Percent Yield

Definitions of different yields:

- **Theoretical yield** is the maximum amount of product that can be produced from a given amount of reactant.
- **Actual yield** is the measured amount of product actual obtained from doing the reaction.
- **Percent yield** is the ratio of actual yield to theoretical yield.

$$Percent\ Yield = \frac{actualy\ yield}{theoretical\ yield}\ x\ 100\%$$

1. Magnesium undergoes a single replacement reaction with nitric acid and forms magnesium nitrate and hydrogen gas as follows:

$$Mg + 2\ HNO_3 \rightarrow Mg(NO_3)_2 + H_2$$

   a. If I start this reaction with 40.0 grams of magnesium and an excess of nitric acid, how many grams of hydrogen gas will I produce? *(Hint: This is your theoretical yield)*

   b. I actually do the experiment in the lab and only 1.7 grams of hydrogen is actually produced *(Hint: This is my actual yield)*, what was my percent yield of hydrogen?

2. The following decomposition reaction takes place in the lab. $NaHCO_3 \rightarrow NaOH + CO_2$

   a. If 25.0 grams of carbon dioxide gas is produced in this reaction, how many grams of sodium hydroxide should be produced? *(Hint: This is your theoretical yield)*

   b. If 20.0 grams of sodium hydroxide are actually produced, what was my percent yield?

3. Write the equation for the reaction of iron (III) phosphate with sodium sulfate to make iron (III) sulfate and sodium phosphate. Balance the reaction.

   a. If I perform this reaction with 25 grams of iron (III) phosphate and an excess of sodium sulfate, how many grams of iron (III) sulfate can I make? *(Theoretical yield)*

   b. If 18.5 grams of iron (III) sulfate are actually made *(actual yield)* when I do this reaction, what is my percent yield?

   c. Is percent yield from #3b reasonable? Explain.

   d. If I do this reaction with 15 grams of sodium sulfate and get a 65.0% yield, how many grams of sodium phosphate will I make?

4. (Multiple Choice Questions) When you do a chemical reaction in the lab, the amount of product you obtain is:
   a. Equal to the theoretical yield.
   b. Less than the theoretical yield.
   c. More than the theoretical yield.
   d. More than the percent yield.

   Can you explain or justify your answer?

5. What are some reasons that your actual yield will be less than your theoretical yield?