Warm Cup Test

Plan a fair investigation and use data to judge a design.

4.1 "The student will demonstrate an understanding of scientific and engineering practices by asking questions and defining problems identify scientific and non-scientific questions develop hypotheses as cause-and-effect relations define a..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the scientific question and the hypothesis. Circle the changed variable, then number the four facts that were kept the same.

Which Sleeve Works Best?

1 Class 4 wanted to design a sleeve that keeps a cup of water warm. Their question was scientific: "How does sleeve material affect water temperature after 15 minutes?" They predicted a cause-and-effect relation: If a sleeve is thicker, then the water will lose less heat because thicker material slows heat transfer.

2 To make it a fair test, the team changed only the covering: no sleeve, felt, bubble wrap, or paper. They kept the cup size, water amount, starting temperature, and room location the same. Using a graduated cylinder, they measured 200 milliliters of water. They used a thermometer at the start and after 15 minutes on a timer.

WATER TEMPERATURE AFTER 15 MINUTES

final water temperature in °C

3 The team first recorded temperature readings. Then they made a bar graph from those data. Felt had the highest final temperature, so it was the best tested sleeve. Their paper-cup model helped them check sleeve fit, but it could not show every heat change in a real cup.

2 ANSWER WITH EVIDENCE

Use the passage

1. What variable did the team change? Name two things they kept the same.

2. Which tool measured the water amount, and how long did the team wait before taking the second temperature reading?

3. According to the bar graph, which covering had the highest final water temperature? What was the temperature?

4. What evidence supports the conclusion that felt was the best tested sleeve? What is one limitation of the paper-cup model?

3 YOUR TURN

Your own words

Plan a fair test for a wrapping material that helps a container keep an ice cube from melting. In 5 to 6 sentences, write a scientific question, an If...then...because hypothesis, the one variable you will change, two things you will keep the same, a metric tool and elapsed time, and one limit of a sketch model.

ANSWER KEY

Warm Cup Test

GRADE 4 · 4.1

PART 1 · READ AND MARK

Underline the scientific question and the hypothesis. Circle the changed variable, then number the four facts that were kept the same. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What variable did the team change? Name two things they kept the same.	**They changed the covering or sleeve material. They kept the cup size, water amount, starting temperature, and room location the same. Any two controls are correct.**
2	Which tool measured the water amount, and how long did the team wait before taking the second temperature reading?	**They used a graduated cylinder, and they waited 15 minutes.**
3	According to the bar graph, which covering had the highest final water temperature? What was the temperature?	**Felt had the highest final water temperature, 56 °C.**
4	What evidence supports the conclusion that felt was the best tested sleeve? What is one limitation of the paper-cup model?	**Felt had the highest final temperature, 56 °C. The model could not show every heat change in a real cup.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

My question is, "How does wrap material affect the amount of melted water after 20 minutes?" If cotton is used as a wrap, then less ice will melt because cotton slows heat transfer. I will change the wrap material and keep the ice cube size and room location the same. I will use a graduated cylinder to measure melted water in milliliters and a timer for 20 minutes. My sketch cannot show all heat moving through the real container.

For Question 1, accept any two listed controlled variables. For Question 4 and Your Turn, accept a model limitation only when it states something the model cannot represent about the real object or process, such as heat changes, not a limit of the test conditions.