Answer on Question #51933-Physics-Field Theory

An ideal gas is contained in two metal cylinders X and Y connected by a tap which is initially closed. The volume and pressure of the gas in the cylinders are as attached.

	pressure/Pa	volume/m³
X	5×10^5	11×10^{-3}
Y	2×10^5	4×10^{-3}

When the tap connecting the two cylinders is opened, what will be the final pressure, in Pa, in the vessel? Assume that the temperature remains constant

2.4×105

3.5×105

4.2×105

5.0×105

Solution

We have

$$P_X V_X = \frac{m_X}{M} RT, P_Y V_Y = \frac{m_Y}{M} RT, P(V_X + V_Y) = \frac{(m_X + m_Y)}{M} RT.$$

So,

$$P_X V_X + P_Y V_Y = P(V_X + V_Y).$$

Thus,

$$P = \frac{P_X V_X + P_Y V_Y}{V_X + V_Y} = \frac{5 \cdot 10^5 \cdot 11 \cdot 10^{-3} + 2 \cdot 10^5 \cdot 4 \cdot 10^{-3}}{(11 + 4) \cdot 10^{-3}} = 4.2 \cdot 10^5 Pa.$$

Answer: $\mathbf{4.2 \cdot 10^5} \boldsymbol{Pa}$.