KEY

Percent Yield

The quantities that we have been calculating in mass-mass problems are theoretical amounts. We are calculating the maximum possible amount of a substance that could be produced through a reaction.

Throughout your lab experience, you have identified sources of error in different procedures. Often times, these sources of error cause the actual amount of product that we produce in a lab to be much less than the theoretical amount we determined.

Chemists want to compare the experimental amount of a substance they produce in lab with the theoretical amount they should **be able to produce**. This is called the **percent yield** of a product.

$$\textbf{Percent yield} = \frac{\text{(actual) } \textbf{experimental amount}}{\textbf{theoretical amount}} \times 100$$

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1. The experimental amount of a product in a reaction is 39.7 g although a mass-mass calculation predicted 65.6g. What is the percent yield of this product?

$\frac{39.7\text{ g}}{65.6\text{ g}} \times 100 = 60.5\%$ yield

2. A chemist was able to form 20.4 g of ammonia using 5.50 g of hydrogen gas. What is the percent yield of ammonia using this procedure?

actual yield

$N_2 + 3H_2 \rightarrow 2NH_3$

5.5g H_2 ? g NH_3

3 mol H_2 = 2 mol NH_3
1 mol H_2 = 2.02g H_2
1 mol NH_3 = 17.04g NH_3

$5.50\text{g } H_2 \left| \frac{1\text{mol } H_2}{2.02\text{g } H_2} \right| \frac{2\text{mol } NH_3}{3\text{mol } H_2} \left| \frac{17.04\text{g } NH_3}{1\text{mol } NH_3} \right. = 30.9\text{g } NH_3$ (theoretical yield)

$\frac{20.4}{30.9} \times 100 = 66.0\%$

3. In lab, I reacted 3.05 moles of sodium chloride with sulfuric acid and I was able to form 1.23 moles of sodium sulfate. What is the percent yield of my product?

actual (experimental)

$2\,NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2\,HCl$

3.05 mol NaCl ? mol Na_2SO_4

2 mol NaCl = 1 mol Na_2SO_4

$3.05\text{mol NaCl} \left| \frac{1\text{mol } Na_2SO_4}{2\text{mol NaCl}} \right. = 1.53\text{mol } Na_2SO_4$ (theoretical)

$\frac{1.23}{1.53} \times 100 = 80.4\%$

4. Use the following equation to answer the questions:

$$CS_2 + 3O_2 \rightarrow CO_2 + 2SO_2$$

1.00 mol O_2 ? mol CO_2

If 1.00 moles of O_2 reacts with CS_2, how many moles of CO_2 should be produced?

$1.00\text{mol } O_2 \left| \frac{1\text{mol } CO_2}{3\text{mol } O_2} \right. = .333\text{mol } CO_2$ (theoretical)

3 mol O_2 = 1 mol CO_2

If 0.300 moles are actually produced in lab, what is the percent yield?

$\frac{.300}{.333} \times 100 = 90.1\%$