Answer on Question #41839, Physics, Other

A volume 0.8 m^3 contains 2 moles of a monatomic gas the average translational kinetic energy of molecules of the gas is $6.27 \cdot 10^{-21}$ J. Calculate

a) the temperature of the gas ?

b) the pressure of the gas?

Solution:

Given:

$n = 2\,moles,$

$V = 0.8\,m^3,$

$KE = 6.27 \cdot 10^{-21}$ J

$T = ?,$

$p = ?$

a)

The average kinetic energy per molecule of the gas is:

$$KE = \langle \frac{1}{2} m v^2 \rangle = \frac{3}{2} kT$$

where k is Boltzmann constant = 1.38066 x 10^{-23} J/K

Thus,

$$T = \frac{2KE}{3k} = \frac{2 \cdot 6.27 \cdot 10^{-21}}{3 \cdot 1.38066 \cdot 10^{-23}} = 302.75 \text{ K}$$

b) The ideal gas equation:

$$pV = nRT$$

where n is the number of moles, R = 8.3145 J/mol K is the universal gas constant.

Thus,

$$p = \frac{nRT}{V} = \frac{2 \cdot 8.3145 \cdot 302.75}{0.8} = 6293.0 \text{ Pa}$$

Answer. $T = 302.75$ K, $p = 6293.0$ Pa.