

Read Temperature and Change

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

Try Readiness question 1 before reading the worked bridge. Your teacher will collect your first response.

Readiness question 1

A water sample starts at 8 degrees Celsius and ends at 12 degrees Celsius after 15 minutes. Name the start, finish, direction and size of change. Can these two readings tell you why it changed?

Worked bridge after your first response

Temperature is a reading at a stated time. Change compares start and finish for the same sample. Example: a sample starts at 11 degrees Celsius and ends at 15 after 10 minutes. It warmed by 4 degrees Celsius. A final value of 15 is not the change. Always name direction as well as difference.

Science ideas for the lesson

Temperature is distinct from the total energy of a sample. The type, state and amount of matter also matter. A temperature change in degrees Celsius is not a quantity of energy in joules. In these passive water examples, net energy transfer is from the warmer part toward the cooler part. Temperature records do not separately identify conduction, convection or radiation.

Constructed comparison conditions

The paper comparisons use equal water masses, matching cups and lids, matched exposure and thermometer procedures, and the stated room and starting temperatures. Sleeves are compared as complete designs; the data do not isolate a material or heat-transfer pathway.

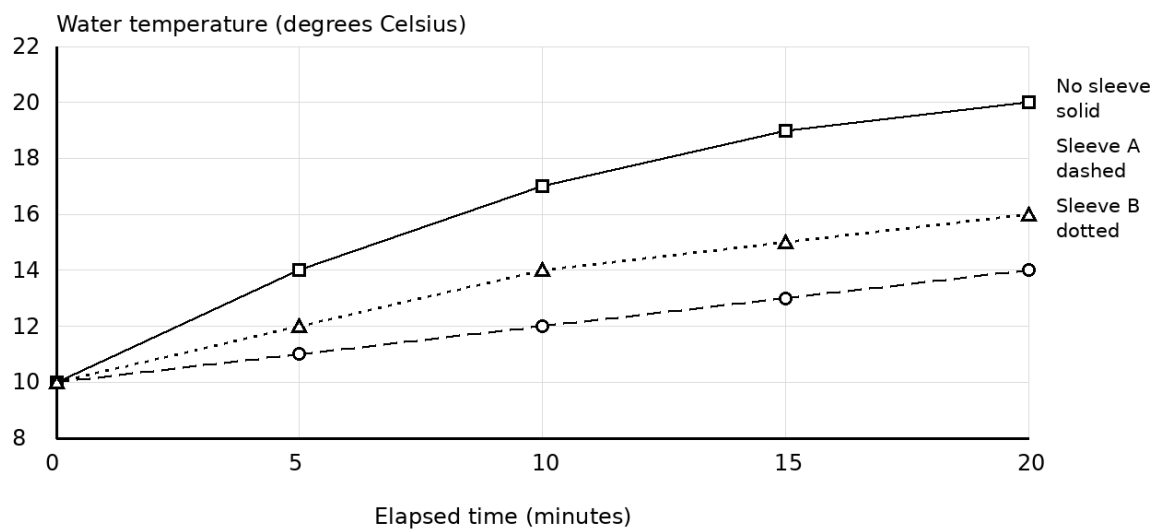
Read One Constructed Trial

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One illustrative trial. Fresh 100 g water samples begin at 10°C in a 22°C room. Cups, lids, exposure, and thermometer procedure match. No ice, active cooling, or direct sunlight is involved.

Time (minutes)	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



The graph repeats the same table values; points joined by lines show the supplied record, not extra measurements.

Explain the Model Comparison

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Time (minutes)	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

Worked comparison

Observations: All samples begin at 10 degrees Celsius. At 20 minutes A is 14, B is 16, and no sleeve is 20 degrees Celsius. A warmed 4 degrees; B 6; no sleeve 10. Explanation using a scientific idea: the room is warmer, so net energy transfer in this passive setup is toward the cooler water. Bounded inference: A is better supported for limiting warming in this one constructed comparison. It did not stop warming. The record does not isolate a transfer pathway or establish performance elsewhere.

Worked example 1

Use the model table and graph to state the 20-minute temperature increase of each setup. Which sleeve better limits warming in this one constructed trial? Revise the claim that it stopped all energy transfer.

Compare Every Matched Trial

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A second constructed comparison: equal 100 g samples start at 9°C in a 21°C room. Cups, lids, exposure and measurement procedure match. The values are endpoints after 15 minutes in three separate trials with fresh samples.

Trial	No sleeve (°C)	Sleeve H (°C)	Sleeve J (°C)
1	18	14	15
2	17	13	15
3	18	14	16

These are three imagined fresh trials. A later row is a new sample comparison, unlike the successive time readings in the model.

Guided practice 1

Find the increase in each design in Trial 1. Which sleeve limits warming more in that trial?

Guided practice 2

Compare H and J across all three matched rows. Write a choice supported by all rows and one useful question these records cannot settle.
