

Bridge · Requirements and predictions

A performance criterion states what a design must achieve. A constraint limits resources, size or procedure. A prediction is a testable expectation, not a measured outcome. We evaluate complete sleeves here; changing two sleeve features does not isolate the effect of one.

100 g, start 10°C, room 22°C, 15 min. Final ≤16°C in EVERY trial; ≤4 tokens; ≤15 mm added thickness. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-P · Supplied design record

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

Design	Tokens	Added mm	Trial 1 final °C	Trial 2 final °C	Trial 3 final °C
H	3	12	16	16	16

K6-P1. Identify the performance criterion and the two resource/size constraints. Does H meet every nominal requirement? Show each check.

K6-P2. H warms from 10°C to 16°C. Does it cool the water or stop all transfer? Classify “sealing its gap may reduce warming” as a prediction or an observed result. What matched test would investigate that prediction?

Grade 6 provisional target; NGSS Grades 6–8 band. Prerequisites: read °C/time, compare changes, consider trials and conditions. Paper and pencil only. Tokens are fictional resource units. Respond in connected prose, orally while pointing to data, or with a labeled representation. Clarify the question, table access, vocabulary and response mode before choosing a reteach. Sparse language can express adequate reasoning.

Model · Check the complete brief

Question: Which designs meet the brief, and how could a teacher choose between feasible designs? A nominal pass concerns these supplied records, not a guarantee.

100 g, start 10°C, room 22°C, 20 min. Final ≤15.5°C in EVERY trial; ≤8 tokens; ≤20 mm added thickness. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-M · Supplied design record

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

Design	Tokens	Added mm	Trial 1 final °C	Trial 2 final °C	Trial 3 final °C
A	5	18	15	15.5	15
B	8	20	14	14.5	14
C	9	18	13.5	14	13.5
D	6	24	14.5	15	14.5

K6-M1. For each design, check all three final readings, tokens and thickness. List every feasible design; record why each other design fails.

K6-M2. Choose a feasible design and name a priority that makes your choice reasonable. Compare its resource use and thermal result with the other feasible design. State one limitation.

Practice · A decision needs a priority

100 g, start 12°C, room 24°C, 18 min. Final ≤17°C in EVERY trial; ≤6 tokens; ≤18 mm added thickness. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-G · Supplied design record

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

Design	Tokens	Added mm	Trial 1 final °C	Trial 2 final °C	Trial 3 final °C
E	4	12	16	16.5	16
F	6	18	15	15.5	15
G	5	15	16	17.5	16

K6-G1. Identify all feasible designs. A fictional response says “G is fine because its average is under 17°C.” Evaluate that response against the actual all-trials rule.

K6-G2. Choose between feasible designs. Explain a genuine tradeoff using at least two matched comparisons. What scientific idea helps explain why all these samples warm?

A lower final reading can be relevant when starts and intervals match; it is not a universal decision rule. A difference in displayed readings is not proof of a reliable advantage.

Independent challenge · Record a proposal first

Quick Check disclosure: this is the same independent challenge used in Teach the Design Challenge. It is not fresh after you have seen or attempted it. Keep the next page out of view until you finish this page.

80 g, start 11°C, room 23°C, 16 min. Final $\leq 16.5^\circ\text{C}$ in EVERY trial; ≤ 5 tokens; ≤ 19 mm added thickness. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-I · Supplied design record

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

Design	Tokens	Added mm	Trial 1 final °C	Trial 2 final °C	Trial 3 final °C
J	3	14	16	16	16.5
K	5	19	15	15.5	15
L	4	16	15	17	15
N	6	18	14	14.5	14

K6-I1. Check every requirement. Which designs are feasible? Select one and justify your priority with relevant comparisons across trials.

K6-I2. Propose a specific modification to your chosen design. State a testable prediction and describe a matched repeated comparison against the unchanged design. Include starting conditions, duration, what to record, and what would count against the prediction.

Independent challenge · Separate redesign evidence

Reveal only after I0. These are specified fictional prototypes, not results for your own unbuilt proposal: J-sealed closes a gap in J with one extra token; K-thin uses a thinner wrap with the same token allowance. Changes are already included in the table. Do not invent a successful result for your proposal.

80 g, start 11°C, room 23°C, 16 min. Final ≤16.5°C in EVERY trial; ≤5 tokens; ≤19 mm added thickness. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-R · Supplied design record

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

Design	Tokens	Added mm	Trial 1 final °C	Trial 2 final °C	Trial 3 final °C
J-sealed	4	14	15.5	16	17
K-thin	5	17	15.5	16	16

K6-I3. Reassess these prototypes against the original brief. Compare each with its original record on I0; what must be revised? Is either a demonstrated universal improvement?

K6-I4. Retain your original proposal as a hypothesis, or revise it. Explain the evidence needed before claiming its success. Name one conclusion the supplied records cannot establish.

Reteach · Meet every requirement

100 g, start 10°C, room 22°C, 20 min. Final ≤15°C in EVERY trial; ≤5 tokens; ≤18 mm added thickness. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-A · Supplied design record

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

Design	Tokens	Added mm	Trial 1 final °C	Trial 2 final °C	Trial 3 final °C
P	7	14	13	13.5	13
Q	5	21	14	14	14.5
R	4	18	14	16	14
S	5	18	14.5	15	14.5

Fictional response: “P wins because all its temperatures are lowest. R also works because its average is below 15°C.”

K6-A1. Evaluate both statements. Check temperatures, budget and thickness separately for every row. Which supplied design meets the whole brief?

K6-A2. Write or say a bounded recommendation that includes its weakest displayed temperature margin and a useful next test. Explain why numerical margin is not a reliability guarantee.

Fresh recheck · What if none qualifies?

100 g, start 10°C, room 22°C, 20 min. Final ≤15°C in EVERY trial; ≤4 tokens; ≤18 mm added thickness. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-Ac · Supplied design record

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

Design	Tokens	Added mm	Trial 1 final °C	Trial 2 final °C	Trial 3 final °C
U	5	14	15	15	15
V	4	19	14	14.5	14
W	4	16	14	16	14

K6-A3. Is there a feasible design? Check each failed requirement. Recommend an honest next step without inventing a successful design or changing the rules silently.

Do not choose a winner merely because the question contains design data. “None meets the brief” can be the supported conclusion.

Reteach · A proposal needs a relevant test

Fictional response: “The new seam made the sleeve better. Its water finished lower, so the seam alone caused the improvement.”

Room 22°C; cups/lids and duration match, but water mass and start differ. One comparison, not repeated trials. Covered liquid water; cups/lids, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Accuracy is not supplied.

K6-D-B · Supplied design record

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

Setup	Water g	Start °C	After 15 min °C
Old whole design	100	10	16
New whole design	200	12	15

K6-B1. Calculate each change. What can be described? Why can neither the endpoints nor subtraction isolate a design improvement here?

K6-B2. Plan a more informative comparison. Distinguish comparing old and new complete designs from isolating a seam’s effect. State how you will retain unexpected or missing readings.

Fresh recheck · Whole design or one feature?

Fresh matched 100 g samples starting at 11°C; 23°C room; 15 min. New design changes both seam overlap and layer count; all other conditions match. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-Bc · Supplied design record

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

Paired trial	Old final °C	New final °C
1	17	15
2	16	14
3	17	15

K6-B3. What does the full matched record support? Does it show that seam overlap alone caused the difference? Propose evidence that would address that narrower question.

A fair comparison of complete designs can change more than one feature. An isolated feature claim needs a comparison that separates that feature from the others.

Later check · Changed requirements

100 g, start 10°C, room 22°C, 20 min. Final ≤15°C in EVERY trial; ≤6 tokens; ≤18 mm added thickness. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-T0 · Supplied design record

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

Design	Tokens	Added mm	Trial 1 final °C	Trial 2 final °C	Trial 3 final °C
X	4	16	14	14.5	14
Y	6	18	13	13.5	13

K6-T1. Evaluate the original brief. Now lower the budget to 4 tokens but keep the other requirements and 22°C room. Which design, if any, is feasible? State the exact scope of that answer.

Record your answer before receiving T1. This is a new later task, not a validated equivalent form or a mastery test.

Later check · One new environment record

100 g, start 10°C, room 28°C, 20 min. Final ≤15°C in EVERY trial; ≤4 tokens; ≤18 mm added thickness. Covered liquid water; cups/lids, mass, starting temperature, duration, exposure and reading procedure match within and across trials. Surroundings stay at the stated room temperature. No ice, phase change, active heating/cooling, direct sunlight or meaningful evaporative cooling. Each trial uses fresh samples. Accuracy is not supplied.

K6-D-T1 · Supplied design record

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

Design	Tokens	Added mm	Trial 1 final °C	Trial 2 final °C	Trial 3 final °C
X only	4	16	17	17.5	17

K6-T2. Does X meet the 15°C criterion in this new record? Compare the new room with T0. What should be retained or narrowed, and can you rank X against Y at 28°C?

K6-T3. Suggest a next design or comparison while keeping the 4-token/18-mm limits. What would you do if the next readings were close or variable and accuracy was unknown?