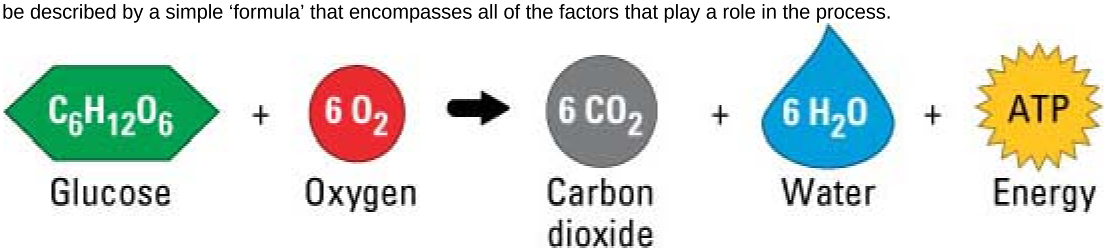
Cellular Respiration

The Process:

Cellular respiration occurs in all living things. It takes place within the mitochondria, and its main goal is to produce adenosine triphosphate (ATP). Mitochondria (below) are found in the majority of eukaryotic cells, and their numerous folds serve as locations for the production of ATP molecules. Cellular respiration can be described by a simple ‘formula’ that encompasses all of the factors that play a role in the process.



The formula above starts out with oxygen and a sugar, glucose, on the left hand side, and through a series of reactions and processes that make up cellular respiration, we are left with the end results (right side).

The process of cellular respiration is known as an *aerobic* process; this means that oxygen is required in order for the process to take place. As you can see, water is one of the results of cellular respiration, and water is formed from the transfer of the hydrogen atoms in glucose to oxygen. The hydrogen transfer plays a very crucial role in cellular respiration, and for that reason, oxygen is fundamental to the production of energy during cellular respiration. The other starting ‘factor’ for cellular respiration is a sugar, and a commonly used fuel is glucose; one glucose molecule can produce up to 38 ATP molecules.

The Stages:

In order to produce the ATP, glucose must be broken down over several steps. These steps can be categorized into the 3 main stages of cellular respiration with the first stage being ***Glycolysis***. During the stage of Glycolysis, one glucose molecule is broken down by two ATP molecules thus creating two new molecules of pyruvic acid. In addition to the two new pyruvic acid molecules that are created, four new ATP molecules will also be produced as a result of the production of the pyruvic acid molecules. Next, the pyruvic acid molecules will convert into acetyl CoA and they will be passed onto the 2nd stage known as the ***Citric Acid Cycle*** (A.K.A. the *Krebs Cycle*).

Now moving on to the Citric Acid Cycle (also commonly referred to as the Krebs cycle). It was previously mentioned that we now have two acetyl CoA molecules that we got from the pyruvic acid molecules. During the Krebs Cycle, the acetyl CoA are broken down into carbon dioxide molecules. Along with the formation of the two carbon dioxide molecules per each acetyl CoA, one ATP molecule is also made. The Krebs Cycle takes place within the matrix of the inner membrane of the mitochondria. There is an image below depicting the Krebs Cycle in its entirety.

In the picture depicting the Krebs Cycle (middle image), you see that there are two electron carriers in the input column, these are NAD+ and FAD. We will elaborate on these in the final stage of cellular respiration known as the ***Electron Transport Chain*** (ETC). The ETC is the 3rd stage of cellular respiration. It occurs in the inner membrane of the mitochondria. You see that the NAD+ carrier turns into NADH after receiving electrons (this is known as a *redox reaction*), then the NADH transfers its electrons to the ETC. Each time that an NADH molecule transfers its electrons to the ETC, energy is released. Going back to the main goal of cellular respiration: to create ATP for cellular work, during this final stage of cellular respiration there is an enzyme called ATP synthase that accounts for 34 of the 38 ATP molecules made per glucose molecule.

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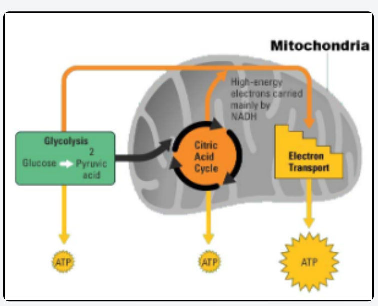
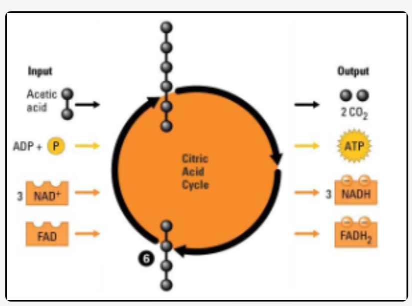
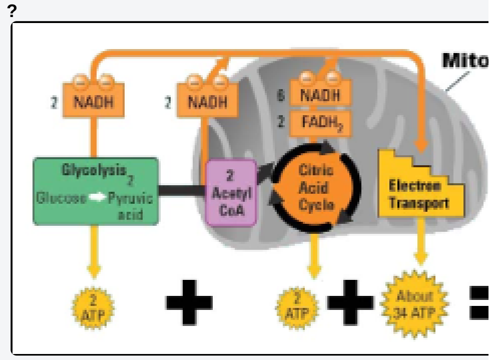
		? 
Shown above are the 3 major processes of cellular respiration: Glycolysis, the Krebs Cycle, and the Electron Transport Chain.	This graphic depicts the Citric Acid Cycle (Krebs Cycle).	In the figure above, there is a more detailed overview of the er respiration process starting with Glycolysis then going through Cycle and finally finishing with the Electron Transport Chain ar of ATP.

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