

 **Activity 5.2.4 Sugar from the Sun****Purpose**

You have heard that plants produce their own food by converting water and carbon dioxide into sugar. How is this possible? What evidence can be found to prove this phenomenon?

The process plants use to convert water and carbon dioxide into glucose, a sugar, is called photosynthesis. As you learned in *Lesson 5.1 Totally Cellular*, plant cells have chloroplasts. Chloroplasts, which can be found in plant leaves, contain a substance called chlorophyll. Chlorophyll uses energy from sunlight to convert water and carbon dioxide into sugar. Without sunlight, plants cannot photosynthesize. Plants use the sugars they produce to live, grow, and reproduce. They also store extra sugars as starch.

The presence of starch can be determined by using a starch indicator solution. Iodine is a solution that reacts with starch and one type of iodine solution is Lugol's solution. When iodine and starch react, the result is a deep blue-black color. How does light exposure affect the production and storage of sugar in plants?

Materials**Per class:**

- Light-exposed plant
- Dark-exposed plant

Per group of four students:

- 600ml beaker
- 2 250ml beakers
- 150ml isopropyl alcohol
- 450ml water
- Hot plate
- Lugol's solution
- Stopwatch

Per pair of students:

- Forceps
- Petri dish
- Beaker tongs
- Pipet

Per student:

- Safety glasses
- Pencil
- *Agriscience Notebook*

Procedure**Part One – Setting Up**

Your teacher will assign you to a group of four students. Your group must first set up the equipment necessary to test for the presence of starch.

1. Wear proper personal protective equipment.
2. Place 150ml of isopropyl alcohol in one of the 250ml beakers.
3. Place 150ml water in the other 250ml beaker.
4. Place 300ml of water in the 600ml beaker.
5. Place the 250ml beaker with isopropyl alcohol inside the 600ml beaker with water.
6. Place the beakers on the hot plate and warm the water just enough to bring the alcohol to a low boil.

- **NOTE:** Alcohol has a much lower boiling point than water; do not bring the water to a boil.

- **CAUTION:** Do not expose the alcohol directly to heat.

7. While you wait for the alcohol bath to reach a boil, make your predictions in Part Two.

Part Two – Predictions

As a group, discuss what you predict will be the differences in amount of starch present in a plant exposed to light compared to a plant exposed to darkness. Write one to two sentences explaining your group's prediction in Table 1 on the student worksheet.

Part Three – Testing for the Presence of Sugar

Within the group, select a partner. Each pair within a group will conduct one test and you will share your results with the other pair in your group.

1. Once the alcohol bath reaches boiling stage, determine which pair of students within your group will test the light-exposed plant and which pair will test the dark exposed plant. Remove a leaf from the plant you are testing.
2. Use the forceps to place the leaf in the beaker of boiling alcohol for 3 minutes. If the other pair is using the alcohol, wait until they are finished.
3. Use the forceps to remove the leaf.
4. Place the leaf in the 250ml beaker with water for 30 seconds.
5. Remove the leaf from the water and place it in the petri dish.
6. Use the pipet to place 5 drops of Lugol's solution on the leaf. Swirl the dish to spread the solution. Let stand for 2 minutes.
7. Carefully pick up the leaf with the forceps and allow any remaining Lugol's solution to drip away.
8. Move the stained leaf to the other portion of the petri dish for observation.
9. When both groups are finished with the alcohol solution, remove the beakers from the hot plate and turn off the heat.

Part Four – Observations and Comparisons

1. Sketch the outline of each leaf in Table 2. Use your pencil to shade in the areas of the leaf that turned dark in color due to the reaction with the iodine solution.
2. Answer the analysis questions on the student worksheet.
3. Clean up your experiment and work area as directed by your teacher.

Conclusion

1. How does the exposure of plants to light affect their production of sugar? Use evidence from this experiment to defend your answer.

the more light the more sugar because you need light for photosynthesis to work correctly

2. Based on what you know, how would starch production be affected if a plant could not obtain water?

it would produce much slower

Name _____

Activity 5.2.4 Student Worksheet

Table 1. Predictions

the leaf that was in the sun light

Table 2. Observations

Leaf from light-exposed plant	Leaf from dark-exposed plant

Analysis Questions

- How do your results compare to your group's predictions?

We all guessed the same (i)

- How do the results of the two experiments provide evidence that plants produce sugars through photosynthesis?

The leaf that was in the light was able to make more starch out of its sugar and turn colors

- Based on what you know about photosynthesis, which plant produced more oxygen during the data collection period? The leaf that was in the sunlight