Heat Meets Cool

Investigate how temperatures change in a closed system.

PH.PS3.4 "Plan and conduct an investigation to provide evidence that the transfer of thermal energy between components in a closed system results in a more uniform distribution among the components in the system (second law of thermodynamics)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the sentence explaining how the box keeps matter from entering or leaving, then circle both temperatures in the first and last table rows to compare them.

Two Tins, One Box

1. At a science museum, a researcher tests how thermal energy spreads between two sealed metal tins touching inside an insulated box. One tin holds warm sand, and the other holds cool sand. The box lid closes around the wires of two temperature probes, so no matter enters or leaves the box. The tins remain in contact during the test.

2. Before the tins touch, the researcher measures each tin with its probe. Then the researcher puts the tins together, closes the box, and reads both probes without opening it. Readings are taken every five minutes. Keeping the same probes in place allows the researcher to track each tin over time without changing the setup.

PROBE READINGS DURING THE TEST

Time (minutes)	Warm tin (°C)	Cool tin (°C)
0	40	20
5	34	25
10	30	28
15	29	29

3. The probes show how each tin's temperature changes while the tins touch. The insulated box slows energy exchange with the room, but does not stop it completely. A shrinking gap between the two readings can show whether the tins are becoming more alike in temperature. The readings alone cannot prove that no energy crossed the box boundary.

2 ANSWER WITH EVIDENCE

Use the passage

1. How did the researcher collect temperature readings without letting matter enter or leave the box?

2. What was the gap between the tin temperatures at 0 minutes and at 15 minutes? How do those gaps compare?

3. Using the readings at 0 and 10 minutes, what evidence suggests thermal energy moved from the warmer tin toward the cooler tin?

4. Why do these readings not prove that the box was perfectly isolated from the room?

3 YOUR TURN

Your own words

With two teacher-provided sealed water bottles, one warm and one cool, fitted with temperature strips, test what happens when they touch inside a clear lidded container: read both strips through the lid at 0, 5, and 10 minutes without opening it. Record all six readings, explain how the temperature gap changes, and name one way to reduce energy exchange with the room.

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PART 1 · READ AND MARK

Underline the sentence explaining how the box keeps matter from entering or leaving, then circle both temperatures in the first and last table rows to compare them. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How did the researcher collect temperature readings without letting matter enter or leave the box?	**The researcher read probes whose wires passed through the closed lid, without opening the box.**
2	What was the gap between the tin temperatures at 0 minutes and at 15 minutes? How do those gaps compare?	**The gap decreased from 20°C to 0°C.**
3	Using the readings at 0 and 10 minutes, what evidence suggests thermal energy moved from the warmer tin toward the cooler tin?	**The warm tin fell from 40°C to 30°C while the cool tin rose from 20°C to 28°C.**
4	Why do these readings not prove that the box was perfectly isolated from the room?	**Insulation slows energy exchange with the room but does not stop it completely.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

At 0 minutes, the warm and cool bottles read 38°C and 21°C. At 5 minutes, they read 33°C and 25°C. At 10 minutes, they read 30°C and 28°C. The bottles stayed sealed and touching inside the closed container while I read the strips through its lid. The gap shrank from 17°C to 2°C, showing that their temperatures became more alike. A towel around the container's sides could reduce energy exchange with the room.

Accept measured values that differ from the sample. Look for six recorded readings, a comparison of the initial and final temperature gaps, and a plausible way to limit energy exchange with the room.