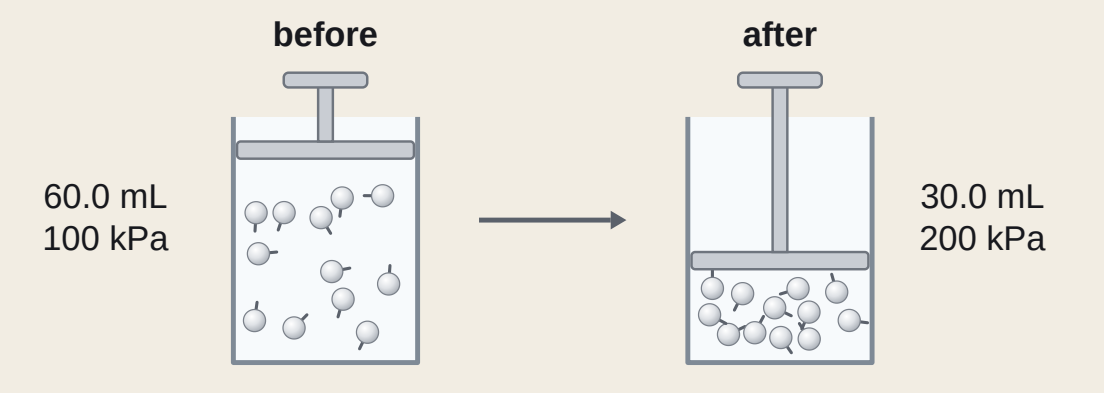
B3 · Boyle's law: pressure and volume · Notes

Goals: Describe how the pressure of a trapped gas changes when its volume changes. State Boyle's law and the two things that must stay the same. Use Boyle's law to find a pressure or a volume.

Name: _____ Date: _____

Slide 1 of 5 · Squeezing a trapped gas

Lessons B1 and B2 gave you the units for pressure and temperature. Now you start to link the four things we measure.



Key ideas

The syringe is sealed, so no air can get _____.

The volume was cut in _____.

The pressure _____.

Example

In the syringe test, which two of the four things we measure were kept the same?

Try it

A trapped gas is squeezed into half its volume. What happens to its pressure?

Slide 2 of 5 · Pressure times volume stays the same

On the last slide the pressure doubled when the volume was cut in half. Now look at more readings.

volume (mL)	pressure (kPa)	P × V
60.0	100	6000
30.0	200	6000
20.0	300	6000
15.0	400	6000

The amount of air and the temperature stayed the same.

Key ideas

Each time the volume went down, the pressure went _____.

_____ is always the same number.

The _____ of air must stay the same.

The _____ must stay the same.

Example

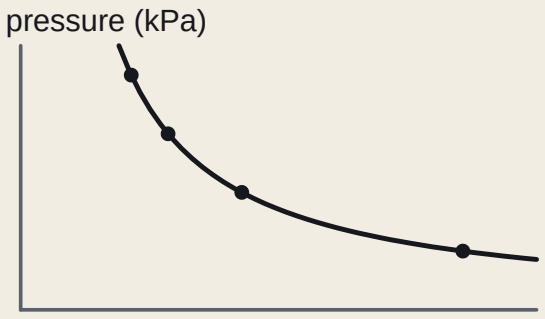
A trapped gas is at 100 kPa and 40.0 mL. Its volume is cut to 10.0 mL. Use "pressure times volume stays the same" to find the new pressure.

Try it

A trapped gas is at 200 kPa and 12.0 mL. Its pressure drops to 100 kPa. Use "pressure times volume stays the same" to find the new volume.

Slide 3 of 5 · The graph for Boyle's law

The last slide showed the results as a table. A graph of the same results makes the pattern easy to see.



Volume up, pressure down.

The dots are the four results.

Key ideas

On the graph, _____ goes along the bottom.

The dots make a _____ that falls.

As the volume gets bigger, the pressure gets _____.

Pressure and volume are _____.

Example

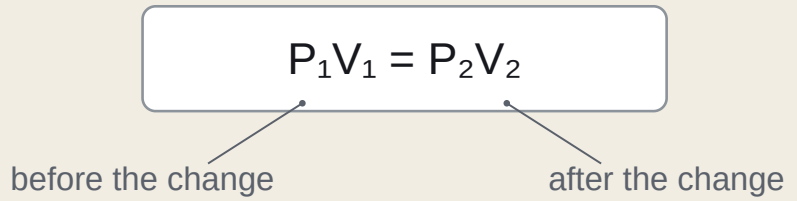
Draw the shape of the graph of pressure against volume for a trapped gas. Say what the shape shows.

Try it

What does "inversely related" mean for pressure and volume?

Slide 4 of 5 · Boyle's law as a formula

The last two slides showed the pattern as a table and as a graph. Now you write it as a formula.



The temperature must stay the same.
The amount of gas must stay the same.

Key ideas

P_1 and V_1 are the pressure and volume _____ a change.

P_2 and V_2 are the pressure and volume _____ the change.

Boyle's law only works when the _____ and the amount of gas stay the same.

Both pressures must be in the _____.

Example

Write Boyle's law as a formula. Say what the small 1 and the small 2 stand for.

Try it

One pressure is in kPa and the other is in atm. What must you do before you use the formula?

Slide 5 of 5 · Using Boyle's law

The last slide gave Boyle's law as a formula. Now you use it to find a volume and a pressure.

$P_1 = 120$ kPa, $V_1 = 6.00$ L, $P_2 = 300$ kPa, $V_2 = ?$

$V_2 = P_1V_1 / P_2$

$V_2 = (120 \text{ kPa} \times 6.00 \text{ L}) / 300 \text{ kPa}$

$V_2 = 2.40$ L

Key ideas

To find the new volume, use V_2 = _____.

When the pressure goes up, the volume goes _____.

When the volume goes up, the pressure goes _____.

Example

Use Boyle's law, $P_1V_1 = P_2V_2$. The temperature and the amount of gas do not change. A gas fills 9.00 L at 100 kPa. It is squeezed until the pressure is 150 kPa. What is the new volume?

Try it

Use Boyle's law, $P_1V_1 = P_2V_2$. The temperature and the amount of gas do not change. A gas fills 3.00 L at 80.0 kPa. It is squeezed to 2.00 L. What is the new pressure?