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As per the latest ICSE syllabus

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Revised and Updated

LIVING SCIENCE BIOLOGY

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9



EDUCATION, OUR MISSION



ICSE

Living Science

Biology

Class 9

Chapter 6 **Respiration in Plants**



LEARNING OBJECTIVES

Process of respiration

- ❖ Glycolysis

Types of respiration

- ❖ Aerobic respiration

- ❖ Anaerobic respiration

Respiration and photosynthesis

- ❖ Respiration differs from combustion

- ❖ Where does exchange of gases take place in plants?

- ❖ How is respiration in plants different from respiration in animals?

What is respiration?

The process of release of energy by oxidation of various organic molecules (glucose) for cellular use is known as respiration. **Respiration** is the release of energy in the form of ATP when glucose molecules are broken down to carbon dioxide and water molecules. The process of respiration takes place in all active cells throughout the day. It is initiated in the cytoplasm and completed in the mitochondria.

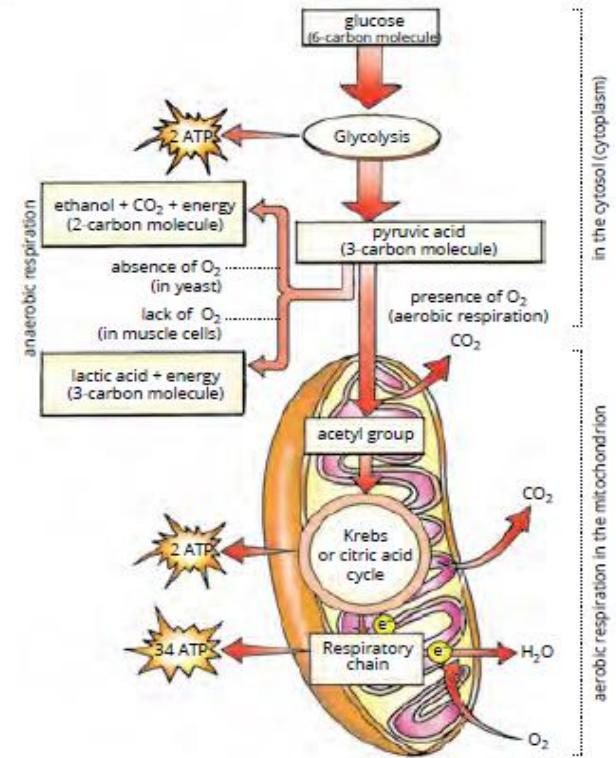


Process of respiration

Glycolysis is the starting point of respiration.

Glycolysis

- ❖ Each molecule of glucose (6-carbon molecule) is broken down into two molecules of pyruvate (3-carbon molecule) by the process of **glycolysis**.
- ❖ It occurs in the cytoplasm of the cell and not in the mitochondria.
- ❖ It does not require the presence of oxygen. The ultimate fate of the glucose molecule depends upon the availability of oxygen.



Types of Respiration

Based upon the availability of oxygen, respiration is of two types – aerobic respiration and anaerobic respiration.

Aerobic respiration

Respiration that occurs in the presence of oxygen is called aerobic respiration. It takes place inside the mitochondria. During aerobic respiration, if sufficient oxygen is available, each of the pyruvate molecule enters mitochondria where it is completely oxidized to form CO₂ and H₂O as end products.



This takes place in three steps –

- 1. Pyruvate oxidation** in which pyruvate or pyruvic acid is converted into acetyl CoA.
- 2. Krebs cycle**, also known as **citric acid cycle** or **tricarboxylic acid cycle (TCA cycle)**, in which acetyl CoA undergoes a cycle of reactions to produce hydrogen.
- 3. Electron transport chain or respiratory chain** in which hydrogen drives a series of reactions which release enough energy to produce ATP.

Anaerobic respiration

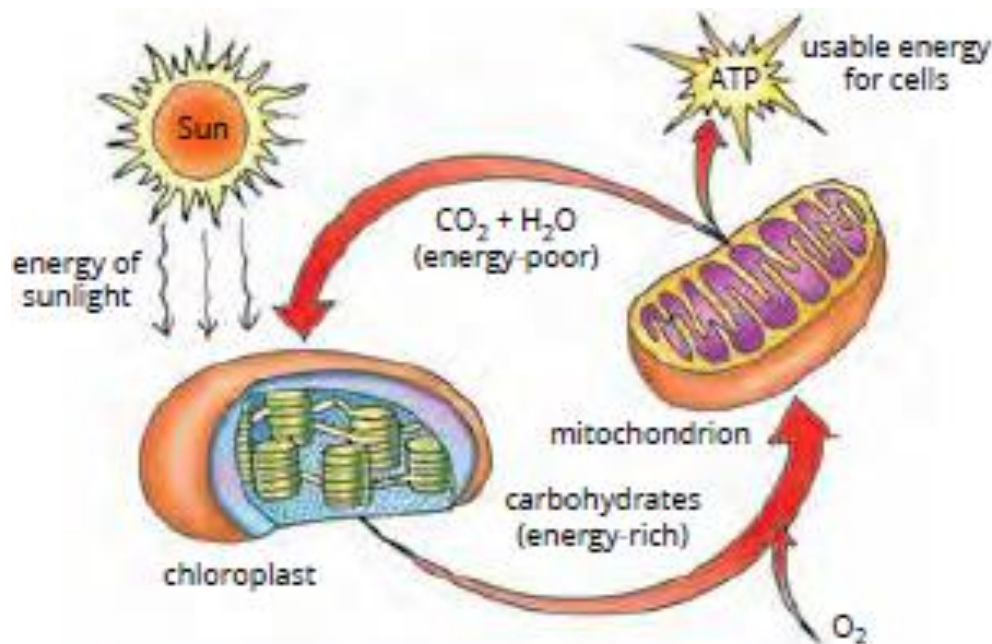
Respiration that occurs in the absence of oxygen is called anaerobic respiration. After glycolysis, if sufficient oxygen is not available, pyruvate does not enter mitochondria but is converted into ethyl alcohol (ethanol) in plants or lactic acid in animals. A number of plants and microorganisms such as yeast obtain energy through anaerobic respiration.

Note: The major differences between aerobic and anaerobic respiration are given in Table 6.1.



Respiration and photosynthesis

Respiration is different from photosynthesis. Photosynthesis is the process of utilizing solar energy for conversion of CO_2 and water into glucose (the storable form). Whereas, respiration is the release of energy from this glucose. In plants, chloroplasts capture light energy during photosynthesis and produce carbohydrates. During respiration, **mitochondria** carry out the final steps in the breakdown of sugars to release energy as ATP.



Note: A comparison between respiration and photosynthesis is given in Table 6.2.



Respiration differs from combustion

Respiration differs from combustion in many respects. Respiration is a metabolic process that takes place in living beings while combustion is a non-metabolic process that takes place in non-living objects.

Where does exchange of gases take place in plants?

Gases normally enter and leave the plants through the **stomata** present on green parts of plant, mostly leaves. In most plants, stomata are closed at night. Respiration, at night, usually occurs through the **cuticle** of plant body. Also, to facilitate gaseous exchange, special structures called **lenticels** are present on the plant cuticle. These structures remain open during the day as well as at night irrespective of the intensity of light falling on them.

How is respiration in plants different from respiration in animals?

- ❖ In plants, there is no gaseous transport system and respiratory gases simply diffuse in and out by diffusion. In animals, gaseous transport occurs.
- ❖ Rate of respiration in plants is much lower than in animals.
- ❖ In plants, during anaerobic respiration, one of the end products is ethyl alcohol while in animals it is lactic acid.
- ❖ Heat liberated as a result of respiration is lesser in plants than in animals.

Note: Refer to P 67-69 for Experiments on respiration in plants



SUMMARY...

- ❖ The process of release of energy by oxidation of glucose (organic molecules) for cellular use is known as respiration. H_2O and CO_2 are also produced as a result of respiration.
- ❖ Cellular respiration includes various metabolic pathways by which glucose is broken down with the simultaneous build up of ATP (energy).
- ❖ Respiration is of two types – aerobic and anaerobic.
- ❖ If respiration occurs in the presence of oxygen, it is called aerobic respiration. If it occurs in the absence of oxygen, it is called anaerobic respiration.
- ❖ There are various steps in respiration. They include glycolysis, pyruvate oxidation, Krebs cycle and respiratory chain or electron transport chain. 38 molecules of ATP are released due to oxidation of one molecule of glucose.

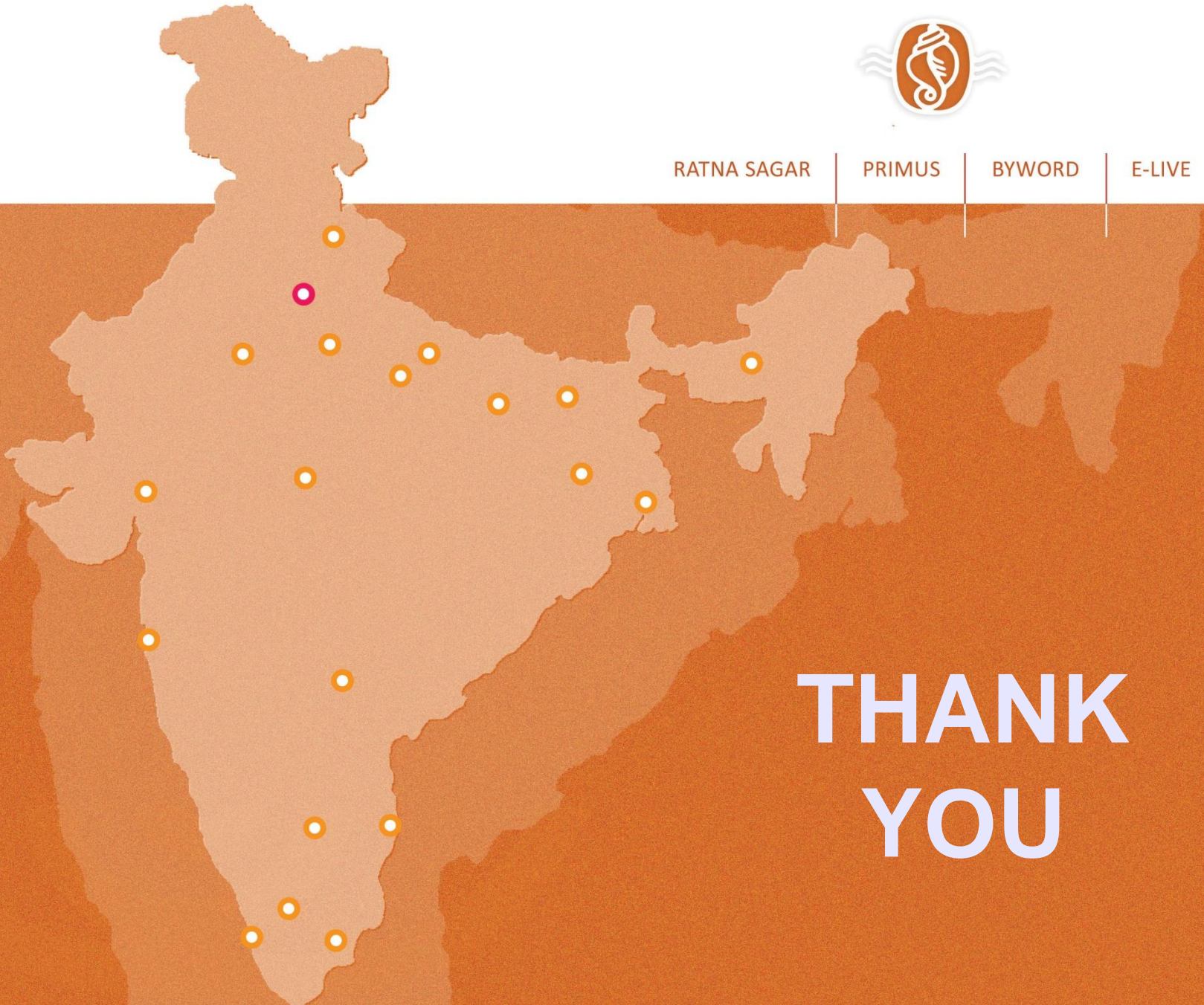


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