



Gas Pressure Piston

Mission: Why does a bike tire look flat on a cold morning? Why do aerosol cans warn "do not heat"? Experiment with a gas in a piston to find how temperature, volume, and particles affect pressure.

Big question: How does the motion of gas particles cause pressure?

★ Warm-up: Real-world riddle

Use particles to explain.

Why do balloons shrink when left in a cold car? ✓ **Cold particles move slower and push less.**

Why does a bike pump get harder to push? ✓ **Squeezing particles into less space means more collisions.**

Key vocabulary

Pressure	How hard particles push on an area (from collisions).
Collision	When particles hit each other or the walls.
Volume	The space the gas fills.
Kelvin (K)	A temperature scale that starts at absolute zero.

1 Box 1

Predict

PREDICTION If you double the temperature (300 K → 600 K), the pressure will...

☐ double ☐ stay the same ☐ drop by half

Temperature trials

Keep 1 L and 30 particles. Record the pressure.

Temperature	Pressure (kPa)
150 K	from simulator
300 K	from simulator
600 K	from simulator

2 Box 2

Temperature rule

You predicted the pressure would _____. What pattern does your table show?

☐ Double the temperature, double the pressure ☐ Temperature doesn't affect pressure

☐ Higher temperature, lower pressure

✓ **Double the temperature, double the pressure**

3 Box 3

Squeeze it

In the simulator: At 300 K with 30 particles, push the piston down to **0.5 L**.

What is the pressure at 0.5 L?

Answer: _____ kPa ✓ **varies: check the student's simulator readout**

4 Box 4

Add particles

In the simulator: Back to 1 L and 300 K, then add particles to reach 60.

What happened to the pressure with twice as many particles, and why?

☐ It doubled: twice as many collisions ☐ It halved ☐ It stayed the same

✓ **It doubled: twice as many collisions**

5 Box 5

Real world

Sort each situation by what happens to the pressure inside.

Sort: A soda can in a hot car · A basketball left outside in winter · Pumping more air into a tire · Letting air out of a balloon · Squeezing a sealed syringe

Pressure goes UP	Pressure goes DOWN
A soda can in a hot car Pumping more air into a tire Squeezing a sealed syringe	A basketball left outside in winter Letting air out of a balloon

6 Box 6

Legend: combine changes Legend only

A gas is at 90 kPa. You double its temperature AND squeeze it to half the volume. What is the new pressure?

Answer: _____ kPa ✓ **360**

Show your thinking:

7 Box 7

Explain the warning label (CER)

Why do aerosol cans say "Do not heat"?

Claim

Look for: Names pressure; at least 6 words

Evidence

Look for: Uses temperature data; Uses pressure data; a number from the simulator; at least 12 words

Reasoning

Look for: Particles move faster; Explains collisions; at least 12 words

Exit ticket: answer the big question in your own words

How does the motion of gas particles cause pressure?

Look for: Gas pressure comes from particles colliding with the walls. Heating a gas makes particles move faster, so they hit harder and more often: pressure rises. Squeezing a gas into less volume, or adding more particles, also means more collisions and more pressure.

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	19E-E
 Investigator	1WE-I
 Legend	11S-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.