

Respiration in Plants

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 CO₂ and water.

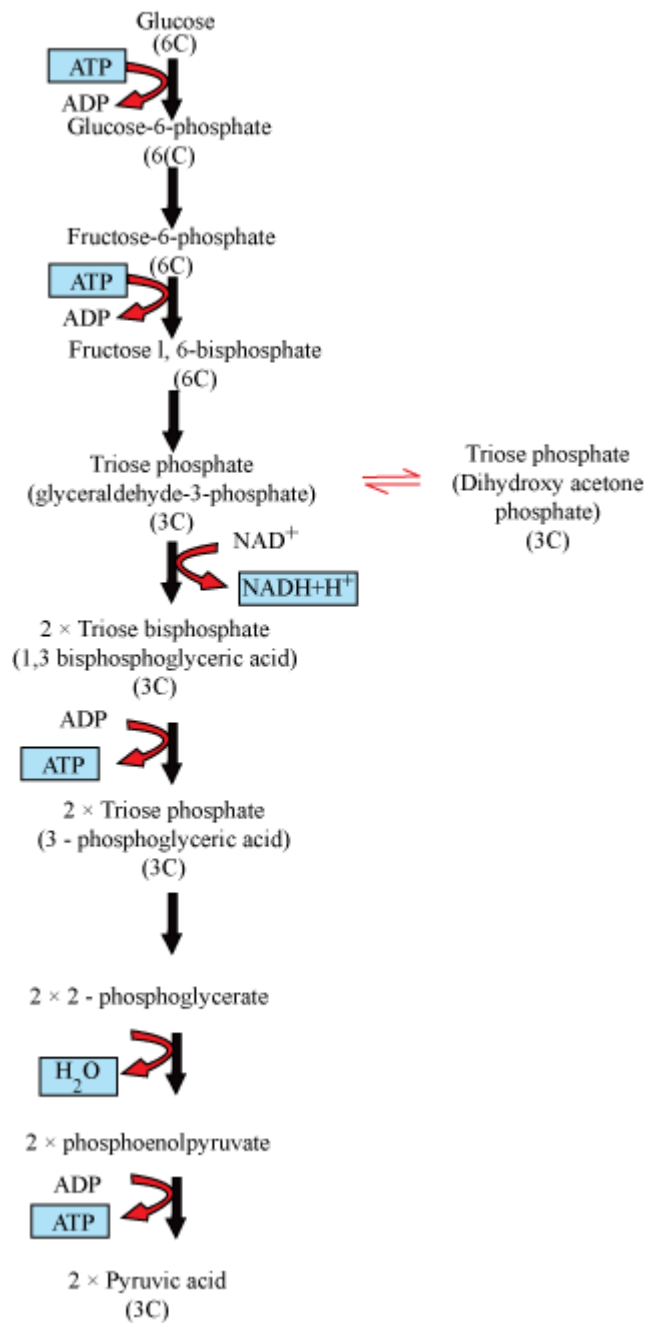


- **Respiratory substrate:** These are the compounds, which get oxidised during cellular respiration. Example: Carbohydrate, fats, proteins, etc.

Glycolysis

- It is a linear pathway that occurs in cell cytoplasm.
- It occurs in both aerobic and anaerobic respiration.
- It involves the partial breakdown of glucose into 2 molecules of pyruvic acid.
- In plants, as we know, sucrose is the end product of photosynthesis. Therefore, this sucrose is converted into glucose and fructose with the help of invertase enzyme.
- The process of glycolysis generates 2 NADH₂ and 2ATP molecules upon breakdown of one glucose molecule.

Steps of glycolysis



- The pyruvate, so produced, may undergo:
 - Lactic acid fermentation
 - Alcoholic fermentation
 - Aerobic respiration (Krebs cycle)

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Tricarboxylic Acid Cycle

- **Aerobic respiration**

- Pyruvate synthesised by the glycolytic catabolism in cytoplasm enters the mitochondrial matrix and undergoes oxidative decarboxylation.
- The acetyl CoA synthesized by **oxidative phosphorylation** then enters Krebs' cycle.
- **Krebs' cycle (Tricarboxylic acid)**
- It is a cyclic process that occurs in mitochondrial matrix.
- The process of Krebs cycle produces 6NADH₂, 2FADH₂, and 2ATP molecules on the breakdown of two acetyl CoA molecules.

Electron Transport System and Oxidative Phosphorylation

Electron Transport System

- By the end of citric acid cycle, glucose molecule is completely oxidised. But, the energy is not release unless NADH and FADH are completely oxidised through electron transport chain.
- It occurs in mitochondrial matrix.
- It is the process where electron passes from one carrier to another via complex I to IV.
- **Oxidative Phosphorylation** is the process in which electrons are transferred from electron donors to oxygen (electron acceptor).
- The enzyme involved in oxidative phosphorylation is **ATP synthase**.
- For every two protons passing through F₀ – F₁ complex, one molecule of ATP is synthesised.

Amphibolic Pathway and Respiratory Quotient

- **Amphibolic Pathway**
- Respiratory pathway involves both anabolic and catabolic pathways. Hence, respiration is termed as amphibolic pathway.
- **Respiratory quotient**
- Respiratory quotient (RQ) =
- Respiratory quotient (RQ) depends on type of respiratory substrate used.
- RQ when carbohydrates are used as substrate = 1
- RQ when fats (Tripalmitin) are used as substrate = 0.7
- RQ when proteins are used as substrate = 0.9