Photosynthesis and Respiration

- **Autotrophic nutrition**
  - Synthesis of food by green plants through the process of photosynthesis.
  - Photosynthesis equation- $6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2$
  - Events of photosynthesis
    - In the grana region of chloroplast:
      - Absorption of light energy
      - Splitting of water in hydrogen and oxygen
      - Synthesis of ATP and $NADPH_2$
    - In the stroma region of chloroplast:
      - Reduction of carbon dioxide to carbohydrates

Plants carry out photosynthesis with the help of structures called stomata.

- Minute pore like structures surrounded by two guard cells
- Help in exchange of CO_2 and O_2

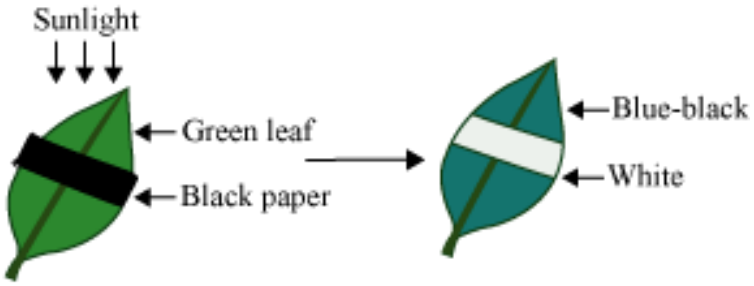
Photosynthesis is affected by factors like:

- CO_2 concentration
- light
- temperature

1. Sunlight is essential for photosynthesis

Place a healthy green potted plant in a dark room for 1-2 days. This is done to ensure that the plant consumes all its reserve food and the leaves do not contain any starch. Then, cover a portion of a leaf of this plant on both sides with two uniform pieces of black paper, fixed in position with two paper clips.

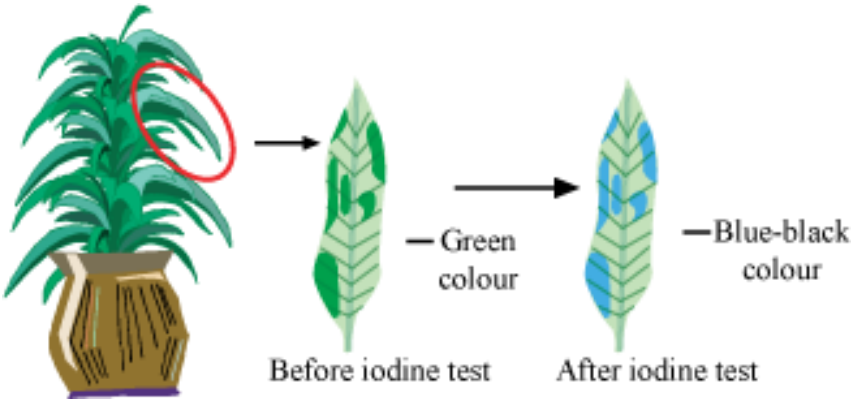
Now, expose this plant to bright light. After a few hours, remove the leaf and decolorized it with alcohol and test the presence of food (starch) with iodine solution.



You will observe that the portion of the leaf covered with black paper does not show any presence of starch (food).

2. Chlorophyll is essential for photosynthesis

Place a variegated plant (i.e. a plant which has both green and non-green areas, for e.g. croton or money plant) in a dark room for 2 − 3 days. This is done to ensure that all the reserve food (starch) is utilized.



Place this plant in sunlight for six hours to allow photosynthesis to take place.

Then, pluck a leaf from this plant and trace the green areas on a sheet of paper.

Now, decolourize the leaf using alcohol and dip it in a dilute solution of iodine for a few minutes. Wash this leaf with water and compare it with the tracings of the leaf done earlier.

It will be observed that only the green areas of the leaf could photosynthesize.

- **Cellular Respiration**
  - It is the process in which food is broken down in the cell to release energy.
  - It occurs in the cells of all living organisms.

- **Two types of Respiration**
  - **Aerobic respiration** – It is the process of breakdown of food in the presence of oxygen.
  - It occurs in all organisms.
  - It leads to production of carbon dioxide, water, and energy.

$$\text{Glucose} \xrightarrow{\text{Oxygen}} CO_2 + \text{Water} + \text{Energy}$$

  - **Anaerobic respiration** – It is the process of breakdown of food in the absence of oxygen.
  - Yeast, bacteria, human muscle cells, etc. respire anaerobically.
  - In yeast cells, anaerobic respiration leads to production of alcohol and carbon dioxide.

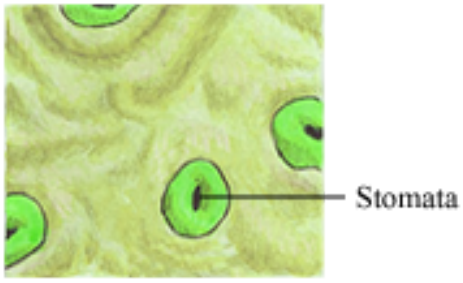
$$\text{Glucose} \xrightarrow[\text{Oxygen}]{\text{without}} \text{Alcohol} + \text{Energy} + CO_2$$

  - During heavy exercise, our muscles respire anaerobically to provide energy to muscle cells. This leads to accumulation of lactic acid that causes muscle cramps and thus, pain in body.

$$\text{Glucose} \xrightarrow[\text{Oxygen}]{\text{without}} \text{Lactic acid}$$

Respiration in Plants

- Plants respire through tiny pores present on their leaves surface called **stomata**. Oxygen enters the plant, while carbon dioxide leaves the plant through these pores.
- Roots of plants respire through air spaces present in the soil.



- **Respiration**

- All living organisms require a continuous supply of energy for carrying out various life activities.
- Cellular respiration is the process of releasing energy from the breakdown of organic substances.
- The released energy is stored in the form of ATP.
- ATP is the energy currency of cell.
- The process of cellular respiration occurs in cytoplasm and mitochondria.
- It involves the consumption of oxygen and liberation of CO_2 and water.
- **The equation of respiration is**
  $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy}$