Photosynthesis Lab

Photosynthesis and Carbon Dioxide Consumption

Photosynthesis is the process by which plants take carbon dioxide from the atmosphere, add water, and use the energy of sunlight to produce sugar and oxygen.

Write the equation for photosynthesis here:

Photosynthesis occurs in the __________________, an organelle in plant cells that contains the molecule ____________________. Chlorophyll absorbs the energy of sunlight. That light energy is converted to chemical energy through the process of photosynthesis.

In this lab, you will use a solution called bromothymol blue to determine if the aquatic plant Elodea uses CO₂ (carbon dioxide) and sunlight to perform photosynthesis. Bromothymol Blue is an indicator solution that appears blue in water but turns green or yellow in the presence of CO₂.

Write a hypothesis about what will happen to CO₂ levels in a solution if a plant in that solution is performing photosynthesis:

If ________________________________,
then ________________________________.

Materials

| 2 test tubes | Water | Crayons |
| 2 sprigs of Elodea | 1 Erlenmeyer flask | 1 funnel |
| 5 mL Bromothymol Blue | 1 Graduated cylinder | Goggles |
| Dry-erase marker | 1 straw |

Safety Precautions

Procedure

1. Put on a pair of safety goggles. Use the dry-erase marker to label your test tubes with your group number (found on the side of your blue tub). Also label one of the test tubes “D” for “dark” and the other one “L” for “light”. For example, if your group’s number is “5”, label your test tubes D5 and L5.
2. Using the graduated cylinder, measure out 5 mL of bromothymol blue solution. The solution is in the squirt bottle on the front lab table.

* CAUTION: BROMOTHYMOL BLUE IS MILDLY TOXIC AND WILL STAIN YOUR SKIN AND CLOTHES. BE CAREFUL! *

3. Pour the 5 mL of Bromothymol Blue (BRB) solution into the Erlenmeyer flask. Use the funnel if necessary.

4. Using the graduated cylinder, measure out 20 mL of water. Add the water to the Erlenmeyer flask. Use the funnel if necessary.

5. Choose the crayon that most closely matches the color of the BRB/water solution and use it to color in this circle:

6. Choose one person to blow into the BRB/water solution with a straw. BE SURE TO BLOW GENTLY, AND DO NOT SUCK IN THROUGH THE STRAW! Blow into the solution until it changes color.

7. Choose the crayon that most closely matches the color of the BRB/water solution now and use it to color in this circle:

8. Pour $\frac{1}{2}$ of the BRB/water solution into each test tube.

9. Put one sprig of elodea into each test tube. Use the straw to push the elodea down into the liquid. Place the straw in the trash when you are finished.

10. Put the test tube labeled “dark” in the cabinet in the back of the room. Put the test tube labeled “light” under the grow light.

*STOP HERE and complete the “Yeast Balloons” lab while you wait to see what happens.*

11. After you have completed the “Yeast Balloons” lab, find your group’s test tubes and take them back to your table. Choose the crayon that most closely matches the color of the BRB/water solution in each test tube and use it to color in the circles below:

“Dark”  “Light”
1. What is photosynthesis?
__________________________________________________________________
__________________________________________________________________

2. What “ingredients” do you need for photosynthesis?
__________________________________________________________________
__________________________________________________________________

3. What are the products of photosynthesis?
__________________________________________________________________
__________________________________________________________________

4. Write the equation for photosynthesis here:

5. Why did you blow air into the BRB/water solution?
__________________________________________________________________

6. Did the Elodea sprig that was placed under the light source perform photosynthesis?
__________

How do you know? ____________________________________________________________________
__________________________________________________________________
7. Did the Elodea sprig that was placed in the dark perform photosynthesis? ________

How do you know? _____________________________________________________________

8. Re-write your original hypothesis here:

If ________________________________________________________________,
then ________________________________________________________________

If your hypothesis was incorrect, write a new hypothesis here:

If ________________________________________________________________,
then ________________________________________________________________

9. If you had not blown air into the BRB/water solution, would either of the Elodea sprigs have performed photosynthesis? ________________

Why or why not?

_________________________________________________________________________

_________________________________________________________________________
In this lab, you will observe yeast as it reacts with sugar and water. Yeast is a type of fungus that is used in baking to make bread “rise”. Since yeast is not a plant, algae, or bacteria, it cannot perform photosynthesis. Before you do this experiment, you need to answer a few questions.

1. What is cellular respiration?
   ____________________________________________________________
   ____________________________________________________________

2. What “ingredients” are needed for cellular respiration?
   ____________________________________________________________

3. What are the products of cellular respiration?
   ____________________________________________________________

4. Write the equation for cellular respiration here:

5. What is fermentation?
   ____________________________________________________________

6. What are the “ingredients” needed for fermentation?
   ____________________________________________________________

7. What are the products of fermentation?
   ____________________________________________________________

8. Write a hypothesis about what will happen to CO₂ levels in a solution if an organism in that solution is performing cellular respiration or fermentation:
   If ____________________________________________________________,
   then ________________________________________________________.
After everyone in your group has answered the above questions, raise your hand and ask a teacher to check your answers. After your answers have been approved, read and follow the lab procedures below.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Safety Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Beaker</td>
<td>Hot water</td>
</tr>
<tr>
<td>1 Plastic spoon</td>
<td>1 Erlenmeyer flask</td>
</tr>
<tr>
<td>Sugar</td>
<td>1 funnel</td>
</tr>
<tr>
<td>Yeast</td>
<td>1 Balloon</td>
</tr>
</tbody>
</table>

1. Stretch out the balloon by pulling it with your hands, and then set it aside.
2. Fill the beaker with 100 mL of hot water from the sink.
3. Add one spoonful of yeast and two spoonfuls of sugar to the water and stir until the yeast and sugar dissolve.
4. Pour the mixture into the flask, using the funnel if necessary.
5. Stretch the mouth of the balloon over the top of the flask and set it aside.

* While you are waiting to see what happens to the balloon, answer questions 1-5 on the "Photosynthesis Lab Analysis" paper.*

6. Check your balloon. Have there been any changes? Write your observations here:

________________________________________________________________________

________________________________________________________________________

* Clean-up: Take your flask to one of the sinks in the back of the room. Hold the flask at the bottom of the sink and carefully remove the balloon. Place the balloon in the trash. Rinse the flask, beaker, and spoon with warm water and dry them. Also rinse and dry the glassware from the Photosynthesis Lab and put everything back in your blue tub.*
1. What happened to the balloon? Write a detailed explanation below, including the name of the process involved, the ingredients used, and the product(s).

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

2. Why is yeast used in baking bread (hint - use your textbook as a resource if you're not sure)?

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

After you have answered the above questions, get your group's test tubes from the "Photosynthesis Lab" and bring them back to your table. Answer question #11 on the "Photosynthesis Lab" paper. When you are finished observing your test tubes, carefully place them in the designated tub to be cleaned.

*Answer the remaining questions on the "Photosynthesis Lab Analysis" paper. If you finish answering all of the questions from both labs, turn your papers in. If you do not finish the questions today, complete them for homework. They should be ready to turn in at the beginning of our next class period.*