Task:

Consider the following balanced equation: $N_2 + 3H_2 \rightarrow 2NH_3$

    a) When 4.50 mole of H_2 react, how many grams of N_2 are needed?

    b) How many grams of H_2 are required to produce 27.0 g of NH_3?

Answer:

a) According to the given equation $N_2 + 3H_2 \rightarrow 2NH_3$, number of moles of H_2 is 3 times greater than N_2.

$$v(N_2) = \frac{v(H_2)}{3} = \frac{4.5}{3} = 1.5 \; moles$$

$$v = \frac{m}{M} \qquad\qquad m = vM$$

$$M(N_2) = 28 \; g/mol$$

$$m(N_2) = 1.5 \cdot 28 = 42 \; g$$

$$v(NH_3) = \frac{m(NH_3)}{M(NH_3)}$$

$$M(NH_3) = 17.0 \; g/mol$$

b) $v(NH_3) = \frac{27.0}{17.0} = 1.6 \; mol$

$$v(H_2) = \frac{3 \cdot v(NH_3)}{2} = \frac{3 \cdot 1.6}{2} = 2.4 \; moles$$

$$M(H_2) = 2 \; g/mol$$

$$m(H_2) = 2.4 \cdot 2 = 4.8 \; g$$