Answer on Question #74192, Physics / Electromagnetism |

Question

One mole of a gas occupies 22.4 liters at 0°C and 760 mm Hg. Calculate the pressure needed to compress 2.00 moles of oxygen into a 3.00-liter container maintained at 25°C.

Solution

$\nu_1 = 1mol$ $\quad$ $\nu_2 = 1mol$

$V_1 = 22.4l$ $\quad$ $V_2 = 3l$

$T_1 = 273K$ $\quad$ $T_2 = 298K$

$P_1 = 760mmHg$ $\quad$ $P_2 - ?$

From ideal gas law we have

$$P_1V_1 = \nu_1RT_1,$$
$$P_2V_2 = \nu_2RT_2,$$

which gives

$$P_2 = P_1\frac{\nu_2T_2V_1}{\nu_1T_1V_2} = 760mmHg\,\frac{2mol \cdot 298K \cdot 22.4l}{1mol \cdot 273K \cdot 3l} = 12388.6mmHg.$$

Answer: $P_2 = 12388.6mmHg$.