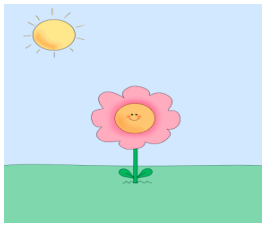


Photosynthesis Play

Lesson Concept Plants take energy from the sun and carbon dioxide from the atmosphere and convert them into sugars/nutrients and oxygen through the process of photosynthesis.

Link In the previous lesson, students learned that leaves have structures to help the plant make its own food. In this lesson, students will learn how photosynthesis uses the nutrients from the soil (water) and carbon dioxide and sunlight from the air to make sugar (food) and oxygen. In the next lesson, students explore the relationship between plants and animals in the oxygen-carbon dioxide cycle.

Time 105 minutes in two parts. Part 1 (Engage and Explore) is 45 minutes; Part II (Explain and Evaluate) is 60 minutes.

Materials

<u>Whole Class</u>

Two plants

Lamp

Box

Watering can

Large Venn diagram

Cookie

Photosynthesis diagram (R4)

<u>Groups of 9-10 students</u>

Photosynthesis reading cards (R1)

Nametags (R2)

Scripts (R3)

Yarn

Orange, blue, green, white, and yellow butcher paper

Scissors and glue

Meter stick

Tape

Stapler

<u>Individual</u>

Recording sheet (H1)

Advance Preparation

1. Cut out (R1) photosynthesis cards for each group.
2. Make a set of (R2) nametags for each group by hole-punching each card and stringing it on yarn.
3. Duplicate (R3) scripts for each group.
4. Duplicate (H1) recording sheet for each student.
5. Have butcher paper, scissors, glue, and meter sticks set out for each group to use.
6. Make a colored copy of the Photosynthesis Diagram (R4).

Procedure:

Engage ***(10 minutes) Plants need water and sunlight/light to thrive and grow.***

1. Place two plants in front of the class. Place one (plant A) under the lamp with watering can and the other (plant B) under the box (make sure to show students the plant first).
2. Distribute H1 (Recording Sheet) to each student and ask students "What is your predict on how each of these plants will grow based on their environment?"
3. Have students record their prediction in words and pictures on their lab sheet and then share with a partner about their ideas.
4. Ask several partners to share their ideas with the class. The students should predict that plant A will grow, and plant B will not because plants need sunlight (or light) and water to live.

Explore ***(35 minutes) Plants take energy from the sun, carbon dioxide from the atmosphere and water from the soil and convert them into sugars/nutrients through the process of photosynthesis.***

5. Have students compare and contrast what humans need to live and what plants need to live. Have students record their findings on their Recording Sheet and then ask them to contribute their ideas for the class Venn Diagram.

Teacher Note: one the differences should be that animals need food and plants don't. If students contribute this idea, build on it in the next steps. If they don't, the next steps will help students see this difference.

6. Show students a cookie and ask: why might this cookie be important to us and not to a plant? Conduct a discussion using their ideas about food and fuel. If needed prompt the discuss with how does a plant get its fuel?
7. Build on what the students say to introduce the process of photosynthesis.
    a. Write photosynthesis on the board. Ask if students know what "photo" means? (light); what synthesis means (to put together). So photosynthesis is a process where light helps put things together.

Teacher Note: Photosynthesis is the process by which plants use chlorophyll to convert sunlight, water and carbon dioxide into sugar and oxygen.

    b. Display R5 on the document camera to reorient the students to the structures in the leaves that help the process of photosynthesis. Refer to this drawing when writing the process in steps c-f below.
    c. Write the process of photosynthesis on the board in common terms, making sure students know that chlorophyll and sunlight are necessary for the reaction to occur: water + carbon dioxide in the presence of chlorophyll and sunlight will produce sugar and oxygen.
    d. Write the chemical formula under the "word formula." $H_2O + CO_2$ in the presence of chlorophyll and sunlight→ $C_6H_{12}O_6$ and O_2.
    e. Explain that the sugar is the plant's food/fuel.
    f. Ask students what they think happens to the oxygen and discuss their ideas.

Teacher Note: Most students will know that oxygen is released to the atmosphere to be used by animals, including humans. Many students will not know that the plant also keeps and uses some of the oxygen to make energy in a process called cellular respiration, which is discussed in the next lesson.

8. Tell the class they will now perform skits about photosynthesis.
9. Distribute the scripts (R3) and name tags (2) and other materials to each group. Ask groups to read the script, decide on parts, and create their props.
10. Allow students time to make their props. A suggestion: have students make a sun on the meter stick to raise up high.
11. Have student rehearse scripts and add their own creativity to them.

Teacher note: Don't have the student memorize the script; instead have them "perform" the play as readers' theatre.

LESSON BREAK

Explain ***(45 minutes) Plants take energy from the sun, carbon dioxide from the atmosphere and water from the soil and convert them into sugars/nutrients through the process of photosynthesis.***

12. Ask students to perform their skits.
13. After all groups have performed, ask each student to complete #4 on their Recording Sheet.
14. Ask a few students to share their answers, correcting through questioning, if necessary.

Evaluate ***(15 minutes) Plants take energy from the sun, carbon dioxide from the atmosphere and water from the soil and convert them into sugars/nutrients through the process of photosynthesis.***

15. Divide students into groups of 2-4 and give them the pre-cut photosynthesis cards
16. Ask students, as a group to read and sequence the cards based on what they learned in the play.
17. Discuss group findings as a class and order the photosynthesis cards as a class on document camera.
18. Ask students to complete this prompt in their notebook: I used to think plants _____but now I know that plants_____to make their food. I'm still wondering about_____.

H1

Name_____

Recording Sheet

1. Record your prediction about Plant A and Plant B

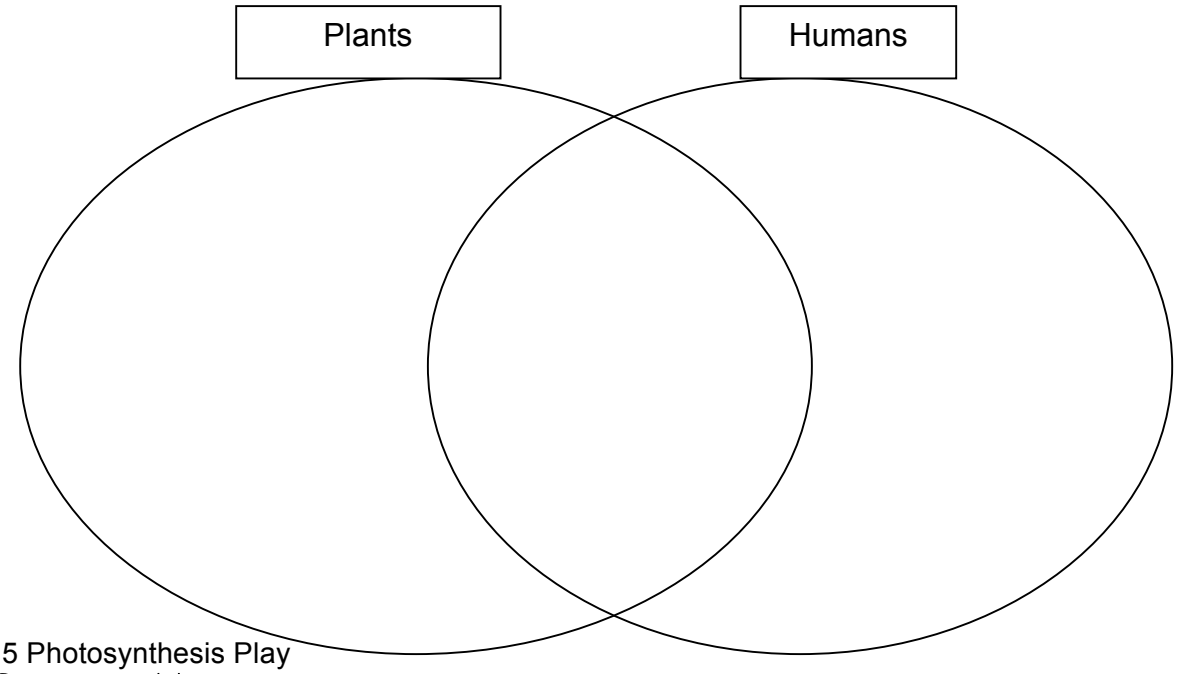
_____

_____

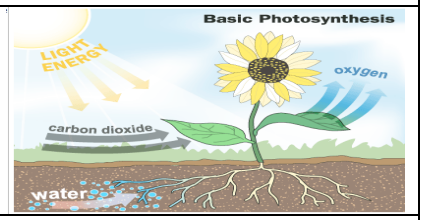
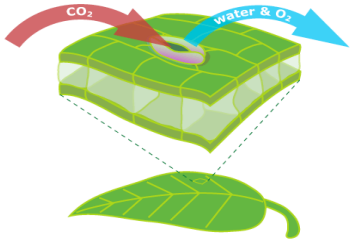
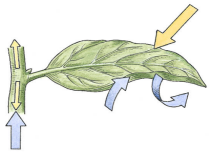
_____

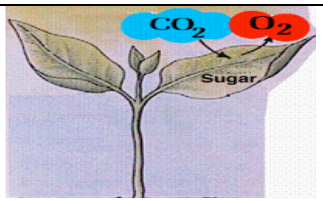
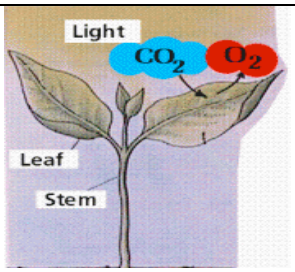
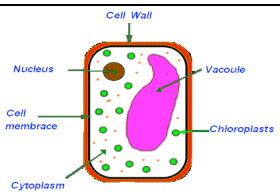
2. Illustrate your prediction.

3. Compare and contrast what humans and plants need to survive.



4. How did Norman make his lunch? Refer to your script if needed.

Photosynthesis Cards	R1
Plants make food through a process called photosynthesis.	
In this process, they use carbon dioxide (CO_2), water (H_2O), and sunlight.	
The leaves of the plants have microscopic holes, which are known as stomata. Carbon dioxide (CO_2) from the atmosphere enters the plant through these holes.	
The leaves also have chloroplasts that contain chlorophyll. These leaves act as solar panels to gather the sun's energy.	
At the same time, water (H_2O) enters the plant through their roots.	
This water (H_2O) travels all the way through the stem to reach the leaves.	
When the sunlight falls on the leaves of the plant, chlorophyll captures the energy in it, and stores it for further use.	

This energy is eventually used to convert water (H_2O) and carbon dioxide (CO_2) into sugar ($C_6H_{12}O_6$) or fuel for the plant and oxygen (O_2), which is a by-product of the reaction.	
The oxygen (O_2) is mostly released into the atmosphere through the stomata. The plant also uses some of the O_2 in its cells to make energy for the plant.	
The sugar ($C_6H_{12}O_6$) is used to feed the cells of the plant and make energy for the plant.	

Photosynthesis Play Character Cards	
Sun	**Water (H_2O)**
Plant	**Sunlight**
Oxygen (O_2)	**Carbon Dioxide (CO_2)**
Sugar ($C_6H_{12}O_6$)	**Narrator**

Photosynthesis Play

Cast of Characters:
Narrator, Sun, Sunlight, Water (H_2O), Sugar ($C_6H_{12}O_6$), Carbon Dioxide (CO_2), Oxygen (O_2), Norman the Plant

Setting:
A garden (students may pick the specific location)

Narrator: There once was a handsome plant named Norman. He was green and lush. He was a happy plant with many other plant pals. But, one day he got really hungry. (*Sun and sunlight stand together on one side of the room and Norman the plant stands on the other side of the room*.)

Norman: I am starving! My friend Bob the Human and Vanessa the Cat eat with their mouth, but do you see a mouth on this face? Nope!

Narrator: Norman sure was hungry, so he lifted his leaves towards the sun.

Sun: What a beautiful day! Let me shoot my rays of sunlight down upon the Earth.

Sunlight: Here I come! (*The sunlight moves quickly from the sun towards the plant*).

Norman: Mmmmm, sunlight, yummy! (*Sunlight high fives Norman's leaf (his hand).*

Narrator: The sunlight hits Norman's chloroplast and his lunch has begun!

Norman: I have begun to process the sunlight, but I am thirsty, too! Water come here!

Water: I will travel through your roots and up your stem. (*Water comes towards Norman's roots.*)

Norman: I have sunlight and water, now I need to suck in some carbon dioxide through my many stomata. (*Norman opens his mouth for the stomata*).

Carbon Dioxide: Here I come from the atmosphere! (*Carbon Dioxide flows towards Norman*.)

Narrator: The process of photosynthesis is almost complete! Now, the sunlight, water, and carbon dioxide need to perform chemical reactions to produce Norman's lunch. (*Water, Sunlight and Carbon Dioxide link arms and walk in a circle around Norman*.)

Norman: I am feeling a chemical reaction occurring! My lunch! My sugary lunch! (*Water, Sunlight and Carbon Dioxide sit down and out runs Sugar*.)

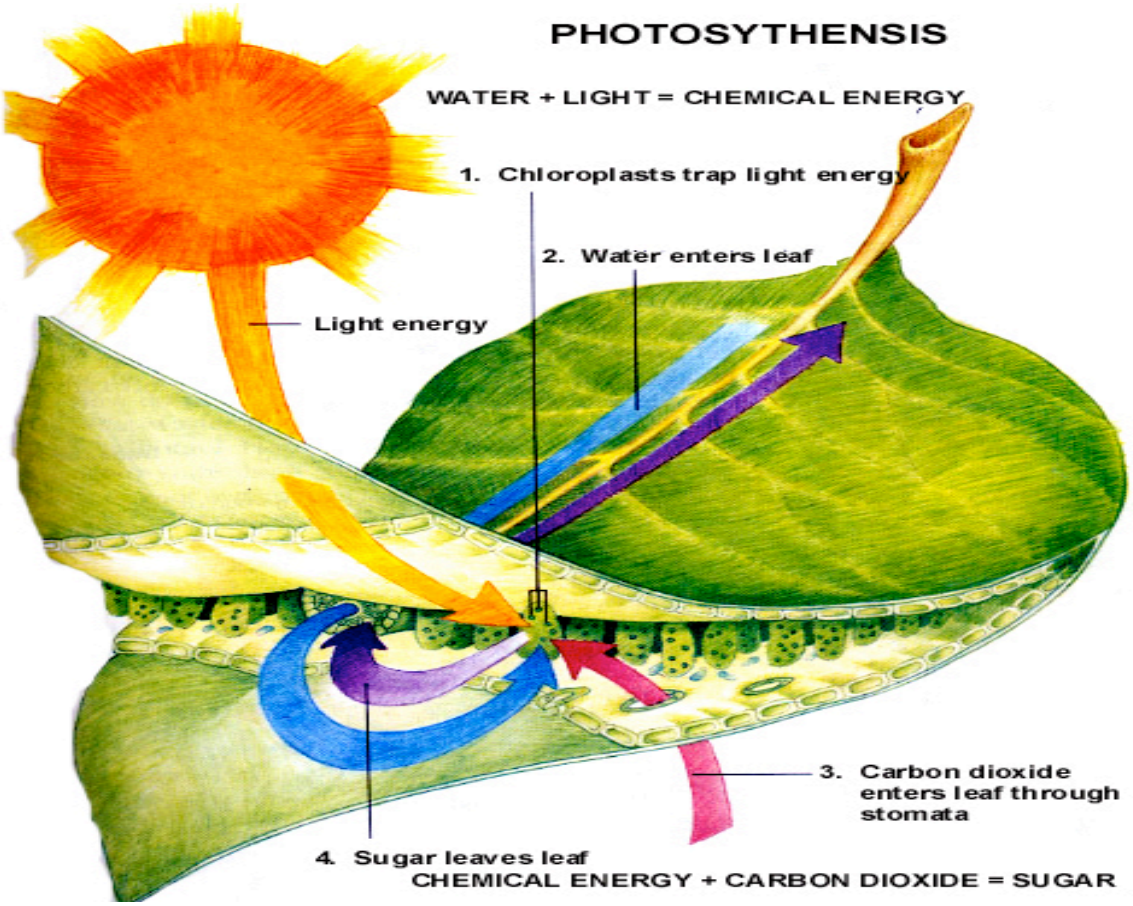
Sugar: I am lunch! I can feed Norman's cells. Don't I look delicious? (*Norman pretends to eat Sugar*.)

Norman: That was delicious, but now I have to take care of the oxygen I created. (*Oxygen molecule comes and stands next to Norman.*)

Oxygen: Part of me stays in Norman to help him get energy in his cells. But most of me leaves Norman through his stomata. The good news is that I am then valuable to animals and humans. (*Oxygen walks away from Norman into the atmosphere*.)

Narrator: As you can see, plants can make their own food through the process of photosynthesis. Thank you, Norman for demonstrating!

The End!


PHOTOSYTHENSIS
WATER + LIGHT = CHEMICAL ENERGY
1. Chloroplasts trap light energy
2. Water enters leaf
Light energy
3. Carbon dioxide enters leaf through stomata
4. Sugar leaves leaf
CHEMICAL ENERGY + CARBON DIOXIDE = SUGAR