Teacher quick start · Read Temperature Data Before Explaining It

Target: distinguish a temperature from its change, read time/units/starts, and separate observations from explanations. Prerequisites: small-table reading and whole-number subtraction; Bridge teaches the needed moves. Paper and pencil only; optional calculator, number line, pointing or oral explanation. Intended for Grade 6; related NGSS expectations span Grades 6–8. Check local course placement.

Print menu

Print choices: Teach the Lesson includes the prerequisite bridge, Model, representation, guided practice and independent task. Use a Quick Check repeats the independent task. Reteach: Compare the Measurements and Reteach: Value or Change provide focused follow-up tasks. Use a Later Check is a separate later task. Each selection includes its data; the full student packet has 8 pages.

Sequence and decisions

Planning estimates: 35–45 minutes for the prerequisite bridge, model and representation, guided practice and unseen independent task; 10–15 minutes for Keep readings in one row or A value is not a change; 5–8 minutes for Later check · A changed direction on a later day. Model Read the whole record and The same record as a graph before the independent task. If that task was already seen, use the reserved Later check · A changed direction; repeating the Quick Check does not create new evidence.

Notice row/column/time accuracy, direction, value-versus-change, and claim limits separately. Choose Compare the Measurements for mixed rows/reversed direction; Value or Change 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 teaching 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.”

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

Read before comparing, question 1: Water temperature; degrees Celsius (°C); start to 10 minutes. Read before comparing, question 2: 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 new follow-up evidence before the Model. Do not infer a science difficulty from a reading-access barrier.

Model explanation and graph key

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.”

Read the whole record, question 1: 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. Read the whole record, question 2: X +7°C, Y +3°C; Y warms less. Read the whole record, question 3: “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.

The same record as a graph, question 1: X at 10 min = 15°C; Y at 15 min = 13°C. Horizontal axis time in minutes; vertical axis water temperature in °C. The same record as a graph, question 2: 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?”

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

Guided practice · Cooling, question 1: K falls 7°C; L falls 4°C. Guided practice · Cooling, question 2: L limits cooling more in this record: 28°C final versus K 25°C from equal starts. Lowest endpoint would select more cooling. Guided practice · Cooling, question 3: K is 25°C at 15 min is an observation; exclusive conduction is not measured by this table.

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

Independent task · New readings, question 1: Water temperature °C, 20-minute interval; Q warms 4°C, R 7°C, S 2°C. Independent task · New readings, question 2: Q has cooler final value (18 vs 22°C); S has smaller rise (2 vs 4°C). Independent task · New readings, question 3: 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.

Compare the measurements

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.

Keep readings in one row, question 1: 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 fresh follow-up check · 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

Keep readings in one row, question 2: 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.

Value or change?

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.”

A value is not a change, question 1: V warmer final; U warms more (5 vs 3°C). A value is not a change, question 2: No isolated protector effect: starts differ. Subtracting does not fix that unequal condition.

Fresh Data fresh comparison check · 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

A value is not a change, question 3: 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

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

Later check · A changed direction, question 1: Temperature °C, elapsed time 15 min; M cools 4°C, N cools 2°C. Later check · A changed direction, question 2: 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.

Later check · A changed direction, question 3: 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 equivalent difficulty to the independent task. If an explanation is unclear, clarify response mode. Then select Keep readings in one row for mismatched time/value readings, or A value is not a change for confusion between endpoints, changes and direction.

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/.

No measured outcomes or guarantees.

Give each practice and check as separate files

Keep readings in one row and A value is not a change now each have a practice-only selection and a separate reserved Fresh check selection in the current preparation menu. Use the practice file during teaching; then give only its matching fresh-check file. Original question numbers are retained for the answer guidance. Save Later check · A changed direction for a different occasion. The earlier combined sheets are historical and should not be distributed during response teaching.

Fictional teaching response — sound for the named task

Named task: Independent task: New readings, questions 1–3

Fictional response — sound for the named task: “These are water temperatures in °C over 20 minutes. Q rises 14→18, a 4°C increase; R rises 14→21, 7°C; S rises 20→22, 2°C. Q is cooler than S at the end, but S changes less. Q warms less than R under their matched start/other stated conditions in this trial. S’s different start prevents its smaller change alone identifying a better protector.”

Visible evidence: Labeled values and changes, endpoint/change distinction and a bounded comparison.

Not established: A physical cause or a universal protector ranking.

Clarify: Ask why the lower endpoint and lower rise can belong to different samples.

Next teaching/evidence: After another learning opportunity use the separate Later assessment, retaining the access conditions used.

This response is invented for teacher interpretation. Accept defensible alternatives. Record access, prior exposure and the actual response; do not assign an ability label or claim mastery from this example.

Later assessment

Fictional teaching response — partially developed

Named task: Independent task: New readings, questions 1–3

Fictional response — partially developed: “Q changes by 4, R by 7, S by 2. All warm.”

Visible evidence: Correct numerical changes and direction.

Not established: Units/interval, endpoint-versus-change reasoning, or the limit involving S’s start.

Clarify: Ask for °C and the interval, then pose the two distinct Q/S questions and ask what was held constant for Q/R.

Next teaching/evidence: If value/change remains unclear, use A value is not a change, practice only, before its separately reserved fresh-check file. Do not distribute the earlier combined sheet.

This response is invented for teacher interpretation. Accept defensible alternatives. Record access, prior exposure and the actual response; do not assign an ability label or claim mastery from this example.

A value is not a change

Reserve until after this practice: A value is not a change — fresh check

Reserve: Later assessment

Fictional teaching response — plausible error

Named task: Independent task: New readings, questions 1–3

Fictional response — plausible error: “Q warmed by 18°C and S warmed by 22°C, so Q changed less.”

Visible evidence: Accurate final readings were located.

Not established: A change calculation: starts were not subtracted. The claimed Q/S change ordering is reversed.

Clarify: Have the learner label start, finish and finish-minus-start within each row.

Next teaching/evidence: Use A value is not a change in its practice-only current file. Then give its separate fresh check with no model visible. Save Later assessment for another occasion.

This response is invented for teacher interpretation. Accept defensible alternatives. Record access, prior exposure and the actual response; do not assign an ability label or claim mastery from this example.

A value is not a change

Reserve until after this practice: A value is not a change — fresh check

Reserve: Later assessment