

# Choose, Test, Improve

Use test data to select and refine a physical science design.

**PS.1.c.iv** “interpreting, analyzing, and evaluating data use data to evaluate and refine design solutions to best meet criteria”

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## 1 READ AND MARK \_\_\_\_\_ Read it twice

**YOUR JOB** Underline each design criterion. Number the data-based reasons that support a design choice, then circle the planned refinement and the new evidence it will need.

### Testing a Cup Holder

- ① A student team designed an insulated cup holder to keep 200 mL of warm water above 55°C for 20 minutes. Their criteria also required materials to cost less than \$1.00 and the holder to fit around a cup. They built three versions, using the same cup, water amount, starting temperature, room, and test time. Repeating controls made their comparison fair.

#### CUP HOLDER TEST RESULTS

| Version        | Water temperature after 20 min | Material cost |
|----------------|--------------------------------|---------------|
| A, paper wrap  | 48°C                           | \$0.20        |
| B, felt sleeve | 57°C                           | \$0.85        |
| C, bubble wrap | 54°C                           | \$0.45        |

- ② Version B was the only design that met both measured criteria. Its water finished at 57°C, which is above 55°C, and its \$0.85 cost is below \$1.00. Version C cost less but ended one degree too cool. Version A was cheapest, but it lost the most heat. The team chose B as the best current solution.
- ③ However, the data did not prove that B was finished. During testing, the felt sleeve absorbed spilled water and dried slowly. The team added a new criterion: the holder should resist spills and dry quickly. They planned a thin waterproof cover for the felt. Then they would repeat temperature and cost tests and measure drying time after equal spills.

## 2 ANSWER WITH EVIDENCE Use the passage

1 Which version met both measured criteria? Use two data values to support your answer.

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2 Why was Version C not chosen, even though it cost less than Version B?

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3 Name two conditions the team kept the same during testing. Why did keeping conditions the same matter?

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4 What new criterion did the team add? What additional data did they plan to collect after refining the design?

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## 3 YOUR TURN Your own words

A device case must have no cracks after three 1-meter drops and weigh under 80 g. Trial X had 0 cracks and weighed 92 g, Trial Y had 1 crack and weighed 72 g, and Trial Z had 0 cracks and weighed 76 g. In exactly three sentences, choose the best current design, cite the data, and propose one useful next refinement or test.

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**PART 1 • READ AND MARK**

Underline each design criterion. Number the data-based reasons that support a design choice, then circle the planned refinement and the new evidence it will need. Accept any marking that follows this job and points at the right text.

**PART 2 • ANSWERS**

| # | QUESTION                                                                                                      | ANSWER                                                                                                                                                                             |
|---|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Which version met both measured criteria? Use two data values to support your answer.                         | <b>Version B. Its water temperature was 57°C, above 55°C, and its material cost was \$0.85, below \$1.00.</b>                                                                      |
| 2 | Why was Version C not chosen, even though it cost less than Version B?                                        | <b>Version C cost \$0.45, but its water temperature was 54°C after 20 minutes. This was below the 55°C temperature criterion.</b>                                                  |
| 3 | Name two conditions the team kept the same during testing. Why did keeping conditions the same matter?        | <b>Any two: cup, water amount, starting temperature, room, or test time. Keeping them the same made the comparison fair, so differences could be linked to the holder designs.</b> |
| 4 | What new criterion did the team add? What additional data did they plan to collect after refining the design? | <b>The holder should resist spills and dry quickly. The team planned to collect temperature, cost, and drying-time data after equal spills.</b>                                    |

**PART 3 • YOUR TURN (SAMPLE ANSWER)**

Trial Z is the best current design because it had no cracks after three drops and weighed 76 g. It meets the crack criterion and stays below the 80 g mass limit. Next, test Trial Z after six drops to see whether it still protects the device.

Accept equivalent evidence-based explanations that compare each result with the stated criteria. For the open task, accept any accurate choice of Trial Z, two relevant data references, and a reasonable next test or refinement.