

Wetland Carbon Loop

Use evidence to explain matter cycling and energy flow, then revise your explanation.

HS-LS2-3 "Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Read the background and Evidence A. Underline a path that carbon can follow. Circle where energy enters or leaves. Do not read the new evidence in the revision stage until you have written your first explanation.

One wetland, two oxygen conditions

- ① Plants use sunlight to build organic matter from carbon dioxide. Organisms use some of the chemical energy stored in that matter for life processes. Dead plant material becomes food for wetland microbes. Carbon atoms can move into microbial cells, dissolved substances, or gases; the atoms are rearranged, not destroyed. Some carbon dioxide can later be taken up by plants again.
- ② In oxygen-rich water, many microbes use aerobic respiration. In oxygen-poor mud, other microbes can use anaerobic pathways. Both can release usable energy from food, although the products and energy yields vary. Energy transfers also release heat to the surroundings. Matter can cycle through the wetland, but the energy leaving as heat does not cycle back into the plants' food; new sunlight supplies energy.
- ③ Evidence A is a simplified classroom simulation, not field data. Two equal microbe samples received the same plant-derived food at the same temperature for one day. Oxygen-rich sample R released 12 units of usable energy and oxygen-free sample M released 3 units. Both consumed food, produced new microbial material, and released heat. R released carbon dioxide; M produced dissolved carbon compounds. Energy units are comparable within this simulation only.

2 ANSWER WITH EVIDENCE _____ Use the passage

- 1** Which evidence shows that microbes can release usable energy without oxygen? Include a comparison with oxygen-rich conditions.

- 2** Trace one possible carbon path from air through a plant and a microbe and back to air. Which parts come from the background or Evidence A?

- 3** Why would drawing the same closed loop for both carbon and energy be misleading?

- 4** A student says R and M must produce identical substances because both release energy. Is that supported? Cite the simulation.

3 YOUR TURN

Your own words

Explain how matter cycles and energy flows in both oxygen conditions using the background and simulation. Write your first explanation before reading the new evidence. Then revise it and identify what changed.

First explanation

Write four or five sentences connecting photosynthesis, food, both microbe samples, matter conservation and energy transfer. Cite at least two observations from Evidence A. State one question that Evidence A leaves open.

New evidence: revise

Evidence B (same classroom simulation): After three days, a second kind of oxygen-free microbe used M's dissolved carbon compounds, released usable energy and heat, and produced methane and carbon dioxide. Some methane escaped; some entered oxygen-rich water, where other microbes used it and produced carbon dioxide. Revise your explanation in four or five sentences to incorporate this branching carbon path. Cite Evidence B, preserve what Evidence A still supports, and explain one change to your first explanation.

PART 1 • READ AND MARK

Read the background and Evidence A. Underline a path that carbon can follow. Circle where energy enters or leaves. Do not read the new evidence in the revision stage until you have written your first explanation. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Which evidence shows that microbes can release usable energy without oxygen? Include a comparison with oxygen-rich conditions.	M released 3 units without oxygen, compared with R's 12 units. M also consumed food and produced heat/new microbial material; oxygen absence does not mean all energy release stops.
2	Trace one possible carbon path from air through a plant and a microbe and back to air. Which parts come from the background or Evidence A?	Background: carbon dioxide enters plants and dead plant matter feeds microbes. Evidence A: R releases carbon dioxide, allowing some carbon to return to air and later plants. Atoms are conserved.
3	Why would drawing the same closed loop for both carbon and energy be misleading?	Carbon can be reused, but energy enters as sunlight, transfers as chemical energy, and leaves as heat. Heat lost to the surroundings does not return through the food pathway.
4	A student says R and M must produce identical substances because both release energy. Is that supported? Cite the simulation.	No. R releases carbon dioxide while M produces dissolved carbon compounds. Both release energy, but their products and amounts of usable energy differ.

PART 3 • YOUR TURN (SAMPLE ANSWER)

First explanation, example. Plants capture sunlight and place carbon from carbon dioxide into food. Both samples rearrange food matter into new microbial material and other products; R returns some carbon as carbon dioxide that plants can reuse. R releases 12 usable-energy units with oxygen, while M releases 3 without it, so energy release occurs in both conditions. Heat leaves both samples, so energy flows rather than cycling like carbon. Evidence A does not show what happens later to M's dissolved carbon compounds.

Revised explanation, example. Plants capture sunlight, and food transfers carbon and chemical energy to microbes under both oxygen conditions. Evidence A shows energy release in R and M, with heat leaving both. Evidence B adds that other anaerobic microbes can use M's dissolved compounds and produce methane and carbon dioxide. Some methane escapes, while some is used aerobically and returns carbon to carbon dioxide, which plants may reuse. I expanded my first explanation to show multiple carbon paths and later energy transfers, while keeping the distinction between cycling matter and flowing energy.

TEACHER ASSESSMENT NOTES

Require an initial and a revised explanation, both grounded in supplied evidence. Ask students to cover the revision stage until their first draft is complete. Accept different unknowns in the first draft; revision must add Evidence B and identify an actual change. Do not require chemical mechanisms or equal energy yields across anaerobic pathways. Methane production is one possible anaerobic pathway, not a universal product. The numerical observations are invented instructional data; no field study is claimed.