Investigating Photosynthesis through Kinesthetics

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Grade Level: Middle-High School

Photosynthesis Equation

$$6CO_2 + 6H_2O \xrightarrow{\text{SUN}} C_6H_{12}O_6 + 6O_2$$

(Carbon Dioxide) (Water) (Glucose) (Oxygen)
(Carbohydrate)
(Reactants) (Products)

Purpose:
To provide middle or high school students with an activity in which they can explore photosynthesis.

Objectives:
Students will be able to:

- Recognize the photosynthesis equation.
- Realize that the carbon dioxide molecules that heterotrophs breathe out are the same carbon dioxide molecules that make up the backbone of the glucose (carbohydrates) molecule.
- Write the equations for photosynthesis with coefficients and subscripts (study time may be required).
- Infer that humans breathe out carbon dioxide and plants take in carbon dioxide and give off oxygen (during the light reactions).

Materials:

1. Six cards with C (Carbon) – (Use template)
2. Twelve cards with H (Hydrogen) – (Use template)
3. Eighteen cards with O (Oxygen) – (Use template)
4. One card that says “Sun” – (Use template)
5. One card with a “+” on it – (Use template)
6. One card with an arrow to represent the yields sign in the equation – (Use template)
7. Poster board with the equation for photosynthesis (to be held up so students know where to position cards)
8. One card that reads “carbon dioxide” – (Use template)
9. One card that reads “water” – (Use template)
10. One card that reads “glucose” – (Use template)
11. One card that reads “oxygen” – (Use template)

Preparation (teacher):
Copy templates
Give students the following warm-up activity:

1. Write the equation for photosynthesis.
2. Define atom, element, molecule and compound.

This activity can be completed in 15-25 minutes depending on the size of your class and their familiarity with the concepts presented.

Procedure:
Variation 1
Each student is given the role of a molecule of carbon, hydrogen, or oxygen. Depending on the size of your class, some students may need to be assigned the same role. For example you may need to give one student two "H's" instead of one "H". If you have a large open area in your classroom, you can conduct this part of the activity inside. Otherwise, you will need to plan to go outdoors or into the hall.

Once you arrive at your destination, hold up the poster board with the equation for Photosynthesis. First, instruct the students to position themselves so that they represent the reactants of the equation. Remember to assign a student to the role of "sun", "+", and "yields".) Once students have gotten into the correct positions give each group of molecules the name of the substance that they represent (carbon dioxide or water). Next, have the students' position themselves so that they represent the products of the photosynthesis equation. Once the students have positioned themselves correctly give each group of molecules the name of the substance they represent (glucose or oxygen). The idea is that students will realize that the same carbon atoms that make up carbon dioxide make up the backbone for the glucose (carbohydrates) molecule.

Variation 2:
Make enough cards to give to individual students, pairs, or teams so that the students can work at their tables under the teacher's guided instruction.

Safety:
No special safety equipment is necessary.

Q**uestions to Ask:**

- How many molecules of carbon dioxide and how many molecules of water are needed for green plants to synthesize one molecule of glucose and six molecules of oxygen?
- What type of nutrient is glucose (carbohydrate, protein, nucleic acid or lipid)?
- What are other sources of carbon dioxide (besides animals exhaling)?
- What gas do plants release?

Extensions:
This activity provides a good transition into the study of acids and bases, chemical bonding, study of nutrients, and the way that cells and the bodies of animals use energy.
Glucose & humans: Research or discussions could also be conducted to explore the physiology of diabetes. Students love to sing. Challenge students to include basic concepts about photosynthesis in a song, poem or rap.

TEMPLATES

- Run off 6 carbon **per group** on blue paper
- Run off 12 hydrogen **per group** on red paper
- Run off 18 oxygen **per group** on green paper
- Run off one set of words and symbols **per group** on any other color

C C

C C

C C

H H

H H

H H

O O

O O

O O

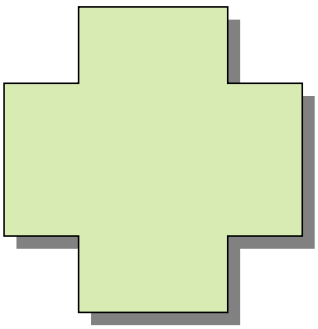
SUN

CARBON DIOXIDE

WATER

OXYGEN

GLUCOSE
(CARBOHYDRATE)



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