

Background

The purpose of gardening within an educational setting is to utilize the garden as an educational tool. The garden and skills developed by gardening provide concrete examples of theoretical or abstract concepts or processes. This is critical for some students and will result in both greater understanding of difficult concepts and application of those concepts across diverse topics. Before one can garden well, a great deal of science needs to be understood and applied. The understanding of photosynthesis is the first of those concepts. This lesson is designed to make this relatively abstract process concrete for students and in particularly young students.

Groundwork: Producers or Consumers

Objective: To determine student understanding of food sources and delineate with examples of the differences between producers and consumers.

1. Ask the students where their food comes from. Make a list of the sources they identify in a visible place under the heading "Where We Get Food?". Encourage the students to come up with as many places as they can.
2. Next to that list place this heading "Where do they get the food?" and "How does it get there?" Ask the students those two questions. Continue the process until all ideas are exhausted.
3. Whether or not they identify a farm, plant or garden lead them to that conclusion and ask where the farmer, gardener, or plant got the food. Ask: Who made food from non-food? Plants made the food from non-food. Plants are the producers! The rest of us are consumers.
4. Have the students make a list of animals and what they eat. Then ask each to identify which ones listed are producers and consumers. (Herbivores will eat producers – plants. Carnivores will eat other consumers. Omnivores will eat both producers and consumers.)

Exploration 1: Building the Building Blocks

Objective: Review the elements involved with photosynthesis.

1. Print out *Building the Building Blocks* puzzle pieces.
2. Before photosynthesis can be understood, the building blocks should be analyzed. Atoms are basic units of elements. Two or more atoms bonded together create molecules. Water is molecule made up of two atoms, hydrogen and oxygen.
3. Using the *Building the Building Blocks* puzzle pieces, create the molecules necessary for photosynthesis. Students can make their own molecules or participate in groups.
4. Ensure that students understand that atoms create molecules. When the photosynthesis puzzle is being constructed, the pieces will become molecules.



Exploration 2: Photosynthesis is a Puzzle

Objective: Explain how plants make food from non-food components in the process known as photosynthesis.

1. Print out *Photosynthesis is a Puzzle* puzzle pieces.
2. Ask the students how plants make food from non-food. Explain that plants capture the energy of sunlight to produce food in a process known as photosynthesis. Pho-



Time:

Groundwork: 25 minutes
Exploration 1: 15 minutes
Exploration 2: 45 minutes
Exploration 3: 25 minutes
Making connections: Ongoing

Materials:

- **Building Molecules Puzzle Pieces**
 - 1 copy per group/student
- **Building Photosynthesis Puzzle Pieces**
 - follow copy directions on pieces, 1 copy per class

Standards At-A-Glance

Florida Standards Met:

SC.3.L.17.2, SC.4.L.17.2, SC.4.L.17.3, SC.7.L.17.1, SC.8.L.18.1, LAFS.6.RI.3.7, LAFS.3.W.1.2, LAFS.3.W.1.3, LAFS.3.W.3.8, LAFS.4.W.1.2, LAFS.4.W.1.3, LAFS.4.W.3.8, LAFS.5.W.1.2, LAFS.5.W.3.8, LAFS.6.W.1.2, LAFS.6.W.1.3, LAFS.7.W.1.2, LAFS.7.W.1.3, LAFS.8.W.1.2, LAFS.8.W.1.3, LAFS.3.SL.2.4, LAFS.4.SL.2.4, LAFS.5.SL.2.4, LAFS.6.SL.2.4, LAFS.7.SL.2.4, LAFS.8.SL.2.4, LAFS.68.WHST.1.2, LAFS.68.WHST.2.4



tosynthesis requires the inputs of water and carbon dioxide and creates the outputs of sugar, water and oxygen.

3. The inputs and outputs of photosynthesis are molecules, made up of atoms. Explain that various molecules make up the process of photosynthesis in an equation.
4. Photosynthesis is a Puzzle Activity:
 - a. Cut out *Photosynthesis is a Puzzle* puzzle pieces
 - b. Attach the puzzle pieces on sticks for students to hold
 - c. Select 11 student volunteers, one for each puzzle piece
 - d. Talk about each piece individually as the formula builds. Invite student volunteers to the front of the room in order to create the formula.
5. Suggested Dialogue:
 - a. What do plants need to grow? (sunlight, air, water, soil)
 - b. Water and carbon dioxide are the inputs. Where do plants get water from? (roots) Where do plants get carbon dioxide from? (openings in leaves/stems) What process creates carbon dioxide? (respiration/breathing)
 - c. Once we have water and carbon dioxide, we need sunlight and chlorophyll to make photosynthesis happen. What makes plants green? (chlorophyll) What does the sun provide the plant? (warmth/energy)
 - d. Sugar, water and oxygen are the outputs of photosynthesis. What types of atoms create a sugar molecule? (carbon, hydrogen, oxygen) Where have we seen these atoms before? (in the inputs) How are molecules getting split apart? (energy from the sun) Water is an input and output of photosynthesis. Oxygen is an output. How did the oxygen molecule form? (energy from the sun split the carbon dioxide molecule)
 - e. After the dialogue, the following photosynthesis formula should be created:



Exploration 3: Balancing the Equation (High School Segment)

Objective: Create a balanced photosynthesis equation.

1. According to the Law of Conservation of Mass, equal amount of atoms should be on each side of the equation resulting in a balanced equation. The balanced equation for photosynthesis is.



2. Older students can be asked to balance the equation. Discuss how many water molecules, carbon dioxide molecules and oxygen molecules are needed to create one sugar molecule.

Making Connections

Ask the students these questions:

- Is photosynthesis the only function of plants?
- Do plants only make sugar?
- What else do plants make?
- What is the source of those components?
- How do the plants acquire those components?

Extensions for middle and high school

1. Have the students research the impact of input deficiencies on the photosynthesis process (lack of light, improper light spectrum, nutritional and water deficiencies).

2. Have students research input excesses (carbon dioxide, water, nutrients, etc.).
3. Have the students research and identify what other atoms are needed to produce starches, proteins, fats, and oils. Expand the protein building to include the human proteins that are used to build muscle, organ tissue, hair, finger and toe nails and/or plant proteins.

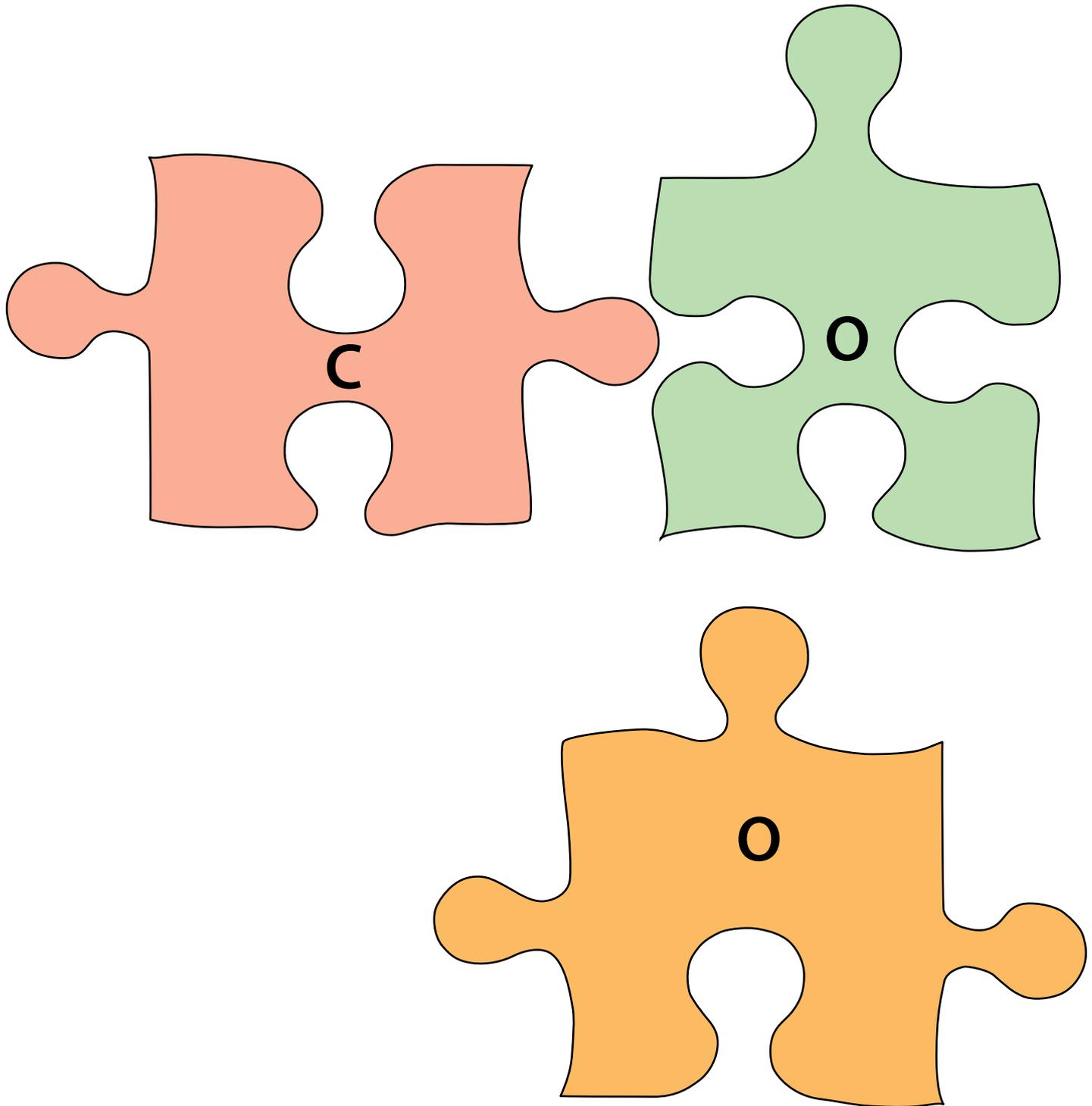


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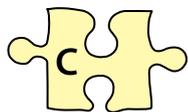
"Activity: We're the Producers!"

Carbon Dioxide

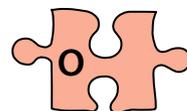
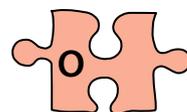
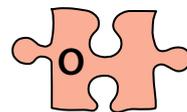
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Sugar

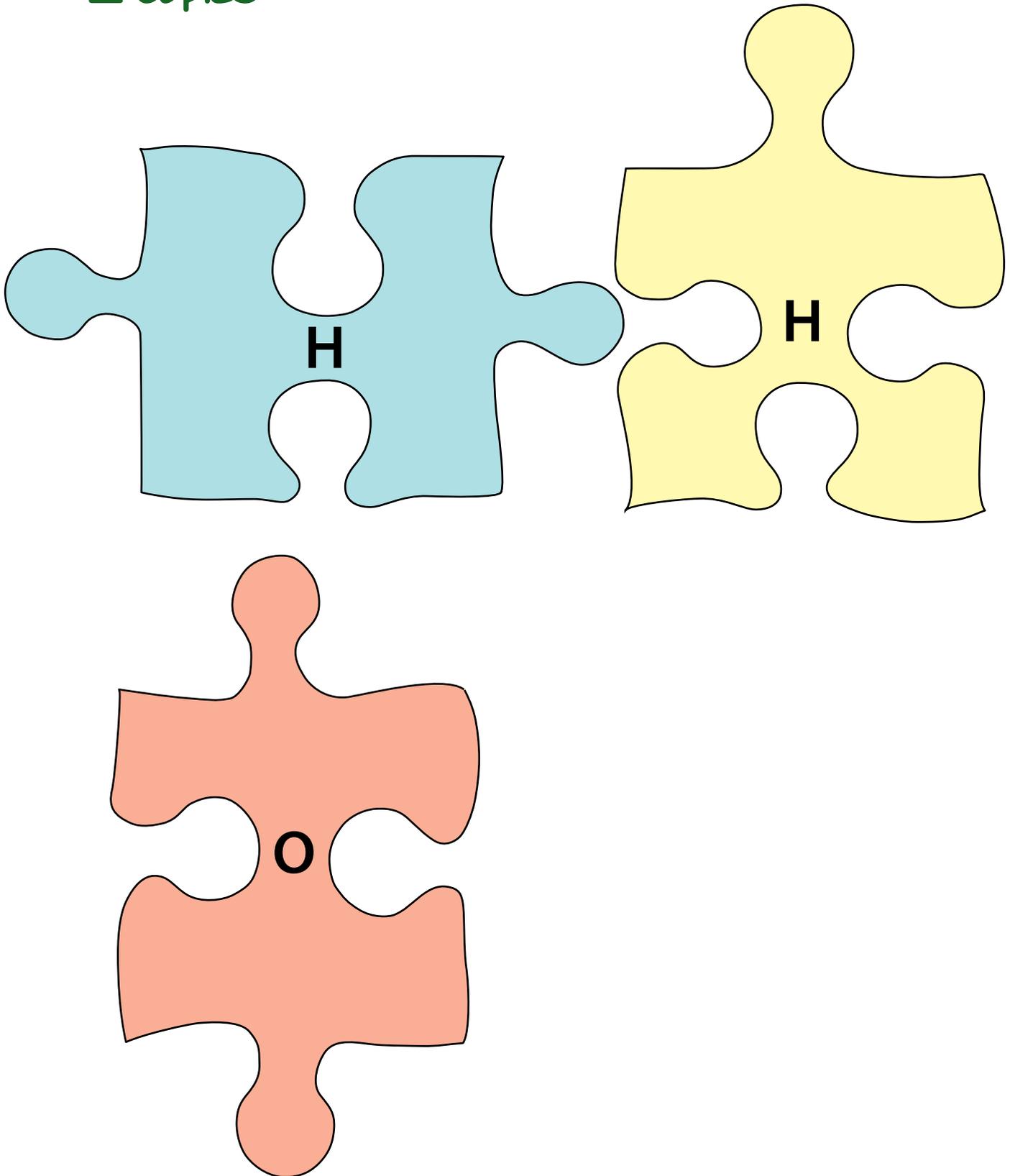


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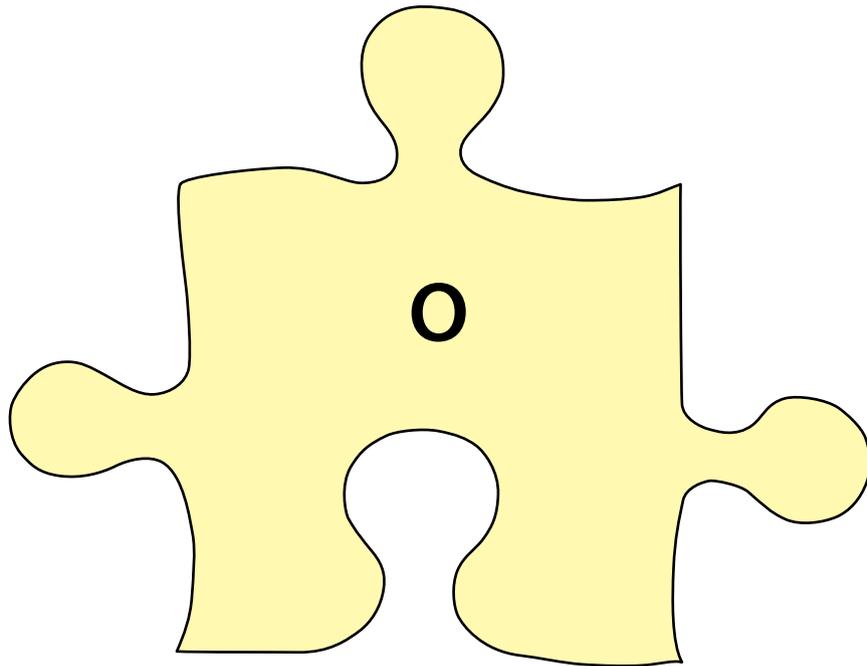
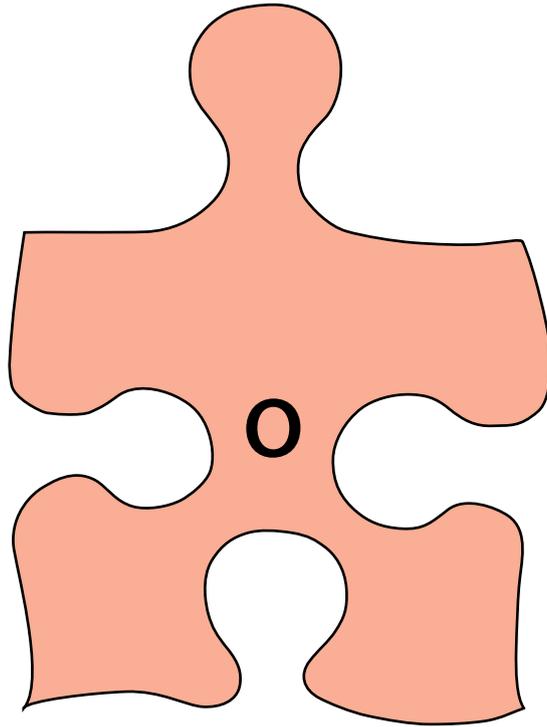
Water

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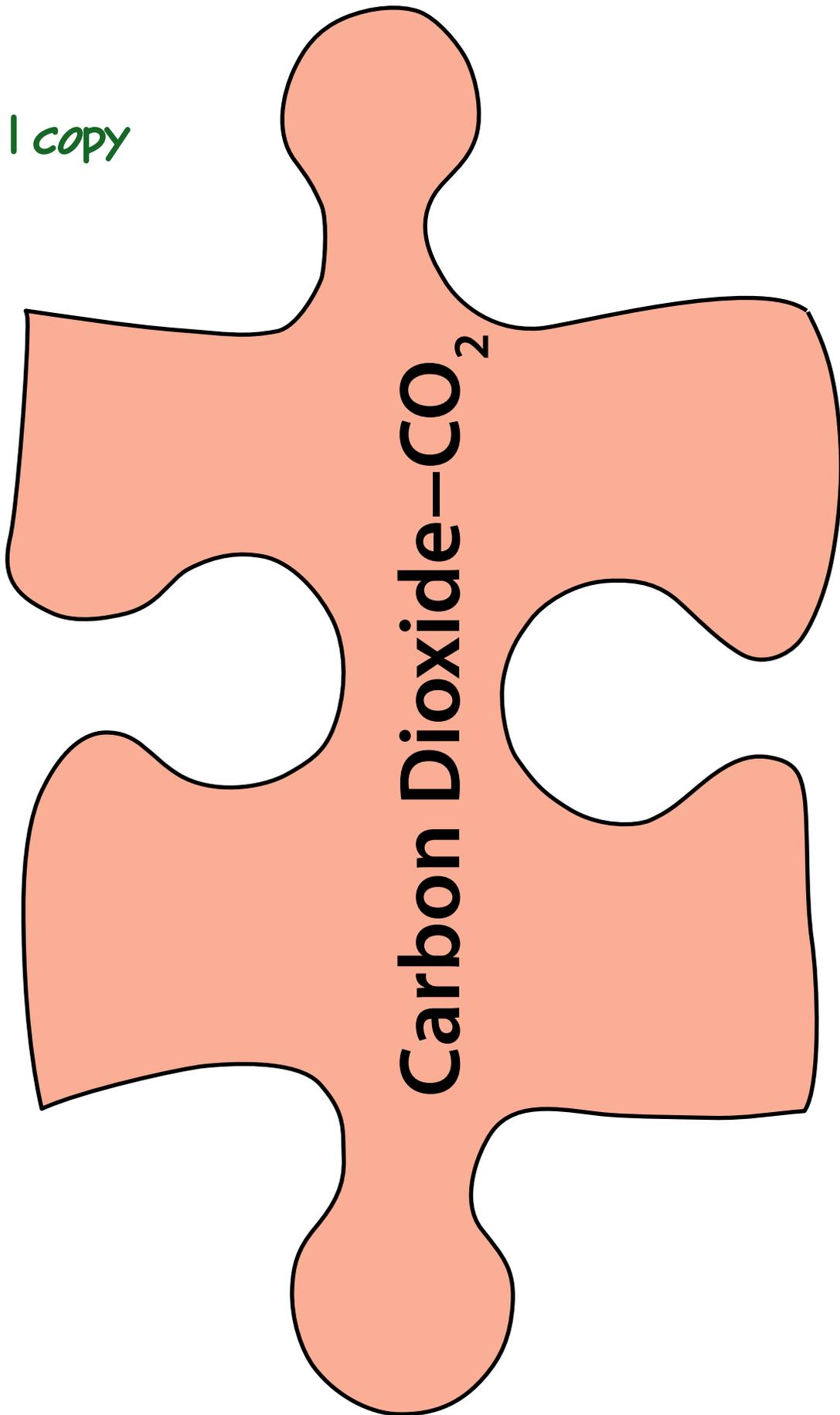


Oxygen

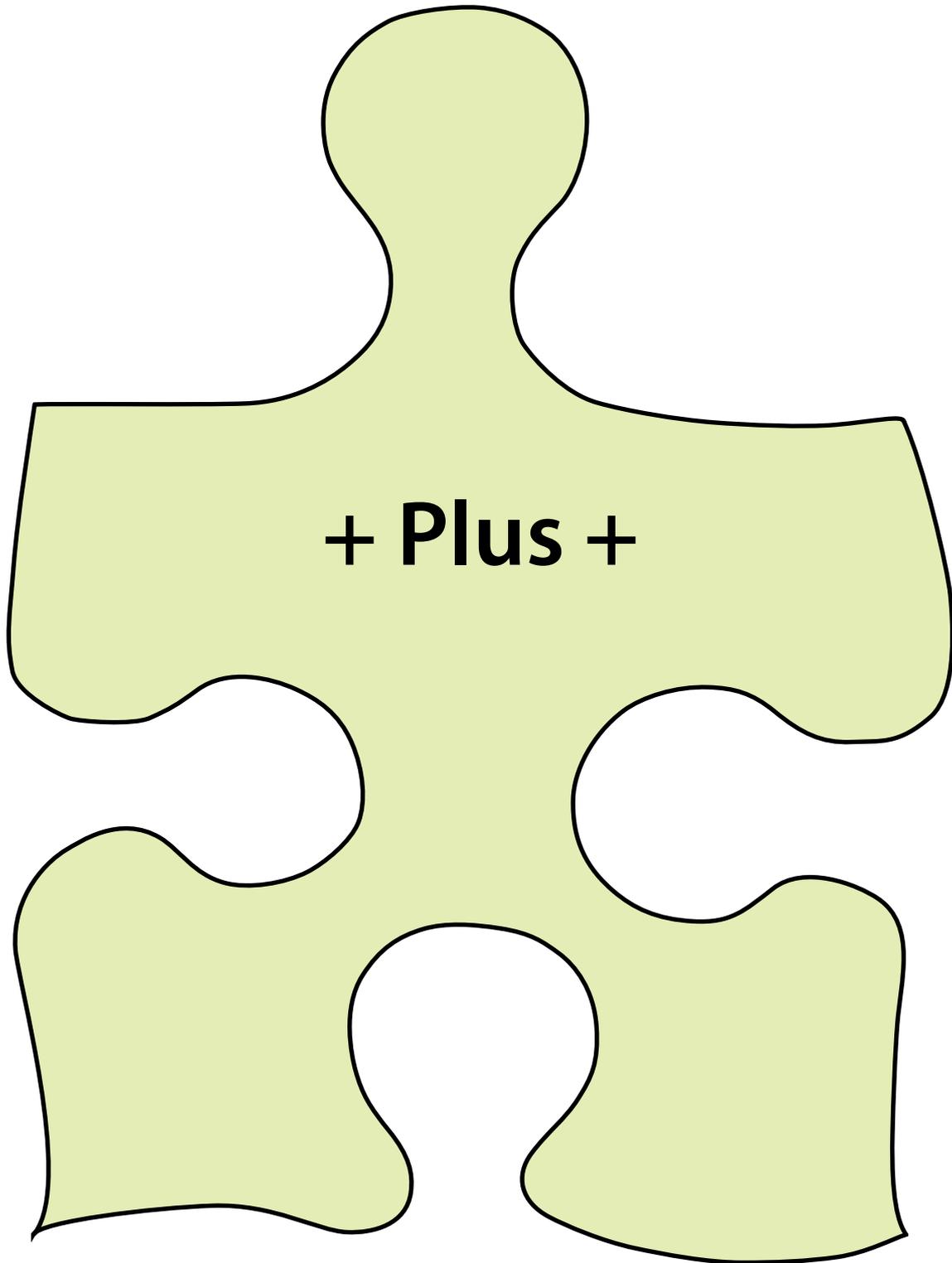
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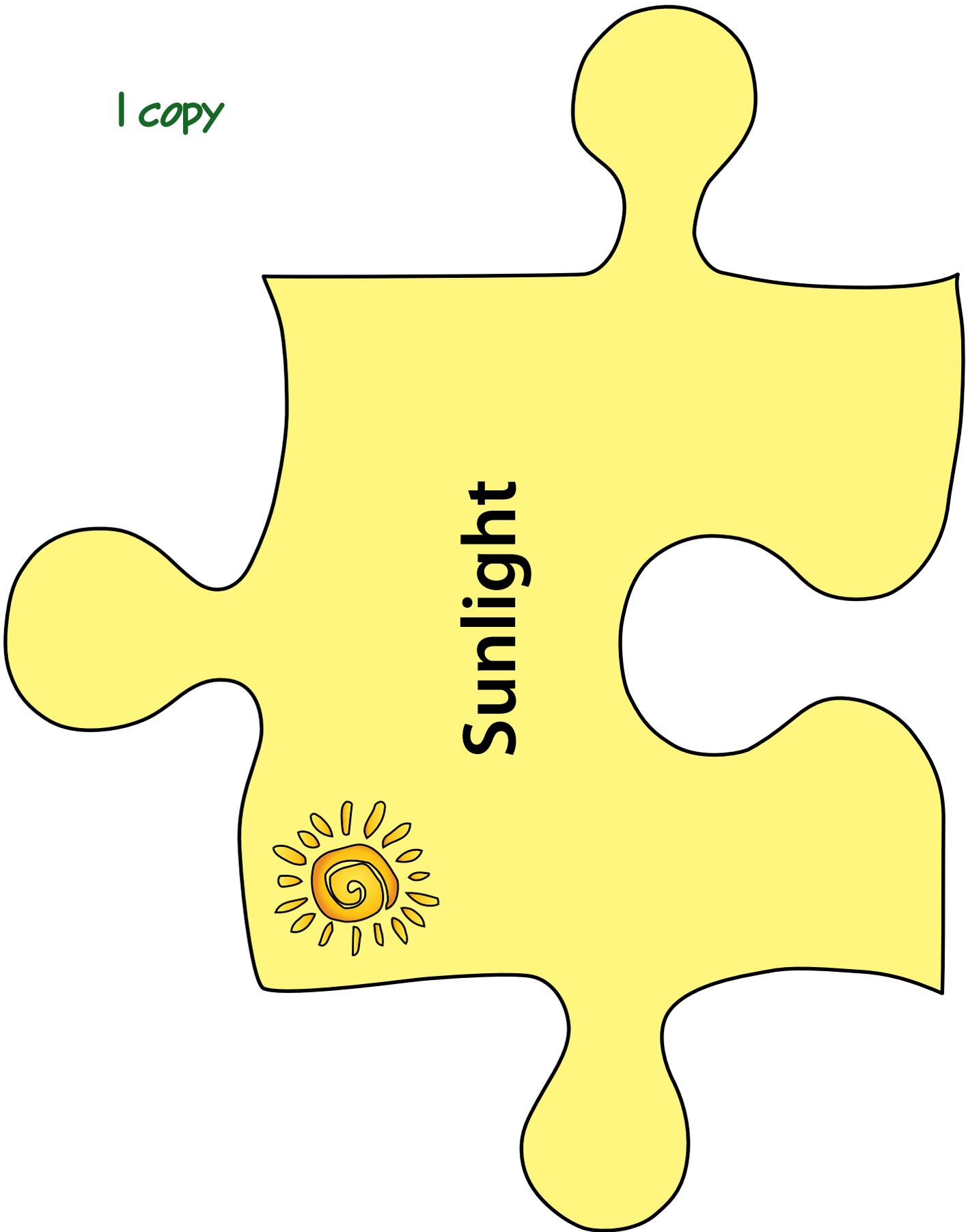
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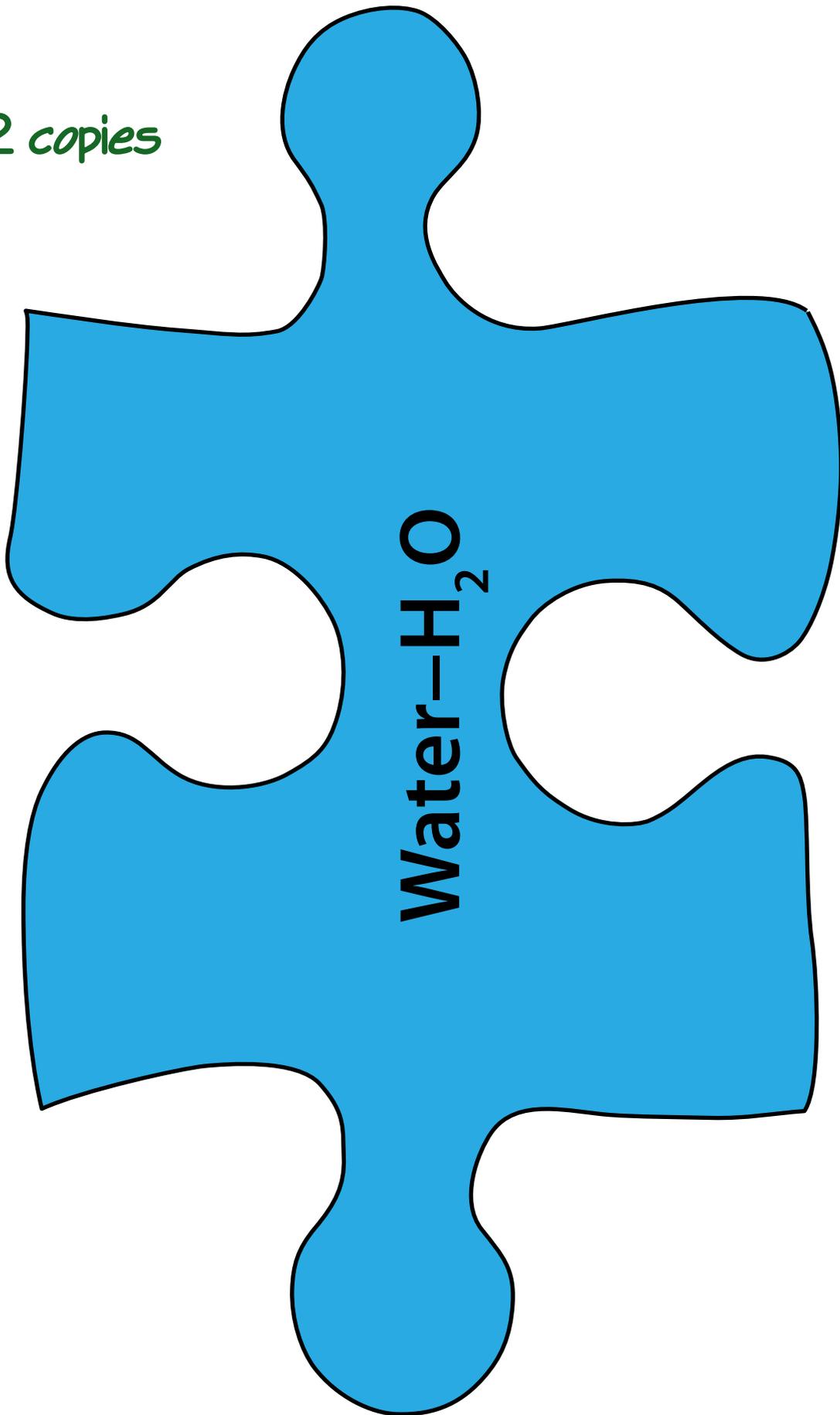
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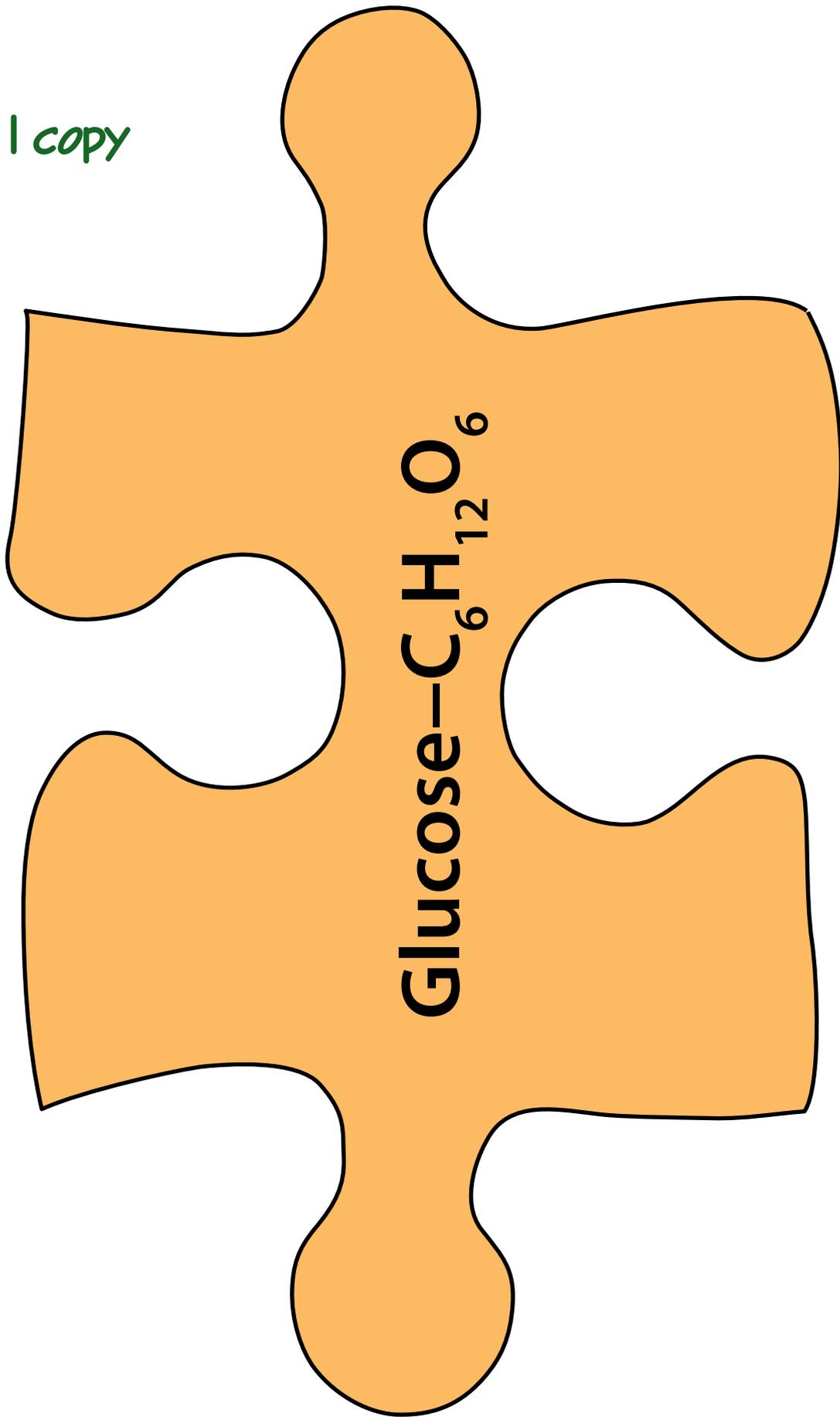
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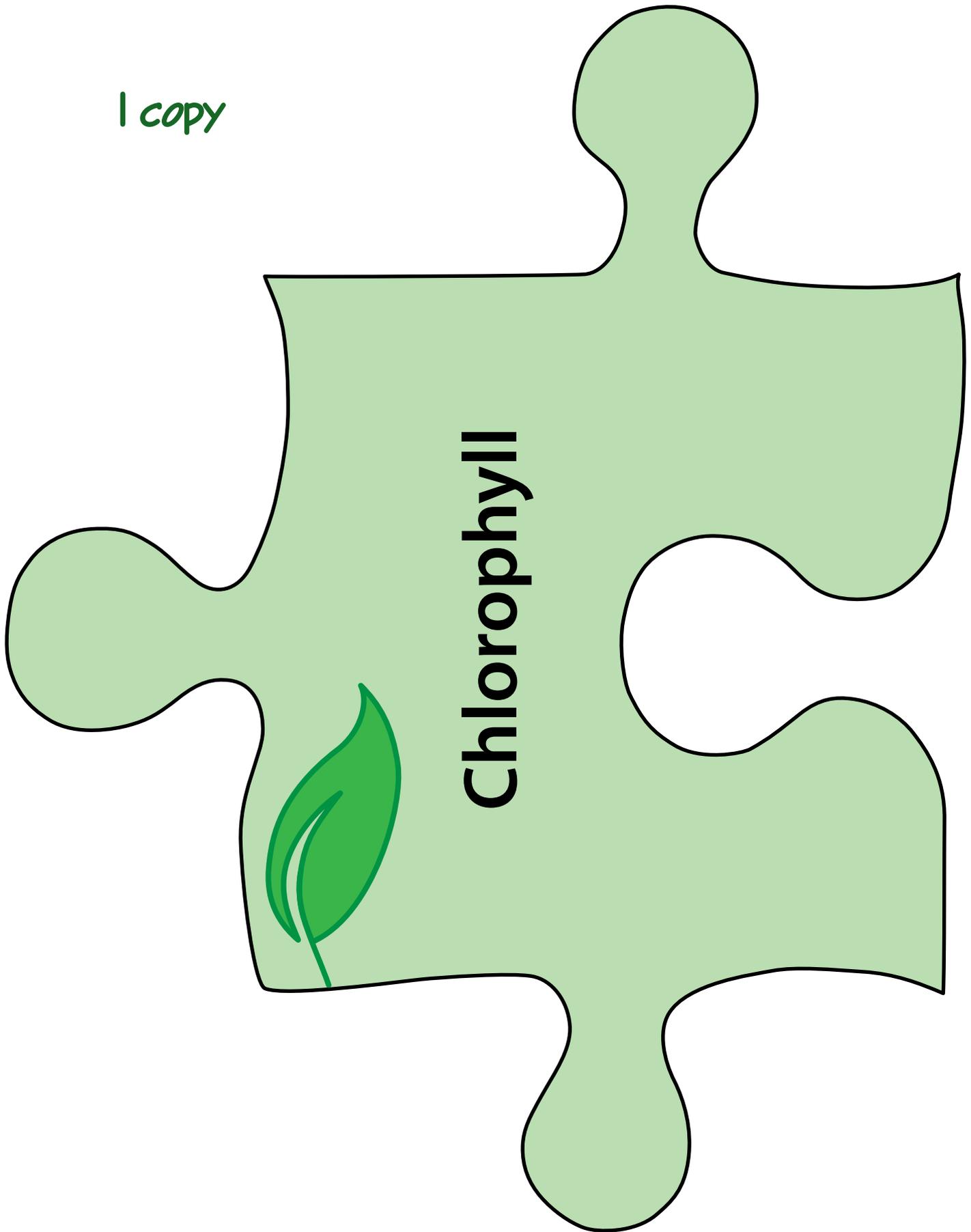
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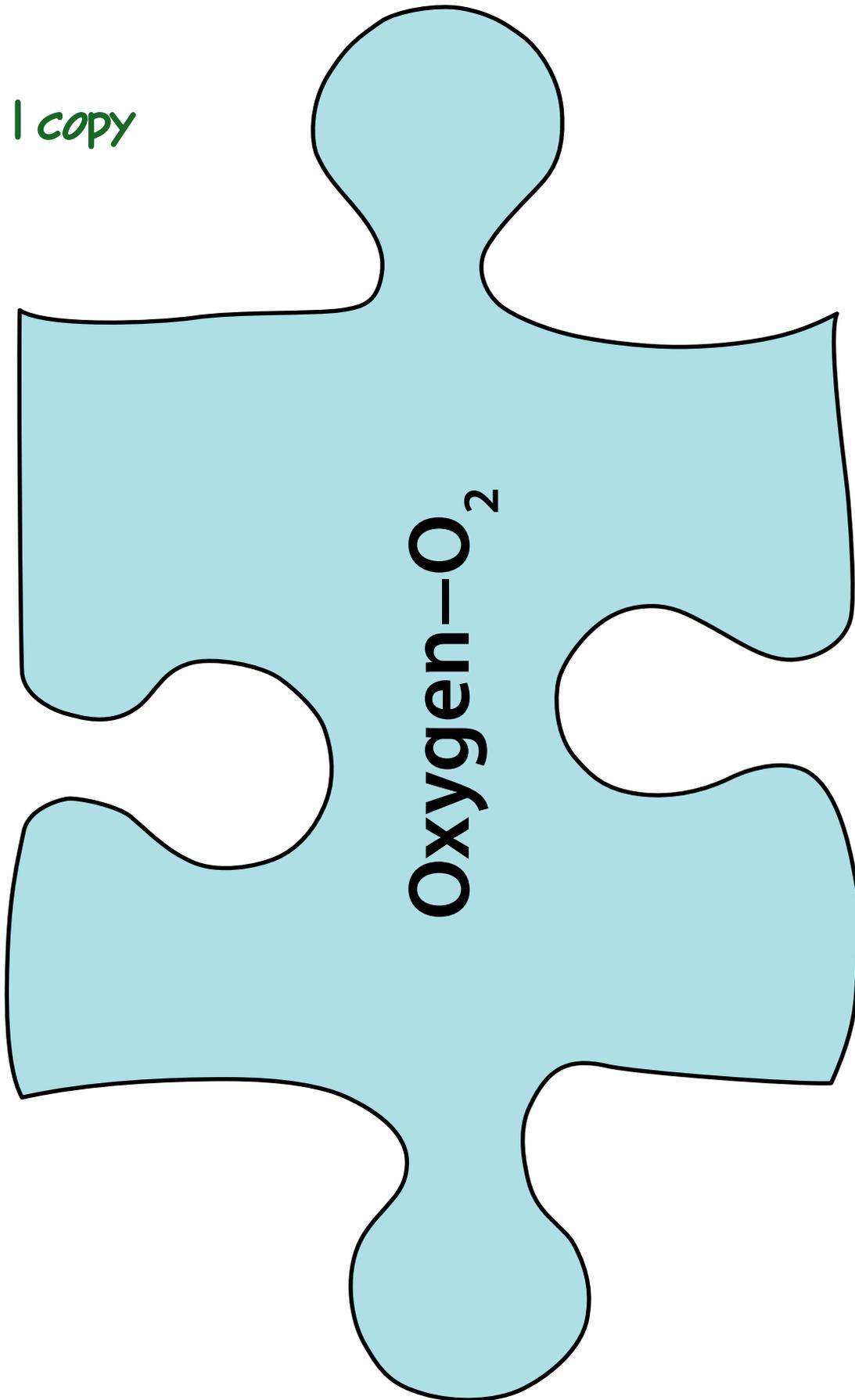
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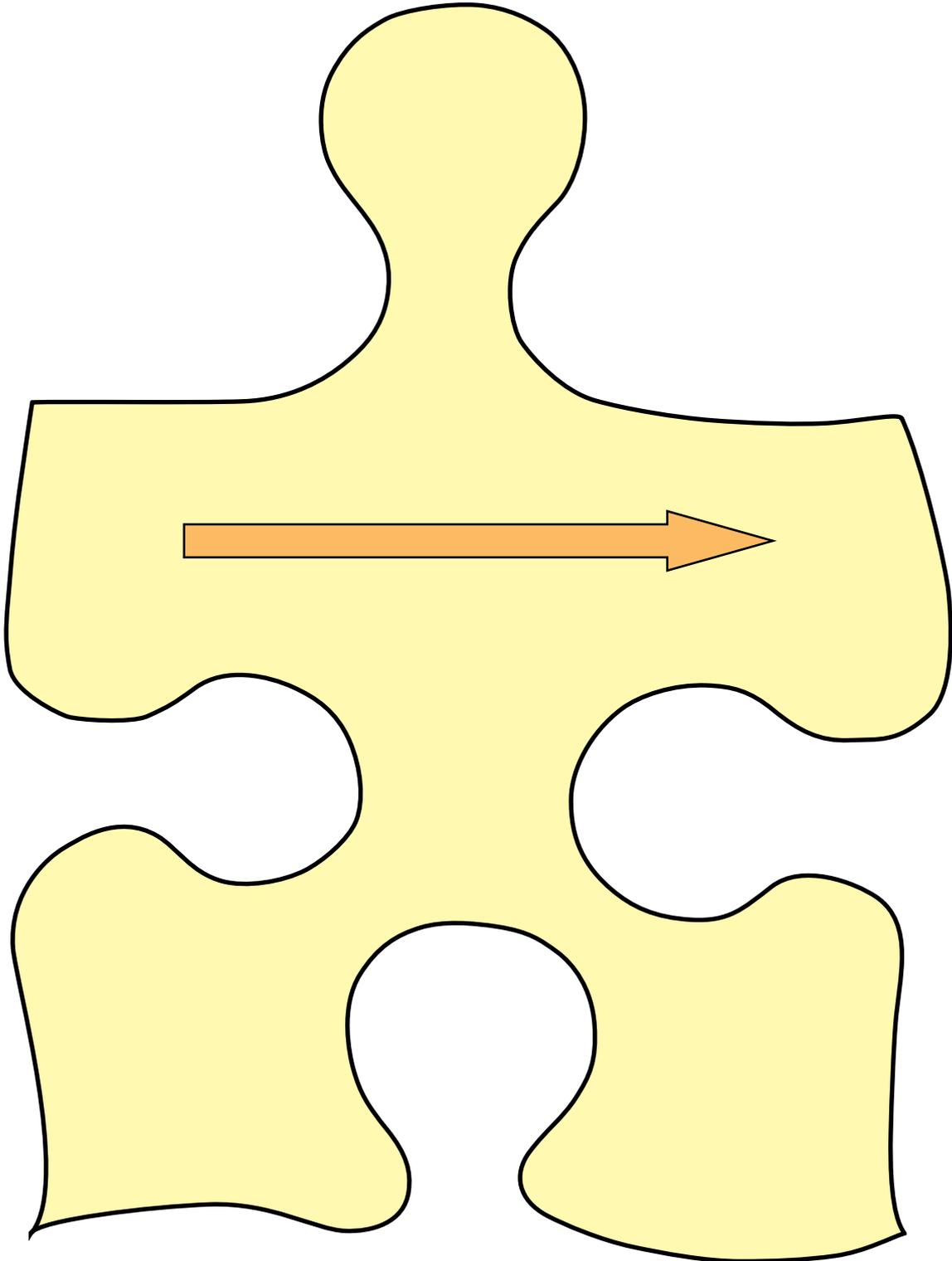
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We're the Producers!

Sample Pre-Post Assessment

1. Plants are producers and animals are consumers. True False
2. What does a plant need for photosynthesis?
 - a. Oxygen, water, soil, sugar
 - b. Nitrogen, water, soil, air
 - c. Carbon dioxide, water, chlorophyll, sunlight
 - d. Carbon dioxide, chlorophyll, sunlight, oxygen
3. A plant gives off _____ that animals need to breathe.
4. Plants take in _____ through their leaves and
_____ through their roots.