

#424925

Topic: Glycolysis

Distinguish between glycolysis and Krebs cycle.

## Solution

	Glycolysis	Krebs cycle
1	It is a linear pathway.	It is a cyclic pathway.
2	It occurs in the cell cytoplasm.	It occurs in the mitochondrial matrix.
3	It occurs in both aerobic as well as anaerobic respiration.	It occurs in aerobic respiration only.
4	The glucose molecules are broken down into two pyruvate molecules along with the production of 8 ATP.	It produces 15 ATP during the interconversion of one pyruvate molecule. Two pyruvate molecules are formed by one molecule of glucose so two molecules of kerb's cycle are needed to process the pyruvates. So, total 30ATP (15 *2) is produced.

#424926

Topic: Anaerobic respiration

Distinguish between aerobic respiration and fermentation.

## Solution

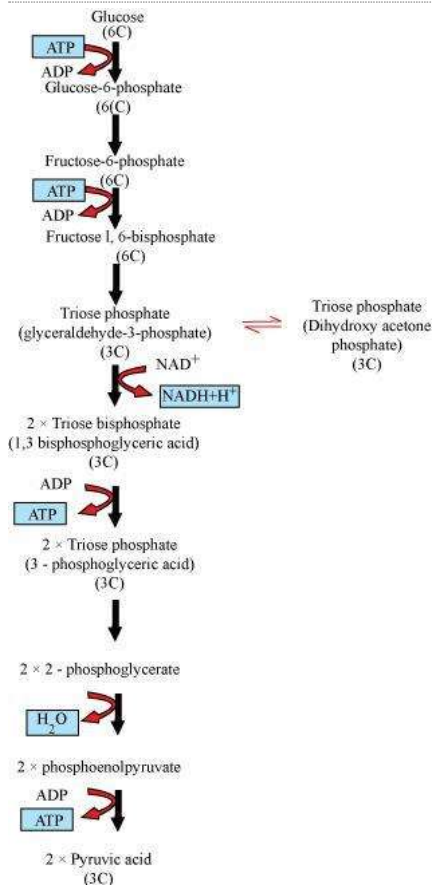
	Aerobic respiration	Fermentation
1	Oxygen is used for deriving energy.	It occurs in the absence of oxygen.
2	It occurs in the cytoplasm and mitochondria.	It occurs in the cytoplasm.
3	End products are carbon dioxide and water.	End products are ethyl alcohol and carbon dioxide.
4	Complete oxidation of the respiratory substrate takes place.	Incomplete oxidation of the respiratory substrate takes place
5	38ATP molecules are produced during aerobic respiration.	Only 2 ATP molecules are produced.

#424928

Topic: Glycolysis

Give the schematic representation of glycolysis?

## Solution



#424929

Topic: Glycolysis

What are the main steps in aerobic respiration? Where does it take place?

Solution

The major steps in aerobic respiration and the sites where they occur are listed in the given table :

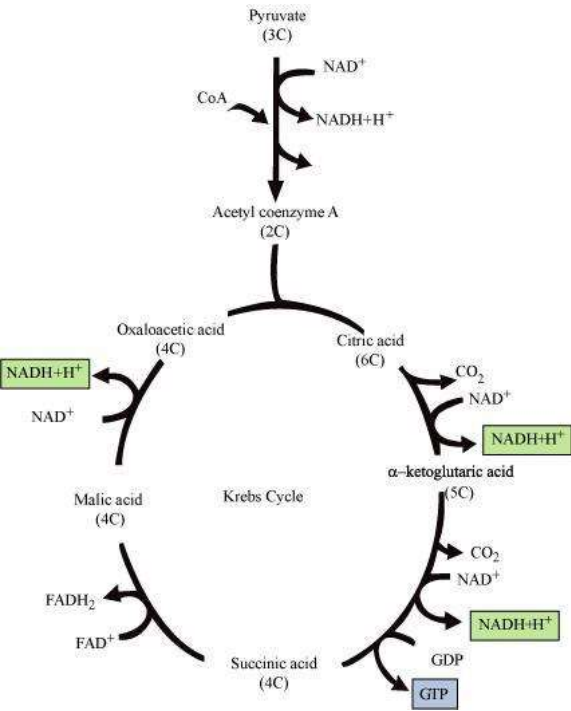
Step	Site of occurrence
Glycolysis	Cytoplasm
Kreb's cycle	Matrix of mitochondria
Electron transport system	Inner mitochondrial membrane
Oxidative phosphorylation	F0 - F1 particles in the inner mitochondrial membrane

#424930

Topic: Aerobic respiration (Kreb's cycle and ETS)

Give the schematic representation of an overall view of Krebs cycle.

Solution



#424931

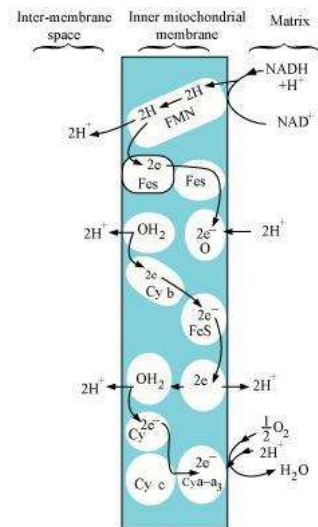
Topic: Aerobic respiration (Kreb's cycle and ETS)

Explain ETS?

Solution

ETS or electron transport system is located in the inner mitochondrial membrane. It helps in releasing and utilizing the energy stored in  $\text{NADH}_2$  and  $\text{FADH}_2$ .  $\text{NADH}_2$  which is formed during glycolysis and citric acid cycle, gets oxidized by NADH dehydrogenase (complex I). The electrons so generated get transferred to ubiquinone through FMN. In a similar manner,  $\text{FADH}_2$  (complex II) generated during citric acid cycle gets transferred to ubiquinone. The electrons from ubiquinone are received by cytochrome bc1 (complex III) and further get transferred to cytochrome c. The cytochrome c acts as a mobile carrier between complex III and cytochrome c oxidase complex, containing cytochrome a and a<sub>3</sub> along with copper centres (complex IV).

During the transfer of electrons from each complex, the process is accompanied by the production of ATP from ADP and inorganic phosphate by the action of ATP synthase (complex V). The amount of ATP produced depends on the molecule, which has been oxidized. 3 ATP molecules are produced by the oxidation of one molecule of  $\text{NADH}$ . One molecule of  $\text{FADH}_2$ , on oxidation, gives 2 ATP molecules.



#424934

Topic: Glycolysis

Define glycolysis and fermentation.

Solution

Glycolysis is a common process during aerobic and anaerobic respiration whereas fermentation occurs anaerobically. Glycolysis takes place in the cytoplasm of the cell and breaks the glucose into two pyruvates. 8 ATP is produced during glycolysis.

Fermentation is the process which takes place in the absence of carbon dioxide. The glucose molecules in the absence of oxygen produce alcohol and carbon dioxide. It produces 2 ATP.

#424935

Topic: Glycolysis

Distinguish between glycolysis and citric acid cycle.

Solution

Glycolysis is a linear pathway. It occurs in the cell cytoplasm. It occurs in both aerobic as well as in anaerobic respiration. One glucose molecule breaks down to generate 2  $\text{NADH}_2$  and 2 ATP molecules.

Citric acid cycle (Krebs cycle) is a cyclic pathway. It occurs in the mitochondrial matrix. It occurs in aerobic respiration only. It produces 15 ATP during the interconversion of one pyruvate molecule. Two pyruvate molecules are formed by one molecule of glucose so two molecules of Krebs' cycle is needed to process the pyruvates. So, total 30 ATP (15 × 2) is produced.

#424936

Topic: Glycolysis

What are the assumptions made during the calculation of net gain of ATP?

Solution

For theoretical calculation of ATP molecules, various assumptions are made, which are as follows :

- (a) It is assumed that various parts of aerobic respiration such as glycolysis, TCA cycle, and ETS occur in a sequential and orderly pathway.
- (b) NADH produced during the process of glycolysis enters into mitochondria to undergo oxidative phosphorylation.
- (c) A glucose molecule is assumed to be the only substrate while it is assumed that no other molecule enters the pathway at intermediate stages.
- (d) The intermediates produced during respiration are not utilized in any other process.

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**#424937**

**Topic:** Aerobic respiration (Kreb's cycle and ETS)

Discuss the respiratory pathway is an amphibolic pathway.

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**Solution**

Respiration is generally assumed to be a catabolic process because, during respiration, various substrates are broken down for deriving energy. Carbohydrates are broken down to glucose before entering respiratory pathways. Fats get converted into fatty acids and glycerol whereas fatty acids get converted into acetyl CoA before entering the respiration. In a similar manner, proteins are converted into amino acids, which enter respiration after deamination.

During synthesis of fatty acids, acetyl-CoA is withdrawn from the respiratory pathway. Also, in the synthesis of proteins, respiratory substrates get withdrawn. Thus, respiration is also involved in anabolism. Therefore, respiration can be termed as the amphibolic pathway as it involves both anabolism and catabolism.

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**#424938**

**Topic:** RQ

Define RQ. What is its value for fats?

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**Solution**

Respiratory quotient (RQ) or respiratory ratio can be defined as the ratio of the volume of CO<sub>2</sub> evolved to the volume of O<sub>2</sub> consumed during respiration. The value of respiratory quotient depends on the type of respiratory substrate. Its value is one for carbohydrates. However, it is always less than one for fats as fats consume more oxygen for respiration than carbohydrates.

It can be illustrated through the example of tripalmitin fatty acid, which consumes 145 molecules of O<sub>2</sub> for respiration while 102 molecules of CO<sub>2</sub> are evolved. The RQ value for tripalmitin is 0.7.

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**#424939**

**Topic:** Aerobic respiration (Kreb's cycle and ETS)

What is oxidative phosphorylation?

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**Solution**

Oxidative phosphorylation is a process in which electrons are transferred from electron donors to oxygen, which acts as an electron acceptor. The oxidation-reduction reaction are involved in the formation of a proton gradient. The main role in oxidative phosphorylation is played by the enzyme ATP synthase (complex V). This enzyme complex consists of F<sub>0</sub> and F<sub>1</sub> components. The F<sub>1</sub> headpiece is a peripheral membrane protein complex and contains the site for ATP synthesis from ADP and inorganic phosphate. F<sub>0</sub> component is a part of membrane protein complex, which acts as a channel for the crossing of the protons from the inner mitochondrial membrane to the mitochondrial matrix. For every two protons passing through F<sub>0</sub> - F<sub>1</sub> complex, synthesis of one ATP molecule takes place.

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**#526097**

**Topic:** Anaerobic respiration

Give example to prove that microbes release gases during metabolism.

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**Solution**

Microbes carry out lactic acid fermentation (the anaerobic respiration) and produce carbon dioxide and lactic acid. The puffy appearance of Idli and Dosa dough is due to carbon dioxide released by microbes during fermentation. Likewise, baking industries use Baker's yeast that causes rise of batter of cakes and pastries during the process. It is also due to released carbon dioxide during lactic acid fermentation.

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**#634594**

**Topic:** Introduction and types of respiration

What is respiration?

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**Solution**

Respiration is the process in which the cells of an organism obtain energy by combining oxygen and glucose, resulting in the release of carbon dioxide, water, and ATP (energy).