

Sleeve Test Data

Use repeated trials and means to choose a heat-saving design.

PS.1.c "interpreting, analyzing, and evaluating data construct and interpret data tables showing independent and dependent variables, repeated trials, and means construct, analyze..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline the words that name what the team changed, circle the words that name what it measured, and number the three limits of the test. These marks help you judge what the data can show and what they cannot show.

Which Sleeve Holds Heat?

- ① Engineers tested four sleeve materials to slow heat loss from identical cups of hot water. Each cup began at 70°C and sat in the same room for 20 minutes. The team changed only the sleeve material, then measured each cup's temperature decrease. Their table lists three trials for each material. A mean, or average, helps compare results.

TEMPERATURE DECREASE AFTER 20 MINUTES

Sleeve material	Trial 1 decrease (°C)	Trial 2 decrease (°C)	Trial 3 decrease (°C)	Mean decrease (°C)
No sleeve	18	17	19	
Felt	10	9	11	
Bubble wrap	7	8	6	
Foil	13	12	14	

- ② The independent variable is the sleeve material, and the dependent variable is the temperature decrease after 20 minutes. The three measurements in each row are repeated trials, not three different conditions. Calculate each mean by adding the trial values and dividing by three. A smaller temperature decrease means the sleeve retained more heat during the test.
- ③ Data do not settle every design decision. The team used only three trials in one room condition, so a draft or unusual measurement could affect the result. The test also does not show whether a sleeve is durable, inexpensive, or easy to reuse. Before choosing a final sleeve, engineers should test more cups under varied conditions and compare the results with their criteria.

2 ANSWER WITH EVIDENCE Use the passage

1 Calculate the mean temperature decrease for each sleeve material. Write all four means.

2 Which sleeve best meets the criterion of reducing heat loss? Use its mean to explain your answer.

3 Why did the team collect three trials for each material instead of only one trial?

4 Name one limitation of this test and one way to refine the investigation.

3 YOUR TURN Your own words

Create a model data table for a 20-minute test comparing one layer and two layers of bubble wrap. Enter three plausible temperature-decrease trials for each thickness, calculate each mean, then write three sentences below the table: identify the independent and dependent variables, recommend a design using the lower-heat-loss criterion, and name one refinement for the test.

BUBBLE-WRAP THICKNESS	TRIAL 1 DECREASE (°C)	TRIAL 2 DECREASE (°C)	TRIAL 3 DECREASE (°C)	MEAN DECREASE (°C)

PART 1 • READ AND MARK

Underline the words that name what the team changed, circle the words that name what it measured, and number the three limits of the test. These marks help you judge what the data can show and what they cannot show. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Calculate the mean temperature decrease for each sleeve material. Write all four means.	No sleeve: 18°C. Felt: 10°C. Bubble wrap: 7°C. Foil: 13°C.
2	Which sleeve best meets the criterion of reducing heat loss? Use its mean to explain your answer.	Bubble wrap. Its mean temperature decrease is 7°C, the smallest mean, so it retained the most heat.
3	Why did the team collect three trials for each material instead of only one trial?	Repeated trials make the result more dependable because one unusual measurement is less likely to control the conclusion.
4	Name one limitation of this test and one way to refine the investigation.	A limitation is that the team tested only three trials in one room condition. They could test more cups under varied conditions.

PART 3 • YOUR TURN (SAMPLE ANSWER)

One layer | 8 | 7 | 9 | 8 Two layers | 5 | 6 | 4 | 5 The independent variable is bubble-wrap thickness, and the dependent variable is temperature decrease after 20 minutes. I recommend two layers because its mean decrease of 5°C is lower than the mean decrease of 8°C for one layer. The team should test more cups in different room conditions to make the comparison more dependable.

Accept any plausible trial data with correctly calculated means. The recommendation should match the lower mean temperature decrease, and the refinement should address repeated trials, testing conditions, or an additional design criterion such as durability or cost.