LEARNING OBJECTIVES:

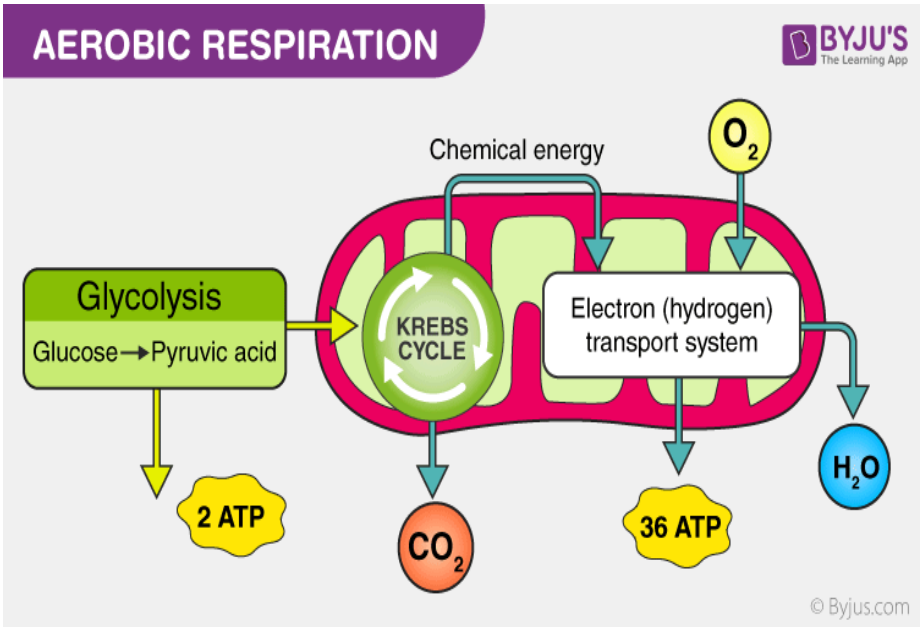
Students will be able to:

- state the word and symbol equations for anaerobic respiration
- compare the processes of aerobic and anaerobic respiration in terms of products formed, need for oxygen, and relative amounts of energy transferred,
- outline the uses of anaerobic respiration (alcoholic fermentation) in yeast to manufacture bread and alcohol,
- recall how cellular respiration differs from the breathing process

AEROBIC AND ANAEROBIC RESPIRATION

Cellular respiration is a process that takes place inside the cells where energy is released by the breakdown of glucose molecules. The process can be conveniently divided into two categories based on the usage of oxygen, namely aerobic and anaerobic respiration.

What is Aerobic Respiration?



As already stated, cellular respiration can be of two types: aerobic and anaerobic. Aerobic means “with air”. Therefore, aerobic respiration is the process of cellular respiration that uses oxygen to produce energy from food. This type of respiration is common in most plants and animals, including humans, birds and other mammals.

While breathing, we inhale air that contains oxygen and we exhale air rich in carbon dioxide. As we breathe in, the oxygen-rich air is transported to all the parts of our body and ultimately to each cell. Inside the cell, the food, which contains glucose, is broken down into carbon dioxide and water with the help of oxygen. The process of breaking down the food particles releases energy, which is then utilized by our body. The energy released via aerobic respiration helps plants and animals, including us, grow.

The process can be simply explained with the help of the following equation:

Glucose + Oxygen → Carbon dioxide + Water + Energy

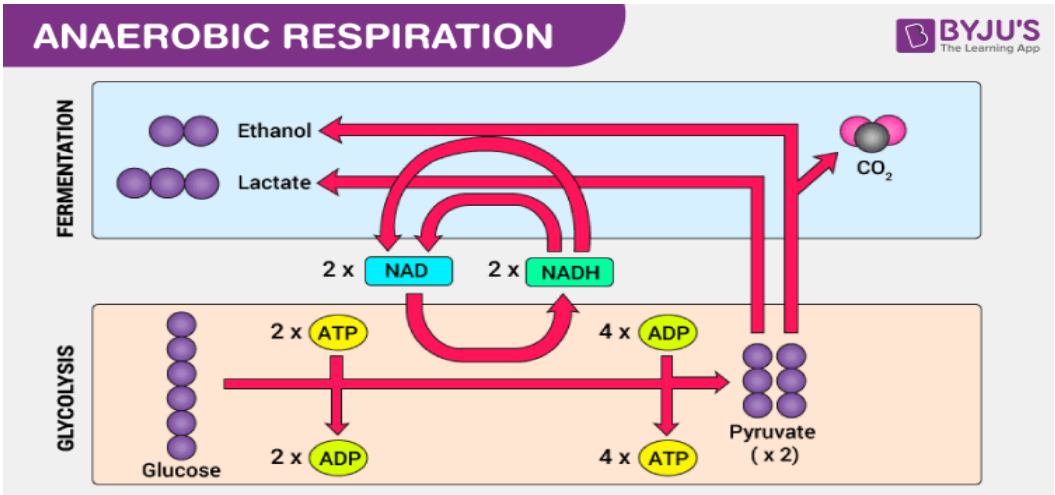
Aerobic respiration is a continuous process and it happens all the time inside the cells of animals and plants.

Differences:

The fundamental difference between aerobic and anaerobic respiration is the usage of oxygen in the process of cellular respiration. Aerobic respiration, as the name suggests, is the process of producing the energy required by cells using oxygen. The by-product of this process produces carbon dioxide along with ATP – the energy currency of the cells. Anaerobic respiration is similar to aerobic respiration, except, the process happens without the presence of oxygen. Consequently, the by-products of this process are lactic acid and ATP.

Contrary to popular belief, multicellular organisms, including humans, use anaerobic respiration to produce energy, though this only happens when the muscles do not get adequate oxygen due to extremely vigorous activities.

What is Anaerobic Respiration?



Anaerobic means “without air”. Therefore, this type of cellular respiration does not use oxygen to produce energy. Sometimes there is not enough oxygen around for some organisms to respire, but they still need the energy to survive. Due to lack of oxygen, they carry out respiration in the absence of oxygen to produce the energy they require, which is referred to as anaerobic respiration. Anaerobic respiration usually occurs in lower plants and microorganisms. In the absence of oxygen, the glucose derived from food is broken down into alcohol and carbon dioxide along with the production of energy.

Glucose → Alcohol + Carbon dioxide + Energy

Anaerobic respiration is also used by multi-cellular organisms, like us, as a temporary response to oxygen-less conditions. During heavy or intensive exercise such as running, sprinting, cycling or weight lifting, our body demands high energy. As the supply of oxygen is limited, the muscle cells inside our body resort to anaerobic respiration to fulfil the energy demand.

How do you feel when you exercise too much? Have you ever wondered why you get those muscle cramps when you run very fast? Anaerobic respiration is the culprit to be blamed. Cramps occur when muscle cells respire anaerobically. Partial breakdown of glucose, due to lack of oxygen, produces lactic acid and the accumulation of lactic acid causes muscle cramps. That is why a hot shower after heavy sports relieves the cramps as it improves blood circulation in the body, which in turn enhances the supply of oxygen to the cells.

Glucose → Lactic acid + Energy

Anaerobic respiration produces a relatively lesser amount of energy as compared to aerobic respiration, as glucose is not completely broken down in the absence of oxygen.

VIDEO

https://youtu.be/yC3HNbbeBqs

POWERPOINT

https://docs.google.com/presentation/d/1D7i29ovniqma_Qlv6VA4-GPp1a3Hqd1N/edit?usp=drivesdk&ouid=111439479446434760200&rtpof=true&sd=true

TEST YOUR KNOWLEDGE

https://docs.google.com/forms/d/e/1FAIpQLSd2U3FR0A3iQ2B87k4wiH1SFdhAbDDvetND_bn0uO5fJsAhyQ/viewform?vc=0&c=0&w=1&flr=0