Answer on Question #64815 - Physics – Molecular Physics | Thermodynamisc

Question: Find the average translational kinetic energy per molecule if one mole of the gas is contained in a volume .00123 metrecube at a pressure 200000Nper metresquare

Solution: Accord to the basic equation of kinetic theory of gases $P = \frac{2}{3}\frac{N}{V}E$ where P is pressure (in Pa), N is a molecule's number, V is volume (in m^3) and E is average translational kinetic energy (in J). The molecule's number is product of Avogadro's number and mole's number ($N = N_A * \nu$). So, $E = \frac{3PV}{2N_A\nu}$.

Given: P = 200000 N/m^2 = $2*10^5$ Pa; V = 0.00123 m^3 = $1.23*10^{-3}$ m^3; v = 1 mole. N_A = $6.02*10^{23}$.

Calculate: $E = \frac{3*2*10^5 Pa*1.23*10^{-3}m^3}{2*6.02*10^{23}*1} = \frac{7.38*10^2 N*m}{12.04*10^{23}} = 0.613 * 10^{-21} N * m = 6.13 * 10^{-22} J$

Answer: The average translational kinetic energy per molecule in the system is $6.13*10^{-22}$ Joules.

Note: The kinetic theory of gases works only for ideal gases.