Lesson Self-Check

CAN YOU EXPLAIN IT?

FIGURE 15: Because ethanol burns more cleanly than gasoline, it is added to gasoline to help reduce the emission of greenhouse gases produced by combustion engines in cars. Like gasoline, ethanol contains energy in its chemical bonds that can be released by the process of combustion.

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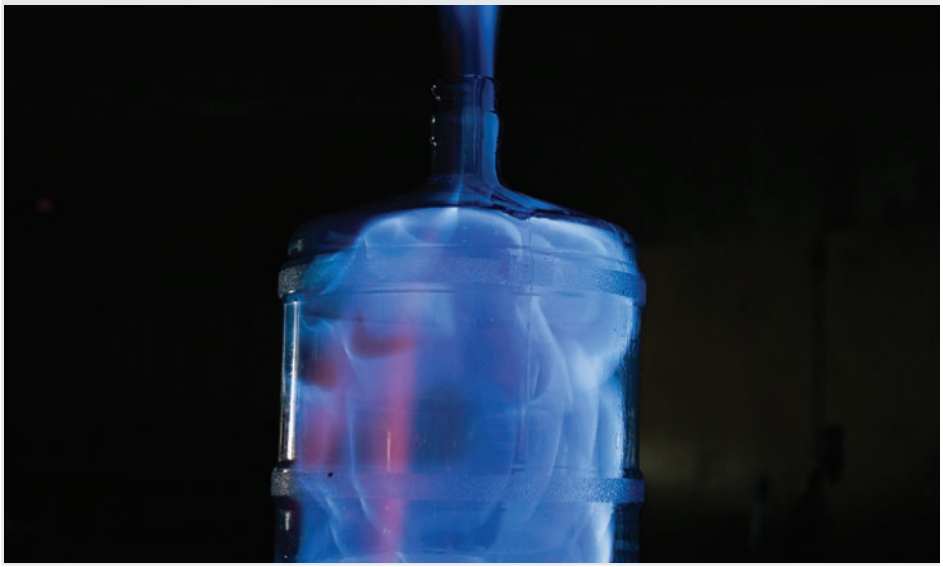

Combustion and cellular respiration are both exothermic reactions that result in the release of energy. The energy is released when chemical bonds that store energy are broken. Combustion is a fast process that results in the production of energy in the forms of heat and light.

$$CH_3CH_2OH + O_2 \longrightarrow \longrightarrow \longrightarrow 2CO_2 + 3H_2O + \text{heat}$$

In contrast, cellular respiration is a slow process, with energy being released over a series of several steps. This makes energy available for use whenever cells of the body need it to carry out cellular activities.

$$C_6H_{12}O_6 + 6O_2 \longrightarrow \longrightarrow \longrightarrow 6CO_2 + 6H_2O + \text{heat} + ATP$$

Explain A scientist named Antoine Lavoisier demonstrated that cellular respiration is a combustion process. Recall that car engines use a combustion reaction to release energy. Construct an explanation for how the breakdown of fuel in a car engine compares to the breakdown of fuel in your body's cells. Answer the following questions:

1. Look carefully at the equations for both combustion and cellular respiration, and compare the inputs and outputs. How can the different inputs result in the same outputs based on what you know about chemical bonds and atoms?
2. What is missing from the process of combustion that makes it an imperfect model for cellular respiration? Explain your answer.

CHECKPOINTS

Check Your Understanding

1. How does carbon flow between photosynthesis and cellular respiration?
   - **a.** Photosynthesis produces carbon dioxide from glucose generated by the process of cellular respiration.
   - **b.** Cellular respiration produces carbon dioxide from glucose generated by the process of photosynthesis.
   - **c.** Photosynthesis produces carbon dioxide from ATP generated by the process of cellular respiration.
   - **d.** Cellular respiration produces carbon dioxide from ATP generated by the process of photosynthesis.

2. Which of the following are the main inputs, or reactants, in cellular respiration? Select all correct answers.
   - **a.** pyruvate
   - **b.** glucose
   - **c.** carbon dioxide
   - **d.** oxygen

3. Which of the following are the main outputs, or products, of cellular respiration? Select all correct answers.
   - **a.** water
   - **b.** energy
   - **c.** oxygen
   - **d.** carbon dioxide

4. Before cellular respiration, glucose must be broken down by the process of
   - **a.** photosynthesis.
   - **b.** glycolysis.
   - **c.** electron transport.
   - **d.** fermentation.

5. During which process is lactic acid formed when there is not enough oxygen present for cellular respiration to take place?
   - **a.** fermentation
   - **b.** glycolysis
   - **c.** Calvin cycle
   - **d.** Krebs cycle

6. Use the following terms to complete the statement: *ATP, cellular respiration, electron transport chain, glycolysis, Krebs cycle, photosynthesis*

   Living things require energy to grow and reproduce and to carry out different cell processes. Certain cells can capture energy from the sun through the process of _____. Through a series of reactions, that energy is transferred to organisms. Through the process of _____, the energy currency of the cell, _____, is produced. This is a three-part process, beginning with _____ in the cell cytoplasm and proceeding within the mitochondrion with the _____ and, finally, the _____.

7. How do you know that energy and matter are conserved during the process of cellular respiration? Explain.

8. Energy is transferred in several different ways during the process of cellular respiration. Give two examples of ways that energy is transferred during this process.

9. Is oxygen necessary for the production of ATP in your cells? Why or why not?

10. How are photosynthesis and cellular respiration related?

MAKE YOUR OWN STUDY GUIDE

In your Evidence Notebook, design a study guide that supports the main idea from this lesson:

Cellular respiration is a process that breaks down food molecules to release energy to fuel cellular processes in organisms.

Remember to include the following information in your study guide:

- Use examples that model main ideas.
- Record explanations for the phenomena you investigated.
- Use evidence to support your explanations. Your support can include drawings, data, graphs, laboratory conclusions, and other evidence recorded throughout the lesson.

Consider how molecules are rearranged and energy is transferred during the process of cellular respiration.