Lesson 3: A Closer Look at Photosynthesis

Introduction

In the last lesson, you explored how the plant uses carbon dioxide and water as the inputs of matter in the chemical reactions of photosynthesis to produce glucose and oxygen. In this lesson, you will take a closer look at the role of energy in the chemical reactions of photosynthesis.

Lesson Question

Process and Procedure

1. Write your best ideas about the lesson focus question in the space below. Leave space to revise your ideas as you learn throughout this lesson. As you have new ideas, record them in a different color.

Energy Transfer in Photosynthesis

2. In the leaf disk investigation, you placed the solution with submerged leaf disks under a light source. As a result of photosynthesis, oxygen was produced, and the leaf disks floated to the surface of the solution. What is the role of light energy in the chemical reactions of photosynthesis?

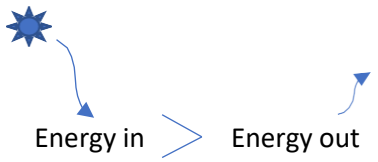
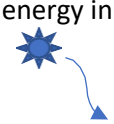
   To think more about energy in photosynthesis, read the science ideas in the left column of the table below. In the right column, draw a labeled diagram that represents that idea.

Energy in Photosynthesis

Science Idea	Labeled Drawing of the Idea
A chemical reaction involves breaking the bonds between the atoms of the reactant (input) molecules and forming new bonds between those atoms to create product (output) molecules.	
Photosynthesis is a chemical reaction. The reactant (input) molecules are carbon dioxide and water. The product (output) molecules are glucose and oxygen.	
During photosynthesis, absorption of light energy is required to break the bonds between the atoms of the reactant molecules (carbon dioxide and water).	
During photosynthesis, energy is released when atoms bond to form the product molecules (glucose and oxygen).	
In photosynthesis the amount of energy required to break the bonds of the reactant molecules (CO_2 and H_2O) is ***greater than*** the amount of energy released when the product molecules ($C_6H_{12}O_6$ and O_2) form. Therefore, the chemical reaction of photosynthesis requires a NET INPUT of energy.	
In photosynthesis, the light energy that is absorbed is transformed into stored chemical energy.	

3. Now that you have drawn representations of the statements above, cut out and sort the card set provided by your teacher and tape the appropriate card beside each statement. Compare your representation to the card and discuss with a partner. Your representation may not be exactly the same, but does it reflect the same idea as that on the card? If not, reread the statement together to clarify your understanding.

Energy in Photosynthesis Card Sort


Chemical reaction: reactants (inputs) ⟶ products (outputs)
Carbon, oxygen, hydrogen atoms ⟶ glucose, oxygen + energy out
Photosynthesis: Carbon dioxide + water ⟶ glucose + oxygen
 transforms to chemical energy (stored)
energy in  Carbon dioxide + water molecules break apart into carbon atoms, oxygen atoms, hydrogen atoms

4. We have seen that photosynthesis requires an input of light energy to power the chemical reactions. Does the type or intensity of light energy affect the rate of the photosynthesis reactions? To explore this question, you will use the leaf disk procedure from lesson 2.

   Your teacher will show you the materials available to change either the quality or intensity of light energy. After considering the materials available, discuss possible questions you could test with your group and complete the table below. Put a star next to the question your group would most like to test.

Question to test	**How we will collect evidence to answer the question**

5. After your teacher approves your question and procedure, set up your investigation and record your data in the table below. Include the data your teacher provides from leaf disks placed in the dark with no light.

Time / **Variable**	**2 min**	**4 min**	**6 min**	**8 min**	**10 min**	**12 min**	**14 min**	**16 min**	**18 min**	**20 min**
No light										

6. Graph your data. Be sure to label the axes and include a key identifying each variable.

7. Recall what you learned about how to write a scientific explanation in the Study of Changes in Populations unit. Working as a group, use the Explanation Tool on the next page to write a scientific explanation that answers the question you investigated.
   1) Begin by writing the question.
   2) Then add evidence from the data and observations you collected.
   3) Then add science ideas. These science ideas will help you justify why your evidence supports your claim.
   4) Write your claim in complete sentences.
   5) Write your explanation.

   Make sure that each member of the group has a complete explanation to share.

Explanation Tool

Question	
Evidence from data and observations (e.g., patterns or trends specific to your investigation)	**Science ideas and concepts (e.g., patterns or trends that are generalizable across many situations; may include science vocabulary).**
Claim (Your claim should answer the question.)	
Scientific Explanation (Be sure to Include the claim, evidence, and reasoning in your explanation. Reasoning includes science concepts and linking words used to connect your ideas in the paragraph.)	

Synthesize and Summarize Ideas

8. Add your ideas about energy transfer to your model of the terrarium plant system. Add labels to help others understand your model.

9. Reread your initial response to the lesson focus question. Consider the ideas from the activities you completed. If you would like to add to or revise your ideas, do so in a different color.

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