

Is the Dam Leaking? A Claim-Evidence-Reasoning Case About a Shrinking Lake

Learning target: I can use a water budget to argue, with evidence and water-cycle reasoning, what caused a lake to drop during a dry summer.

Claim, evidence, reasoning

About 45 min

Individual

MS-ESS2-4 · practice

writing

data analysis

Name

Date

Period

Directions

Read the scenario and the water district's notes. Study the dataset. Answer the warm-up questions first; they will give you the numbers your evidence needs. Then write your Claim, Evidence and Reasoning in the boxes. A strong response uses specific totals from the table, says what each number rules in or rules out, and explains the science of how water leaves a lake.

You will need: This worksheet, Pencil, Calculator, Scrap paper

The scenario

Mirror Lake is a small reservoir behind an earthen dam. Between June 1 and July 27, during a hot, rainless summer, the lake level fell 45 cm. At a town meeting, a resident named Mr. Okafor stood up and said: 'That dam has a crack. The lake is losing about 3 centimeters a week through it. Fix it before the lake is gone.' The water district manager, Ms. Reyes, said she would look at the numbers before spending money on repairs. Her team already measures the lake every week. Their notes and data are below.

Water district notes — 1. The lake level is read from a fixed staff gauge every Monday morning. 2. A floating evaporation pan sits in the lake so that its water is the same temperature as the lake; the pan's water loss is a good estimate of how much the lake surface loses to the air. 3. The only stream flowing in is gauged, and the water released through the dam's outlet pipe to the town is metered; both have been converted into centimeters of lake level so they can be compared with the drop. 4. No rain fell during the eight weeks. 5. The highest water temperature measured in the lake all summer was **23 °C**. 6. A diver inspected the dam face on June 3 and found no crack, but Mr. Okafor says a crack could be below the mud.

Mirror Lake weekly water budget, June 1 to July 27 (teaching dataset)

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

Week	Lake level drop (cm)	Evaporation pan loss (cm)	Stream inflow (cm)	Release to town (cm)
1	6.0	4.8	1.0	2.2
2	6.4	5.1	0.9	2.2
3	6.7	5.4	0.8	2.0
4	5.6	5.3	0.7	1.0
5	5.8	4.9	0.6	1.5
6	5.3	4.6	0.6	1.2
7	4.9	4.2	0.5	1.2
8	4.4	3.8	0.5	1.1

Simulated data for teaching. All values are in centimeters of lake level. Inflow raises the lake; evaporation and releases lower it. Readings are to the nearest 0.1 cm.

Warm-up: get the numbers ready

1. Add each column for the eight weeks: total drop, total evaporation, total inflow, total release. Show the four sums.

2. A water budget predicts the drop as: **evaporation + release – inflow**. Calculate the predicted drop from your totals, then subtract it from the measured total drop. How many centimeters of the drop are **not** explained by evaporation, release and inflow?

3. What percent of the measured drop is explained by evaporation alone? Show the division. Then calculate how many centimeters Mr. Okafor's claim ('about 3 cm a week') would add up to over eight weeks.

4. The lake never got warmer than 23 °C, yet the pan lost about 5 cm a week in June. Explain in terms of water molecules why so much water can evaporate from a lake that is nowhere near boiling.

5. Why did the evaporation loss fall from 5.4 cm in week 3 to 3.8 cm in week 8, even though it was still summer? Give one reasonable cause connected to the sun's energy or to the air.

Your argument

CLAIM

Claim: State what caused Mirror Lake to drop 45 cm, and whether the data support the claim that the dam is leaking about 3 cm a week.

EVIDENCE

Evidence: Give at least three specific pieces of evidence with numbers from the table and your warm-up answers (for example, the evaporation total, the unexplained remainder, the diver's inspection, the lake temperature). For each piece, say what it supports or rules out.

REASONING

Reasoning: Explain how the water cycle connects your evidence to your claim. Your reasoning must explain where the sun's energy and gravity each act in this lake system, why water can leave the surface below boiling, and why a small unexplained remainder does not prove a leak.

Organize before you write

Make a two-column list on scrap paper. Left column: 'Supports a leak.' Right column: 'Does not need a leak.' Put each number from your warm-up answers into one column with a few words on why. If the right column is much longer, your claim should say the lake's drop is explained without a leak. Then write your evidence straight from the list, one sentence per item.

Design the test that would settle it

Mr. Okafor is not convinced; he says the evaporation pan might be wrong. Design a two-week test that could settle the question without draining the lake. Say what you would measure, how often, what result would support a leak and what result would rule one out. One hint: a leak through a dam does not depend on sunshine, but evaporation does. Write your plan as numbered steps with a sentence on the expected results for each possibility.