LESSON MAKER PRO

Gas Under Pressure

Predict how a trapped gas changes.

HIGH SCHOOL · PS.5

PS.5 "Analyze and interpret data to justify the selection of a specific material for a practical application, considering a range of constraints. a..."

NAME _____ DATE _____

THE GAS RULE

For a fixed amount of gas, $P_1V_1/T_1 = P_2V_2/T_2$. Use absolute pressure and temperature in kelvins. If one quantity stays fixed, cancel it before solving.

WORKED EXAMPLE

A trapped gas stays at 280 K. Find its final volume.

State	Pressure (atm)	Volume (L)
Start	4	15
Final	8	?

1. Temperature stays fixed, so pressure times volume stays fixed.
2. 4 * 15 = 8x
3. x = 60/8 = 7.5 L

Answer: 7.5 L

PRACTICE 4 problems

1 At a fixed temperature, a gas holds 12 L at 5 atm. What volume will it hold at 10 atm?

ANSWER _____

2 At a fixed pressure, a gas holds 7 L at 200 K. What volume will it hold at 400 K?

ANSWER _____

3 At a fixed volume, a gas has a pressure of 9 atm at 240 K. What is its pressure at 160 K?

ANSWER _____

4 A gas starts at 12 atm, 5 L, and 180 K. Its pressure changes to 10 atm and its temperature to 300 K. What is its new volume?

ANSWER _____

APPLY IT Show your work

1 A bike tire warms as you ride. Treat its volume as fixed. Find its final absolute pressure.

BIKE TIRE DATA

State	Temperature (K)	Absolute pressure (kPa)
Start	290	290
Final	300	?

ANSWER _____

2 A student squeezes a sealed air pillow from 10 L to 6 L. Its starting absolute pressure is 90 kPa, and its temperature stays fixed. Find its final pressure.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A gas starts at 100 kPa, 12 L, and 240 K. It warms to 300 K and is compressed to 10 L. Find its final pressure. Explain how each change affects the pressure.

WORK SPACE AND ANSWER

Gas Under Pressure

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	At a fixed temperature, a gas holds 12 L at 5 atm. What volume will it hold at 10 atm?	**6 L**
2	At a fixed pressure, a gas holds 7 L at 200 K. What volume will it hold at 400 K?	**14 L**
3	At a fixed volume, a gas has a pressure of 9 atm at 240 K. What is its pressure at 160 K?	**6 atm**
4	A gas starts at 12 atm, 5 L, and 180 K. Its pressure changes to 10 atm and its temperature to 300 K. What is its new volume?	**10 L**

PART 2 · APPLY IT

1. **300 kPa** With volume fixed, pressure and kelvin temperature change in the same ratio: 290 * 300/290 = 300 kPa.
2. **150 kPa** At a fixed temperature, pressure times volume stays fixed: 90 * 10/6 = 150 kPa.

CHALLENGE

150 kPa. Warming the gas and decreasing its volume both raise its pressure.

Use absolute pressure, not gauge pressure, in gas calculations. For the challenge, 100 * 12 * 300/(240 * 10) = 150 kPa.