LESSON MAKER PRO

Gas Under Pressure

Predict how gases change when pressure, volume, or temperature changes.

HIGH SCHOOL · CHE.7

CHE.7 "Students will demonstrate an understanding of the structure and behavior of gases. Analyze the behavior of ideal and real gases in terms of pressure, volume, temperature, and number of particles..."

NAME _____ DATE _____

THE BIG IDEA

For a fixed amount of gas, P V/T stays constant as pressure (P), volume (V), and temperature (T) change. Use P1 V1/T1 = P2 V2/T2, with temperature in kelvins (K). To convert degrees Celsius to kelvins, add 273.

WORKED EXAMPLE

A gas occupies 8 L at 1.5 atm and 240 K. What volume will it occupy at 3 atm and 360 K?

1. (1.5 atm)(8 L)/(240 K) = (3 atm)x/(360 K)
2. x = (1.5)(8)(360)/[(240)(3)] L
3. x = 6 L

Answer: 6 L

PRACTICE 6 problems

1 A gas occupies 12 L at 2 atm and 300 K. It is compressed to 2 L while its temperature stays at 300 K. What is its final pressure?

ANSWER _____

2 A gas occupies 10 L at 1 atm and 250 K. Its temperature rises to 500 K while its pressure stays at 1 atm. What is its final volume?

ANSWER _____

3 A gas occupies 9 L at 2 atm and 300 K. Its volume changes to 12 L and its temperature drops to 200 K. What is its final pressure?

ANSWER _____

4 A gas occupies 15 L at 1 atm and 300 K. Its pressure rises to 2 atm while its temperature drops to 200 K. What is its final volume?

ANSWER _____

5 A gas occupies 10 L at 2 atm and 300 K. It changes to 15 L at 1 atm. What is its final temperature in kelvins?

ANSWER _____

6 A gas occupies 15 L at 1 atm and 27°C. It changes to 2 atm and 127°C. What is its final volume? Convert both temperatures to kelvins first.

ANSWER _____

APPLY IT Show your work

1 After a ride, the air inside a bike tire warms from 300 K to 330 K. Treat the tire's volume as constant. If the air started at 2 atm, what is its final pressure?

WORK SPACE

ANSWER _____

2 A weather balloon holds 20 L of gas at 1 atm and 300 K. Higher in the sky, the pressure is 0.75 atm and the gas temperature is 270 K. Assuming the amount of gas stays the same, what is the balloon's new volume?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A test chamber starts with gas at 2 atm, 10 L, and 300 K. Then half its gas particles escape, its volume increases to 20 L, and the remaining gas reaches 450 K. For a changing amount of gas, P V/(n T) stays constant, where n is the amount of gas. What is the final pressure? Show how you account for the particles that escaped.

WORK SPACE AND ANSWER

Gas Under Pressure

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A gas occupies 12 L at 2 atm and 300 K. It is compressed to 2 L while its temperature stays at 300 K. What is its final pressure?	**12 atm**
2	A gas occupies 10 L at 1 atm and 250 K. Its temperature rises to 500 K while its pressure stays at 1 atm. What is its final volume?	**20 L**
3	A gas occupies 9 L at 2 atm and 300 K. Its volume changes to 12 L and its temperature drops to 200 K. What is its final pressure?	**1 atm**
4	A gas occupies 15 L at 1 atm and 300 K. Its pressure rises to 2 atm while its temperature drops to 200 K. What is its final volume?	**5 L**
5	A gas occupies 10 L at 2 atm and 300 K. It changes to 15 L at 1 atm. What is its final temperature in kelvins?	**225 K**
6	A gas occupies 15 L at 1 atm and 27°C. It changes to 2 atm and 127°C. What is its final volume? Convert both temperatures to kelvins first.	**10 L**

PART 2 · APPLY IT

1. **2.2 atm** With volume constant, P2 = (2 atm)(330 K)/(300 K) = 2.2 atm.
2. **24 L** V2 = (1 atm)(20 L)(270 K)/[(300 K)(0.75 atm)] = 24 L.

CHALLENGE

P2 = (2 atm)(1/2)(10 L/20 L)(450 K/300 K) = 0.75 atm.

Accept equivalent calculations with correct units. Pressure values are absolute pressures, and the gas-law calculations assume ideal-gas behavior.