Chapter 17 Problem 18 [†]

Given
$T = 350\ K$
$V = 8.5\ L = 8.5 \times 10^{-3}\ m^3$
$P = 180\ kPa = 1.80 \times 10^5\ Pa$
$R = 8.31\ J/mol \cdot K$

Solution
How many molecules are in the sample?

The ideal gas law states

$$PV = nRT$$

Find the number of moles

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

$$n = 0.526\ mol$$

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

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

[†]Problem from Essential University Physics, Wolfson