NAME _____

DATE _____

Introduction to Photosynthesis Using *Coleus* Plants

Photosynthesis is the process through which a green plant converts carbon dioxide and water into glucose, a simple carbohydrate. Glucose molecules may then be linked together to form starch as a food storage product for the plant. Starch formation often occurs in the same plant tissues in which photosynthesis occurs. In this investigation, you will use an iodine reaction to test for the presence of starch in *Coleus* leaves that have been exposed to either light or darkness, and you will draw conclusions about photosynthesis.

Exposure to Sunlight

1. Take your *Coleus* plant (that has at least 4–5 leaves) and place it in an area with plenty of sunlight, either by a window or in a greenhouse, for at least 24 hours. If natural light is not available, you may use a grow light.
2. Cut a full leaf from the plant and make a sagittal cut along the midvein, dividing the leaf into halves. One half will be your control leaf sample, and the other will be your test leaf sample.
3. Set the control sample aside for later comparison, and place the test sample in a petri dish for the iodine test.

Iodine Test

1. Half-fill a heat-resistant glass beaker with tap water, place it on a hot plate, and bring the water to a rolling boil.
2. Push your test leaf sample to the bottom of a heat-resistant glass test tube. Pour enough ethanol into the test tube to cover the leaf.
3. Using a heat-resistant glove or a test tube clamp, carefully lower the test tube into the beaker of boiling water. Make sure that the test tube stays upright and that the ethanol does not boil or spill out of the test tube.
4. Within 1 minute, you will see the ethanol in the test tube turn green. Boil for another minute until the leaf is white or colorless.
5. Again using the glove or clamp, carefully remove the test tube and place it in a test tube rack.
6. Using either a glass rod or forceps, carefully remove the leaf from the test tube and place the leaf in a clean petri dish.
7. Using a plastic transfer pipet, apply several drops of iodine potassium iodide to the surface area of the test leaf in the dish. Leave for 1 minute or longer.
8. With deionized water or springwater, gently rinse the leaf in the dish to remove excess iodine.
9. Place the test half-leaf next to the control and note any color differences.
10. Record data in the Observations section.

Exposure to Darkness

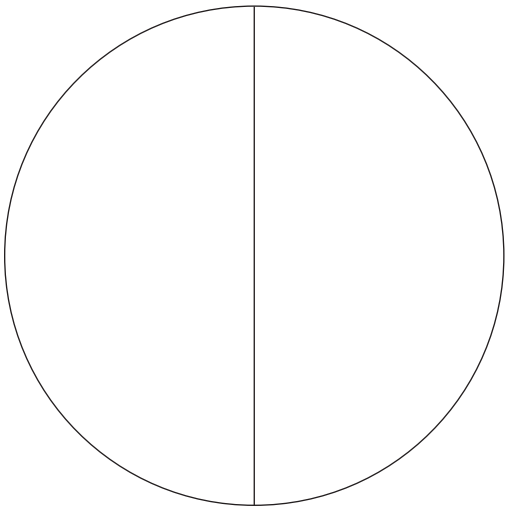
1. Place the plant with its remaining leaves on a flat surface, preferably in a dark room (devoid of artificial or natural light).
2. Place a box over the plant and make certain that no light can enter the box.
3. Leave the plant in the absence of any light for 24 hours.
4. At 24 hours, uncover the plant and quickly cut a full leaf from it before covering the plant again and returning it to darkness. In the same method used earlier, cut the leaf into left and right halves—a control sample and a test sample.
5. Place the test sample in a petri dish and perform the iodine test and record data.
6. Return the plant to darkness and keep it there for another 24 hours. Remove the plant from darkness, repeat the test process with another leaf, and record data.

Re-exposure to Sunlight

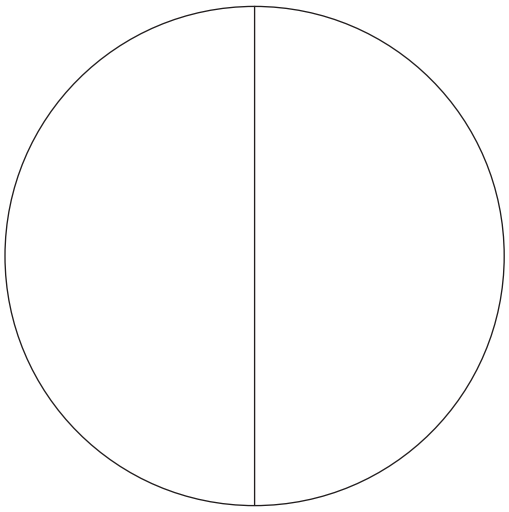
1. After performing the test of the leaf kept in the dark for 48 hours, move the plant to an area with plenty of sunlight, either by a window or in a greenhouse.
2. After the plant has been exposed to light for 12–24 hours, again collect a leaf and cut it into left and right halves. Perform the iodine test on the test sample.
3. Place the test sample next to the control sample and note any color differences.
4. Record data in the Observations section.

Observations

Examine both halves of your *Coleus* leaf—the control sample and the test sample. Make a color sketch of each and record observations about leaf color and any effects that appear to result from the light treatment. Note any color changes resulting from the iodine test, and explain any that occurred.

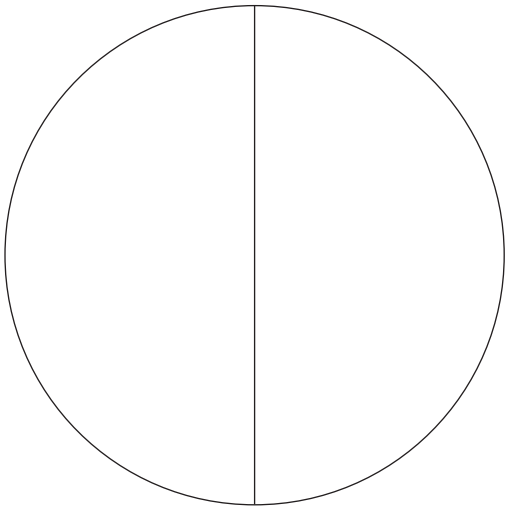


Coleus at 24 hours of exposure to sunlight



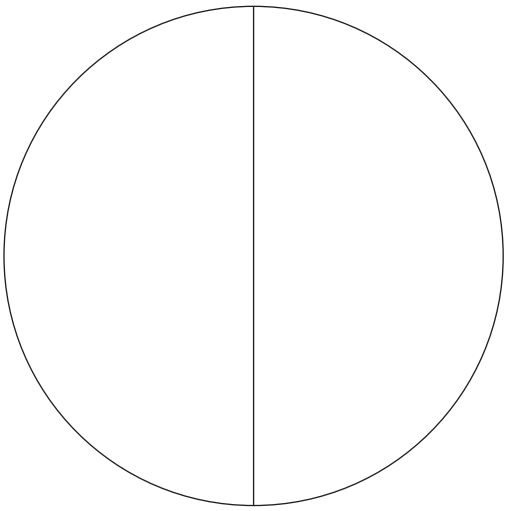
test control

Coleus at 24 hours of darkness



test control

Coleus at 48 hours of darkness



test control

Coleus at 12–24 hours of re-exposure to sunlight

Questions

1. What is photosynthesis, and what are its two main products?

2. Why is glucose important for plants?

3. What cellular organelle is the site of photosynthesis in plants?

4. What is the main photopigment of green plants?

5. What color(s) from the light spectrum does chlorophyll absorb? What color does it reflect?

6. Observe the variegated plant. Where in this plant do you think that photosynthesis is occurring? Why there?

7. How can you test for the presence of starch?

8. When the *Coleus* leaf was boiled in ethanol, the liquid turned green. Identify the green substance.

9. What part of a terrestrial plant body usually lacks chlorophyll? Why is it absent from this part?

10. When the *Coleus* ran out of stored energy (starch), as indicated by the iodine test, why did the plant not wither and die?

11. Describe how photosynthesis helps sustain life on earth.

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