

Teacher quick start · Kit 1

Target: distinguish a temperature from its change, read time/units/starts, and separate observations from explanations.

Prerequisites: small-table reading and whole-number subtraction; section P teaches the needed moves. 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: Kit1-v1.0.0-Teach-the-Lesson.pdf (P, M, V, G, I). Quick Check: Kit1-v1.0.0-Use-a-Quick-Check.pdf (I only; alternate route, not fresh after the lesson). Reteach: Compare the Measurements (A); Reteach: Value or Change? (B); Use a Later Check (T). All named PDFs include their own data. Teacher sections use matching IDs. Full student packet contains all 8 pages.

Sequence and decisions

Author estimate, not observed timing: 35–45 min for P → M/V → G → unseen I; 10–15 min for A or B; 5–8 min for T on a later day. Model M/V before asking for I. If I was seen, use T rather than reusing Quick Check.

Notice row/column/time accuracy, direction, value-versus-change, and claim limits separately. Choose A for mixed rows/reversed direction; B for endpoint/change confusion. Clarify unclear responses first. 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.

Every numerical record is constructed, not collected. No apparatus route. See Start Here for vocabulary, the response index, planning record, sources and per-resource review limits.

Prerequisite teaching and key

Say: “Temperature tells the reading at a time. I read the same sample at start and finish. W starts at 11°C and ends at 15°C after 10 minutes. Its temperature rose 4°C. I name both the amount and direction.”

Data P · equal 100 g water; 22°C room; matching cups/lids and method

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

Sample	Start (°C)	After 10 min (°C)
W	11	15
Z	11	13

K1-P1: Water temperature; degrees Celsius (°C); start to 10 minutes. K1-P2: W warms 4°C, Z warms 2°C. Accept +4/+2 with warming stated. A written negative calculation does not by itself show direction understanding.

Check readiness: Ask for a point to the start, final and matching label. If subtraction is difficult, supply a number line or permit a calculator. If units/time or warming are still unclear after an oral explanation, model A1 before M. Do not infer a science difficulty from a reading-access barrier.

Model explanation and graph key

Data M · 100 g water each; 10°C start, 22°C room; matched cups/lids, exposure and procedure

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

Time (min)	Sample X (°C)	Sample Y (°C)
0	10	10
5	13	11
10	15	12
15	17	13

Think aloud: “At 15 minutes X is 17°C and Y is 13°C. Both began at 10°C. X rose 7°C; Y rose 3°C. Y ended cooler than X, yet it became warmer than its own start. This record describes different warming of two complete setups in one trial. It does not identify why.”

K1-M1: Water temperature (°C), elapsed time (min). Accept any two correct time/value observations, e.g. X is 15°C at 10 min and Y is 13°C at 15 min. K1-M2: X +7°C, Y +3°C; Y warms less. K1-M3: “Y became cooler” is false; Y limited warming relative to X. One trial cannot establish universal superiority, an exact pathway, or real performance from invented values.

K1-V1: X at 10 min = 15°C; Y at 15 min = 13°C. Horizontal axis time in minutes; vertical axis water temperature in °C. K1-V2: Same measurements, no new trial. Equal 5-minute steps occupy equal horizontal distances. Accept an oral reading from the table if graph access is difficult.

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 practice and independent key

Prompts: “Read K from 0 to 15 minutes. Is its finish higher or lower?” Anticipate “7°C warming”; trace 32 → 25 and ask direction. Then: “Compare L using its own start. Which goal are we answering?”

Data G · matched 100 g samples; 32°C start, 22°C room; 15 minutes

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

Time (min)	Sample K (°C)	Sample L (°C)
0	32	32
5	29	30
10	27	29
15	25	28

K1-G1: K falls 7°C; L falls 4°C. K1-G2: L limits cooling more in this record: 28°C final versus K 25°C from equal starts. Lowest endpoint would select more cooling. K1-G3: K is 25°C at 15 min is an observation; exclusive conduction is not measured by this table.

Data I · 100 g each, 25°C room, 20 minutes; S starts differently

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

Sample	Start (°C)	After 20 min (°C)
Q	14	18
R	14	21
S	20	22

K1-I1: Water temperature °C, 20-minute interval; Q warms 4°C, R 7°C, S 2°C. K1-I2: Q has cooler final value (18 vs 22°C); S has smaller rise (2 vs 4°C). K1-I3: Q warms 3°C less than R from the same 14°C start. S has a different start, so its smaller change does not isolate protector performance. Accept limits about one trial, constructed data, other conditions or unmeasured mechanism. Do not demand a cause before it has been taught.

Intervention · Compare the measurements

Data A · 100 g each; 24°C room; same 10 minutes and method

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

Sample	Start (°C)	After 10 min (°C)
E	12	16
F	12	19

Think aloud: “The row named E links 12 to 16; I must not borrow F’s 19. E rises 4°C. I read F separately: 12 to 19 is 7°C.” Ask the learner to mark the complete row and name it aloud.

K1-A1: E +4°C, F +7°C; fictional answer uses F’s endpoint with E’s label. Accept a corrected labeled arrow without prose.

Fresh Data Ac · matched 100 g samples, 22°C room, 10 minutes

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

Sample	Start (°C)	After 10 min (°C)
J	28	25
K	28	26

K1-A2: J cools 3°C (28 → 25), K cools 2°C (28 → 26). Accept −3/−2 with direction clear. If both row accuracy and direction are now visible, return to a new check; do not score a long paragraph. If subtraction alone fails, supply number-line support and retain the science question.

Intervention · Value or change?

Data B · 100 g each; 24°C room; 15 minutes; starts differ

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

Sample	Start (°C)	After 15 min (°C)
U	14	19
V	18	21

Think aloud: “V ends warmer, 21°C compared with U’s 19°C. But U rose from 14 to 19, or 5°C; V rose 3°C. A final reading and a change answer different questions.”

K1-B1: V warmer final; U warms more (5 vs 3°C). K1-B2: No isolated protector effect: starts differ. Subtracting does not fix that unequal condition.

Fresh Data Bc · matched 100 g samples in 22°C room for 15 minutes

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

Sample	Start (°C)	After 15 min (°C)
C	32	29
D	32	27

K1-B3: C cools 3°C; D cools 5°C. C better limits cooling in this comparison, ending 29°C versus 27°C from equal 32°C starts. Accept endpoint evidence when matching starts and interval are recognized. Ask “less change toward what goal?” if the learner uses only a lowest-value rule.

Later check key and interpretation

Data T · matched 100 g samples; 22°C room, 15 minutes

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

Sample	Start (°C)	After 15 min (°C)
M	32	28
N	32	30

K1-T1: Temperature °C, elapsed time 15 min; M cools 4°C, N cools 2°C. K1-T2: N limits cooling here, 30 versus 28°C from 32°C; accept changes 2 versus 4°C. Useful limits: one illustrative trial, other water masses/times/room conditions, no measured pathway, constructed data.

K1-T3: No. Celsius is not a total-energy scale; type, state and amount of matter also matter. Accept a clear statement that these readings do not establish an energy ratio without requiring particle vocabulary.

A response can show reading and comparison in a new cooling context. It does not prove lasting mastery, actual investigation skill, or validated equivalence to I. If an explanation is unclear, clarify response mode before assigning A or B.

Response notes, sources and limits

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: reading/direction; relevant comparison; observation versus explanation; limits. Write visible, partly visible or not yet visible plus an actual excerpt/support used. Do not make a broad scientific-ability score. Fictional “Y cooled” calls for tracing starts; “7°C because 19–12” calls for row matching; “graph proves conduction” calls for distinguishing an observation from an idea.

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/>.

Resource-specific limitations: author estimates only; independent AI review is distinct from human science review, classroom feedback and assistive-technology checks. Actual review version, scope and findings are recorded on the kit page and in its review report. No measured outcomes or guarantees.