Answer on Question #45271, Physics, Molecular Physics | Thermodynamics

Question:

At what temperature will the root-mean-square speed of oxygen molecules have the value of 640 m/s? 1 kilomole of oxygen has a mass of 32kg.

Answer:

The root mean square velocity can be expressed as:

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

where R is ideal gas constant $R = 8.3145 \frac{J}{K \cdot mol}$, T is absolute temperature in Kelvin, M is mass of a mole of the gas in kilograms.

Therefore, temperature equals:

$$T = \frac{v^2 M}{3R} = \frac{640^2 \cdot 0.32}{3 \cdot 8.31} = 5258 \, K \approx 5300 \, K$$