Velocity of an O_2 molecule

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Solution: First we use the kinetic theory of gases.

$$\frac{1}{2}Nmv^2 = \frac{3}{2}nRT$$

And we rewrite the expression so that the n will cancel.

$$\frac{1}{2}nM_m v^2 = \frac{3}{2}nRT$$

We solve for the average velocity.

$$v = \sqrt{\frac{3RT}{M_m}}$$

Velocity of an O_2 molecule

What is the average velocity of an O_2 molecule at 298 K?

Using the equation for the root-mean-square (kind of average) velocity,

$$v = \sqrt{\frac{3RT}{M_m}}$$

we can substitute in the known molar mass.

$$v = \sqrt{\frac{3\left(8.31\,\frac{J}{molK}\right)(298\ K)}{0.032\ kg/mol}} = 482\ m/s$$