



Build-a-Thermometer

Mission: The weather club needs a homemade thermometer. Place a bottle with a thin tube and a balloon bottle in water baths of different temperatures, calibrate the tube with marks, and explain why it works.

Big question: Why do liquids and gases expand when heated, and how can that measure temperature?

★ Warm-up: Notice & wonder

Answer with what you notice and wonder.

Bridges have small gaps between sections. Why? ✓ **So they can expand in hot weather without cracking.**

Why is it easier to open a tight jar lid after running it under hot water? ✓ **The metal lid expands.**

Key vocabulary

Thermal expansion	Matter getting bigger (taking up more space) when heated.
Contraction	Matter getting smaller when cooled.
Calibrate	Mark a tool using known values so it measures accurately.
Linear pattern	Changing by the same amount each step.

1 Box 1

Predict

PREDICTION What will happen to the balloon in ice water (0 °C)?

☐ It will shrink ☐ It will grow ☐ No change

Cool it down

In the simulator: Set the bath to 0 °C.

You predicted: _____. Why did the balloon shrink?

☐ Air particles slowed down and took up less space ☐ Air leaked out ☐ The balloon froze

✓ **Air particles slowed down and took up less space**

2 Box 2

Calibrate

Record the column height at each temperature.

Bath	Column (mm)
0 °C	from simulator
20 °C	from simulator
40 °C	from simulator
80 °C	from simulator

3 Box 3

Find the rule

How many mm does the column rise for every 10 °C?

Answer: _____ mm ✓ 15

Show your thinking:

Use your thermometer

The column reads 85 mm. What is the temperature?

Answer: _____ °C ✓ 30

Show your thinking:

4 Box 4

Legend: design choice 🏆 Legend only

Why do real thermometers use a very THIN tube?

- ☐ A small expansion makes a big, easy-to-read change in height ☐ Thin tubes are cheaper only
☐ Liquid expands more in thin tubes

✓ A small expansion makes a big, easy-to-read change in height

5 Box 5

How it works (CER)

Explain how your homemade thermometer measures temperature.

Claim

Look for: Names expansion; at least 6 words

Evidence

Look for: Uses column heights; a number from the simulator; at least 12 words

Reasoning

Look for: Particles move faster; Particles spread apart; at least 12 words

Exit ticket: answer the big question in your own words

Why do liquids and gases expand when heated, and how can that measure temperature?

Look for: When matter is heated, its particles move faster and spread slightly farther apart, so it expands. The liquid in a thin tube rises when heated and falls when cooled. By marking the height at known temperatures, we can build a thermometer.

Completion codes

Students see a code like **ABC-I3** when they finish. The first part must match below. The letter is the level (E = Explorer, I = Investigator, L = Legend), and the number at the end is how many stars they earned.

Level	Code starts with
 Explorer	10Q-E
 Investigator	15C-I
 Legend	1II-L

! Watch for these misconceptions

- "Particles in a solid do not move." They vibrate in place.
- "The bubbles in boiling water are air." They are water vapor (gas).
- "Particles expand when heated." Particles themselves do not grow; the spaces between them get larger.