**Answer on Question 40305, 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.
Solution. From the fact that 1 kilomole of oxygen has a mass of 32kg we can
find the mass of molecule of oxygen. Indeed, we know how many molecules are
in 1 kilomole, hence

$$m = 10^3 \cdot N_A 32 = \frac{32}{6.022 \cdot 10^{26}} = 5.3 \cdot 10^{-26}$$

Now we just use formula that connects rsm velocity and temperature

$$v_{\text{rms}} = \sqrt{\frac{3kT}{m}}$$

where k is Boltzmann constant. Hence

$$T = \frac{mv_{\text{rms}}^2}{3k} = \frac{5.3 \cdot 10^{-26} \cdot 640^2}{3 \cdot 1.38 \cdot 10^{-23}} \approx 723.6 \, K$$