Gas Phase Reactions

Exercise \(\PageIndex{1}\))

5.00 g of Mg is added to 50.0 mL of 0.800M HCl. A double displacement reaction occurs in a sealed container at 25.0°C. What is the pressure of the hydrogen gas generated if the volume above the solution is 100.0 ml, and we ignore any pressure due to the evaporated water?

Answer

\(P_{H_2} = \frac{n_{H_2}RT}{V} = \frac{0.0200 \text{ mol } H_2 \left( 0.08206 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \right) 298 \text{K}}{0.100 \text{L}} = 4.89 \text{atm}\)

Exercise \(\PageIndex{2}\))

Nitrogen dioxide is formed in a closed container at 90°C and 1.00 atm when 1.50 g NO and 2.00 mole of O\(_2\) are mixed. After the reaction is finished the pressure changes to 3.90 atm. What is the final temperature?

Answer

\(T_2 = T_1 \left( \frac{n_1}{n_2} \right) \left( \frac{P_2}{P_1} \right) = 363.15 \text{K} \left( \frac{2.05 \text{mol}}{2.025 \text{mol}} \right) \left( \frac{3.90 \text{atm}}{1.00 \text{atm}} \right) = 1433.77 \text{K} = 1400 \text{K}\)