

Cellular Respiration



- Recall our discussion of photosynthesis, what is needed for all of the life functions to occur?

Energy

- In what form is this present at the end of photosynthesis?

Trapped in the bonds of glucose

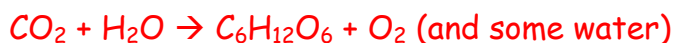
- Why does this present a problem for the cell?

Cells cannot use the energy in this form

- What must occur to resolve this problem?

Glucose must be broken down to put this trapped energy in a usable form

- **This is where cellular respiration comes in.**
- Looking back to your notes on photosynthesis or from memory, record the formula for photosynthesis in the space provided below:



- Now write the reverse in the space below:

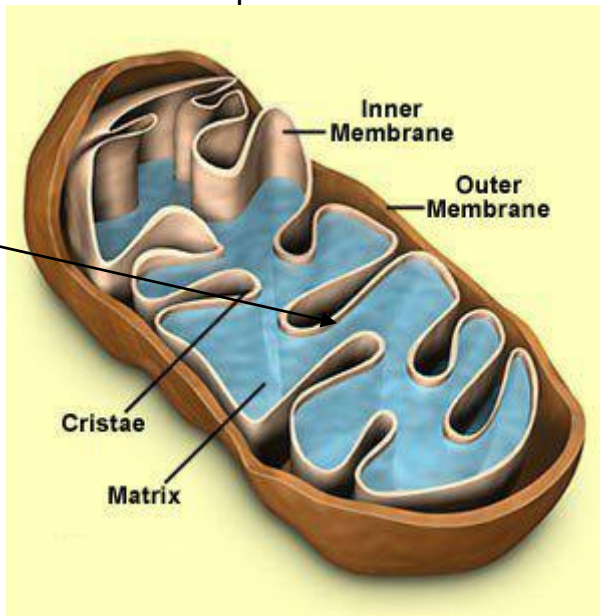
Glucose + oxygen \rightarrow carbon dioxide and water

- This is essentially the formula for aerobic respiration.
- What is the major goal of respiration?

To put energy in a usable form for the cell (ATP)

- Main Ideas of Cellular Respiration:
 - Energy trapped in glucose must be released by breaking glucose down
 - Energy must be put in a usable form
- Exact formula for Cellular (aerobic) respiration:

$$6O_2 + C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O + 36 ATP$$
- Adaptations for Cellular Respiration:
 - Where in the cell does cellular (aerobic) respiration occur?
 - Mitochondria
 - Examine the diagram of this organelle below and describe how it is designed to efficiently carry out aerobic respiration:



*oxygen in & carbon dioxide out

Explanation:

The folds provide increased surface area, which enables more respiration to occur at once.

Anaerobic Respiration

- Recall the heterotroph hypothesis, why did the first cells have to carry out anaerobic respiration?

The lack of oxygen in the atmosphere

- Certain organisms live in environments similar to the first cells, even today such as those found by thermal vents deep in the ocean floor, or those found in hot springs.
 - As a result, these organisms **MUST** carry out anaerobic respiration instead of aerobic for the same reasons as the first cells.
 - Other organisms are found in environments where aerobic respiration can occur, but use anaerobic respiration anyway, as one of the raw materials is actually toxic to them.
- Anaerobic Respiration at a glance:
 - Glucose is broken down in anaerobic respiration as well.
 - What substance is **NOT** used though?
Oxygen
 - As a result, anaerobic respiration only yields a net gain of 2 ATP molecules; how does this compare to the amount of ATP produced by aerobic respiration?

Aerobic yields 36 ATP/molecule of glucose, therefore anaerobic yields substantially less per molecule of glucose

- Which type of respiration is more efficient?
aerobic
- Different anaerobic organisms produce different end products:
 - Certain anaerobic organisms **give off alcohol** as an end product, which is why they are used to create alcoholic beverages such as wine and beer in a process known as **FERMENTATION**

- While humans carry out aerobic respiration for the most part, sometimes our cells are forced to carry out anaerobic respiration.

- What type of situation would cause our cells to have to carry out anaerobic respiration?

When we cannot replace the oxygen fast enough (such as during strenuous exercise)

- As a result of anaerobic respiration in our cells, the compound LACTIC ACID is formed, which results in the sensation of fatigue, or muscle soreness, which persists until the lactic acid has been digested and removed from our bodies.

<u>Anaerobic</u>	<u>Both</u>	<u>Aerobic</u>
Doesn't use oxygen	break down glucose	Uses oxygen
Yields 2 ATP	release CO ₂	Yields 36 ATP
Occurs in cytoplasm		occurs in mitochondria