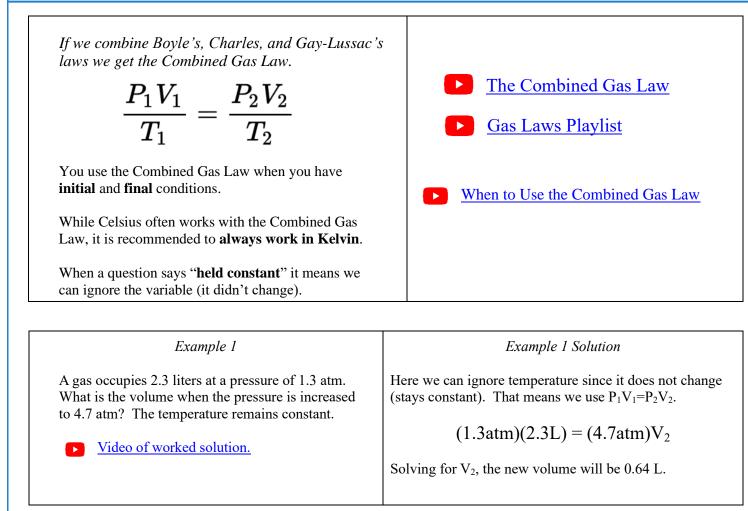


Gas Laws: Combined Gas Law

Video Workbook with Dr. B.



Example 2	Example 2 Solution
3.22 L of a gas is collected at 23.0 °C. What will be its volume after it cools to 15.0 °C if pressure remains constant?	We can ignore P as the pressure remains constant. We use: $\label{eq:V1} V_1/T_1 = V_2/T_2$
Video of worked solution.	$3.22L/296.15K = V_2/288.15K$
	Solving for V_2 the new volume is 3.13 L.
	Note, you would get the same answer using °C but this doesn't always work.

Example 3	Example 3 Solution
For a gas in a closed container the pressure is increased from 11.0 atmospheres to 12.2 atmospheres. If the original temperature was 25.0 °C, what is the	Since volume is not stated in the problem we assume it is held constant and we can ignore it.
final temperature of the gas?	$P_1/T_1 = P_2/T_2$
Video of worked solution.	$(11.0atm)(298.15K) = (27.0atm)/T_2$
	Solving for T_2 we get 330 K .
Example 4	Example 4 Solution
A gas initially at 2.00 atm, 1.20 L, and 273 K has its pressure reduced to 0.90 atm, and the volume is increased to 3.1 L. Determine the final temperature.	In this problem we have P, V, and T so we use: $P_1V_1/T_1 = P_2T_2/V_2$
Video of worked solution.	$\frac{(2.0 \text{atm})(1.2 \text{L})}{273 \text{K}} = \frac{(0.9 \text{atm})(3.1 \text{L})}{\text{T}_2}$
	Solving for T ₂ we get 317 K.
Example 5	Example 5 Solution
A balloon has a volume of 3.5 L at STP. What will the new volume be if the balloon is taken outside on a day where the new term protuction $17.15 ^{\circ}\text{C2}$ A graph the	The key to this problem is recognizing that STP is Standard Temperature and Pressure (1 atm and 273.15K).
where the new temperature is -17.15 °C? Assume the pressure inside and outside is the same (1.0 atm).	$\frac{(1.0 \text{ atm})(3.5 \text{L})}{273.15 \text{K}} = \frac{(1.0 \text{ atm})(\text{V2})}{255.95 \text{K}}$
	Solving for V_2 we get 3.3 L.

Example 6	We can extend the Combined Gas Law to include moles (n).
A sample of 2.0 moles of gas has a pressure of 1.33 atm, a volume of 5.24 L, and temperature of 35.5 °C. If you cool it to a final temperature of 10.0 °C, decrease the	$\frac{P_1 \cdot V_1}{T_1 \cdot n_1} = \frac{P_2 \cdot V_2}{T_2 \cdot n_2}$
volume to 2.32 L, and add an additional 3.0 moles of gas (for a final of 5.0 moles), what will the pressure be?	$\frac{(1.33 \text{ atm})(5.24 \text{L})}{(308.65 \text{K})(2.0 \text{mol})} = \frac{P_2(2.32 \text{L})}{(283.15 \text{K})(5.0 \text{mol})}$
$\frac{P_1 \cdot V_1}{T_1 \cdot n_1} = \frac{P_2 \cdot V_2}{T_2 \cdot n_2}$	Note, for T_2 we add the initial moles (2.0) and the amount we added (3.0) to get the final number of moles (5.0 moles).
	Solving for P_2 we get 6.8 atm.
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Example 7 Solution

A sample of gas has a volume of 15.0L at a pressure of 1.0 atm and a temperature of 27.2 degrees Celsius. What is the new volume if the pressure is raised to 1580 mmHg and the temperature is raised to 356.2K degrees Celsius?

Note: 1atm = 760 mmHg

Video of worked solution.

Example 7 Solution

The challenge here is that the units for the initial and final don't match for pressure or temperature.

Divide 1580 mmHg by 760 mmHg/atm to get P in atm.

 $\frac{(1.0 \text{atm})(15.0 \text{L})}{300.35 \text{K}} = \frac{(2.08 \text{atm})(\text{V}_2)}{356.2 \text{K}}$

Solving for P_2 we get 8.6 L.

Guides

KMT and the Gas Laws

Combined Gas Law (this guide)

Ideal Gas Law

Report errors and suggestions to DrB@breslyn.org



