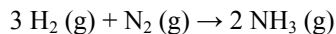


Example: Two containers at 25.0 °C, one 5.0 L and the other 10.0 L are connected by an empty valve with a volume of 125 mL.

The 5.0 L Container holds 5.00 g of hydrogen, the 10.0 L, 5.00 g of nitrogen.

What is the pressure of the system when the valve is opened if the gases react according to the following reaction?



First, find the limiting reactant:

$$5.00 \text{ g H}_2 * \frac{1 \text{ mol H}_2}{2.016 \text{ g H}_2} * \frac{1 \text{ mol N}_2}{3 \text{ mol H}_2} * \frac{28.014 \text{ g N}_2}{1 \text{ mol N}_2} = 23.2 \text{ g N}_2 \text{ needed}$$

Since we only have 5.00 g N₂, N₂ is limiting and H₂ is in excess.

Second, determine the moles of NH₃ produced and the amount of H₂ that is left-over.

$$5.00 \text{ g N}_2 * \frac{1 \text{ mol N}_2}{28.014 \text{ g N}_2} * \frac{3 \text{ mol H}_2}{1 \text{ mol N}_2} * \frac{2.016 \text{ g H}_2}{1 \text{ mol H}_2} = 1.08 \text{ g H}_2 \text{ needed}$$

$$\text{Leftover H}_2 = 5.00 \text{ g H}_2 - 1.08 \text{ g H}_2 = 3.92 \text{ g H}_2$$

$$5.00 \text{ g N}_2 * \frac{1 \text{ mol N}_2}{28.014 \text{ g N}_2} * \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} * \frac{17.031 \text{ g NH}_3}{1 \text{ mol NH}_3} = 6.08 \text{ g NH}_3 \text{ produced}$$

$$3.92 \text{ g H}_2 * \frac{1 \text{ mol H}_2}{2.016 \text{ g H}_2} = 1.94 \text{ mol H}_2$$

$$6.08 \text{ g NH}_3 * \frac{1 \text{ mol NH}_3}{17.031 \text{ g NH}_3} = 0.357 \text{ mol NH}_3$$

Last,

$$n_{\text{tot}} = 1.94 \text{ mol H}_2 + 0.357 \text{ mol N}_2 = 2.30 \text{ moles total}$$

$$V_{\text{tot}} = 5.0 \text{ L} + 10.0 \text{ L} + 125 \text{ mL} = 5.0 \text{ L} + 10.0 \text{ L} + 0.125 \text{ L} = 15.1 \text{ L total}$$

we know that $P_{\text{tot}} V_{\text{tot}} = n_{\text{tot}} R T$ and we need P_{tot} ...

$$P_{\text{tot}} = \frac{n_{\text{tot}} R T}{V_{\text{tot}}} = \frac{2.30 \text{ mol} * 0.08206 \frac{\text{L} * \text{atm}}{\text{mol} * \text{K}} * 298.15 \text{ K}}{15.1 \text{ L}} = 3.73 \text{ atm}$$