Answer on Question #43122-Physics-Molecular Physics-Thermodynamics

Calculate the root mean square velocity for oxygen molecules at temperatures 30c

Solution

Using $v_{rms} = \sqrt{\frac{3RT}{M}}$, the molar mass of molecular oxygen is $M = 31.9998 \frac{g}{mol}$; the molar gas constant has the value $R = 8.3143 \frac{J}{mol\ K}$, and the temperature is $T = 303.15\ K$. Since the joule is the $\frac{kgm^2}{s^2}$, the molar mass must be expressed as $M = 0.0319998 \frac{kg}{mol}$. The root mean square velocity is then given by:

$$v_{rms} = \sqrt{\frac{3 \cdot 8.3143 \cdot 303.15}{0.0319998}} = 486.1 \frac{m}{s}.$$

Answer: $\mathbf{486.1 \frac{m}{s}}$.