

The Vanishing Log: Where Did 9.6 Kilograms Go?

Learning target: I can use measurements from an open cage and a sealed jar to argue where the matter of a decaying log went, and explain why the law of conservation of matter still holds when something seems to disappear.

Claim, evidence, reasoning

About 45 min

Individual

MS-LS2-3 · assesses

MS-LS1-7 · supports

writing

data analysis

Name

Date

Period

Directions

Read the scenario and study the two tables and the field notes. Answer the warm-up questions first; they will organize your evidence. Then write your Claim, Evidence and Reasoning in the boxes. A strong response names specific numbers, names the reservoirs the matter moved to, and explains why the sealed jar matters for the argument.

You will need: This worksheet, Pencil, Scrap paper for the evidence columns, Calculator (optional)

The scenario

Three years ago, a science club placed a freshly cut oak log inside a wire-mesh cage on the ground at the edge of the school garden. The mesh let in air, rain, insects, fungi and bacteria but kept out dogs, raccoons and people. Each spring the club lifted the log out, brushed off loose dirt, weighed it, and put it back. This spring the log was a dark, crumbly shape that fell apart when lifted. The club's question: **the log lost 9.6 kg. Where did that matter go?**

Mass of the caged log, measured each spring (teaching dataset)

Simulated teaching dataset: the numbers are invented to be realistic, not measured.

Year	Mass of log (kg)	Appearance
0	12.0	Fresh, bark tight, pale wood
1	9.1	Bark loose; white fungus threads under bark; beetle holes
2	5.8	Bark gone; wood soft and brown; many insects
3	2.4	Dark, crumbly; breaks apart when lifted

Simulated data for teaching. The pattern is realistic for a log in a mild, moist climate, though most hardwood logs take longer than three years to break down this far.

To test whether decaying matter really disappears, the club also ran a sealed-jar experiment this year. They put 600 g of damp oak leaves and 200 g of garden soil (with its bacteria and fungi) into a 1-liter glass jar fitted with a small carbon dioxide sensor, sealed the lid with tape, and placed the whole jar on a balance that reads to 0.1 g every 30 days.

The sealed jar over 90 days (teaching dataset)

Simulated teaching dataset: the numbers are invented to be realistic, not measured.

Day	Total mass of sealed jar (g)	Carbon dioxide inside (ppm)	What the leaves looked like
0	850.0	600	Whole, brown, damp
30	850.0	2100	Spotted with white mold
60	849.9	3800	Dark and soft; pile settling and mold spreading
90	850.0	4900	Dark, limp and partly crumbled; edges blending into the soil

Simulated data for teaching. The balance reads to 0.1 g; the sensor reads carbon dioxide inside the jar.

Field notes from the cage site — 1. The soil directly under the log is darker than the soil 2 m away. A soil test showed 3.1 percent organic matter under the log and 1.2 percent in the comparison spot. 2. The cage mesh was intact all three years; no chunks of wood were found outside it. 3. On warm, damp days a faint earthy smell came from the cage. 4. Rain fell on the log every winter and drained into the soil below.

Warm-up: organize the evidence

1. Calculate the mass the log lost each year (year 0 to 1, 1 to 2, 2 to 3) and the total loss. Which year had the largest loss? Show your work.
2. In the sealed jar, the leaves clearly broke down, yet the total mass stayed at 850.0 g (within 0.1 g). What changed inside the jar as the leaves broke down? Use a number.
3. The cage and the jar differ in one important way for this argument. What is it, and why does that difference explain why one lost mass and the other did not?

Your argument

CLAIM

Claim: State where the log's missing 9.6 kg went. Name the reservoirs it moved to and the organisms that moved it.

EVIDENCE

Evidence: Give at least three specific pieces of evidence from the two datasets and the field notes, with numbers. For each one, say what it shows about where the matter went or did not go.

REASONING

Reasoning: Explain how the law of conservation of matter and the difference between an open system (the cage) and a closed system (the jar) connect your evidence to your claim. Your reasoning must explain why the jar's constant mass is evidence about the cage even though the jar lost nothing.

4. A classmate argues: 'Most of the log's mass went into the soil under it.' Using the field notes and your knowledge of decomposers, explain why the soil can account for only a small part of the 9.6 kg and where the rest must have gone.

5. If the club had put the whole log in a sealed container big enough to hold it, with a balance underneath, what reading would they expect after three years, and what would they expect the air inside to be like? Explain.

Two columns: what left, what stayed

On scrap paper make two columns headed 'Evidence that matter LEFT the log' and 'Evidence about WHERE it went.' Put the yearly mass losses and the intact mesh in the first column. Put the jar's rising carbon dioxide, the jar's constant total mass, the darker soil, and the earthy smell in the second column. Each item in the second column points to a reservoir: the air (as carbon dioxide and water vapor) or the soil (as dark organic matter). Your Claim names those reservoirs; your Evidence is the two columns; your Reasoning is why a closed jar proves that 'missing' mass became gas.

Carbon out of the fast cycle

Part of the log's carbon is now dark organic matter in the soil, where it may stay for decades. Under the right conditions, buried plant matter can stay out of the fast carbon cycle for millions of years and become coal. Write a paragraph comparing the cage, the jar and a coal seam as three reservoirs: how long carbon stays in each, what process moves it out, and why burning the coal is different from the decay in the cage even though both release carbon dioxide.