**Cellular respiration notes**

* Cellular Respiration: Release of the energy stored in food.
* ATP: Useable form of energy
* Glycolysis: first step in aerobic or anaerobic respiration.
* Anaerobic: without oxygen
* Aerobic: with oxygen
* Oxidation: Reaction when an atom or molecule loses electrons
* Reduction: Reaction when an atom or molecule gains electrons,
* Fermentation: Glycolysis is followed by the conversion of pyruvic acid into some end product with no further release of energy
* Kreb’s Cycle:Continuing series of reactions
* Electron Transport Chain: reaction within the mitochondrion that powers the formation of ATP.

**Hydrogen (Electron) Acceptors**

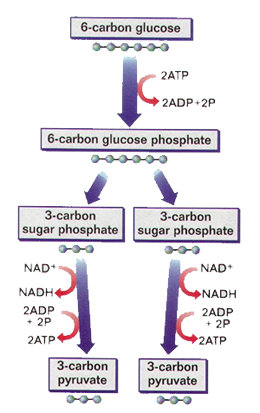
* Recall: Oxidation and Reduction
* After complex carbs are broken down into glucose, glucose is broken down in a biochemical pathway. Oxidation and reduction take place along the way.
* NAD (nicotinamide adenine dinucleotide) and FAD (flavine adenine dinucleotide) are electron carriers (or acceptors)
* NAD and FAD c an each accept a pair of high-energy electrons and a proton, becoming reduced.
* After accepting high-energy electrons, molecules gain energy temporarily

**Glycolysis**

* Occurs in cytoplasm of the cell
* Is the first step in both aerobic and anaerobic respiration
* In this step, glucose is split.

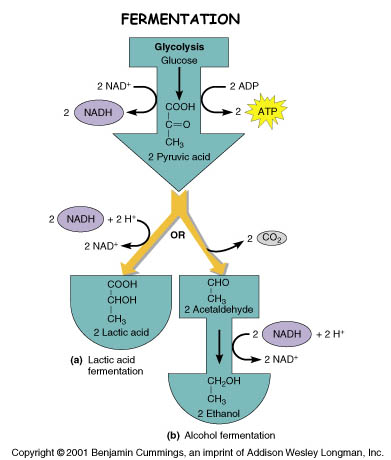
2 phosphate groups are bonded to a glucose molecule. This uses 2 molecules of ATP.

* A group of chemical reactions break down the glucose molecule into 2 molecules of pyruvic acid. This produces 4 molecules of ATP.
* The net result is thus 2 molecules of ATP for every glucose. Also, 2 molecules of NADH are formed.



**Fermentation**

* In anaerobic respiration, glycolysis is followed by a conversion of pyruvic acid into some end product with no further release of energy (no more ATP formed)
* This is called fermentation
* Examples: In plant cells, the end result is ethyl alcohol. In animal cells, it is lactic acid.
* In fermentation, pyruvic acid acts as an electron acceptor. They get these electrons from NADH, which is then ready as NAD to be used again.

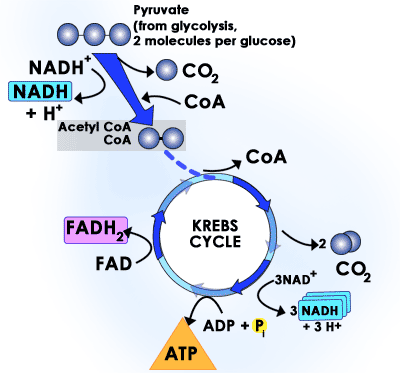


**Aerobic Respiration**

* The use of oxygen in the breakdown of food substances allows the cell to release far more energy.
* Aerobic respiration begins with glycolysis. The rest of the steps take place within the mitochondria.
* Inside the mitochondrion, pyruvic acid breaks down into CO2 NADH, and a 2-carbon compound. This compound, combined with coenzyme A, forms acetyl CoA.

**Krebs Cycle**

* Named for Sir Hans Krebs
* Acetyl CoA begins the Krebs Cycle, which is a continuing series of reactions
* Each turn of the Krebs Cycle takes one molecule of Acetyl CoA and converts it to 2 molecules of CO2, 3 molecules of NADH, 1 molecule of FADH2.
* Only 1 molecule of ATP is produced by each turn.



**Electron Transport Chain**

* Most of the energy released by breaking down glucose comes through the electron transport chain.
* This is a highly organized system of enzymes and coenzymes on the inner membrane of the mitochondrion.
* NADH and FADH2 carry electrons into the chain and pass them from one compound to another. Eventually, oxygen is the final acceptor.
* At various points, energy is given up and used to pump hydrogen ions across the mitchondrial membrane.
* This creates an electrical gradient, which provides the energy to convert ADP to ATP
* In glycolysis, one molecule of glucose forms 2 molecules of ATP.
* In the Krebs cycle, 2 more molecules of ATP are formed (1 for each pyruvic acid)
* In the Electron Transport Chain, 32 molecules of ATP are formed from each glucose molecule.
* Therefore, each glucose molecule yields 36 ATP molecules.
* The net reaction is:

C6H12O6 + 6O2  → 6CO2 + 6H2O + Energy (36 ATP)