



Heating Curve Lab

Mission: A strange thing happens when you heat ice: the thermometer gets "stuck" twice. Heat ice steadily, graph the temperature over time, and explain the flat parts using particles.

Big question: Why does temperature stop rising during melting and boiling?

★ Warm-up: Read the graph

Sketch a graph of temperature vs time for a cup of hot cocoa cooling. Answer:

What would the line do over time? ✓ **Go down quickly at first, then more slowly.**

What does a flat line on a temperature graph mean? ✓ **The temperature is not changing.**

Key vocabulary

Heating curve	A graph of temperature versus time as something is heated.
Plateau	A flat part of the graph where temperature stays the same.
Change of state	Melting, freezing, boiling, condensing.
Slope	How steep a line is; steeper means faster change.

1 Box 1

Predict the shape

PREDICTION If you heat ice at a steady rate, what will the temperature graph look like?

☐ A straight line going up ☐ A line going up with flat parts ☐ A line going down

Heat the ice

In the simulator: Turn on the burner (low flame) and heat until ALL the water becomes steam.

You predicted: _____. How many flat parts (plateaus) are on the graph?

☐ 2 ☐ 1 ☐ 0 ☐ 4

✓ **2**

2 Box 2

Read the graph

Record when each plateau started (read the graph or readouts).

Event	Temperature (°C)	Started at (min)
Melting plateau	0	from simulator
Boiling plateau	100	from simulator

3 Box 3

Where does the energy go?

The burner keeps adding energy during the plateaus. Where does that energy go?

☐ Into breaking particles apart (changing state) ☐ Nowhere; it is wasted ☐ Into making particles bigger
☐ Into cooling the beaker

✓ **Into breaking particles apart (changing state)**

Which plateau is longer?

The boiling plateau is much longer than the melting plateau. What does that tell you?

- ☐ Boiling needs more energy to pull particles completely apart ☐ Water boils slower because it is hot
☐ The burner turned down

✓ **Boiling needs more energy to pull particles completely apart**

4 Box 4

High flame

In the simulator: Heat new ice to steam on high flame.

With more power, what changed and what stayed the same?

- ☐ Everything happened faster, but plateaus were still at 0 °C and 100 °C
☐ The plateaus moved to new temperatures ☐ There were no plateaus

✓ **Everything happened faster, but plateaus were still at 0 °C and 100 °C**

5 Box 5

Legend: cooling curve Legend only

Steam is cooled steadily. Put the parts of its COOLING curve in order.

Put in order: Flat at 0 °C while water freezes · Flat at 100 °C while steam condenses · Ice cools below 0 °C · Steam cools down to 100 °C
· Water cools from 100 °C to 0 °C

1. **Steam cools down to 100 °C**
2. **Flat at 100 °C while steam condenses**
3. **Water cools from 100 °C to 0 °C**
4. **Flat at 0 °C while water freezes**
5. **Ice cools below 0 °C**

6 Box 6

Explain the plateaus (CER)

Why does temperature stop rising during melting and boiling?

Claim

Look for: Mentions energy or change of state; at least 6 words

Evidence

Look for: Names the plateau temperatures; a number from the simulator; at least 10 words

Reasoning

Look for: Explains particles breaking apart; Explains why speed/temperature doesn't rise; at least 12 words

Exit ticket: answer the big question in your own words

Why does temperature stop rising during melting and boiling?

Look for: A heating curve has two flat plateaus: at 0 °C (melting) and 100 °C (boiling). During a plateau, the energy added breaks particles apart from each other instead of speeding them up, so temperature stays the same until the change of state is complete.

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	1XW-E
 Investigator	1P6-I
 Legend	QX5-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.