

Answer on the question #62982, Chemistry / General Chemistry

Question:

For the following reaction, 3.70 grams of sulfuric acid are mixed with excess calcium hydroxide. The reaction yields 3.39 grams of calcium sulfate.

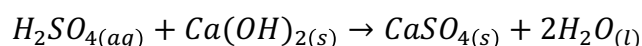
sulfuric acid (aq) + calcium hydroxide (s) calcium sulfate (s) + water (l)

What is the theoretical yield of calcium sulfate ? grams

What is the percent yield of calcium sulfate ? %

Solution:

The reaction equation is:



Let's calculate the number of the moles of sulfuric acid:

$$n(H_2SO_{4(aq)}) = \frac{m(H_2SO_{4(aq)})}{M(H_2SO_{4(aq)})} = \frac{3.70 (g)}{98.07848(\frac{g}{mol})} = 0.037725 (mol)$$

According to the stoichiometry of the reaction, the number of the moles of sulfuric acid is equal to the number of the moles of calcium sulfate:

$$n(H_2SO_{4(aq)}) = n(CaSO_{4(s)})$$

Then, theoretical mass of calcium sulfate produced is:

$$\begin{aligned} m(CaSO_{4(s)}) &= n(CaSO_{4(s)}) \cdot M(CaSO_{4(s)}) = 0.037725(mol) \cdot 136.1406 \left(\frac{g}{mol}\right) \\ &= 5.136 g \end{aligned}$$

Experimental yield of calcium sulfate:

$$\omega = \frac{m(CaSO_{4(s)})_{exp}}{m(CaSO_{4(s)})_{theor}} \cdot 100\% = \frac{3.39(g)}{5.136(g)} \cdot 100\% = 66\%$$

Answer: theoretical yield of calcium sulfate is 5.136 g, percent yield is 66%