

Lesson 1 Cells and Energy

Grade Seven Science Content Standard. 1.d. Students know that mitochondria liberate energy for the work that cells do and that chloroplasts capture sunlight energy for photosynthesis. Also covers: 1.b.

MAIN Idea

Cellular respiration and photosynthesis provide energy.

What You'll Learn

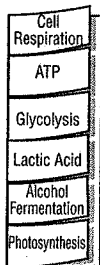
- the basic chemical reaction in photosynthesis
- the importance of pigments in photosynthesis
- the differences between photosynthesis and cellular respiration

Study Coach

Create Notes Use sticky notes to mark places in the text that you find interesting or that you have questions about. Write your comment or question on the sticky note and stick it to the page.

FOLDABLES™

C Define Make a six-tab Foldable. Label the tabs as illustrated, define the terms, and explain each as they relate to cell functions under the tabs.



● Before You Read

Plants and animals both need energy to survive. Where do you think that energy comes from? Write your ideas on the lines below. Read the lesson to learn about cellular respiration and photosynthesis.

● Read to Learn

Cellular Respiration

Most automobiles run on gasoline or diesel fuel. These fuels come from crude oil. You cannot put crude oil in a car's engine. Instead, the crude oil must be processed and refined into fuels cars can use. In the last lesson, you learned that the energy stored in food molecules is not in a form cells can use. **Cellular respiration** is a series of chemical reactions that transforms food into a usable form of energy. The usable energy is in molecules of **ATP**—adenosine triphosphate (uh DEN uh seen • tri FAHS fayt).

What are the reactions in the cytoplasm?

Cellular respiration happens in three steps. The first step is called **glycolysis** (gli KAH lih sis). Glycolysis takes place in a cell's cytoplasm. During glycolysis a glucose molecule is broken down into two smaller molecules. The glucose molecule is a type of sugar. Energy is needed to fuel the chemical reactions of glycolysis. The process releases electrons that are used in the last step of cellular respiration.

What is produced during cellular respiration?

The second stage of cellular respiration happens in mitochondria. This step uses the smaller molecules produced by glycolysis. The smaller molecules are broken down into molecules of carbon dioxide. More electrons are released.

The third step of cellular respiration requires oxygen. This step uses the electrons that were released in the first two steps to produce large amounts of ATP—usable energy—and water—a waste product.

What is lactic acid fermentation?

When a person exercises, his or her muscles use lots of oxygen. As a result, the muscle cells might not have enough oxygen to produce energy through cellular respiration. Instead, the cells release energy through a process called lactic acid **fermentation**. ✓

Lactic acid fermentation begins and ends in the cytoplasm. It does not involve mitochondria or use oxygen. It uses glucose and produces lactic acid, carbon dioxide, and some ATP molecules. However it does not produce as much ATP as cellular respiration does. Cheese and yogurt are made using fungi and bacteria that perform lactic acid fermentation.

What is alcohol fermentation?

Another type of fermentation that releases energy is alcohol fermentation. The process is similar to lactic acid fermentation except it produces ethanol (a kind of alcohol) instead of lactic acid. Like lactic acid fermentation, alcohol fermentation creates carbon dioxide and a couple of ATP molecules. Cellular respiration, lactic acid fermentation, and alcohol fermentation are necessary for life to continue. All three processes produce ATP. The table below compares the three processes.

Processes that Release Cellular Energy			
Process	Oxygen Required	Number of ATP Molecules Available to a Cell	Waste Products
Cellular respiration	Yes	36	water, carbon dioxide
Lactic acid fermentation	No	2	lactic acid, carbon dioxide
Alcoholic fermentation	No	2	alcohol, carbon dioxide

✓ Reading Check

- 1. Generalize** When do cells use lactic acid fermentation?

Picture This

- 2. Identify** What are three waste products created during fermentation?

 **Reading Check**

3. Identify What is the source of energy for organisms that make their own food?

Academic Vocabulary series (SIH reez) (noun) a number of things coming together one after another




Think it Over

4. Synthesize Name two reasons that photosynthesis is important to life on Earth.

Photosynthesis

Some organisms, such as humans, get energy from the food they eat. Other organisms make their own food by using energy from the Sun or other light sources.

Photosynthesis (foh toh SIHN thuh sus) is a series of chemical reactions that makes food in these organisms. 

Why are leaves green?

Plants contain pigments that reflect and absorb light. Chlorophyll (KLOR uh fihl) is a green pigment. Most leaves appear green because they contain more chlorophyll than any other pigment. Some leaves change color in the fall. This happens when the plant stops producing chlorophyll, allowing light to be reflected by different pigments in leaves.

What happens in chloroplasts?

Chlorophyll and other pigments absorb energy from sunlight. The energy is used in a series of chemical reactions called photosynthesis. Photosynthesis takes place in the chloroplasts. It is a process in which light energy, water, and carbon dioxide are used to make sugars. Photosynthesis also produces oxygen, which is released into the atmosphere.

Why is photosynthesis important?

The fruits and vegetables we eat grow because of photosynthesis. Photosynthesis supplies Earth's atmosphere with oxygen, which we must have for our cells to perform cellular respiration. The carbon dioxide produced by organisms during cellular respiration would become toxic if it were not used in photosynthesis.

What have you learned about cells and energy?

Cellular respiration changes unusable energy in food molecules into usable energy. The usable energy is in the form of ATP molecules. Two processes that produce ATP without oxygen are lactic acid fermentation and alcohol fermentation.

Light energy fuels photosynthesis. Organisms that perform photosynthesis have pigments that take in the light energy. Most organisms depend on photosynthesis.