

Comparing Aerobic vs. Anaerobic Respiration

Objective:

- Students will compare the two types of cellular respiration: aerobic respiration and anaerobic respiration (fermentation). Students will note similarities and differences between the two processes including when, where, and how each process occurs.
- Students will develop a concept map using Inspiration indicating the criteria for aerobic and anaerobic respiration. This concept map will indicate:
 - ✓ Three similarities between the two processes.
 - ✓ Two types of cells that perform each process.
 - ✓ Location in the cell where each process occurs.
 - ✓ Oxygen requirements for each process.
 - ✓ Reactants and products for each process.
 - ✓ Energy output for each process.
- Two different types of anaerobic respiration.
 - Reactants and products for each.
 - Types of cells that perform each process.

Introduction:

- This activity will follow a fermentation (anaerobic respiration) lab using yeast. This lab will address the process of alcoholic fermentation.
- Students will perform push-ups to experience lactic acid build-up in muscle cells.
- These activities will gain interest in the process of anaerobic respiration.
- Students will have already studied the detailed process of aerobic cellular respiration.

Procedure:

- Students will work in pairs or trios to answer questions (as seen in benchmarks) on aerobic and anaerobic respiration.
- Students will use previous notes and lab activities to summarize main ideas for aerobic and anaerobic respiration.
- Individually, students will create a concept map using Inspiration to further integrate and separate the two processes.

Accommodations:

- Instructions will be provided in written format as well as read orally. Instructions will also be on an overhead.
- One example will be provided for students on how to summarize data.
- Students will be shown examples of concept maps.
- Individual groups will have to show completed summary before proceeding to complete concept map.
- Students will be asked to draw a part of their concept map on paper before proceeding to computer to ensure understanding of procedure.

Difference Between Aerobic and Anaerobic Respiration:

BASIS FOR COMPARISON	AEROBIC RESPIRATION	ANAEROBIC RESPIRATION
Definition	The breakdown of glucose in the presence of oxygen to produce more amount of energy is called as aerobic respiration.	The breakdown of glucose in the absence of oxygen to produce energy is called as anaerobic respiration.
Chemical Equation	Glucose + Oxygen gives Carbon dioxide +water + energy	Glucose gives Lactic acid + energy
It occurs in	The cytoplasm to mitochondria.	Takes place in cytoplasm only.
Energy produced	The high amount of energy is produced.	Less amount of energy produced.
Number of ATP released	38 ATP.	2 ATP.
Final product is	Carbon dioxide and water.	Lactic acid (animal cells), carbon dioxide and ethanol (plant cell).
It requires	Oxygen and glucose to produce energy.	It does not require oxygen but uses glucose to produce energy.

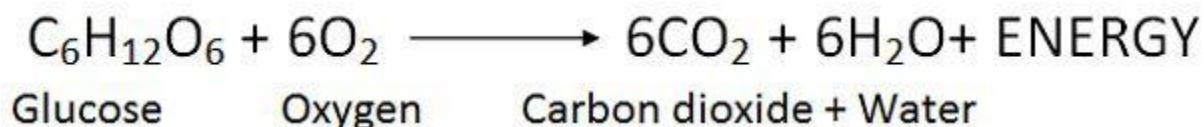
BASIS FOR COMPARISON	AEROBIC RESPIRATION	ANAEROBIC RESPIRATION
It involves	1. Glycolysis - also called Embden-Meyerhof-Parnas(EMP) pathway. 2. The respiratory chain (electron transport and oxidative phosphorylation). 3. The tricarboxylic acid cycle (TCA), also known as the citric acid cycle or Krebs cycle.	1. Glycolysis. 2. Fermentation
Process of combustion	Complete	Incomplete.
Type of process	It is a long process for the production of energy.	It is a fast process in comparison to aerobic respiration.
Examples	Aerobic respiration occurs in many plants and animals (eukaryotes).	Anaerobic respiration occurs in human muscle cells (eukaryotes), bacteria, yeast (prokaryotes), etc.

Definition of Aerobic Respiration

Aerobic respiration can be described as the chain of reactions catalyzed by enzymes. The mechanism involves the transfer of electrons from the molecules acting as the source of fuel like glucose to the oxygen, which works as the final electron acceptor.

This is the principal pathway for yielding the energy in aerobic respiration. This scheme at the end provides ATP and metabolic intermediates, working as the precursor for many other pathways in the cell, like carbohydrates, lipid and protein synthesis.

Thus the equation can be summarized as: Aerobic reaction



So the total yield of ATP is 40: Four from glycolysis, two from the TCA, and 34 from electron transport. Though 2 ATP were used in early Glycolysis, so this gives only 38 ATP at a time.

While the amount of total energy released is 2900 kJ/mol of glucose. There is no production of lactic acid. The aerobic respiration process goes on continuously in the body of plants and animals.

Aerobic respiration

When the body is able to supply the cells with the oxygen and glucose that they need, it carries out **aerobic** respiration.

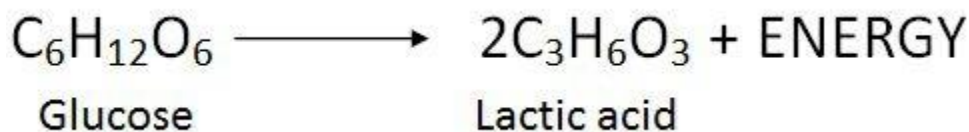


Definition of Anaerobic Respiration

Anaerobic respiration can be distinguished from that of aerobic respiration regarding the involvement of oxygen while converting the given resources such as glucose into energy.

Some bacteria, have evolved this kind of system where it utilizes oxygen-containing salts, rather using free oxygen as the electron acceptor. The energy produced by the anaerobic respiration is useful at the time of high energy demand in tissues when the oxygen produced by aerobic respiration is not able to fulfill the required demand. However, it is produced in very less amount as compared to aerobic respiration.

Thus, the equation can be summarized as: anaerobic respiration



As in the above reaction, glucose does not completely break down, and hence it produces very less energy. So the total amount of the energy released regarding kilo per joules is 120 kJ/mol of glucose. It produces lactic acid.

Anaerobic respiration

When the body **cannot** supply the cells with the oxygen needed to break down glucose, then it has to carry out **anaerobic** respiration. Energy is released **without oxygen**:



Conclusion

From the above article, we can say that energy is an essential factor, concerning the work performed by the body. The energy requirement is fulfilled by the two type of chemical reactions occurring inside the cell within the body of all kinds of living beings like microorganisms, plants, animals. These chemical reactions are of two types one is called aerobic respiration and the another is called anaerobic respiration, which we discussed above.

Respiration and breathing are the two different kind process, that takes place simultaneously inside the body, where the former (respiration) is related to the production of energy, involving the breakdown of nutrient and converting it to the form of energy, while the latter (breathing) is linked to the inhalation and the exhalation process of oxygen and carbon dioxide relatively.

Video Links for Reference: https://www.youtube.com/watch?v=8Y_Fdjl2v4I