

LIFE PROCESSES

Class 10 Biology
RESPIRATION
MODULE 1/3



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RESPIRATION

INTRODUCTION:

When we hear the word respiration, we immediately think about breathing. But breathing is only taking in and giving out air and is important for respiration to take place.

Breathing is a physical process and is called **external respiration**.

Respiration is a chemical process and is called **internal respiration**, or **cellular respiration** and takes place inside every living cell.

All organisms, from single celled bacteria to human beings undergo respiration.

What is respiration?

RESPIRATION is the biochemical process in living organisms involving the production of energy. This is typically done with intake of oxygen and this results in the release of carbon dioxide, water, and ATP (the currency of energy in cells).

- The food material that we eat during the process of nutrition is used in cells to provide energy for various life processes and there are various biochemical reactions that take place and produce energy from this food.

RESPIRATION

Why is respiration important?

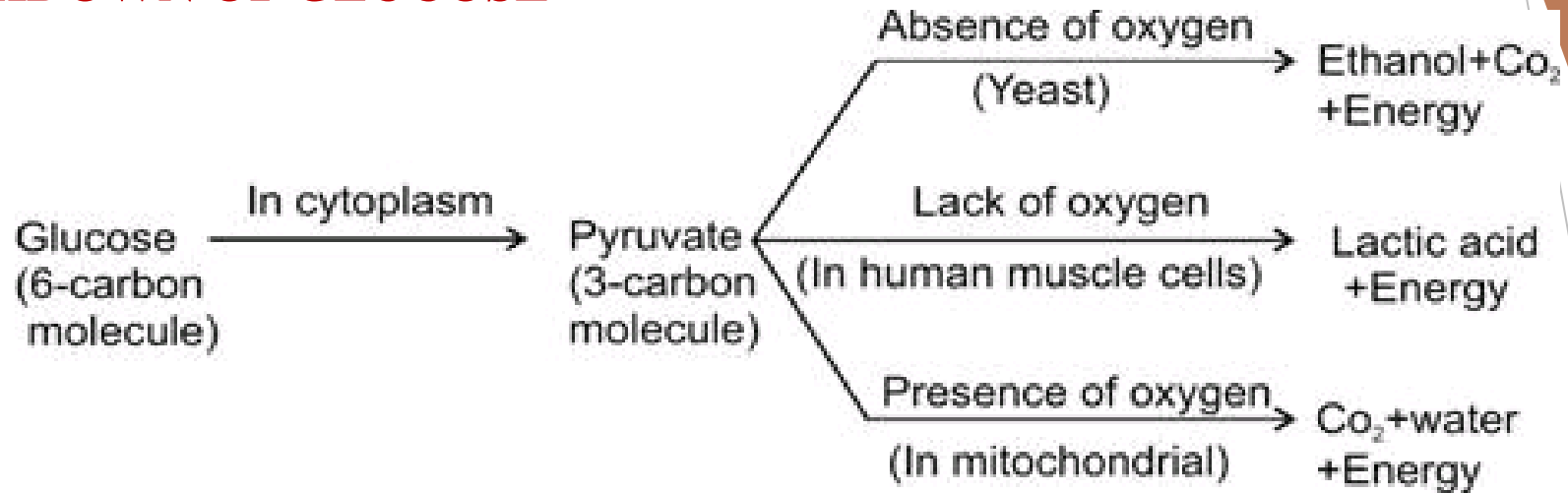
- **Respiration is important** because it produces energy that is essential for the normal functioning of the body. It provides cells with oxygen and expels toxic carbon dioxide and water molecules involved in each 'turn' of the process.
- Organisms do this in different ways – some use oxygen to break-down glucose completely into carbon dioxide and water, some use other pathways that do not involve oxygen.
- Equation: $C_6H_{12}O_6$ (glucose) + $6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy}$
- **Types of Respiration**
- Aerobic and anaerobic respiration are the two types of respiration, based on the presence or absence of oxygen.
- Respiration process that occurs in the presence of **oxygen** is called **aerobic respiration**, generally seen among humans.
- In certain organisms like bacteria and algae, respiration occurs in the **absence of oxygen**, and is called **anaerobic respiration**.
- In both the types of respiration, it is the glucose (carbohydrate molecule) that undergoes reactions.

RESPIRATION

DIFFERENCE BETWEEN AEROBIC AND ANAEROBIC RESPIRATION

AEROBIC	ANAEROBIC
1. Requires oxygen for breaking the respiratory substrate.	1. Does not require oxygen for breaking the respiratory substrate.
2. Occurs in all living cells of higher organisms.	2. Occurs in yeast and bacteria.
3. The end products are CO_2 and H_2O .	3. The end products are Ethanol and CO_2 OR Lactic acid.
4. Oxidation of one molecule of glucose produces 38 ATP molecules.	4. Only 2 ATP molecules are produced.
5. It occurs in cytoplasm and mitochondria.	5. It occurs only in the cytoplasm.

BREAKDOWN OF GLUCOSE



(Break down of glucose by various pathways)

In organisms that perform cellular respiration, glycolysis is the first step of breakdown of glucose to release energy.

Glycolysis is an anaerobic process and takes place in the cytoplasm. It is the first stage of respiration—and is common for both aerobic and anaerobic respiration.

It converts Glucose $C_6H_{12}O_6$, a 6 carbon compound to 2 molecules of Pyruvate CH_3COCOO^- . A 3 carbon compound.

After glycolysis, its product (pyruvate) gets converted into different compounds depending on the absence of oxygen, lack of oxygen or presence of oxygen.

The 3 pathways after Formation of Pyruvate

1. **In absence of Oxygen in Yeast** - In absence of Oxygen, in yeast, pyruvate is converted into ethanol and CO₂ and small amount of energy. This is called fermentation.



2. **In Lack of Oxygen in our skeletal muscle** - due to lack of oxygen, the cells undergo anaerobic respiration. When our muscles are overworked, blood cannot supply oxygen fast enough for aerobic respiration. So now pyruvate gets converted to lactic acid. This build-up of lactic acid in our muscles during sudden activity causes cramps.



3. **In Presence of oxygen** - the oxidation of pyruvate occurs in the MITOCHONDRIA and gives the end products CO₂ and water and energy. This is aerobic respiration and 38 molecules of ATP are formed. Hence the energy made available is much greater than in the case of anaerobic respiration.



The energy released during cellular respiration, is used to synthesize ATP, Which is the fuel for all other activities in the cell.

Resources:

NCERT science text book for class 10

Google

Continued on Module 2/3

THANK YOU