

## Photosynthesis and Cellular Respiration Notes

### Where does ENERGY come from?

The \_\_\_\_\_ is the original source of all energy.

### Autotrophs and Heterotrophs

Energy is \_\_\_\_\_.

\_\_\_\_\_ are organisms that make their own food. (like \_\_\_\_\_)

\_\_\_\_\_ obtain energy from the foods that they consume.

### Chemical Energy and ATP

\_\_\_\_\_ (Adenosine Triphosphate): principle chemical compound that cells use to store and release energy.

ATP consists of:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_



Phosphate groups are the key to ATP's ability to store and release energy.

Energy is released by \_\_\_\_\_ the chemical bond between the \_\_\_\_\_ and \_\_\_\_\_ phosphate in ATP.

**Adenosine Diphosphate** (\_\_\_\_\_) looks almost like ATP, except that it has \_\_\_\_\_ groups instead of three.

When available, energy is stored by adding a phosphate group to ADP making ATP.

### Using Biochemical Energy

Most cells have only a small amount of ATP, enough to last them for a \_\_\_\_\_ of activity.

Energy from ATP powers the \_\_\_\_\_ of proteins and nucleic acids, responses to chemicals at the cell surface, and can even be used to produce light.

### Photosynthesis

Photosynthesis is the process where a plant uses the \_\_\_\_\_ to convert water and carbon dioxide into high energy carbohydrates (sugars and starches)

Photosynthesis equation:  $6\text{CO}_2 + 6\text{H}_2\text{O} \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$

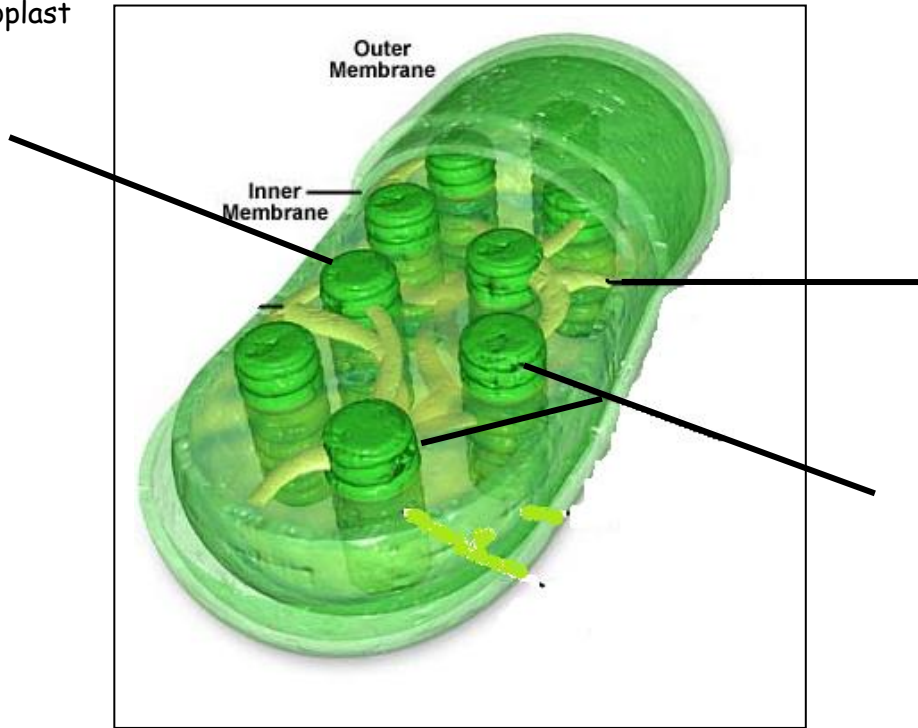
\_\_\_\_\_ + \_\_\_\_\_  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_

Photosynthesis occurs in the \_\_\_\_\_ of eukaryotes.

In plants, chloroplasts contain \_\_\_\_\_ that absorb light. These pigments are called \_\_\_\_\_.

Chlorophyll \_\_\_\_\_ all colors except for green (which it \_\_\_\_\_.) This is why most plants appear \_\_\_\_\_.

### The Chloroplast



Step 1: The LIGHT reactions capture SUNLIGHT's energy and uses \_\_\_\_\_ to pass the energy through electrons to make ATP and NADPH, \_\_\_\_\_ is a waste product.

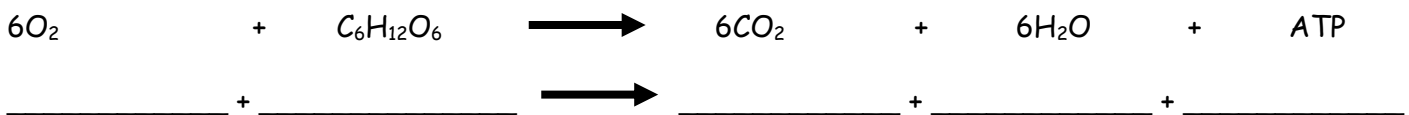
Step 2: The DARK reactions (or light independent) fixes carbon from carbon dioxide and using ATP and NADPH as energy makes \_\_\_\_\_ = food for the plant and for us!

### What can affect the rate of photosynthesis?

1. Too little \_\_\_\_\_ can slow or stop photosynthesis.
2. \_\_\_\_\_: Too HOT or too COLD can slow or stop photosynthesis. Photosynthesis needs enzymes; high or low temperature can slow down enzymes and denature them
3. Too much or too little \_\_\_\_\_ can slow or stop photosynthesis.

### Cellular Respiration

#### Cellular Respiration Equation

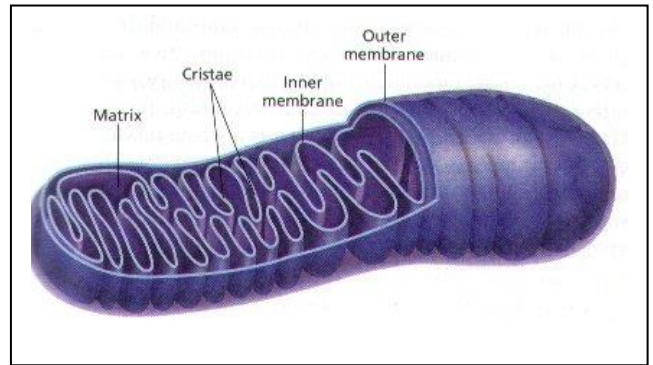


Cellular Respiration is the process that releases \_\_\_\_\_ by breaking down the \_\_\_\_\_ (sugar) originally produced by plants.

Cellular respiration occurs in the \_\_\_\_\_ of eukaryotes.

In the presence of Oxygen ( \_\_\_\_\_ ) Cellular respiration has three steps:

1. Glycolysis
2. the Krebs Cycle
3. the Electron Transport Chain



**FERMENTATION**

\_\_\_\_\_ occurs when \_\_\_\_\_ is \_\_\_\_\_ present.

This process can also be called fermentation and only produces \_\_\_\_\_ amounts of \_\_\_\_\_ when breaking down glucose.

- Aerobic respiration produces ~36 ATP per glucose
- Anaerobic respiration produces 2 ATP per glucose

Two main types are

1. Alcoholic ( \_\_\_\_\_ and \_\_\_\_\_ )
2. Lactic acid (when your \_\_\_\_\_ after exercise)

Fermentation does not release a lot of energy.

**Photosynthesis**

vs.

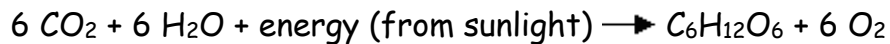
**Cellular Respiration**

_____ energy - plants get the energy from sunlight.	_____ energy to break down food.
_____ Carbon dioxide from the air.	_____ carbon dioxide into the air.
_____ oxygen into the air.	_____ oxygen from the air.
Occurs only in plants, algae and some bacteria.	Occurs in _____ Eukaryotes and Prokaryotes.

Use the information below to color code and label the pictures on your foldable.

## ***Chloroplasts and Mitochondria***

Plant cells contain an organelle called the **chloroplast**. The chloroplast allows plants to harvest **energy** from **sunlight**. Specialized pigments in the chloroplast (including the common green pigment **chlorophyll**) absorb sunlight and use this energy to complete the chemical reaction:



In this way, plant cells manufacture **glucose** and other **carbohydrates** that they can store for later use. Photosynthetic cells may have **thousands** of chloroplasts. Chloroplasts are double membrane organelles with an inner membrane folded into disc-shaped sacs called **thylakoids**. Thylakoids contain chlorophyll and other **accessory pigments**, and are in stacks called **granum** (**grana**, plural). Grana are connected to each other by structures called lamellae, and they are surrounded by a gel-like material called **stroma**.

Figure 1:

**Color and label** the inner membrane light green.

**Color and label** the grana (stacks) dark green.

**Color and label** the stroma light blue.

Figure 2:

**Color and label** a single thylakoid (disc) purple.

**Color and label** a granum stack red.

**Mitochondria** are the powerhouses of the cell. **Glucose** and other **carbohydrates** made by plants during photosynthesis are broken down by the process of **aerobic cellular respiration** in the mitochondria of the cell. This releases **energy (ATP)** for the cell. The more active a cell (such as a muscle cell), the more mitochondria it will have. The mitochondria are about the size of a bacterial cell and are often peanut-shaped. Mitochondria have a **double membrane** like the nucleus and chloroplast. The **outer membrane** is smooth, while the **inner membrane** is convoluted into folds called **cristae**. This greatly increases the surface area of the membrane so that carbohydrates (simple sugars) can combine with oxygen to produce ATP, **adenosine triphosphate** (the energy molecule of the cell). The **electron transport chain** takes place across the membranes of the **cristae** (**crista**, singular). Inside the folds or cristae is a space called the **matrix** that contains enzymes needed for the **Kreb's Cycle**.

Figure 3:

**Color and label** the outer membrane pink.

**Color and label** the cristae red.

**Color and label** the matrix yellow.