Name:_____ Per._____

Energy Molecules: Glucose and ATP

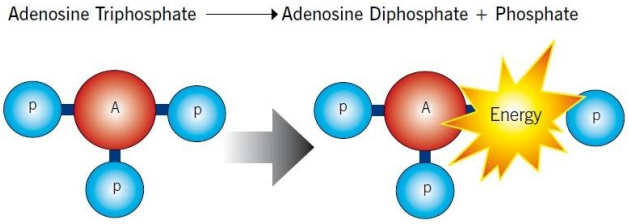
Organisms mainly use two types of molecules for chemical energy: glucose and ATP. Both molecules are used as fuels throughout the living world. Both molecules are also key players in the process of photosynthesis.

Glucose

Glucose is a simple carbohydrate with the chemical formula $C_6H_{12}O_6$. It stores chemical energy in a concentrated, stable form. In your body, glucose is the form of energy that is carried in your blood and taken up by each of your trillions of cells. Glucose is the end product of photosynthesis, and it is the nearly universal food for life.

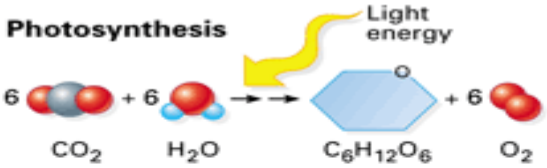
ATP

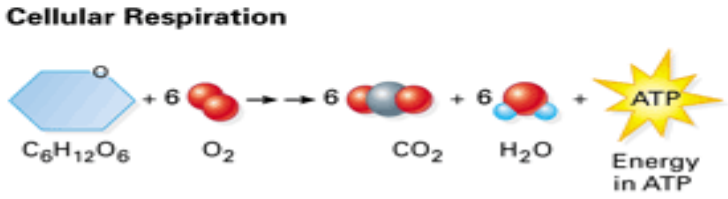
ATP (adenosine triphosphate) is the energy-carrying molecule that cells use for energy. ATP is made during photosynthesis, when glucose is also made. It is also used for energy by cells for most other cellular processes. ATP releases energy when it gives up one of its three phosphate groups and changes to ADP. See picture to the right.



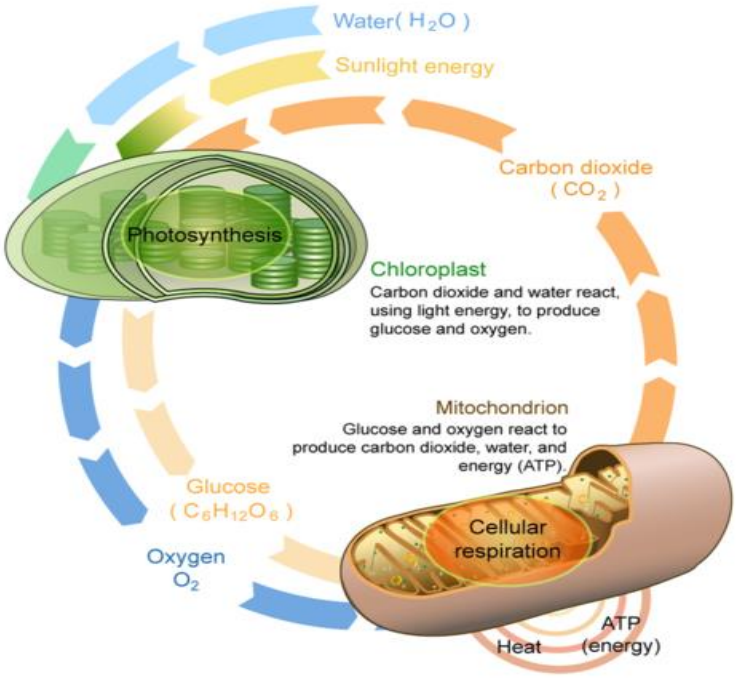
Cellular Respiration and Photosynthesis

Photosynthesis and cellular respiration are connected through an important relationship. This relationship enables life to survive as we know it. The **products** of one process are the **reactants** of the other. Notice that the equation for **cellular respiration** is the direct opposite of **photosynthesis.**

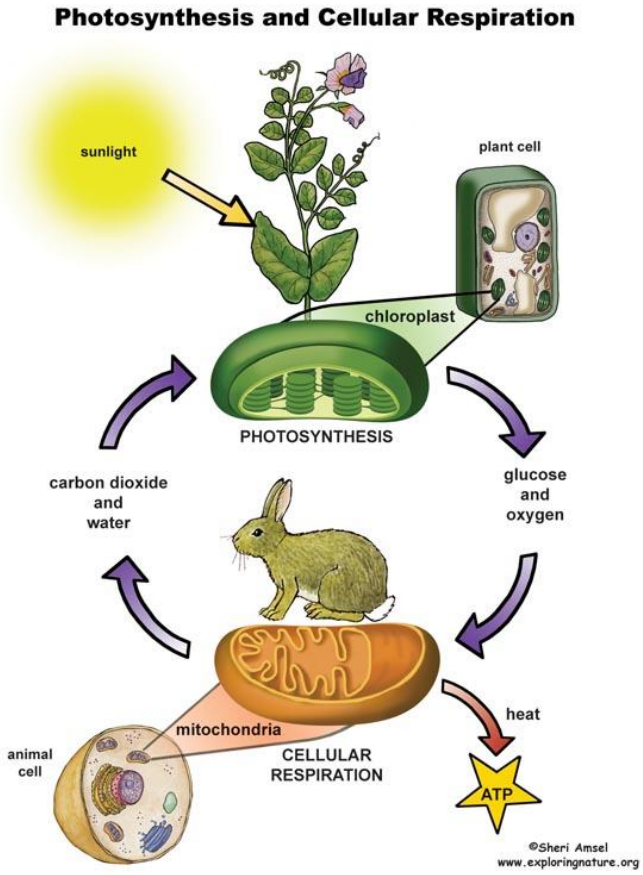




Photosynthesis makes the glucose that is used in cellular respiration to make ATP. The glucose is then turned back into carbon dioxide, which is used in photosynthesis. While water is broken down to form oxygen during photosynthesis, in cellular respiration oxygen is combined with hydrogen to form water. While photosynthesis requires carbon dioxide and releases oxygen, cellular respiration requires oxygen and releases carbon dioxide. It is the released oxygen that is used by us and most other organisms for cellular respiration. We breathe in that oxygen, which is carried through our blood to all our cells. In our cells, oxygen allows cellular respiration to proceed. Cellular respiration works best in the presence of oxygen. Without oxygen, much less ATP would be produced. Photosynthesis occurs in plants only, however respiration occurs in both plants and animals.



Cellular respiration and photosynthesis are direct opposite reactions. Some of the ATP made in the mitochondria is used as energy for work, and some is lost to the environment as heat.



How Organisms Get Energy: Autotrophs and Heterotrophs

The chemical energy that organisms need comes from food. **Food** consists of organic molecules that store energy in their chemical bonds. In terms of obtaining food for energy, there are two types of organisms: autotrophs and heterotrophs.

Autotrophs

Autotrophs are organisms that make their own food. Most autotrophs use the energy in sunlight to make food in a process called **photosynthesis**. Only three types of organisms —plants, algae, and some bacteria —can make food through photosynthesis.

Autotrophs are also called **producers**. They produce food not only for themselves but for all other living things as well (which are known as consumers). This is why autotrophs form the basis of food chains.

Heterotrophs

Heterotrophs are living things that cannot make their own food. Instead, they get their food by consuming other organisms, which is why they are also called **consumers**. They may consume autotrophs or other heterotrophs. Heterotrophs include all animals and fungi and many single-celled organisms. What do you think would happen to consumers if all producers were to vanish from Earth?

Questions:

1.) What do ATP and Glucose have in common?

They are both "energy molecules" that can store energy (within their bonds)

2.) Please write the reaction for photosynthesis below

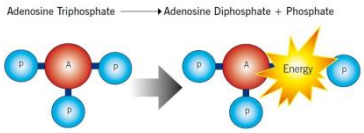
Light + Water + CO_2 = Glucose + O_2

3.) Please write the reaction for respiration below

Glucose + O_2 = CO_2 + H_2O + ATP

4.) How or when does ATP release energy? Please draw a picture to support your claim.

When one of the phosphates is released



5.) What does photosynthesis require in order to work?

Light, water and oxygen

6.) What does cellular respiration require in order to work?

Glucose and Oxygen

7.) In what cells (plant animal or both) does cellular respiration occur?

Both

8.) In what cells (plant animal or both) does photosynthesis occur?

Animals (even though frogs are green, it does NOT occur in frogs)

9.) Distinguish between autotrophs and heterotrophs.

Autotrophs produce their own food, and heterotrophs have to obtain it by eating or consuming.

10.) Why are autotrophs considered the basis of the food chain?

Many things eat plants (autotrophs)

Ex. Cows eat grass, people eat cows.

Not an Example: Grass eating horses.

11.) Draw a diagram of how cellular respiration and photosynthesis work, being sure to include all the products and reactants that occur with each. (for example, the reactants in photosynthesis are light, water)