

Advisement Teacher & Room # \_\_\_\_\_

Student Name \_\_\_\_\_ Tutor: \_\_\_\_\_

## Biology Tutorial #9

Biology Teacher's Name \_\_\_\_\_ Period \_\_\_\_\_

CA State Standard 1g – Students know the role of the mitochondria in making stored chemical-bond' energy available to cells by completing the breakdown of glucose to carbon dioxide.

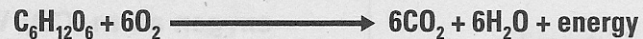
### HOW IS THE ENERGY REMOVED FROM FOOD?

All living things must either make their own food through photosynthesis or take food in from the environment. Molecules, carbohydrates, lipids, or proteins in food must be broken down to make a molecule called adenosine triphosphate (ATP), which transfers energy that can be used for cell processes.

During cellular respiration,

**sugar + oxygen** → **carbon dioxide + water + energy**

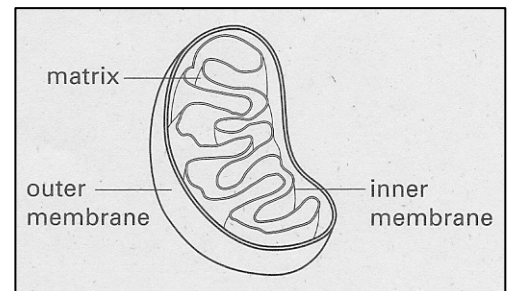
The chemical equation for cellular respiration is:



In a eukaryotic cell, organelles called mitochondria use oxygen (O<sub>2</sub>) to produce most of the cell's ATP through a process called **cellular respiration**.

### WHAT IS THE STRUCTURE OF A MITOCHONDRION?

Mitochondria (singular *mitochondrion*) are small organelles with two membranes, as shown in the diagram. To release the energy, cells first break down glucose molecules in the cytoplasm through a process called **glycolysis**. Inside the mitochondria, chemical reactions that break down carbon-based molecules take place in the matrix, or inside of a mitochondrion in a process called **Cellular Respiration**. Proteins and enzymes in the inner mitochondrial membrane are responsible for most of the ATP production in the mitochondria.



### HOW IS ATP PRODUCED?

Although fats and proteins can be broken down to make ATP, a simple sugar called glucose is most commonly broken down to make ATP. In the cytoplasm of a cell, a six-carbon glucose molecule is broken down into two three-carbon molecules (glycolysis) before it can enter the mitochondrion.

These molecules are transported into the **matrix** of a mitochondrion. In the matrix a series of reactions called the **Krebs cycle** breaks down the three-carbon molecules. The Krebs cycle produces a small number of ATP, other energy-carrying molecules, and carbon dioxide (CO<sub>2</sub>), which is released as a waste product.

In the second part of cellular respiration, energy from the energy-carrying molecules is transferred along proteins in the **inner mitochondrial membrane** where it is used to **make many more ATP** molecules. In this stage of cellular respiration, oxygen is needed to pick up electrons that are transferred along the inner membrane. During this stage, water (H<sub>2</sub>O) is released as a waste product.

Overall, **cellular respiration**, uses (1) glucose molecule and (6) O<sub>2</sub> molecules. It produces (6) CO<sub>2</sub> and (6) H<sub>2</sub>O molecules as waste, along with as many as 38 ATP molecules that can be used for cell processes and other metabolic activities.

Answer the following questions:

1. What is the function of cellular respiration?

2. Describe the structure of a mitochondrion:

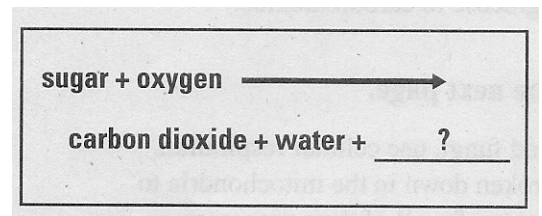
3. What is the waste product that is produced in the matrix of the mitochondrion?

4. In which part of the mitochondrion is the majority of ATP made?

5. Complete the analogy below, make up your own, to help you remember the function of mitochondria. "Mitochondria are like car engines, and CO<sub>2</sub> and H<sub>2</sub>O are like car exhaust because..."

6. The diagram on the right describes the process of cellular respiration. During this process, cells use sugar and oxygen to form carbon dioxide and water, and to produce a usable form of energy. What is the missing product in the equation? →

- A) mitochondria
- B) ATP
- C) sugar
- D) sunlight



7. Mitochondria are often called the cell's powerhouses because mitochondria

- A) release energy from sugars
- B) pump oxygen around the cell.
- C) distribute electricity.
- D) direct the movement of the cell.

8. During cellular respiration, a series of chemical reactions produces which of the following molecules as a waste product?

- A) proteins
- B) carbon dioxide
- C) ATP
- D) oxygen

9. The heart is a muscle that pumps blood throughout the body. In order to perform its function, the heart requires a lot of energy. Which of the following would the heart need the *most* of in order to get the energy it needs to pump blood throughout the body?

- A) lysosomes
- B) mitochondria
- C) DNA
- D) endoplasmic reticulum

10. Carbon monoxide is a gas that has one carbon atom bonded with one oxygen atom (CO). When inhaled, carbon monoxide is deadly because it prevents red blood cells from carrying oxygen to other cells in the body. Without oxygen, cells cannot undergo

- A) cellular respiration.
- B) photosynthesis.
- C) DNA replication.
- D) passive transport.