Cup Sleeve Test

Plan a fair investigation and judge the quality of its data.

PS.1.b "planning and carrying out investigations independently and collaboratively plan and conduct observational and experimental investigations; identify variables, constants..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the independent variable and measured outcome, box the control condition, circle each constant, and number the actions that protect safety or improve data quality.

Testing a Reusable Cup Sleeve

1. To test whether a cardboard sleeve slows the cooling of hot water, Mira's team planned an experiment before collecting data. They chose water temperature as the measured outcome. The independent variable was sleeve type: no sleeve, one-layer cardboard, or two-layer cardboard. A cup with no sleeve served as the control condition. The team predicted that two layers would keep water warmest after ten minutes. They listed constants: identical paper cups, 200 mL of water, starting temperature, room location, and wait time.

2. Using heat-resistant gloves, the team poured 200 mL of hot water into each cup and placed a thermometer probe in the water without touching the cup bottom. They recorded temperatures to the nearest 0.1°C at the start and after ten minutes. They used three cups for each sleeve type, rather than one, and read the probe at eye level. They kept hot water away from the table edge and cleaned spills promptly. No one tasted the water or handled hot cups without gloves.

3. Afterward, the team subtracted each final temperature from its starting temperature to find temperature change. They calculated the mean change for the three trials in each condition. Repeating trials and averaging reduced the effect of an unusual reading, but it did not fix a thermometer that was miscalibrated. To improve accuracy, the team could check the thermometer against a known reference temperature before testing. Their evidence would support a decision about which sleeve design to construct for a reusable cup.

2 ANSWER WITH EVIDENCE

Use the passage

1. What was the independent variable, what was the measured outcome, and what condition was the control?

2. Name two constants in this investigation. Why must constants stay the same?

3. Identify one action that improved data collection and one action that improved data analysis.

4. Why would averaging the trials not fix a miscalibrated thermometer? What should the team do instead?

3 YOUR TURN

Your own words

Plan an investigation to test how surface material affects the distance a toy car rolls. In 80 to 110 words, include the independent variable, measured outcome, baseline control, constants, metric tool, repeated trials, one accuracy step, and one safety step.

ANSWER KEY

Cup Sleeve Test

GRADES 7-8 · PS.1.b

PART 1 · READ AND MARK

Underline the independent variable and measured outcome, box the control condition, circle each constant, and number the actions that protect safety or improve data quality. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What was the independent variable, what was the measured outcome, and what condition was the control?	**Independent variable: sleeve type. Measured outcome: water temperature, or temperature change. Control condition: the cup with no sleeve.**
2	Name two constants in this investigation. Why must constants stay the same?	**Accept any two: identical paper cups, 200 mL of water, starting temperature, room location, or wait time. Constants make sleeve type the main cause of any difference in results.**
3	Identify one action that improved data collection and one action that improved data analysis.	**Data collection actions include reading the probe at eye level, recording to the nearest 0.1°C, or using three cups per sleeve type. Data analysis action: calculating the mean temperature change for the three trials.**
4	Why would averaging the trials not fix a miscalibrated thermometer? What should the team do instead?	**A miscalibrated thermometer gives consistently incorrect readings, so averaging does not correct them. The team should check it against a known reference temperature before testing.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I will test whether a toy car rolls farther on smooth plastic or felt. The surface type is the independent variable, and rolling distance in centimeters is the dependent variable. I will use the same car, ramp height, release point, floor location, and metric tape measure each time. A bare floor will be my comparison condition. I will release the car without pushing it three times on each surface, record each distance to the nearest centimeter, and calculate each mean. I will keep the ramp low, clear the path, and keep hands away from the moving car.

Accept equivalent wording for variables, control, constants, safety practices, and accuracy practices when it matches the passage. For the open response, accept any feasible fair test that includes every required investigation element and uses an appropriate metric measurement.