

CONCEPT 4

# Solar energy enters the biosphere through photosynthesis and cellular respiration.

## Activity

### KWL Chart

Use a KWL chart to organize the ideas you have about photosynthesis and cellular respiration. Which organisms carry out each process, and for what purpose? How are the processes complementary? Record answers to these questions and anything else you know or want to know about photosynthesis and cellular respiration. After you finish Concept 4, fill in the “What I Learned” column of your chart.



**T**he Sun is the direct source of energy for almost all living things on Earth. Green plants and single-celled plant-like organisms use the Sun’s energy to make their own food. To do so, they carry out photosynthesis, in which they transform light energy into chemical energy. The chemical energy is stored in energy-rich food compounds such as glucose, which is a type of sugar. All living things need the chemical energy stored in glucose to live. Most living things use cellular respiration to break apart these compounds to release their stored energy. Once released, it can be used for life functions. **Table 4.4**, which runs across the bottom of these two pages, summarizes details about photosynthesis and cellular respiration.

**Table 4.4 Comparing Photosynthesis and Cellular Respiration**

	Photosynthesis
1. What is it?	A series of chemical changes in which green plants capture the Sun’s light energy and transform it into chemical energy that is stored in energy-rich food compounds such as sugars
2. Which living things use it?	Green plants and certain kinds of single-celled organisms
3. How is energy changed?	Light energy is changed to chemical energy
4. What substances does it use?	<ul style="list-style-type: none"> <li>• carbon dioxide (CO<sub>2</sub>)</li> <li>• water (H<sub>2</sub>O)</li> </ul>
5. What substances does it produce?	<ul style="list-style-type: none"> <li>• glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)</li> <li>• oxygen (O<sub>2</sub>)</li> </ul>
6. How can it be represented?	light energy + carbon dioxide + water → glucose + oxygen light energy from the Sun + CO <sub>2</sub> + H <sub>2</sub> O → C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> + O <sub>2</sub>
7. Why is it important?	<ul style="list-style-type: none"> <li>• Photosynthesis transforms the Sun’s energy into a form that living things can use to survive</li> <li>• Photosynthesis produces the oxygen that most living things need to survive</li> </ul>



## Photosynthesis and Cellular Respiration Balance Each Other

Notice in **Table 4.4** that photosynthesis and cellular respiration are complementary processes—they balance each other.

- Photosynthesis stores energy. Cellular respiration releases energy.
- Photosynthesis uses carbon dioxide and water, and produces glucose and oxygen.
- Cellular respiration uses glucose and oxygen, and produces carbon dioxide and water.

So each process makes the raw materials that the other process needs to store energy or to release energy. In this way, each process sustains the other. Together, both processes sustain life.

### Activity

#### The Sun and Earth's Spheres

Using a mind map, show how the Sun's energy affects each of Earth's spheres. Think about how the spheres interact as a result of the Sun's energy and represent those interactions in your final product as well.

### Before you leave this page . . .

1. What forms of energy are transformed during photosynthesis and cellular respiration?
2. Which substances are used and produced by photosynthesis and by cellular respiration?

Cellular Respiration	
A series of chemical changes that let living things release the energy stored in energy-rich food compounds such as sugars to fuel all life functions	1. What is it?
Nearly all living things on Earth	2. Which living things use it?
Chemical energy is changed to other forms of energy such as kinetic (motion) energy and heat	3. How is energy changed?
<ul style="list-style-type: none"> <li>• glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)</li> <li>• oxygen (O<sub>2</sub>)</li> </ul>	4. What substances does it use?
<ul style="list-style-type: none"> <li>• carbon dioxide (CO<sub>2</sub>)</li> <li>• water (H<sub>2</sub>O)</li> </ul>	5. What substances does it produce?
glucose + oxygen → carbon dioxide + water + usable energy $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O + \text{usable energy}$	6. How can it be represented?
<ul style="list-style-type: none"> <li>• Cellular respiration releases the energy that living things use to survive</li> <li>• Cellular respiration produces the carbon dioxide that green plants need to carry out photosynthesis</li> </ul>	7. Why is it important?