

# LAB – “A CELLULAR RESPIRATION MODEL”

We know that the mitochondria use oxygen and glucose to make ATP (energy for the cell), but how does that work exactly? This lab will show you how.

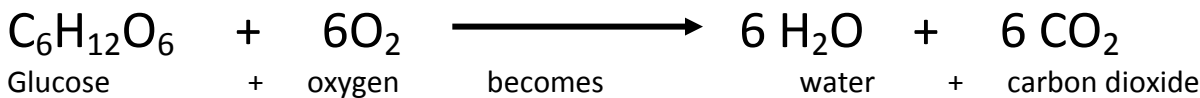
## You will need:

- 18 blue oxygen atoms,
- 6 black carbon atoms,
- 12 white hydrogen atoms,
- 36 bonds (white tubes)
- a large paper cutout to represent the cell

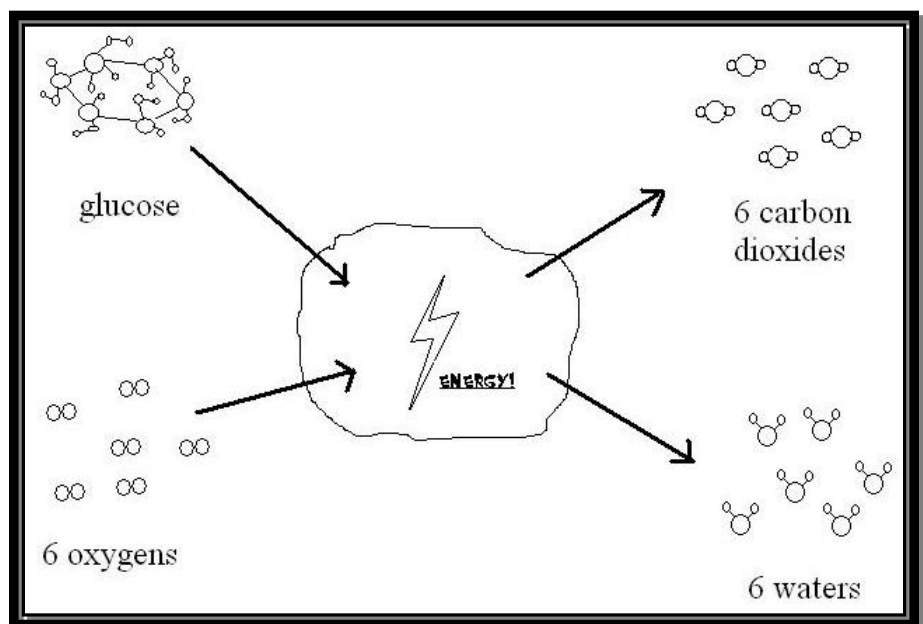
1. Build a molecule of glucose according to the instructions.
2. With your remaining atoms and bonds, build six oxygen molecules. Remember the formula for oxygen is  $O_2$ . You should have no remaining atoms or bonds.
3. Pretend glucose and six oxygen molecules are flowing through the blood next to your cell.
4. Have them enter the cell. Once they meet, pull apart the molecule bonds quickly and vigorously to show energy being released. **ENERGY! ENERGY! ENERGY!** Be careful not to break off the stubs from the atoms.
5. Now, since matter can be neither created nor destroyed, take all of these atoms and convert them into new molecules. Make six  $CO_2$  molecules and six  $H_2O$  molecules.
6. Carbon dioxide and water are considered waste products to the cell, so the cell gets rid of them. Place the carbon dioxide and water molecules into the bloodstream and move them away from the cell.  
What would happen to these waste molecules next?

## Building your conclusions:

A very complex set of chemical reactions is going on in cells that release the stored energy from glucose. Oxygen is needed to make these reactions occur, and carbon dioxide (and also water) is what's left after the reactions occur. To simplify these reactions, scientists write one equation:



What this looks like in the cell is this:



The glucose and oxygen molecules react, and the stored energy is released. The chemical reaction produces water and carbon dioxide, which leave the cell.

This process that cells use to get energy from food is called **cellular respiration**. It is the reason why you can't live more than a few minutes if you stop breathing. If cells can't get oxygen, they can't get the energy out of food, and they die very quickly. What would happen to you if your brain cells couldn't get oxygen?

What's the difference between a burning a marshmallow and a marshmallow being used inside your cells?

Cellular respiration is very similar to the process of producing energy in the form of heat and light when you burn a marshmallow.

- both require oxygen
- both released energy stored in the molecule bonds
- both create thermal energy (heat energy)
- both produce carbon dioxide
- both produce water (**breathe into your cupped hands for 30 seconds to see**)

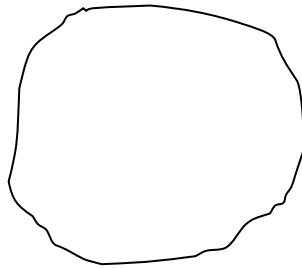
There is a difference though: your body cannot burn food with a flame, and it doesn't need or produce light energy either. But it does need and produce heat energy which is used to keep your body warm -- much warmer (usually) than the surrounding temperature of the air.

Also, burning a marshmallow provides too much energy too fast. Your body needs energy all the time in much smaller, controlled amounts. How does it do this? How does cellular respiration release small amounts of energy? It does it by using only small amounts of glucose and oxygen, and by storing the energy released in molecules called **ATP**. Each of the ATP molecules can store the energy from glucose in very small usable quantities -- unlike a candle, which burns quickly and releases energy quickly. These energy-rich ATP molecules travel all over the cell, supplying energy wherever and whenever needed. Perhaps it is used for motion in muscle cells, for light in the light-producing cells of the firefly, or for electrical signals in brain cells.

# CELL RESPIRATION LAB

NAME \_\_\_\_\_/30

1. What substance in the air is needed for paper, wood, or marshmallows to burn? \_\_\_\_\_
2. Where do your cells "burn" the food you give it? (in what organelle?) \_\_\_\_\_
3. \_\_\_\_\_ and \_\_\_\_\_ are produced as waste products when food is used for energy.
4. What is the chemical formula for glucose? \_\_\_\_\_
5. What is the chemical formula for oxygen? \_\_\_\_\_
6. What is the chemical formula for water? \_\_\_\_\_
7. What is the chemical formula for carbon dioxide? \_\_\_\_\_
8. Draw a picture of Cellular Respiration below. (5 points)



9. Write the full chemical equation for cellular respiration (write with letters what is happening in the cell picture) [4pts]

\_\_\_\_\_

10. What two items are needed in the cell? (2 points) \_\_\_\_\_
11. What two items leave the cell? (2 points) \_\_\_\_\_
12. How is cell respiration like burning a marshmallow? (5pts)

1 \_\_\_\_\_

2 \_\_\_\_\_

3 \_\_\_\_\_

4 \_\_\_\_\_

5 \_\_\_\_\_

13. What is the name of the molecule that stores energy so that it can be transported to other places in the cell? \_\_\_\_\_

14. Name at least 3 things that a human body might use ATP for.

1 \_\_\_\_\_

2 \_\_\_\_\_

3 \_\_\_\_\_

