Roof Color Test

Examine how a design choice affects an experimental claim.

FSL.3C "Students will apply scientific literacy and thinking skills to analyze scientific investigations found in various experimental designs including, but not limited to, those found in sample ACT science passages…"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the question the class tested, circle the tools and measurements, and number two details that could make the color comparison unreliable.

Two Roofs in the Sun

1 At a school facing higher cooling costs, a class asked whether a white roof would keep a small model room cooler than a black roof under the same sunlight. They built two cardboard boxes with identical dimensions and lids made from the same material. They painted only the outside of each lid, one white and one black. A digital temperature probe hung two centimeters below each lid, away from the walls. Before testing, both boxes sat indoors until their interior air reached 22°C. The class planned to compare the change in interior air temperature, not the temperature of the painted surfaces.

2 At noon, students placed the boxes side by side outdoors, with both lids facing upward. They used a ruler to check that the boxes were the same distance from a nearby wall. The probes recorded interior air temperature every five minutes for 30 minutes. After 15 minutes, the wall's shadow began crossing the white box, while the black box stayed in direct sunlight. At 30 minutes, the white box read 28°C and the black box read 34°C. The class had used only one pair of boxes and had not checked whether the two probes agreed at the same temperature.

3 One student argued that the final readings proved white roofs always keep rooms cooler. Another noted that sunlight exposure was no longer equal, so lid color was not the only possible cause of the difference. The students could repeat the test in an open area far from walls and trees, checking both probe readings together before each run. They could also repeat runs on several sunny days and exchange the probes between boxes. Those changes would help them separate effects of lid color from effects of shade, weather, or a faulty probe. The results would still apply directly to model boxes, not full buildings.

2 ANSWER WITH EVIDENCE

Use the passage

1. Is the class's question testable? Identify the variable they changed, the outcome they measured, and one feature they kept the same.

2. Why did the class hang the probes below the lids instead of placing them against the painted surfaces?

3. Do the final readings alone show that lid color caused the temperature difference? Use one procedure detail to explain.

4. Suppose the class repeats the test in an unshaded area but still uses only one pair of boxes. Which concern does that change reduce, and which concern remains?

3 YOUR TURN

Your own words

Design an alternate test using one model room and a lamp instead of two boxes outdoors. In 3 to 5 sentences, name what you would change and measure, explain how you would keep conditions comparable, and propose an additional trial with its purpose.

ANSWER KEY

Roof Color Test

HIGH SCHOOL · FSL.3C

PART 1 · READ AND MARK

Underline the question the class tested, circle the tools and measurements, and number two details that could make the color comparison unreliable. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Is the class's question testable? Identify the variable they changed, the outcome they measured, and one feature they kept the same.	**Yes. They changed lid color and measured the change in interior air temperature. The boxes had identical dimensions, for example.**
2	Why did the class hang the probes below the lids instead of placing them against the painted surfaces?	**The question concerns interior air temperature. A probe touching a lid would measure the surface rather than the air below it.**
3	Do the final readings alone show that lid color caused the temperature difference? Use one procedure detail to explain.	**No. The white box entered the wall's shadow while the black box stayed in direct sunlight, so unequal sunlight could have affected the readings.**
4	Suppose the class repeats the test in an unshaded area but still uses only one pair of boxes. Which concern does that change reduce, and which concern remains?	**It reduces the concern that unequal shade caused the difference. A difference between the particular boxes or probes could still affect a single test.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would use one model room with interchangeable black and white lids and shine the same lamp on each lid in separate runs. Lid color would change, and I would measure the room's air temperature after 30 minutes with the same probe. I would keep the lamp distance fixed and let the room return to 22°C before each run. I would repeat both runs in reverse order to check whether run order affected the temperature difference.

Accept other controlled features stated in the passage, such as lid material or starting temperature. For the alternate test, accept a feasible additional trial that checks consistency or a possible source of error.