



You Are My Sunshine

Photosynthesis

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Grade Level	10th – 12th Grade	Time Frame	2-3 class period(s)
Subject	Science	Duration	100 minutes
Course	Biology, Environmental Science		

Essential Question

How does energy guide function?

Summary

This is a lesson that revolves around a modified version of The College Board's floating disks lab for AP biology. It can be used as an introduction or a wrap-up of a photosynthesis lesson.

Snapshot

Engage

Students will watch sun dancing toys and write down observations.

Explore

Students will conduct a lab with spinach and light.

Explain

Students will answer questions about the lab.

Extend

Students will read articles about photosynthesis and renewable energy.

Evaluate

Students will make a 2-minute documentary over their article.

Standards

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-PS3: Energy

HS-LS1-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

Oklahoma Academic Standards (Physical Science)

B.LS1.1.2: All cells contain genetic information in the form of DNA molecules.

Oklahoma Academic Standards (Physical Science)

CH.PS3: In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.

Oklahoma Academic Standards (Physical Science)

PS.PS3: Use mathematical representations to support the explanation that the total momentum of a system of objects is conserved when there is no net force on the system.

Oklahoma Academic Standards (Physical Science)

PH.PS3: If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by change in the momentum of objects outside the system.

Attachments

- [Carbon-Is-Not-the-Enemy-You-Are-My-Sunshine.docx](#)
- [Carbon-Is-Not-the-Enemy-You-Are-My-Sunshine.pdf](#)
- [Photosynthesis LEARN PP.pptx](#)
- [Photosynthesis-Lab-You-Are-My-Sunshine.docx](#)
- [Photosynthesis-Lab-You-Are-My-Sunshine.pdf](#)
- [Reverse-Photosynthesis-Uses-Sunlight-to-Convert-Plant-Biomass-Into-Fuel-You-Are-My-Sunshine.docx](#)
- [Reverse-Photosynthesis-Uses-Sunlight-to-Convert-Plant-Biomass-Into-Fuel-You-Are-My-Sunshine.pdf](#)
- [The-Difference-Between-Photosynthesis-and-Solar-Cells-You-Are-My-Sunshine.docx](#)
- [The-Difference-Between-Photosynthesis-and-Solar-Cells-You-Are-My-Sunshine.pdf](#)
- [Why-the-Secret-of-Blue-Begonias-Can-Improve-Energy-Efficiency-You-Are-My-Sunshine.docx](#)
- [Why-the-Secret-of-Blue-Begonias-Can-Improve-Energy-Efficiency-You-Are-My-Sunshine.pdf](#)

Materials

- Three solar dancing toys (Engage)
- Light lamps (Engage & Explore)
- Spinach (Explore)
- Hole punch (Explore)
- Clear cups (Explore)
- Syringe without needle (Explore)
- Baking soda (Explore)
- Dish soap (Explore)
- Water (Explore)
- Copies of the articles (Extend)

Engage

Setting Up Before The Lesson

For this Engage, you need three [solar dancing toys](#), and two lamps of different strength. Have one toy under a strong light source, so it's "dancing" a lot; then have one under a moderate light to "dance" a little; finally, have one toy under no light or in the shade so it is not moving at all.

Allow students the freedom to come in and watch them and giggle or whatever the students want to do. After a minute, post the question: "Why is this happening?" Have students use that question to write a speculation statement of what is happening with the toys. Then, have the students share their explanations with a partner.

They will revisit both the question and their original statement at the end, so have the students store it for later.

Too Busy To Shop?

Solar dancing toys are cheap and can be found at most dollar stores. However, if you can't do that, here is a video of [sunflowers following the sun](#) instead. Ask the same question, still have them share with a partner, and still have them hang on to it. It's not as fun as having something tangible, and doesn't relate as much to the Extend activity, but it'll work.

Explore

Distribute the lab handouts included. There are only three pre-lab questions; allow students to form lab groups and answer the pre-lab before starting the lab.

Easy Set-Up

This lab is relatively cheap and has a very easy set-up for the teacher. In fact, it is as easy as just putting out the materials. The students make the solutions, which are harmless and don't even need gloves (even though goggles are always technically recommended). Plus, the lab usually takes 30 minutes at the most, which makes this an easy example of the gas production of photosynthesis.

The procedures are on the handout, but what students will be doing is extracting the gases from leaves, then a carbonate solution and light will allow the leaves to go through photosynthesis, which produces oxygen gas that makes the leaves buoyant (thus float).

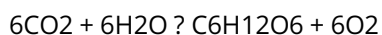
After the students are done collecting the data, have them answer the post lab questions.

Sort Of Ap Approved

This lab is a lab recommended by College Board. HOWEVER, the way it is written and the pre/post lab questions are NOT challenging enough for AP. If you are hoping to use the lesson for AP, follow all the steps, but use the [College Board version](#) of the lab instead.

Explain

Once the students are done with the lab, Show a diagram of photosynthesis within the chloroplast. Then, post the equation for photosynthesis on the board.



Then ask the students to write down the answers to the following questions in the first part of a [Think, Pair, Share](#).

- In the lab, where did the carbon dioxide come from?
- In the lab, what role did the light play? What did the light do?
- In the lab, what did you observe to let you know that photosynthesis was happening? How does that observation fit into the equation?
- Do you think sugar was still being made in the leaves in the dark treatment?

After they've written an answer, have them share their answers with an elbow partner.

Once they have confidence in their answers, have various groups share their speculations to the whole class.

Clear The Air

This is the opportunity to gauge what understanding level the students are at, and to clear up misconceptions. If the students do not understand the material at this point, then they're not really going to.

Extend

Group students so that there are five groups (or more if you need to, there are just five natural groups with the articles provided). Assign one of the included articles to each group.

Only Four Articles, Though!

The article titled Carbon is not the enemy is very long compared to the others, so it was broken into two parts. It actually works well that way, since the first two pages are about the hazards of the language of current environmental legislation and the second two pages are suggestions to use the carbon cycle and photosynthesis for sustainable construction.

Have the students read through their article, then [CUS and Discuss](#). That means that the students will:

- Circle words they don't know
- Underline details that support the main idea
- Star the most important parts/main idea
- Discuss what they marked with their group

Help Give Direction

Each article talks about something different, and has very valuable details for the students. As they are CUS and Discussing, guide them towards those great details if they miss them. One is about how begonias will produce blue chloroplasts in low light because green light is more available than blue in low light (which reinforces light absorption properties). One is about how carbon is not as bad as politics would give the impression, and using the properties of photosynthetic plants to create buildings that are more like forests. One article is about reverse photosynthesis, and how the process of photosynthesis can be used to make biofuels. One is about

Evaluate

Once the students have discussed their article with their group, tell the students that they will be making a [Two-Minute Documentary](#) to present the information from their article to the entire class.

Have Fun, But Stay On Task

As they prepare their documentaries, walk around and make sure that they're including those important details they talked about in the Extend section.

Resources

- Solar toys (Engage): <http://www.officeplayground.com/desk-toys-c13/solar-motion-toys-c77.html>
- Sunflower video (Alternate Engage): <https://www.youtube.com/watch?v=IwI0tGzr4S8>
- Lab Version that inspired Explore Handout: [http://www.biologyjunction.com/5b-
photoinleafdisklesson.pdf](http://www.biologyjunction.com/5b-
photoinleafdisklesson.pdf)
- Think, Pair, Share (Explain):
<https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5064b49>
- [http://www.techtimes.com/articles/147122/20160405/reverse-photosynthesis-uses-sunlight-to-
convert-plant-biomass-into-fuel.htm](http://www.techtimes.com/articles/147122/20160405/reverse-photosynthesis-uses-sunlight-to-
convert-plant-biomass-into-fuel.htm)
- <https://www.sciencedaily.com/releases/2016/06/160624100258.htm>
- <http://education.seattlepi.com/difference-between-photosynthesis-solar-cells-4700.html>
- CUS and Discuss: <https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5073969>
- Two-Minute Documentary (Evaluate):
<https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f507bb21>