The Lid Test

Predict how a design change could affect an experiment

FSL.3C.4 "Predict how modifying the experimental design or adding another measurement in an experimental design will affect results of the experiment."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the conditions kept the same in the two-cup test, and circle each way the passage says water can lose thermal energy. Use your marks to support your predictions.

Where Did the Heat Go?

1. Two students investigate whether a lid changes how quickly hot water cools. They pour 100 milliliters of water at 70 °C into each of two identical ceramic cups. One cup gets a snug lid; the other stays open. Both cups sit on the same counter, away from sunlight and drafts. The room is 22 °C. The students measure the water temperature at the start and after 20 minutes. At the end, the open cup reads 48 °C and the covered cup reads 55 °C. Those readings support a comparison, but they do not prove that every covered cup cools at the same rate.

2. Warm water transfers energy to cooler air and to the cup itself. In an open cup, moving air can carry away warmed air near the surface. Evaporation also removes water and thermal energy. A lid limits contact between the water surface and the room air, although it does not stop cooling. The cups must begin with equal amounts at the same temperature so that a difference after 20 minutes is easier to connect to the lid. Cup material and location should stay the same unless students deliberately test their effects in a separate experiment.

3. Results from one pair of cups can be affected by small differences in placement or how a thermometer is read. Running several trials and comparing average end temperatures would make a chance difference less persuasive. A design change can also alter what the test actually compares: changing only one cup's position adds a second possible cause of any temperature gap. Before predicting a new result, identify what changes, what stays fixed, and which heat-transfer process the change might affect. Additional measurements can strengthen an explanation, provided they are taken consistently for both cups.

2 ANSWER WITH EVIDENCE

Use the passage

1. If the covered cup has a loose lid instead of a snug one, how would you expect its temperature after 20 minutes to compare with 55 °C? Explain.

2. Suppose only the open cup is moved next to a fan. Predict how its final temperature and the gap between the cups might change.

3. If the students also measure both temperatures after 10 minutes, what pattern would you predict? What could that measurement help them find out?

4. The students weigh the water in each cup before and after the test. Predict which cup would lose more water, and explain how that measurement could help account for the temperature results.

3 YOUR TURN

Your own words

Propose a different change to the two-cup design that no question above uses. State what you would keep the same, predict how the change would affect a temperature result, and explain your prediction using a way heat moves.

ANSWER KEY

The Lid Test

PART 1 · READ AND MARK

Underline the conditions kept the same in the two-cup test, and circle each way the passage says water can lose thermal energy. Use your marks to support your predictions. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	If the covered cup has a loose lid instead of a snug one, how would you expect its temperature after 20 minutes to compare with 55 °C? Explain.	**It would likely be lower than 55 °C because a loose lid allows more contact with room air.**
2	Suppose only the open cup is moved next to a fan. Predict how its final temperature and the gap between the cups might change.	**The open cup would likely end below 48 °C, making the temperature gap larger. Moving air can carry heat away faster.**
3	If the students also measure both temperatures after 10 minutes, what pattern would you predict? What could that measurement help them find out?	**The open cup would likely be cooler than the covered cup. The readings would show whether a temperature gap is already present after 10 minutes.**
4	The students weigh the water in each cup before and after the test. Predict which cup would lose more water, and explain how that measurement could help account for the temperature results.	**The open cup would likely lose more water. That would support evaporation as one reason it ended cooler.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would use two identical insulated cups instead of ceramic cups, keeping the starting water amounts, temperatures, and lid setup the same. I predict both cups would be warmer after 20 minutes than they were in the original test. Insulated cup walls should slow the transfer of energy from the water to the cooler room.

Accept predictions supported by a heat-transfer process in the passage, even when an exact temperature cannot be determined. For Part 3, the change must differ from those in the questions and include a control, a predicted result, and a reason.