Answer on Question #62994 - Chemistry - General Chemistry

Ammonia is prepared industrially by the reaction of nitrogen and hydrogen according to the following equation. If 29.7 g of N2 is added to 3.31 g of H2, which reactant is the limiting reactant and how much ammonia (NH3) is formed?

Solution

$$\boldsymbol{\nu(N_2) = \frac{29.7g}{28\ g/mol} = 1.06\ mol}$$

$$\boldsymbol{\nu(H_2) = \frac{3.31g}{2\ g/mol} = 1.66\ mol}$$

$$\boldsymbol{N_2 + 3H_2 = 2NH_3}$$

According to the reaction, we need 3 moles of H_2 for every mole of N_2. Therefore, we need 3.18 moles of H_2 to react with N_2 given. Therefore, H_2 is the limiting reagent.

$$\boldsymbol{\nu(NH_3) = 1.66mol \times \frac{2}{3} \approx 1.1mol}$$

$$\boldsymbol{m(NH_3) = 1.1mol \times 17.03 \frac{g}{mol} = 18.78g}$$

Answer: $\boldsymbol{H2\ is\ the\ limiting\ reagent; 18.78h\ of\ ammonia\ is\ formed.}$