

## 9.1 Cellular Respiration: An Overview

### Lesson Objectives

- ▶ Explain where organisms get the energy they need for life processes.
- ▶ Define cellular respiration.
- ▶ Compare photosynthesis and cellular respiration.

### Lesson Summary

**Chemical Energy and Food** Chemical energy is stored in food molecules.

- ▶ Energy is released when chemical bonds in food molecules are broken.
- ▶ Energy is measured in a unit called a **calorie**, the amount of energy needed to raise the temperature of 1 gram of water 1 degree Celsius.
- ▶ Fats store more energy per gram than do carbohydrates and proteins.

**Overview of Cellular Respiration** Cellular respiration is the process that releases energy from food in the presence of oxygen.

- ▶ Cellular respiration captures the energy from food in three main stages:
  - glycolysis
  - the Krebs cycle
  - the electron transport chain
- ▶ Glycolysis does not require oxygen. The Krebs cycle and electron transport chain both require oxygen.
  - **Aerobic** pathways are processes that require oxygen.
  - **Anaerobic** pathways are processes that occur without oxygen.

**Comparing Photosynthesis and Cellular Respiration** The energy in photosynthesis and cellular respiration flows in opposite directions. Their equations are the reverse of each other.

- ▶ Photosynthesis removes carbon dioxide from the atmosphere, and cellular respiration puts it back.
- ▶ Photosynthesis releases oxygen into the atmosphere, and cellular respiration uses oxygen to release energy from food.

### Chemical Energy and Food

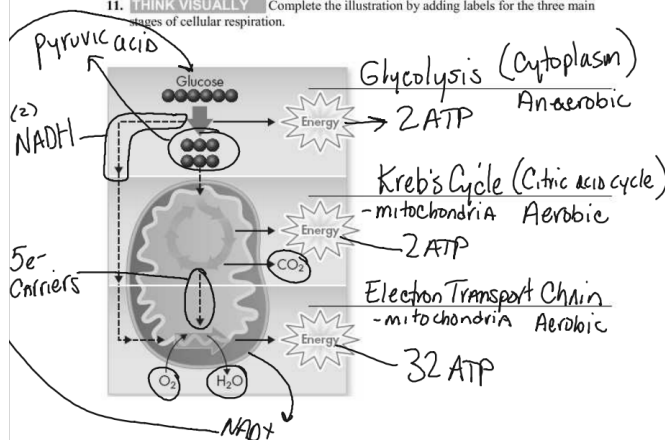
For Questions 1–4, complete each statement by writing the correct word or words.

1. A calorie is a unit of ENERGY.
2. The Calorie used on food labels is equal to 1,000 calories.
3. A Calorie is also referred to as a Kilocalorie.
4. Cells use the energy stored in chemical bonds of foods to produce compounds that directly power the cell's activities, such as \_\_\_\_\_.

## Overview of Cellular Respiration

For Questions 5–10, complete each statement by writing the correct word or words.

5. The equation that summarizes cellular respiration, using chemical formulas, is  $6\text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Energy (ATP)}$
6. If cellular respiration took place in just one step, most of the Energy would be lost in the form of light and heat.
7. Cellular respiration begins with a pathway called glycolysis, which takes place in the Cytoplasm of the cell.
8. At the end of glycolysis, about 90 percent of the chemical energy is locked in the bonds of the pyruvic molecule.
9. Cellular respiration continues in the mitochondria of the cell with the Krebs Cycle and electron transport chain.
10. The pathways of cellular respiration that require oxygen are said to be Aerobic. Pathways that do not require oxygen are said to be AnAerobic.
11. **THINK VISUALLY** Complete the illustration by adding labels for the three main stages of cellular respiration.



### Comparing Photosynthesis and Cellular Respiration

For Questions 12–15, write True if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

F opposite 12. The energy flow in photosynthesis and cellular respiration occurs in the same direction.

T 13. Photosynthesis deposits energy in Earth's "savings account" for living organisms.

F O<sub>2</sub> 14. Cellular respiration removes carbon dioxide from the air.

F Cellular respiration 15. Photosynthesis takes place in nearly all life.

16. Complete the table comparing photosynthesis and cellular respiration.

A Comparison of Photosynthesis and Cellular Respiration		
Aspect	Photosynthesis	Cellular Respiration
Function	energy capture - <u>MAKE SUGAR (FOOD)</u>	<u>releasing energy</u> +/or using
Location of reactions	chloroplasts ( <u>Chlorophyll</u> )	<u>mitochondria + cytoplasm</u>
Reactants	<u>SUN</u> + CO <sub>2</sub> + H <sub>2</sub> O	O <sub>2</sub> + C <sub>6</sub> H <sub>12</sub> O <sub>6</sub>
Products	O <sub>2</sub> + C <sub>6</sub> H <sub>12</sub> O <sub>6</sub>	CO <sub>2</sub> + H <sub>2</sub> O + ATP

#### Apply the Big idea

17. How does an understanding of the process of cellular respiration support the theory that the cell is the basic functional unit of life?

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