

Teacher quick start · Kit 2

Target: identify confounds, specify matched conditions and plan repeated comparisons. Prerequisites: small-table reading, whole-number subtraction, temperature versus change; P includes a check and support. Paper and pencil only; optional calculator, number line, pointing or oral explanation. Grade 6 is the provisional authoring target; related NGSS expectations span Grades 6–8. Check local course placement.

Print menu

Teach the Lesson: Kit2-v1.0.0-Teach-the-Lesson.pdf (P, M, G, I). Use a Quick Check (I, alternate route); Reteach: Repair the Comparison (A); Reteach: Specify the Plan (B); Use a Later Check (T). Prefix each selection with Kit2-v1.0.0-. All contain their own setups and data; keys use matching IDs. Full student packet has 7 pages.

Author estimate: 35–45 min P → M → G → unseen I; 10–15 min A/B; 5–8 min later T. These are not observed timings. If I was already seen, use T. Notice goal, relevant conditions, measurement/recording plan and limits separately.

Choose A if changes are used to excuse unequal conditions; choose B for vague plans or treating complete designs as material tests. Clarify unclear responses before reteaching. Accept a scientifically adequate labeled diagram, an oral explanation pointing to data, or connected prose. Ask the learner to point to the relevant row, restate the question, and explain a comparison aloud before selecting a reteach. A blank or unclear answer is insufficient evidence of a science difficulty.

No equipment or practical investigation. All setups/results are constructed. See Start Here for shared tools, sources and independent per-resource review records.

Prerequisite teaching and answers

Data P · imagined setup cards, no collected results

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

Condition	Sleeve A	Sleeve B
Water mass	100 g	100 g
Start	10°C	10°C
Cup and lid	Cup C + lid L	Cup C + lid L
Time / room	20 min / 22°C	20 min / 22°C
Reading method	Same method	Same method

Say: “I name the question first: compare complete sleeve designs. Sleeve design is the factor; water temperature after the same interval is the outcome. Mass, initial temperature, cup/lid, time, surroundings and reading procedure can affect the comparison, so we match them.”

K2-P1: Compared factor sleeve design A/B; measured quantity water temperature at start and end or temperature change over 20 min. Any two listed controls accepted. K2-P2: No; different mass would be another relevant difference. Do not make one-variable-at-a-time a rule for every scientific investigation; here it serves this question.

Readiness: Ask for a sample 10 → 14°C change (4°C warming) and a 30 → 26°C change (4°C cooling), then a pointed-to condition pair. If the data cannot be accessed, use oral/number-line support. If start/change is still confused, use Kit 1 A or B before the main critique.

Teacher model and complete key

Data M · same 15 minutes, 22°C room, cups/lids and reading method

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

Setup	Water mass (g)	Start (°C)	After 15 min (°C)
Sleeve A	100	8	14
Sleeve B	200	10	13

Think aloud: “A warmed 6°C; B warmed 3°C. That describes these complete setups. A has 100 g starting at 8°C; B has 200 g starting at 10°C. Sleeve, mass and start changed. Smaller warming alone does not identify a sleeve effect. Subtraction does not remove those differences.”

K2-M1: +6/+3°C; cannot assign to sleeve alone. K2-M2: Water mass and start are confounds. A defensible repaired plan: both 100 g at 10°C in 22°C room for 15 min, matching cups/lids/position and consistent reading procedure; compare A/B. Accept both 200 g or both 8°C when all other conditions match and the proposed question remains explicit.

K2-M3: B’s complete setup warmed less in the supplied record; no isolated sleeve preference. Change comparison does not fix confounds. Temperature is a reading, not the total energy stored in a sample. Total energy also depends on the type, state and amount of matter. In these passive water examples, net thermal-energy transfer is from the warmer part toward the cooler part. A temperature record alone does not identify conduction, convection or radiation separately. Less warming does not mean cooling or stopped transfer.

Guided prompts and independent key

Data G · proposed setup cards

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

Condition	Sleeve C	Sleeve D
Water mass / start	100 g / 10°C	100 g / 10°C
Cup	Cup C	Cup D
Lid	Lid L	No lid
Time / room	20 min / 22°C	20 min / 22°C
Reading method	Same method	Same method

Ask: “What is our factor? What else changes?” Anticipate “Only sleeves”; point to cup and lid. Then ask for D’s exact replacement conditions. Do not settle for “keep things fair.”

K2-G1: Cup geometry and presence of lid differ, so their effects are mixed with sleeve choice. K2-G2: D uses 100 g at 10°C, Cup C with lid L, 20 min in 22°C room, matching position and reading method. C unchanged. Accept a common alternative cup/lid specified for both.

K2-G3: Fresh matched samples for, e.g., three independent trials; same probe placement and stabilization/readout procedure; record trial/setup ID, mass, start, room, elapsed time, every final reading, method and departures. No invented instrument accuracy. For a material-only question, sleeve dimensions, layers/fit/gaps also need matching.

Data I · 24°C room, cups/lids/position and reading method match

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

Setup	Mass (g)	Start (°C)	Time (min)	Final (°C)
Sleeve E	80	12	10	18
Sleeve F	120	12	20	16

K2-I1: E warms 6°C, F 4°C. F’s complete setup shows less warming; no isolated sleeve effect. K2-I2: Mass and elapsed time differ; repair to both 100 g starting 12°C for 20 min in 24°C room with matched cups/lids/position and procedure. Accept both 80 or 120 g, or both 10 min, with explicit matching. K2-I3: Fresh samples and multiple matched trials, retain raw readings and notes. Accept specific limits about other conditions, small trial count, constructed data, unknown accuracy or mechanism.

Follow-up · Repair the comparison

Data A · 22°C room, 20 minutes, same cups/lids and method

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

Setup	Mass (g)	Start (°C)	Final (°C)
Sleeve H	60	10	17
Sleeve J	120	10	15

Think aloud: “Starts match, but masses do not. H warms 7°C, J 5°C. I can describe these setups; I cannot assign the difference only to the sleeve. I choose one common mass for a retest.”

K2-A1: H +7°C, J +5°C. No isolated sleeve effect. Accept both 60, both 120 or another equal mass, same 10°C start, 20 minutes, 22°C room, cups/lids/position and reading procedure, with fresh repeated samples.

Data Ac · matched samples; 23°C room, 15 minutes

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

Setup	Mass (g)	Start (°C)	Final (°C)
Sleeve U	100	12	17
Sleeve V	100	12	16

K2-A2: U warms 5°C, V 4°C; V limits warming more in this one supplied trial. This is a nominal record comparison, not a reliable or universal guarantee. More matched trials and information about accuracy/conditions would support a stronger claim. Accept cautious withholding of a confident preference because the difference is small. Do not dismiss that alternative.

Follow-up · Specify the plan

Data B · three fresh 100 g trials, 10°C start, 22°C room, 20 minutes; matched conditions

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

Trial	Sleeve J final (°C)	Sleeve K final (°C)
1	15	16
2	16	17
3	15	16

Think aloud: “J warms 5,6,5°C; K warms 6,7,6°C. J has 1°C less warming in each row. These invented records favor J under these conditions; they do not establish a specific material property. A usable plan says what to match and what to record.”

K2-B1: J lower in each trial. No isolated material property or exact transfer pathway. Accept a cautious preference or a qualified request for accuracy/repeats instead of a confident ranking.

K2-B2: Example paper plan: compare complete J/K sleeves; fresh equal 100 g samples at 10°C, identical cups/lids and positions in 22°C room; 20 min; consistent probe position/readout stabilization; three fresh matched trials. Record trial ID, sleeve version, mass, initial and final raw temperatures, room temperature, elapsed time, instrument/method ID and departures. Mark missing readings as missing. Three is a planning choice, not guaranteed sufficient evidence. No need to name a thermometer specification that was not supplied.

Fresh Data Bc · equal 100 g, 23°C room, matching cups/lids and method

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

Setup	Start (°C)	Time (min)	Final (°C)
Sleeve R	11	20	16
Sleeve S	11	10	15

K2-B3: Match duration, e.g. 20 min for both, and repeat. R warms 5°C over 20 min; S 4°C over 10 min. Do not attribute this to the sleeve or simply divide to invent a constant warming rate.

Later check · Key and limits

Data T · 22°C room, 15 minutes, cups/lids and method match

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

Setup	Mass (g)	Start (°C)	Final (°C)
Sleeve P	100	36	29
Sleeve Q	150	36	32

K2-T1: P falls 7°C; Q falls 4°C. Mass differs (100/150 g); higher final Q reading does not isolate sleeve effect.

Data Tr · fresh matched 100 g samples, 36°C start, 22°C room, 15 minutes

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

Trial	Sleeve P final (°C)	Sleeve Q final (°C)
1	30	32
2	31	32
3	30	33

K2-T2: P falls 6,5,6°C; Q falls 4,4,3°C. Q limits cooling more in each matched trial; endpoints or changes accepted.

Bound to these constructed records and conditions; no universal, actual product or exact mechanism claim. K2-T3: No, analysis of supplied values is not physical construction/testing.

This checks critique and bounded comparison in a cooling context. It does not prove mastery or establish equivalence to I. If the learner explains the confound but cannot write a plan, clarify the expression demand and offer an oral plan before B.

Response guidance and sources

Accept a scientifically adequate labeled diagram, an oral explanation pointing to data, or connected prose. Ask the learner to point to the relevant row, restate the question, and explain a comparison aloud before selecting a reteach. A blank or unclear answer is insufficient evidence of a science difficulty.

Keep separate notes for stated question, relevant controls, recording/repetition, and limits. Fictional “F always works better” needs attribution limits; “we will keep everything the same” needs actual conditions; “throw away an odd trial” needs raw-record retention and a documented reason. More trials do not automatically remove systematic bias. Display precision is not accuracy.

Official sources checked 2026-09-29: NGSS MS-PS3-4 (<https://www.nextgenscience.org/pe/ms-ps3-4-energy>) supports temperature/energy distinctions and investigation planning; MS-PS3-3 (<https://www.nextgenscience.org/pe/ms-ps3-3-energy>) supports transfer direction and requires actual design, construction and testing. These paper tasks address selected components, not complete performance expectations. Original text/data/graph; no third-party passages or graphics reproduced. Classroom copying/adaptation follows <https://mentorteaching.com/terms-of-use/>.

Kit 2 addresses planning components of MS-PS3-4 and evidence reasoning connected to MS-PS3-3. It does not cover all mass/material/temperature relationships or fulfill actual device construction/testing. Independent AI, human science and classroom feedback statuses remain separate on the resource page and in its own review record.