

# Cellular Respiration

**Pg 231**



## Define *cellular respiration*.

The process by which mitochondria break down food molecules to produce **ATP** is called cellular respiration.

In plants...breaking sugar (glucose) to get energy.



In animals...breaking down food to get energy.





How many stages of cellular respiration takes place?





Name the 1st Stage

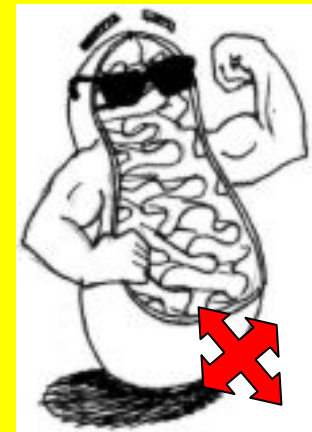
# Glycolysis



This stage is anaerobic which means no oxygen is required.

💡 Greek words: *an* meaning "without" and *aeros* meaning "air"

💡 Location of Reaction: Directly outside the mitochondria.





Name the 2nd Stage

# Citric Acid Cycle

💡 Location of Reaction: Directly inside the mitochondria.



 Name the 3rd Stage

# Electron Transport Chain (etc)

💡 Location of Reaction: Directly in the middle of the mitochondria.





The 2nd and 3rd Stages are...

Aerobic

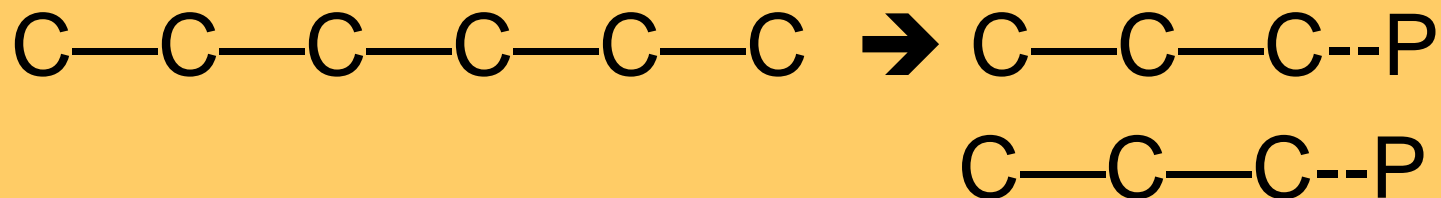
which means that *oxygen* is required



# Glycolysis

## Step #1:

Breaks down the 6 carbon sugar (glucose) into *pyruvic acid* (3 carbon sugar molecules with phosphate attached).



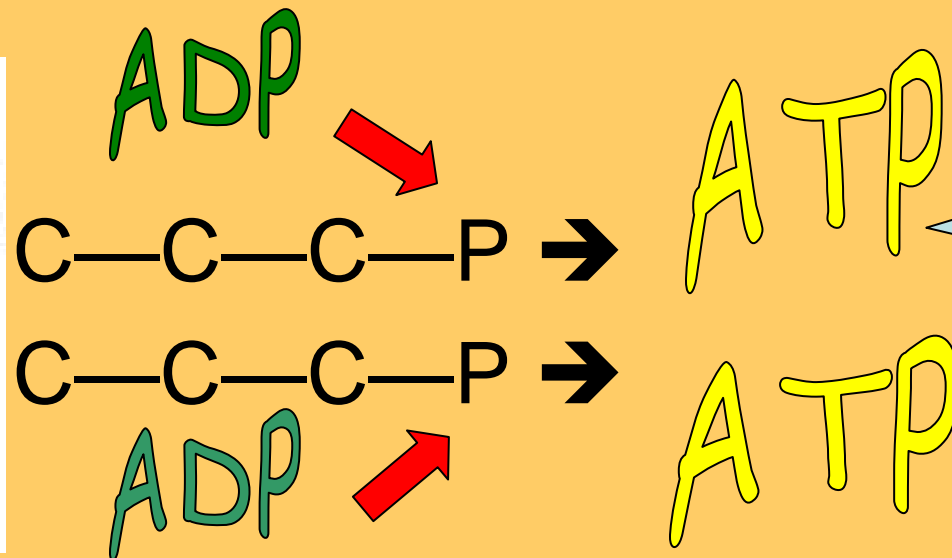




# Glycolysis

## Step #2:

Floating ADP (energy molecules) picks up the **phosphate** that is attached to the **3 carbon molecules** in order to make **ATP** energy molecules.



1 of the by-products of cellular respiration

# Glycolysis

- ❖ Not an efficient cycle.
- ❖ Only produces 2 **ATP** energy molecules for each glucose molecule that is broken down.

# Citric Acid Cycle

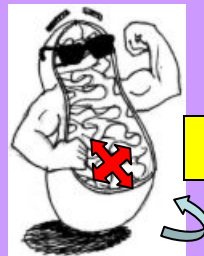
❖ Its common name is "Kreb Cycle"

## Step #1:

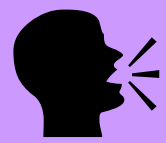
Pyruvic acid changes shape and binds with coenzyme A to make Acetyl-CoA



Directly outside



Directly inside



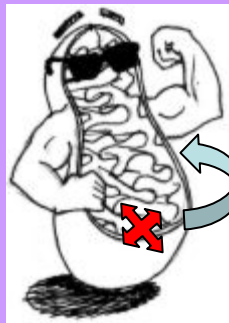
# Citric Acid Cycle

## Step #2:

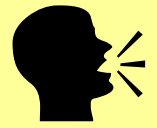
*CO<sub>2</sub>* is lost during this reaction.

2<sup>nd</sup> by-  
products of  
cellular  
respiration

## Step #3:

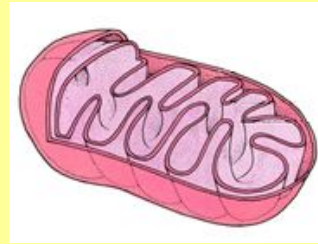


Excited electrons are picked up by energy carrier molecules ( $\text{NAD}^+$ ,  $\text{FAD}^+$ ) to be transported to the inner mitochondria's electron transport chain (etc).



## Electron Transport Chain (etc)


Excited electrons carried by  $\text{NAD}^+$  &  $\text{FAD}^+$  are released at the electron transport chain (etc).

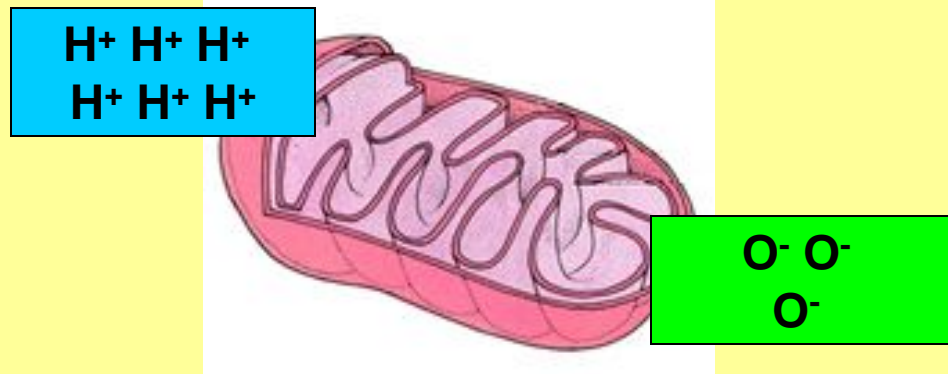


Energy is **slowly released** as the electrons go down the electron transport chain.

Lost energy is used to make **ATP** molecules.


# Electron Transport Chain (etc)

 What pulls the excited electrons ( $H^+$  ions) down the electron transport chain (etc)?



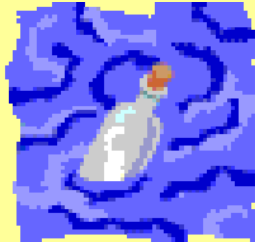
  $O^-$  ions located at the opposite end of the electron transport chain.


# Electron Transport Chain (etc)

 What molecule is formed when  $H^+$  ions and  $O^-$  ions are joined together?

Water

3<sup>rd</sup> by-products of cellular respiration



 Where did the  $O^-$  ions come from?

❖ Splitting of water in phase 1 of photosynthesis.

💡 Between the 2nd and 3rd Stages...

36 ATP

molecules are made.





# Comparison of Photosynthesis and Cellular Respiration

Process	Location
Photosynthesis	chloroplast
Cellular Respiration	mitochondria



# Comparison of Photosynthesis and Cellular Respiration

Process	Food
Photosynthesis	Food is <i>synthesized</i> (to make)
Cellular Respiration	Food is <i>broken down</i>



# Comparison of Photosynthesis and Cellular Respiration

Process	Energy
Photosynthesis	Energy from sun is stored in glucose molecules
Cellular Respiration	Energy stored in glucose molecules is released



# Comparison of Photosynthesis and Cellular Respiration

Process	Carbon Dioxide ( $CO_2$ )
Photosynthesis	Carbon dioxide is <i>taken in</i>
Cellular Respiration	Carbon dioxide is <i>given off</i>



# Comparison of Photosynthesis and Cellular Respiration

Process	Oxygen (O <sub>2</sub> )
Photosynthesis	Oxygen is <i>given off</i>
Cellular Respiration	Oxygen is <i>taken in</i>



# Comparison of Photosynthesis and Cellular Respiration

Process	Products Produced
Photosynthesis	Produces <i>oxygen</i> and <i>sugars (glucose)</i>
Cellular Respiration	Produces <i>carbon dioxide, water, and energy</i>



# Comparison of Photosynthesis and Cellular Respiration

Process	Presence of Light
Photosynthesis	Requires light (Phase 1: Light-Dependent Reaction)
Cellular Respiration	Does <u>not</u> require light