

Answer on Question #66756-Physics-Molecular Physics-Thermodynamics

Calculate the most probable speed, average speed & root mean square speed for gas molecule at 300K .the mass of gas molecule is 5×10^{-28} kg

Solution

The root mean square speed is

$$v_{rms} = \sqrt{\frac{3RT}{M_m}} = \sqrt{\frac{3RT}{m \cdot N_A}} = \sqrt{\frac{3 \cdot 8.31 \frac{J}{K \cdot mol} \cdot 300K}{5 \cdot 10^{-28} kg \cdot 6.02 \cdot 10^{23} \frac{1}{mol}}} = 4985 \frac{m}{s}$$

The average speed is

$$v_{ave} = \sqrt{\frac{8RT}{\pi M_m}} = \sqrt{\frac{8RT}{\pi m \cdot N_A}} = \sqrt{\frac{8 \cdot 8.31 \frac{J}{K \cdot mol} \cdot 300K}{5\pi \cdot 10^{-28} kg \cdot 6.02 \cdot 10^{23} \frac{1}{mol}}} = 4592 \frac{m}{s}$$

The most probable speed is

$$v_p = \sqrt{\frac{2RT}{M_m}} = \sqrt{\frac{2RT}{m \cdot N_A}} = \sqrt{\frac{2 \cdot 8.31 \frac{J}{K \cdot mol} \cdot 300K}{5 \cdot 10^{-28} kg \cdot 6.02 \cdot 10^{23} \frac{1}{mol}}} = 4070 \frac{m}{s}$$

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