3 COMPUTE Substitute values for P_1, T_2, and T_1 to obtain the new pressure, P_2.

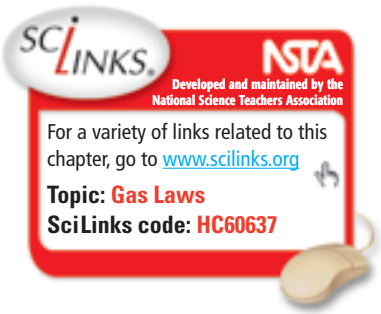
$$P_2 = \frac{(3.00 \text{ atm})(325 \cancel{\text{K}})}{298 \cancel{\text{K}}} = 3.27 \text{ atm}$$

4 EVALUATE As expected, a temperature increase at constant volume causes the pressure of the contents in the container to increase. Units cancel correctly. The answer contains the proper number of significant figures. It is close to an estimated value of 3.25, calculated as $(3 \times 325)/300$.

PRACTICE *Answers in Appendix E*

1. At 120.0°C, the pressure of a sample of nitrogen is 1.07 atm. What will the pressure be at 205°C, assuming constant volume?
2. At 122°C the pressure of a sample of nitrogen gas is 1.07 atm. What will the pressure be at 205°C, assuming constant volume?
3. A sample of helium gas has a pressure of 1.20 atm at 22°C. At what Celsius temperature will the helium reach a pressure of 2.00 atm, assuming constant volume?

extension
Go to **go.hrw.com** for more practice problems that ask you to use Gay-Lussac's law.
Keyword: HC6GASX



The Combined Gas Law

A gas sample often undergoes changes in temperature, pressure, and volume all at the same time. When this happens, three variables must be dealt with at once. Boyle's law, Charles's law, and Gay-Lussac's law can be combined into a single expression that is useful in such situations. *The* **combined gas law** *expresses the relationship between pressure, volume, and temperature of a fixed amount of gas.* The combined gas law can be expressed as follows.

$$\frac{PV}{T} = k$$

In the equation, k is constant and depends on the amount of gas. The combined gas law can also be written as follows.

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

The subscripts in the equation above indicate two different sets of conditions, and T represents Kelvin temperature.

From this expression, any value can be calculated if the other five are known. Note that each of the gas laws can be obtained from the combined gas law when the proper variable is constant. For example, Boyle's law is obtained when the temperature is constant. Because $T_1 = T_2$, T_1 and T_2 will cancel out on both sides of the combined gas law equation, giving Boyle's law.

$$P_1V_1 = P_2V_2$$

extension
Chemical Content
Go to **go.hrw.com** for more information on how the combined gas law can be derived from Boyle's law, Charles's law, and Gay-Lussac's law.
Keyword: HC6GASX