

Chapter 17 Problem 19 †

Given

$$T = 350 \text{ K}$$

$$V = 8.5 \text{ L} = 8.5 \times 10^{-3} \text{ m}^3$$

$$P = 180 \text{ kPa} = 1.80 \times 10^5 \text{ Pa}$$

$$R = 8.31 \text{ J/mol} \cdot \text{K}$$

Solution

How many molecules are in the sample?

The ideal gas law states

$$PV = nRT$$

Find the number of moles

$$n = \frac{PV}{RT} = \frac{(1.80 \times 10^5 \text{ Pa})(8.5 \times 10^{-3} \text{ m}^3)}{(8.31 \text{ J/mol} \cdot \text{K})(350 \text{ K})}$$

$$n = 0.526 \text{ mol}$$

To find the number of molecules, multiple the number of moles by Avagadro's number.

$$N = nN_a = (0.526 \text{ mol})(6.02 \times 10^{23}) = 3.17 \times 10^{23} \text{ molecules}$$

†Problem from Essential University Physics, Wolfson