

Prerequisite mini-lesson · Read before comparing

Question: What do the headings and numbers tell us before we explain a result? A temperature is a reading in degrees Celsius (°C). A temperature change compares two readings from the same setup. A higher final value than the start means warming; a lower one means cooling.

For a fair design comparison, check that starts, water mass, elapsed time, room conditions, and measurement method match. Compare the same points in time. Repeated trials give more than one chance to see a pattern; do not choose only a convenient row.

Three separate water samples in one 22°C room. Each has 100 g of water and the same cup, lid, and measurement method. The labels W, X, and Y name samples, not sleeve designs.

Temperatures at the start and after 15 minutes

Constructed teaching data: these values were invented for this activity, not collected in an experiment.

Trial	Start (°C)	After 15 min (°C)
W	12	16
X	12	15
Y	12	17

1. Point to the heading that names the measured quantity and unit. What does the 15-minute column mean?

2. How much did W, X, and Y change? Say whether each warmed or cooled.

3. If another sample started at 30°C and ended at 26°C after 15 minutes, did it warm or cool, and by how much?

4. Why would a 10-minute result from a different starting temperature be a weak direct comparison with X?

Support: Trace start → finish with a finger or number line. You may explain aloud or use a labeled arrow instead of a paragraph.

Teacher model · Which sleeve slowed warming?

Question: Which complete sleeve design better limited warming of cool water in this 20-minute comparison?

One illustrative trial. Equal 100 g water samples begin at 10°C in a 22°C room. Matching cups and lids, exposure time, and thermometer procedure are stated. No ice, active cooling, or direct sunlight is involved. The sleeve designs differ.

Water temperature over 20 minutes

Constructed teaching data: these values were invented for this activity, not collected in an experiment.

Time (min)	No sleeve (°C)	Sleeve A (°C)	Sleeve B (°C)
0	10	10	10
5	14	11	12
10	17	12	14
15	19	13	15
20	20	14	16

1. What is measured? Give two observations without explaining the cause.

2. Find the 0-to-20-minute temperature change for all three setups.

3. Which sleeve is better supported? Compare it with the other sleeve and with no sleeve at the same time.

4. A fictional student says, ‘Sleeve A stopped all energy transfer because its water stayed colder.’ Which part is supported? What must change?

5. Explain the direction of net thermal-energy transfer and name one conclusion this record cannot establish.

Guided practice · Check every trial

Question: In these repeated comparisons, which sleeve is better supported for limiting warming?

Three separate trials with fresh 100 g water samples, each starting at 10°C in a 22°C room. Cups, lids, 20-minute exposure, and thermometer procedure match. Each row compares setups tested under the same stated conditions.

Final water temperatures after 20 minutes

Constructed teaching data: these values were invented for this activity, not collected in an experiment.

Trial	No sleeve: final °C	Sleeve L: final °C	Sleeve N: final °C
1	20	16	17
2	21	17	18
3	20	16	17

1. In Trial 1, how much did L and N warm? Which comparison is relevant?

2. Look at Trials 2 and 3. Does the same design have less warming in each? Cite the matched pairs.

3. Make a claim for these conditions. Include one limit. Does the table prove which heat-transfer pathway caused the result?