Answer on the question #55801 - Chemistry - General chemistry

Question:

what temperature (c) of 1.75g of O_2 gas occupying 3.7 L at 1.00 atm?

Solution:

Assuming the ideal gas behavior, the temperature can be calculated, using the ideal gas law:

$$pV = nRT$$

where p is the pressure, V is the volume, n is the number of the moles, R is the ideal gas constant and T is the temperature. Deriving the temperature from this equation, we have:

$$T = \frac{pV}{nR}.$$

The volume is given to be $V = 3.7 \cdot 10^{-3}\ m^3$. Pressure is 1 atm and that is 101.325 kPa. The ideal gas constant is 8.314 $Jmol^{-1}\ K^{-1}$. The number of the moles can be calculated from the mass, using the molar mass:

$$n = \frac{m(O_2)}{M(O_2)} = \frac{1.75(g)}{16.0(g\ mol^{-1})} = 0.109\ mol$$

Then, the temperature in the system is:

$$T = \frac{101325\ (Pa) \cdot 3.7 \cdot 10^{-3}(m^3)}{0.109(mol) \cdot 8.314(J\ mol^{-1}\ K^{-1})} = 412.3\ K$$

Answer: 412.3 K