



Deep Freeze to Furnace

Mission: The extreme temperature wing can go from $-250\text{ }^{\circ}\text{C}$ to $3,000\text{ }^{\circ}\text{C}$. Use the chart of melting and boiling points to predict the state of seven substances in each chamber, then solve the lab's storage puzzles.

Big question: How can melting and boiling points predict a substance's state?

★ Warm-up: True or false?

T or F? Fix the false ones.

Everything melts at $0\text{ }^{\circ}\text{C}$. ✓ **False: each substance has its own melting point.**

Oxygen is a gas at room temperature. ✓ **True.**

Key vocabulary

Melting point	Solid $\leftrightarrow$ liquid temperature.
Boiling point	Liquid $\leftrightarrow$ gas temperature.
Characteristic property	A property that helps identify a substance, like its boiling point.
Room temperature	About $20\text{ }^{\circ}\text{C}$.

1 Box 1

Read the chart

Mercury is used in old thermometers. Using the chart, why is it a good choice?

☐ It is liquid from $-39\text{ }^{\circ}\text{C}$ to $357\text{ }^{\circ}\text{C}$ ☐ It is a gas at room temperature ☐ It is solid at room temperature

✓ **It is liquid from $-39\text{ }^{\circ}\text{C}$ to $357\text{ }^{\circ}\text{C}$**

2 Box 2

State table

Set each temperature and record the states.

Temperature	Water	Ethanol	Tin
$-50\text{ }^{\circ}\text{C}$	from simulator	from simulator	from simulator
$100\text{ }^{\circ}\text{C}$ exactly	from simulator	from simulator	from simulator
$500\text{ }^{\circ}\text{C}$	from simulator	from simulator	from simulator

3 Box 3

Storage puzzle 1

In the simulator: Find a temperature where water AND ethanol are BOTH liquids but oxygen is a gas. Set the slider there.

Which range works for puzzle 1?

☐ Between $0\text{ }^{\circ}\text{C}$ and $78\text{ }^{\circ}\text{C}$ ☐ Between $-114\text{ }^{\circ}\text{C}$ and $0\text{ }^{\circ}\text{C}$ ☐ Above $100\text{ }^{\circ}\text{C}$

✓ **Between $0\text{ }^{\circ}\text{C}$ and $78\text{ }^{\circ}\text{C}$**

Storage puzzle 2

In the simulator: Find a temperature where tin is LIQUID but candle wax is a GAS.

What is the lowest whole-degree temperature where wax is a gas and tin is liquid?

Answer: _____ $^{\circ}\text{C}$ ✓ **370**

4 Box 4

Identify by boiling point

A clear unknown liquid boils at 78 °C. Which substance is it most likely?

☐ Ethanol ☐ Water ☐ Mercury ☐ Oxygen

✓ **Ethanol**

5 Box 5

Legend: particles Legend only

Oxygen boils at –183 °C but iron boils at 2,862 °C. What does this say about their particles?

☐ Iron particles attract each other much more strongly ☐ Oxygen particles are heavier

☐ Iron particles don't move

✓ **Iron particles attract each other much more strongly**

6 Box 6

Explain the rule

Explain how to use melting and boiling points to predict if a substance is a solid, liquid, or gas.

Look for: Below melting point → solid; Between the points → liquid; Above boiling point → gas



Exit ticket: answer the big question in your own words

How can melting and boiling points predict a substance's state?

Look for: Each substance has its own melting and boiling point. Below its melting point it is a solid; between the two it is a liquid; above its boiling point it is a gas. Comparing a temperature to these points predicts the state.

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	XWE-E
 Investigator	DPH-I
 Legend	N1I-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.