The Combined Gas Law

Math Skill: Calculating with Significant Figures

You may want to read more about this **Math Skill** in the **Skills and Reference Handbook** at the end of your textbook.

A gas in a cylinder has a pressure of 235 kPa at a volume of 5.00 L. The volume is reduced to 1.25 L. The temperature does not change. Find the new pressure of the gas.

1. Read and Understand

What information are you given?

$V_1 = 5.00$ L $\quad V_2 = 1.25$ L $\quad P_1 = 235$ kPa

2. Plan and Solve

What unknown are you trying to calculate? P_2

What expression can you use?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Cancel out the variable that does not change and rearrange the expression to solve for P_2.

$$P_1V_1 = P_2V_2 \qquad P_2 = \frac{P_1V_1}{V_2}$$

Replace each variable with its known value.

$$P_2 = 235 \text{ kPa} \times \frac{5.00 \text{ L}}{1.25 \text{ L}} = 940 \text{ kPa}$$

3. Look Back and Check

Is your answer reasonable?

The volume of a gas is inversely proportional to its pressure if the temperature and number of particles are constant. The volume decreased by a factor of four, from 5.00 L to 1.25 L. The answer, 940 kPa, is four times the original pressure, 235 kPa.

Math Practice

On a separate sheet of paper, solve the following problems. The number of particles remains constant for all problems.

1. A gas has a pressure of 340 kPa at a volume of 3.20 L. What happens to the pressure when the volume is increased to 5.44 L? The temperature does not change.

2. A gas has a pressure of 180 kPa at a temperature of 300 K. At what temperature will the gas have a pressure of 276 kPa? The volume does not change.

3. At 47°C, a gas has a pressure of 140 kPa. The gas is cooled until the pressure decreases to 105 kPa. If the volume remains constant, what will the final temperature be in Kelvins? In degrees Celsius?