Stoichiometry   **Name**_____

Percent Yield

Read from **Lesson 2: Relating Stoichiometric Quantities** in the **Chemistry Tutorial Section, Chapter 9** of **The Physics Classroom**:   Part d: <u>Percent Yield</u>   Part e: <u>Stoichiometry Plus</u>

Percent Yield

"**Yield**" in chemistry refers to the amount (usually grams) of a product produced by a chemical reaction.

Actual Yield is the amount that was actually produced in lab, while **Theoretical Yield** is the amount of product we would expect to be produced based on stoichiometry calculations. All of the stoichiometric calculations so far have been calculating theoretical amounts of products.

The equation for calculating **percent yield** is …

$$\% \text{ Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100$$

For example:

When 37.5 grams of $Ba(ClO_3)_2$ and excess $NaNO_3$ react in a double displacement reaction, 25.0 g of $Ba(NO_3)_2$ forms. What is the percent yield of barium nitrate?

- First, write the balanced equation and do a normal stoichiometry problem to find the theoretical yield of $Ba(NO_3)_2$ from 37.5 g $Ba(ClO_3)_2$

$$Ba(ClO_3)_2 + 2\ NaNO_3 \rightarrow Ba(NO_3)_2 + 2\ NaClO_3$$
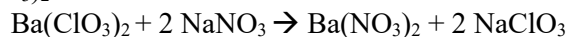
$$37.5 \text{ g } Ba(ClO_3)_2 \cdot \frac{1 \text{ mol } Ba(ClO_3)_2}{304.23 \text{ g } Ba(ClO_3)_2} \cdot \frac{1 \text{ mol } Ba(NO_3)_2}{1 \text{ mol } Ba(ClO_3)_2} \cdot \frac{261.34 \text{ g } Ba(NO_3)_2}{1 \text{ mol } Ba(NO_3)_2} = 32.2 \text{ g } Ba(NO_3)_2$$

This is the theoretical yield

- Then, calculate the percent yield using the formula.

$$\% \text{ Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100 = \frac{25.0 \text{ g}}{32.2 \text{ g}} \cdot 100 = 77.6\%$$ <u>**The percent yield is 77.6%**</u>

Problems:

1. Flo and Clo Wrene (the identical twin chem students) are in lab working on the decomposition of aluminum chlorate. Aluminum chlorate decomposes into aluminum chloride and oxygen gas.

    a. Write the balanced equation for this reaction using the correct formulae and coefficients.

    b. If 871 g of aluminum chlorate decompose, how many grams of O_2 would theoretically be formed?

    c. If Flo and Clo collect 395 grams of O_2 while in the lab, what is the percent yield?

2.   Sally Kon and Aaron Agin are performing an experiment involving a single replacement reaction between copper metal and a solution of silver nitrate. The products are copper (II) nitrate and silver metal.

a. Write the balanced equation for this reaction using the correct formulae and coefficients.

b.   Aaron Agin wants to make 0.500 g of solid silver. Looking at the mole ratio of silver to copper in the balanced equation, Aaron states that they will need 0.250 g of copper (and an excess of silver nitrate solution) to produce this amount of silver. Sally states that they will need only 0.147 g of copper to produce 0.500 g of silver. Who is correct and incorrect? Use stoichiometry to justify your reasoning.

c.   Sally and Aaron can only find 0.0804 g of copper in the chem lab. They react this amount of copper with an excess of silver nitrate to produce 0.189 g of silver. What is the percent yield of this experiment?

3.   Acetic acid reacts with sodium carbonate to produce sodium acetate, water, and carbon dioxide gas.
a.   Write the balanced equation for this reaction using the correct formulae and coefficients.

b.   If 10.0 g of sodium carbonate is used in the reaction and there is a 79% yield, how many grams of sodium acetate will be formed?