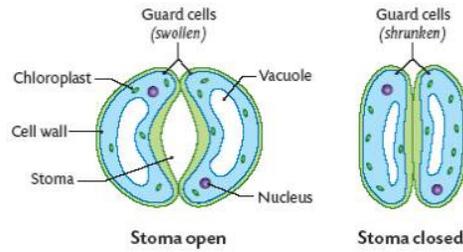
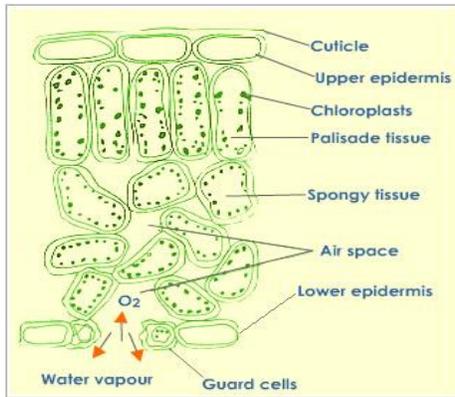
- Upper epidermis:** a single layer of closed packed cells **without chloroplast** with a waxy cuticle layer to protect the inner leaf tissues and prevent excessive evaporation of water.
- Palisade and Spongy mesophyll:** cells **contain chloroplasts** to carry out photosynthesis. The cells are covered with a thin film of moisture to facilitate gaseous exchange by diffusion.
- Vascular bundle:** Top part contain xylem tubes for water & mineral transport, bottom part contain phloem to translocate sucrose and amino acid from leaf to other parts.
- Lower epidermis:** similar to upper epidermis with thinner cuticle layer.
- Stomas:** 2 guard cells with chloroplast. Guard cells walls are thicker on one side so that when the guard cells become turgid (due to lower water potential when glucose was produced during photosynthesis), the cells curved and open the stoma.



- **Petiole:** to hold the leaf up to reach out for sunlight and air.
- **Network of Veins:** to transport water and translocate nutrients

### 5. Gaseous exchange of leaf through the Stomata

- **CO<sub>2</sub>:** during the day when there is photosynthesis, CO<sub>2</sub> was used up by the leaf thus lower CO<sub>2</sub> concentration in the intercellular space. CO<sub>2</sub> from atmosphere diffuse into the leaf, dissolve into the moisture layer and diffuse into the cells. At night when there is no photosynthesis, CO<sub>2</sub> was stored in the intercellular spaces.
- **O<sub>2</sub>** and **H<sub>2</sub>O** vapor enter or leave the leaf in similar manner.
- **Compensation point:** when rate of photosynthesis=rate of respiration, there is not net intake of CO<sub>2</sub>/O<sub>2</sub> by the plant.

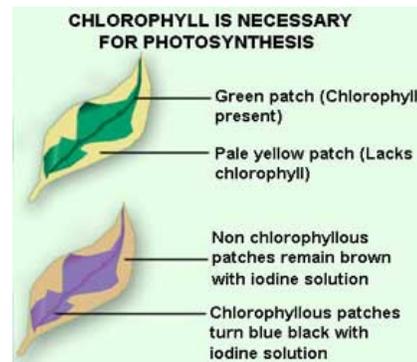
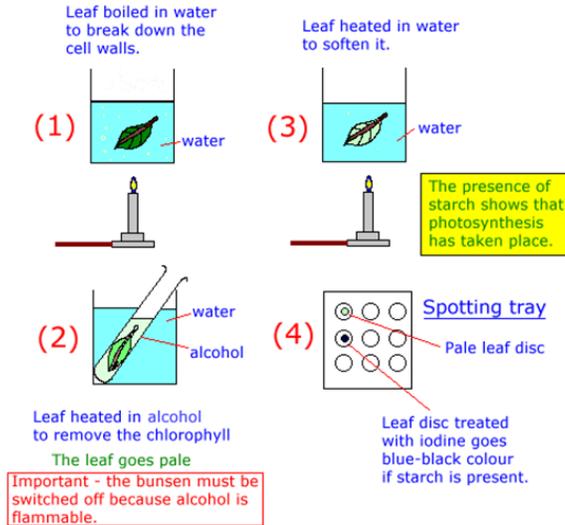


**6. What happen to Glucose produced from photosynthesis?**

- Respiration of plant cells break down some of the glucose to release energy for vital activities. Glucose converted to sucrose for translocation via Phloem.
- Used in synthesis of plant cellulose cell walls.
- Converted to Amino acids and proteins to build new cells for plant growth.
- Converted to fats for seeds and storage.
- Excess store temporarily as starch in leaf and storage roots.

**7. Essential Experimental skills :**

- To de-starch a plant: by putting it in the dark for 2 days.
- To test for starch in a leaf:



- To test for need of chlorophyll: Use **Variogated leaf**, only green parts has chlorophyll.
- To test for need of CO<sub>2</sub>: Use **KOH or NaOH** to absorb CO<sub>2</sub> in bell jar.
- To provide CO<sub>2</sub> to water plant at controlled concentration: Use **Sodium hydrogen Carbonate** solution with different concentration.
- Always cover the soil of plants used in experiment with plastic bag and setup a proper control.