

Introduction:

In most chemical reactions, one does not obtain 100 percent of the predicted amount of product. Although measurement errors can always be a problem, some material will be lost in the process of reacting chemicals and obtaining the product. Some organic chemical reactions can yield less than 30% (obtained 30% of the expected product). We expect our high school labs to produce at least 95% of what was predicted (5% difference, 95% yield).

Percent Yield:

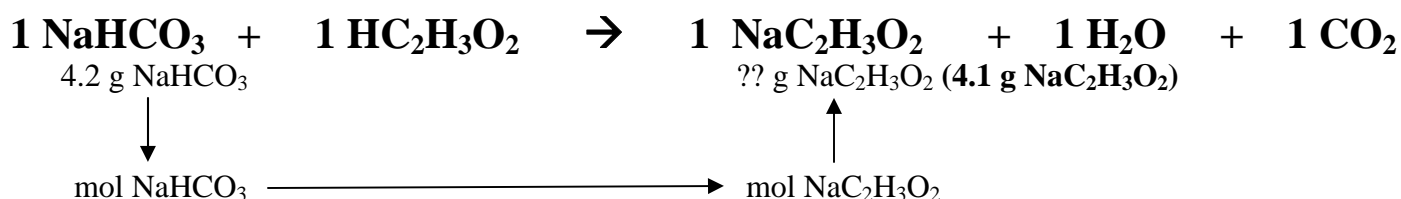
The percentage yield is easily calculated – it is the percentage of chemical that you expected to obtain. All you have to do is take the amount you obtained and divide it by the predicted amount:

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

- The actual amount is easy – it is the grams of product that you measured in lab.
- The predicted amount is nothing but a **gram to gram** calculation using the **amount you started with** and **using the balanced equation**.

An Example:

In our recent lab, we weighed out 4.2 grams of baking soda and expected 4.1 grams of sodium acetate from the equation:



Let us imagine that you obtained 3.7 grams of product (NaC₂H₃O₂).

So:

Your actual amount = 3.7 g

Your predicted amount = 4.1 g

Your % yield was: 90. % % Yield = (3.7 / 4.1) x 100

The Final Word

Percentage Yield is only one additional step after a **gram to gram problem**.

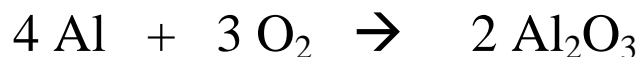
- Do the gram to gram to get the **Predicted Amount**
- Divide the actual amount obtained (from lab or given in a problem) by the **Predicted Amount** (x 100).

Percentage Yield Problem Set

1. You used an excess (more than enough) of aluminum in a solution that held 26.8 grams copper (II) chloride. You obtained 10.3 grams of copper metal. What was the percentage yield of copper in this reaction? (Do a gram to gram to figure out the predicted amount: $26.8 \text{ g CuCl}_2 \rightarrow \text{g Cu}$)
[12.7 g predicted, 81 % yield] **Show Detailed Work**



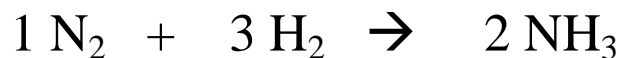
2. You burn 75.0 grams of Aluminum powder (Al) in a camp stove. You collect the powder formed (Al_2O_3) and it weighs 132.0 grams. What was your percentage yield in the reaction?
[141.7 g predicted, 93.2 % yield] **Show Detailed Work**



3. You use an electrolysis apparatus to separate water into hydrogen and oxygen. You find that you used 14.0 grams of water and created 4.78 grams of Oxygen. What was your percentage yield?
[6.22 g predicted, 76.8 % yield] **Show Detailed Work**



4. A chemist tries to make ammonia (NH₃) by mixing Nitrogen (N₂) and Hydrogen (H₂) gases. She places 40.0 grams of hydrogen gas into the reaction vessel and when the reaction stops, she removes 17.5 g of ammonia (NH₃). What was the percentage yield?
[225 g predicted, 7.7% yield] **Show Detailed Work**



5. When Zinc is placed in a Copper (II) sulfate solution, zinc forces copper atoms to accept electrons and become neutral, precipitated copper. You placed 34.6 grams of zinc into a copper (II) sulfate solution and 25.2 grams of pure copper formed. What was the percent yield for the reaction?
[33.6 g predicted, 75% yield] **Show Detailed Work**



6. You placed 29.6 grams of iron into a copper (I) nitrate solution, producing 57.6 grams of copper metal. What was the percentage yield for this reaction?
[67.4 g predicted, 85.5% yield] **Show Detailed Work**

