Photosynthesis: Matter Cycles, Energy Flows

Teacher		**Class**	Grade 7
Subject	Science	**Topic**	Photosynthesis
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students learn how photosynthesis cycles matter and moves energy into life. They sort evidence and write a claim-evidence-reasoning explanation.

Curriculum links

- Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms [1]

Learning objectives

- Students will identify inputs and outputs of photosynthesis using the equation.
- Students will trace how atoms cycle through photosynthesis into sugar and oxygen.
- Students will explain how light energy flows into chemical energy stored in sugar.

Success criteria

- I can write the photosynthesis equation and label reactants and products.
- I can trace carbon, hydrogen and oxygen atoms to sugar and oxygen.
- I can describe energy flow from sunlight to chemical energy in sugar.

What students already know

Ask: Where does a growing plant get most of its new weight - soil, water, or air? Show of hands, then turn and tell a neighbor why.

Key words

photosynthesis	the process where green living things make sugar from water and carbon dioxide using light [5]
carbon dioxide	a gas in air that plants breathe in and use to build sugar [7]
glucose	a kind of sugar that stores energy plants can use to grow [5]
chlorophyll	green coloring inside leaves that catches blue and red light [7]
chemical energy	energy held in sugar links that living things can later use [5]

Materials

- Slides 1-4, 6, 9, 11-12 with projector and sound
- Video clip 1 on slide 6 tested to play
- printed evidence cards
- large claim sheet
- markers
- Worksheet Task F copies - Complete the talk to explain photosynthesis with evidence

Before the lesson

- Print one set of evidence cards and one large claim sheet plus markers per group of 3-4
- Print Worksheet Task F copies for each student
- Test Slide 6 Video clip 1 (0:00–5:00) for picture and sound and queue Slide 9 task
- Arrange desks for groups of 3-4 with space to read and write

Created with LessonDino.com · AI lesson planner with checkable sources

Lesson outline

0–8 min **Starter** 8 min · Whole class

Hook students and surface ideas about where plant mass comes from.

YOU DO

1. Show Slide 1 and read the title question: How do plants turn sunlight into life?
2. Use the hook: A student says plants eat soil to grow bigger. How would you prove them wrong with evidence?
3. Poll the class: soil, water, or air for most new wood, then have neighbors give one reason in 1 minute.
4. Show Slide 2 objectives and tell students they will prove the answer with evidence today.

STUDENTS DO

1. Vote soil, water, or air and tell a neighbor one reason.
2. Share two or three ideas with the class.
3. Listen to today's goals on Slide 2.

Say: Today we settle where a plant's new weight really comes from. You will use evidence to show how matter cycles and energy flows in photosynthesis. By the end you will write the equation and explain it like a scientist.

Ask: If a plant gains wood but the soil amount stays almost the same, what does that suggest? (The new mass did not come mostly from soil, so it came from water and air.) · What three things do plants need to live? (Water, sunlight, and carbon dioxide [7].)

Check understanding: Thumbs up, sideways, or down for: I can name what a plant takes in. If many are unsure, restate water, sunlight, and carbon dioxide [7] before moving on.

Support: Give talk slip: I think most mass comes from ___ because ___. **Stretch:** Ask: If mass comes from air, which gas could supply the carbon?

Use: Slides 1–2

8–20 min **Teaching** 12 min · Whole class

Explain inputs, outputs, and energy change in photosynthesis.

YOU DO

1. Show Slide 3 and explain plants are not alone — algae and some bacteria photosynthesize too, all using sunlight to turn water and carbon dioxide into sugar and oxygen.
2. Show Slide 4 timeline and explain chlorophyll inside chloroplasts captures sunlight, with chlorophyll residing inside chloroplasts [7] and reflecting green while absorbing blue and red light [7].
3. Model the equation on the board: 6CO2 + 6H2O + light -> C6H12O6 + 6O2 [5], labeling carbon dioxide and water as reactants and glucose sugar and oxygen as products.
4. Think aloud that photosynthesis is a process used by plants, algae, and certain bacteria to harness energy from sunlight into chemical energy stored in sugar made from water and carbon dioxide [5].

STUDENTS DO

1. Copy the equation and label reactants and products in two colors.
2. Count carbon, hydrogen, and oxygen with the teacher on mini boards.
3. Repeat the energy sentence: light energy becomes chemical energy in sugar [5].

Say: Matter cycles in and out. Carbon dioxide plus water rearrange into sugar plus oxygen [5]. Atoms are not created, they are rearranged. Energy flows one way, from sunlight into chemical energy held in sugar [5].

Worked example: I do: Left side 6CO2 has 6 carbon and 12 oxygen, 6H2O has 12 hydrogen and 6 oxygen, total 6 carbon, 12 hydrogen, 18 oxygen. Right side C6H12O6 has 6 carbon, 12 hydrogen, 6 oxygen, plus 6O2 adds 12 oxygen, total 6 carbon, 12 hydrogen, 18 oxygen [5]. Same atoms, new molecules, light energy in, chemical energy stored.

Ask: What goes in and what comes out in photosynthesis? (In: carbon dioxide, water, and light. Out: glucose sugar and oxygen [5].) · Where does the energy in sugar come from? (From sunlight, harnessed and stored as chemical energy in sugar [5].) · Where does light get captured? (By chlorophyll inside chloroplasts [7].)

Check understanding: All hold up mini boards with the equation from memory. If atoms do not balance, recount together before video.

Support: Leave word bank on board: carbon dioxide, water, light, glucose, oxygen with formulas. **Stretch:** Ask: Why is oxygen released if the plant wanted sugar? Which atoms were left over?

Use: Slides 3–4

20–30 min **Video focus** 10 min · Whole class

Use video to see atoms rearrange while energy flows into sugar.

YOU DO

1. Show Slide 6 and set task: Spot water, carbon dioxide, and light going in and sugar and oxygen coming out.
2. Play Video clip 1 (0:00–5:00) without stopping.
3. Replay one 30-second section if students missed atom rearrangement and pause to label inputs and outputs.
4. Summarize: atoms cycle, energy flows from Sun to sugar [1].

STUDENTS DO

1. Watch Video clip 1 (0:00–5:00) and note inputs and outputs.
2. Write one matter note and one energy note.
3. Share notes with a neighbor and agree on the equation.

Say: Watch for two things. Follow matter: carbon dioxide and water become sugar and oxygen. Follow energy: sunlight becomes chemical energy in sugar bonds [5]. Write one fact for matter and one for energy.

Ask: What evidence from the video shows atoms were rearranged, not lost? (Same kinds of atoms appear before and after, just in sugar and oxygen [5].) · What evidence shows energy flowed into the plant? (Light went in and energy ended up stored in sugar that organisms can use [5].)

Check understanding: Cold-call for one matter note and one energy note. If energy is described as matter, restate light energy becomes chemical energy in sugar bonds [5].

Support: Provide sentence frame: Matter ___ became ___. Energy changed from ___ to ___. **Stretch:** Ask: If the plant is eaten, where do its carbon atoms and its stored energy go next?

Use: Slide 6, Video clip 1 (0:00–5:00)

Created with LessonDino.com · AI lesson planner with checkable sources

30–50 min **Main activity** 20 min · Groups

Build a claim-evidence-reasoning explanation for photosynthesis.

YOU DO

1. Show Slide 9 task and hand out printed evidence cards, large claim sheet, and markers.
2. Model sorting one card: plants need water, sunlight, and carbon dioxide [7] goes under matter in and energy in.
3. Circulate while groups sort cards showing they harness sunlight into chemical energy stored in sugar made from water and carbon dioxide [5] and release oxygen [7].
4. Prompt groups to write a paragraph that constructs a scientific explanation based on evidence for how matter cycles and energy flows [1].

STUDENTS DO

1. In groups sort evidence cards into matter in, matter out, and energy flow.
2. Write the equation, label reactants and products, and trace carbon, hydrogen, and oxygen.
3. Complete Worksheet Task F talk and write the group explanation on the large claim sheet.

Say: You will prove it like a scientist. Sort the evidence into matter cycling and energy flow. Then write the equation, trace the atoms, and draw energy flow from sunlight in to chemical energy in sugar. Finish Task F to explain it with evidence.

Worked example: Claim: New plant mass comes mostly from air and water, not soil. Evidence: Plants need water, sunlight, and carbon dioxide [7]; equation is 6CO2 + 6H2O + light -> C6H12O6 + 6O2 [5]; oxygen is breathed out [7]. Reasoning: Carbon from carbon dioxide and hydrogen and oxygen from water rearrange into glucose and oxygen, so atoms cycle, while light energy is stored as chemical energy in sugar [5].

Ask: Where did the new wood atoms come from if soil mass stayed the same? (Mostly from carbon dioxide in air and water, rearranged into sugar [5].) · How does your evidence show energy flowed into the organism? (Light energy was harnessed and stored as chemical energy in sugar bonds [5].)

Check understanding: Gallery check of claim sheets for equation, atom trace, and energy arrow. If missing, send group back to one evidence card to add it.

Support: Give a claim-evidence-reasoning frame with starters: Photosynthesis moves matter by ___ and Energy flows by ___. **Stretch:** Have them add what evidence they would still want to collect, such as mass of soil before and after growth.

Use: Slide 9, Worksheet Task F

Created with LessonDino.com · AI lesson planner with checkable sources

50–60 min **Plenary** 10 min · Whole class

Check understanding of matter cycling and energy flow.

YOU DO

1. State big idea: In photosynthesis, atoms are recycled but energy flows one way — from Sun to life.
2. Lead Slide 11 think, pair, share: A plant gains wood but soil stays the same — where did the new mass come from?
3. Run Slide 12 quick quiz orally for inputs, products, and energy location.
4. Collect exit answers on paper.

STUDENTS DO

1. Think, pair, share the soil question using matter and energy ideas.
2. Answer quiz questions as a class.
3. Write three-line exit ticket on their own.

Say: Same atoms move on, energy moves forward. Carbon dioxide and water rearrange into sugar and oxygen, and light energy becomes chemical energy in sugar [5]. Tell your partner the soil answer using the equation.

Ask: A plant gains wood but soil stays the same — where did the new mass come from? (Mostly carbon from carbon dioxide in air plus water, built into sugar and wood [5].) · What cycles? What flows? (Atoms of carbon, hydrogen, and oxygen cycle; energy flows from sunlight to chemical energy in sugar [1].)

Check understanding: Read three exit tickets aloud. If explanations miss energy flow, restate light to chemical energy [5] and have students add it.

Support: Allow pointing to equation and word bank when answering. **Stretch:** Ask: What would happen to animals if photosynthesis stopped making sugar and oxygen?

Use: Slides 11–12

Common mistakes

Mistake	How to spot it	How to fix it
Thinks plant mass comes from soil being eaten.	Explanation says roots eat soil and soil loss equals wood gain.	Weigh idea: soil stays nearly same while carbon dioxide plus water rearrange into sugar plus oxygen [5], so mass comes from air and water.
Thinks sunlight is food or becomes an atom in sugar.	Draws light as part of glucose molecule.	Show light is energy, not matter: plants harness sunlight into chemical energy stored in sugar made from water and carbon dioxide [5].
Thinks oxygen breathed out comes from nowhere or energy cycles like atoms.	Says energy cycles back to the Sun or oxygen appears without input.	Trace oxygen atoms from carbon dioxide and water to oxygen gas, and stress energy flows one way from Sun to sugar [1].

Support

- Pre-filled equation with word bank: carbon dioxide, water, light, glucose, oxygen.
- Talk frames for claim, evidence, and reasoning plus enlarged evidence cards.

Stretch

- Trace one carbon atom from air into leaf sugar, then into an animal that eats the plant.
- Design a soil-mass test to add as new evidence for the explanation.

For the LSE or teaching assistant

Sit with target groups during main activity, read evidence cards aloud, prompt atom counting, and scribe energy arrow if needed.

Check for understanding

Question	Answer
What three inputs does photosynthesis need?	Carbon dioxide, water, and sunlight [7].
What two products are made and where is energy stored?	Glucose sugar and oxygen; energy stored as chemical energy in sugar [5].
A seedling in a pot gains 500 grams but soil loses 10 grams. Explain with evidence.	Extra mass came from carbon dioxide and water rearranged into sugar and wood, with light energy stored [5].

Homework

Draw the equation with labeled arrows showing atoms cycling and energy flowing from sunlight to sugar.

Sources

1. 7th Grade Science Curriculum · boepublic.parkhill.k12.mo.us · https://boepublic.parkhill.k12.mo.us/attachments/f1e48687-3039-4450-aee4-ec4de68a9a3e.pdf
2. Grade 7 Science Curriculum - Fairfax County Public Schools · fcps.edu · https://www.fcps.edu/academics/middle/science/grade-7-life-science
3. Department of Energy Announces $100 Million for Artificial Photosynthesis Research | Department of Energy · energy.gov · https://www.energy.gov/articles/department-energy-announces-100-million-artificial-photosynthesis-research
4. Top seven photosynthesis researchers include three Plant Biology faculty members | School of Integrative Biology | Illinois · sib.illinois.edu · https://sib.illinois.edu/news/2025-12-10/top-seven-photosynthesis-researchers-include-three-plant-biology-faculty-members
5. Define photosynthesis. - Definition | CK-12 Foundation · ck12.org · https://www.ck12.org/flexi/biology/chloroplast/define-photosynthesis./
6. photosynthesis | PBS News · pbs.org · https://www.pbs.org/newshour/tag/photosynthesis
7. Photosynthesis · istitutolipani.com · http://www.istitutolipani.com/wp-content/uploads/2019/05/Photosynthesis.pdf
8. photosynthesis.bg Website Traffic, Ranking, Analytics [September 2026] · semrush.com · https://www.semrush.com/website/photosynthesis.bg/overview/?source=trending-websites
9. United States (US) Artificial Photosynthesis Market (2025-2031) | Outlook Growth & Trends · 6wresearch.com · https://www.6wresearch.com/industry-report/united-states-us-artificial-photosynthesis-market
10. CyberScope Daily - United States Plant Photosynthesis Instrument Market Brands 2026: Size & Ap · sites.google.com · https://sites.google.com/view/cyberscope-daily/top-trending-reports/united-states-plant-photosynthesis-instrument-market-brands-2026-size-ap

Created with LessonDino.com · AI lesson planner with checkable sources