This reaction is used to produce ammonia commercially.

$$3H_2\ (aq)\ +\ N_2\ (aq)\ \rightarrow\ 2HN_3\ (g)$$
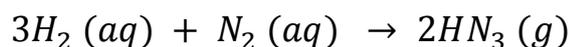
If 1.40 g of nitrogen is used in the reaction, what mass of hydrogen is needed?

Answer:

We are given:

$$m(N_2) = 1.4\ g$$

Thus, amount of substance of nitrogen is:

$$v(N_2) = \frac{m(N_2)}{M(N_2)}$$

Where

$M(N_2)$ is molar mass of nitrogen;

$$M(N_2) = 2 * 14 = 28\ g/mol$$

So:

$$v(N_2) = \frac{1.4}{28} = 0.05\ mol$$

As it is seen form reaction equation:

$$\frac{v(N_2)}{v(H_2)} = \frac{1}{3}$$

Thus:

$$v(H_2) = v(N_2) * 3 = 0.15\ mol$$

molar mass of hydrogen;

$$M(H_2) = 2 * 1 = 2\ g/mol$$

Thus:

$$m(H_2) = v(H_2) * M(H_2) = 0.15 * 2 = 0.3 \ g$$

Answer: **0.3 g**

References:

1) http://en.wikipedia.org/wiki/Molar_mass#Molar_masses_of_compounds