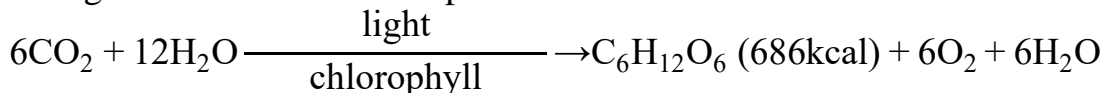


Photosynthesis:

It is the process by which energy rich compound is formed by the combination of simple inorganic compound as CO_2 and H_2O in presence of sunlight in chlorophyll containing cells. It is an anabolic process.



It is an important physiological process by which food is prepared and oxygen is evolved as byproduct. It uses huge amount of CO_2 from the atmosphere so it helps to reduce global warming. The food prepared by plant consumed by different organism from which energy produce by oxidation. Fuel is also indirect source of photosynthesis.

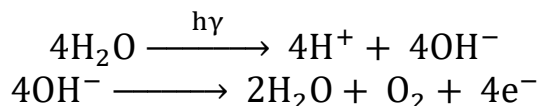
The green plants are independent to prepare their food by themselves. They are not dependent on other organisms for their food materials. Hence, they are also known as autotrophic organisms.

They prepare large amount of food and supplied to other living organisms in different forms. Thus, all living organisms are directly or indirectly depend upon plants for food. Hence, they are ecologically known as producers.

Photosynthesis a complex oxidation and reduction process which is completed in two main stages.

1. Light reaction: It is the first stage of photosynthesis which requires light to complete. It is also known as Hill reaction after the name of Robin Hill (1937). It takes place in granum of chloroplast. In this reaction, chlorophyll absorbs light to split H_2O .

The breaking down of water and produce O_2 in presence of light is called photolysis of water.



In this reaction, one electron is produced per water molecule. Thus produce electron is accepted by different intermediates.

Thus produced electrons passes into photophosphorylation process where energy rich chemicals like ATP and NADPH_2 are produced.

2. Dark reaction: In this reaction, fixation and reduction of CO_2 takes place by utilization of ATP and NADPH_2 (Nicotinamide adenine dinucleotide dihydrogen phosphate). It takes place in stroma of chloroplast. It was discovered by Calvin, Benson and their colleagues in USA. Hence, is called Calvin cycle that do not require light.

In this process, 5 carbon containing compound RuBP (Ribulose 1, 5 – biphosphate) is carbon acceptor and first stable product is 3 carbon containing compound 3 – phosphoglyceric acid.

Factors affecting photosynthesis:

Photosynthesis is influenced by various factors. These factors are studied under following headings.

1. External Factors: The external factors are as follows.

a. Light: It is one of the most important factors of photosynthesis. It cannot occur in the dark and the primary source of light is sunlight.

Photosynthesis begins at low light intensities and gradually increases until it reaches its peak at the brightest time of day. The amount of light required by different plants is different. Generally light is a limiting factor at high intensities. When the intensity is high, the temperature of the plant rises, resulting in increased transpiration that causes less CO₂ intake. So photosynthesis is reduced.

The rate of photosynthesis is faster in periodic light than continuous light.

The rate of photosynthesis is more in red and blue region of visible light.

b. Temperature: The rate of photosynthesis increases with increasing temperature until it reaches the optimum level for that plant. Photosynthesis exceeds in between 6°C to 37°C. The temperature lower than 6°C and more than 37°C reduces the rate of photosynthesis.

c. Carbon dioxide: Carbon dioxide is raw material for photosynthesis. Plant absorbs it from the atmosphere. The rate of photosynthesis is increased by the increasing CO₂ concentration in atmosphere by 1%. High concentration of CO₂ reduces the rate of photosynthesis.

d. Water: Water is one of the most important factors of photosynthesis. When water is decreases, the rate of photosynthesis reduces.

e. Oxygen: Photosynthesis benefits from optimal oxygen level. Increasing the oxygen level reduces the rate of photosynthesis.

2. Internal Factors: The internal factors are as follows.

a. Chlorophyll content: Chlorophyll is the one of the important factor for photosynthesis. It fixes the CO₂ in the plant body to run the photosynthesis. Hence, the rate of photosynthesis increases when increase chlorophyll.

b. Photosynthetic end product: The end product of photosynthesis is carbohydrate. When carbohydrate increases, it reduces water in cell. This process reduces the rate of photosynthesis.

c. Anatomy of photosynthetic parts: Normal leaves help in photosynthesis. Any modifications in leaves reduce the intensity and quality of light that reduces the rate of photosynthesis.

d. Leaf age: Photosynthesis increases in matured leaves. Immature and aging leaves reduce the rate of photosynthesis.

- e. Protoplasmic factors:** The proper hydrated protoplasm helps in photosynthesis. Excess deposition of other substances reduces the amount of water that reduces the rate of photosynthesis.

Photorespiration: It is the process of light dependent uptake of oxygen with release of carbon dioxide from organic compounds. It is the metabolic pathway which takes place in presence of light. It is influenced by high temperature as well as light intensity and accelerating the formation of glycolate. It takes place in chloroplast, peroxisomes and mitochondria.

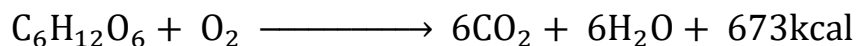
Advantages and Disadvantages of Photorespiration: Refer text book.

Importance of photosynthesis:

1. It is the primary source of organic food and food energy (ATP) for all forms of life, either directly or indirectly.
2. Excess sugars produced in photosynthesis are either stored in the form of carbohydrates or used in the biosynthesis of other organic compounds.
3. They are most essential biotic components in ecosystem as they are producers.
4. It helps to purify air and it maintains balance of oxygen and carbon dioxide in the ecosystem.
5. The energy stored in fossil fuels is basically solar energy which was trapped and stored during photosynthesis.

Respiration:

It is the process by which carbohydrate is breaking down into carbon dioxide and water in presence of oxygen. In other words, respiration is defined as cellular oxidation of carbohydrate by which carbon dioxide and water are produced as final product. It is the oxidative process occurring within the living cells. It is a catabolic process.



Various organic compounds such as carbohydrates, fats, proteins etc are oxidized to release energy during respiration. Among them, glucose is commonest. These compounds are called 'respiratory substrates'.

The energy produced by respiration is stored in the form of ATP. It is made up of one molecule of adenine, ribose sugar and inorganic phosphate. On hydrolysis of ATP, it release high amount of energy.



Types of Respiration:

On the basis of using molecular oxygen, it is of two types.

- 1. Aerobic respiration:** Here, organic food is breaking down in presence of molecular oxygen.
- 2. Anaerobic respiration:** Here, organic food is breaking down in absence of molecular oxygen.

Difference between Aerobic and Anaerobic respiration:

Aerobic respiration	Anaerobic respiration
1. It is the breaking down of carbohydrate in presence of oxygen.	1. It is the breaking down of carbohydrate in absence of oxygen.
2. The release energy is stored in terms of ATP.	2. The release energy is not stored for further utilization.
3. Here, the electron acceptor is oxygen.	3. Here, the electron acceptors are sulphate, nitrate, sulphur etc.
4. It occurs inside the mitochondria.	4. It occurs at cytoplasm.
5. Huge amount of energy is release (673kcal or 38ATP).	5. Few amount of energy is release (28kcal or 2ATP).
6. Organic food is completely broken down.	6. Organic food is partially breakdown.
7. The final product is inorganic.	7. The final product is organic.
8. It consists of 4 different phases.	8. It consists of 2 different phases.

Factors affecting Respiration:

Respiration is affected by two broad factors.

- 1. External factors (Environmental factors):** The external factors that influence the respiration are as follows.
 - a. Temperature:** It is the most important factor that affects the rate of respiration. Generally the rate of respiration increases by increase in temperature from 5°C to 30°C. The temperature lower than 5°C and higher than 30°C reduces the rate of respiration.
 - b. Oxygen:** Oxygen is essential for aerobic respiration whereas in anaerobic respiration, it does not. Hence, the rate of aerobic respiration increases by increasing oxygen and rate of anaerobic respiration increases by decreasing oxygen.
 - c. Water:** Water is the medium for all metabolic activities. It plays an important role in enzyme activation, gaseous diffusion, transportation, etc. The rate of respiration increases with increasing the amount of water.
 - d. Light:** Light is the factor which does not influenced directly because respiration takes place in presence or absence of light. Generally, respiration increases with increasing light.

- e. **Carbon dioxide:** Carbon dioxide is released during respiration. Hence, increase in the concentration of carbon dioxide reduces respiration.
- 2. **Internal factors (Plant factors):** The internal factors that influence the respiration are as follows.
 - a. **Protoplasm:** Protoplasm is the material inside the cell which provides different essential substances to the cell and it is active. The activity of protoplasm is affected by various factors such as hydration, pH, temperature, etc. These are more adequately available in meristematic cells than in mature cells.
 - b. **Respiratory substrate:** Different types of simple sugars such as glucose, fructose, and maltose are present in the cell along with complex food such as starch and fats. These simple foods are easily and rapidly burned in the presence of oxygen to produce energy, whereas complex food takes a long time and is tough to burn in oxygen. Because of this, simple food accelerates the respiration and complex food retards the respiration process.
 - c. **Age of cell:** The rate of respiration is higher in young cells than in mature and old cells.
 - d. **Wound:** The rate of respiration increases in a wound to promote healing.

Importance of Respiration:

1. It provides energy to living organisms. This energy is essential for various cellular processes such as growth, repair, and maintenance.
2. It helps in breaking down glucose and other molecules that are important for cellular function and homeostasis.
3. It releases CO₂ gas into the environment that supports the photosynthesis process.
4. It helps in the regulation of pH levels and the overall chemical balance within the cells. The removal of carbon dioxide helps maintain acid-base balance in the body.
5. Anaerobic respiration is used in various industries such as dairies, bakeries, distilleries, leather industries, paper industries, etc.
6. Anaerobic respiration also helps in the production of alcohols, antibiotics, vitamins, etc.