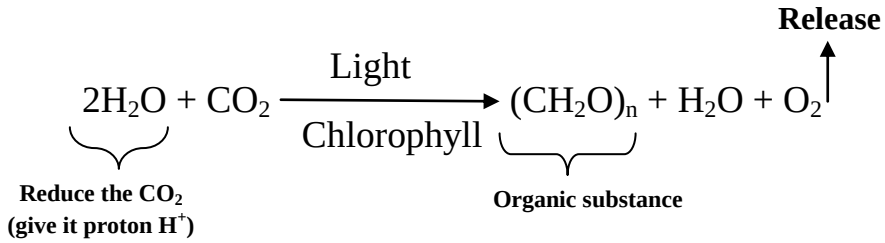
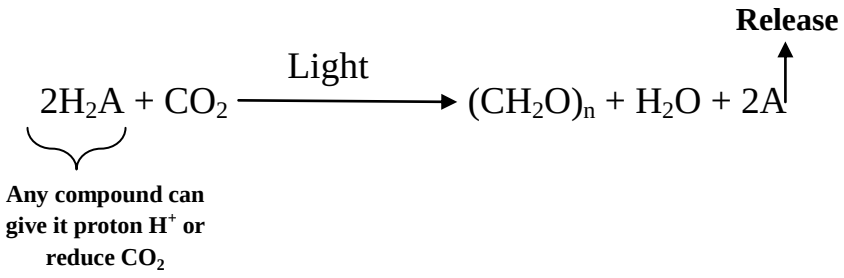
Lab. 16:Photosynthesis

Process in which plants convert **light energy** (sun light) to **chemical energy** through absorbing the light by pigments that exists in special structures (**chloroplasts**) inside the cells of green plants and algae. In this process carbon dioxide, water and energy are consumed and oxygen gas released which is necessary for living organism's respiration.

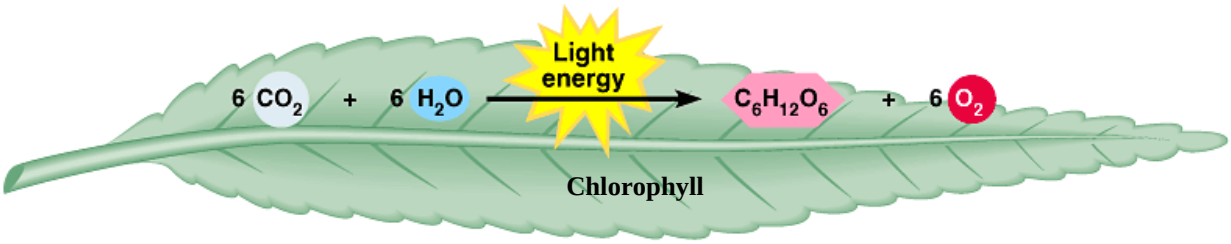
The principle equation of photosynthesis is:



- In bacteria which cannot depend on water to reduction the CO_2 molecules, the water replaced by the (H_2S).
- So that the (Van Niel equation) the general equation of photosynthesis is:



- In green plants the equation is:



Photosynthesis pigments:

Organic compounds that absorb the light energy and change it to chemical one, they are found chloroplast which as regarded special organelles found in plant cell

only, the pigments of the leaf are mostly confined to mesophyll cells. Thus in the mesophyll the protoplasm and its colored inclusions, chloroplast is the site of photosynthesis.

These plastids contain a group of pigments; all of them activated during the process of photosynthesis and each of them have special role, types are:

1. **Chlorophylls**, which include:
    - Chlorophyll a, b, c and d.
    - Bacteria chlorophyll a and b.
    - Cholorobium chlorophyll 650 and 660.

2. **Carotenoids**, include:
    - Carotene B, α and Lycopene.
    - Xanthophyll.
    - Phycobillins.

Photosynthesis reactions:

1. Light or hill reactions (photochemical) light, physical, fast reactions, occurring inside the grana include chloroplast, the light must be found and they products:

- Photolysis of water and releasing (O2).
- Reduction force ($NADPH_2$) formed and release the ATP energy from the photophosphorylation process.
- Translocate electron through (electrons chain translocation).

2. Dark or black man reactions:

Enzymatic, slowly, not need to light reaction occurs in stroma, they sensitively for temperature and inhibitors (CO2) molecules reduced by the force of reduction ($NADPH_2$) with the consumed energy to formation the (organic molecule).

Factors affecting photosynthesis:

- **Environmental factors:**
    1. CO2 conc. α Rate of photosynthesis
    2. T α Rate of photosynthesis.

3. Light; intensity, wavelength, lightning period.
4. Water and nutrient elements.
5. O2 α Rate of photosynthesis
6. Pollutions; ozone, oxides of N, S, Cl and Fl.

- **Plant factors**:
  1. Chlorophyll; mass, quality.
  2. Accumulation of the products of photosynthesis α 1/ Rate of photosynthesis.

Methods of photosynthesis measurement:

1. Bubble counting of (O2) released.
2. Volume counting.
3. Pressure change (manometer).
4. $^{14}CO_2$ Isotopes.
5. Increase in dry weight.
6. Chlorophyll content.
7. Electronic method for photosynthesis measurement; polar graphy and infrared spectrometer.

Practice part:

Extraction the chlorophyll from fresh green tissues of plant by ethanol alcohol:

- Cut fresh leaves into small pieces, put 0.5g in a dark bottle then add 10ml of concentrated ethanol alcohol.
- Add 10ml of ethanol alcohol again after 24 hrs, and another 10ml after 24 hrs.
- The total amount of alcohol (ethanol) after three days is 30ml.
- Filtrate and take the absorbance for supernatant at 649, 665 nanometer (nm) wavelength by spectrophotometer.
- calculate chlorophyll **a** and **b** content as follows:

The amount of chlorophyll content in the sample calculated by using the following formula and expressed in mg g^{-1} fresh weight.

$$\textbf{Chlorophyll 'a'} = (12.7 \times A665) - (2.69 \times A649) \times \frac{V}{1000 \times W}$$

$$\textbf{Chlorophyll 'b'} = (22.9 \times A649) - (4.68 \times A665) \times \frac{V}{1000 \times W}$$

Total chlorophyll = Chl. a + Chl. b.
where,
A = Absorbance
w = Fresh weight of the sample (0.5 g) V = Volume of the extract (30 ml)