

Build the Best

Compare prototype test data to combine useful design features.

MS-ETS1-3 "Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline the three success criteria. Circle each test result that meets a criterion, and write 1, 2, or 3 beside results for the same criterion so you can compare the prototypes.

Cold Water Challenge

- ① An after-school engineering team designed containers to carry cold water during a field hike. Their success criteria were clear: after 30 minutes in warm sunlight, water should stay below 10°C, the empty container should weigh less than 250 grams, and the container should not leak. The team built three different prototypes. Before choosing one, they agreed to test each prototype in the same sunny location with the same amount of ice water. They also measured mass with the same scale and checked each container for leaks.
- ② Prototype A used a steel bottle, a thick foam sleeve, and a snap lid. Its water was 8°C after the test, and it did not leak, but it weighed 310 grams. Prototype B used a light plastic bottle and a tight screw cap. It weighed 180 grams and did not leak, but its water reached 14°C. Prototype C used a thin metal bottle, a cork stopper, and a reflective outer coating. It weighed 240 grams, and its water was 9°C, but 5 milliliters leaked from the stopper.
- ③ The results showed no single prototype met every criterion. A kept water cold, did not leak, yet was heavy. B met mass and leak criteria, yet it did not keep water cold enough. C met temperature and mass criteria, yet its stopper leaked. The team sought useful characteristics, not one winner. They noticed that A's thick foam sleeve was linked to the coldest water, while B's light plastic bottle and tight screw cap were linked to low mass and no leaks. A new design could combine those characteristics, then be tested again.

2 ANSWER WITH EVIDENCE Use the passage

- 1 Compare A and B. What criterion did both prototypes meet? What different criterion did A miss, and what different criterion did B miss?

- 2 Prototype C was similar to A in one successful result and similar to B in another successful result. Identify both similarities.

- 3 What evidence shows that C should not be chosen without a design change, even though it met the temperature and mass criteria?

- 4 Why did the team look for useful characteristics from several prototypes instead of naming one prototype the winner?

3 YOUR TURN Your own words

In exactly three sentences, propose a new container using at least two named characteristics from different prototypes. Explain how the results support your choices and describe a fair retest, including what you would keep the same and what you would measure.

PART 1 • READ AND MARK

Underline the three success criteria. Circle each test result that meets a criterion, and write 1, 2, or 3 beside results for the same criterion so you can compare the prototypes. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Compare A and B. What criterion did both prototypes meet? What different criterion did A miss, and what different criterion did B miss?	Both did not leak. A missed the mass criterion because it weighed 310 grams. B missed the temperature criterion because its water reached 14°C.
2	Prototype C was similar to A in one successful result and similar to B in another successful result. Identify both similarities.	Like A, C kept water below 10°C. Like B, C weighed less than 250 grams.
3	What evidence shows that C should not be chosen without a design change, even though it met the temperature and mass criteria?	Five milliliters leaked from C's cork stopper, so it did not meet the no-leak criterion.
4	Why did the team look for useful characteristics from several prototypes instead of naming one prototype the winner?	No prototype met all three criteria. A was too heavy, B did not keep water cold enough, and C leaked.

PART 3 • YOUR TURN (SAMPLE ANSWER)

I would build a container with B's light plastic bottle and tight screw cap, covered by A's thick foam sleeve. A's sleeve kept water at 8°C, while B weighed 180 grams and did not leak. I would test it beside the other prototypes in the same sunlight with the same ice water, then measure water temperature, mass, and leaks.

Accept equivalent comparisons that accurately use the criteria and test data. For the open task, accept other evidence-based combinations if the student names features, explains the data connection, and describes a controlled retest with measurements.