

Aerobic Respiration

Aerobic respiration is the part of cellular respiration that requires oxygen to generate energy. It occurs in the mitochondrial matrix and starts where glycolysis leaves off. The first process is pyruvate decarboxylation in which 2 pyruvate molecules (generated during glycolysis) are input. The outputs are 2 acetyl-CoA molecules and 2 NADH. Those 2 acetyl-CoA enter the Krebs Cycle (TCA, Citric Acid Cycle) and are oxidized and given off as CO₂. The outputs of the Krebs cycle are 6NADH (3 per acetyl-CoA), 2 FADH₂ (2 per acetyl-CoA), and 2 ATPs created by substrate level phosphorylation (1 per acetyl-CoA). The ATPs are formed through a GTP intermediate. The Krebs cycle actually converts 2 GDP to 2 GTP, but those 2 GTP transfer a phosphate group to ADP to form 2 ATP.



PLAY PICMONIC

Mitochondrial Matrix

Matrix-background

Aerobic respiration takes place in the mitochondrial matrix, which is inside the inner mitochondrial membrane.

2 Pyruvate

(2) Tutu Pie-roots

Two pyruvate molecules are consumed in pyruvate decarboxylation. These two pyruvates came from the breakdown of a single glucose molecule in glycolysis.

Pyruvate Decarboxylation

Pie-roots put into D-cardboard-box

Pyruvate decarboxylation is the process of converting pyruvate into acetyl-CoA for the Krebs cycle. Acetyl-CoA is an acetyl group bound to a coenzyme A molecule. Though the process is known as pyruvate decarboxylation, the enzyme complex responsible for this process is pyruvate dehydrogenase.

2 NADH

(2) Tutu Cigarette-H

Two NAD⁺ molecules (nicotinamide adenine dinucleotide) are reduced to two NADH in pyruvate decarboxylation and carry high energy electrons to the electron transport chain in oxidative phosphorylation.

2 Acetyl-CoA

(2) Tutu Seagull-CoA-purse

Two acetyl-CoA molecules are the products of pyruvate decarboxylation, which then enter the Krebs cycle.

Krebs Cycle

Crab

The Krebs cycle (also known as TCA or Citric Acid Cycle) is the primary generator of NADH and FADH₂ in aerobic respiration. Each acetyl-CoA turns the Krebs cycle once, so it turns twice per glucose molecule.

6 NADH

(6) Sax Cigarette-H

Six NAD⁺ molecules (nicotinamide adenine dinucleotide) are reduced to six NADH in the Krebs cycle and carry high energy electrons to the electron transport chain in oxidative phosphorylation.

2 FADH₂

(2) Tutu Flag-H₂

Two FAD (flavin adenine dinucleotide) molecules are reduced to FADH₂ in the Krebs cycle and carry high energy electrons to the electron transport chain in oxidative phosphorylation.

2 Substrate Level ATPs

(2) Tutu Sub ATP-battery

In the Krebs cycle, 2 GDP are converted to GTP by substrate-level phosphorylation, and those GTP give their phosphate groups to 2 ADP molecules to form 2 ATP. Substrate-level phosphorylation is the formation of ATP by adding a phosphate group to ADP via a phospho-intermediate.