LESSON MAKER PRO

Gas Under Pressure

Calculate how a confined gas changes.

HIGH SCHOOL · PS.5.c

PS.5.c "Use mathematical and computational thinking to determine the quantitative relationships among temperature, pressure, and volume of confined gases."

NAME _____ DATE _____

THE GAS RULE

For a fixed amount of gas, $P_1V_1/T_1 = P_2V_2/T_2$. Use temperature in kelvins, where K = °C + 273. If a quantity stays the same, cancel it from both sides before solving.

WORKED EXAMPLE

A gas has a pressure of 75 kPa, a volume of 8 L, and a temperature of 250 K. Its pressure rises to 100 kPa while its temperature stays the same. Find its new volume.

1. Write the rule: 75 × 8 / 250 = 100 × x / 250.
2. Cancel 250 from both sides: 75 × 8 = 100x.
3. Multiply: 600 = 100x.
4. Divide by 100: x = 6.

Answer: 6 L

PRACTICE 6 problems

1 A gas has a volume of 9 L at 80 kPa. Its temperature stays the same as its pressure rises to 160 kPa. What is its new volume?

ANSWER _____

2 A gas is at 140 kPa in a 7 L container. At the same temperature, it expands to 14 L. What is its new pressure?

ANSWER _____

3 A gas in a rigid container is at 90 kPa and 270 K. It warms to 360 K. What is its new pressure?

ANSWER _____

4 A gas fills 10 L at 240 K. Its pressure stays the same as it warms to 360 K. What is its new volume?

ANSWER _____

5 A gas occupies 12 L at 80 kPa and 240 K. Its pressure rises to 160 kPa, and its temperature rises to 300 K. What is its new volume?

ANSWER _____

6 A gas in a rigid container is at 110 kPa and 27°C. It warms to 327°C. What is its new pressure?

ANSWER _____

APPLY IT Show your work

1 A basketball is at 192 kPa and 280 K before it is left in a hot car. When its temperature reaches 315 K, what is its pressure? Assume its volume does not change.

WORK SPACE

ANSWER _____

2 A sealed, flexible camping pillow holds 15 L of gas at 120 kPa and 300 K in a test chamber. At a campsite, its gas pressure is 90 kPa and its temperature is 270 K. What is its new volume?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A gas occupies 10 L at 150 kPa and 300 K. It expands to 15 L while its pressure drops to 125 kPa. Find its final temperature in kelvins and degrees Celsius.

WORK SPACE AND ANSWER

ANSWER KEY

Gas Under Pressure

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A gas has a volume of 9 L at 80 kPa. Its temperature stays the same as its pressure rises to 160 kPa. What is its new volume?	**4.5 L**
2	A gas is at 140 kPa in a 7 L container. At the same temperature, it expands to 14 L. What is its new pressure?	**70 kPa**
3	A gas in a rigid container is at 90 kPa and 270 K. It warms to 360 K. What is its new pressure?	**120 kPa**
4	A gas fills 10 L at 240 K. Its pressure stays the same as it warms to 360 K. What is its new volume?	**15 L**
5	A gas occupies 12 L at 80 kPa and 240 K. Its pressure rises to 160 kPa, and its temperature rises to 300 K. What is its new volume?	**7.5 L**
6	A gas in a rigid container is at 110 kPa and 27°C. It warms to 327°C. What is its new pressure?	**220 kPa**

PART 2 · APPLY IT

1. **216 kPa** With volume fixed, $P_2 = 192 \times 315 / 280 = 216$ kPa.
2. **18 L** Use the combined gas rule: $V_2 = 15 \times 120 \times 270 / (300 \times 90) = 18$ L.

CHALLENGE

375 K and 102°C

Accept equivalent calculations that use kelvins and give the stated final units. In the challenge, $T_2 = 300 \times 125 \times 15 / (150 \times 10) = 375$ K, and $375 - 273 = 102$°C.