***Group Activity: Limiting Reactant and Percent Yield Unit 7 Part 2***

**Exercises:** The following exercises were written in the order given to help you to develop the skills necessary to master limiting reactant, theoretical yield, and percent yield. You will need a [calculator](http://kaffee.50webs.com/Science/calc4chem.html) and a [periodic table](http://kaffee.50webs.com/Science/Periodic_Table.5fig.pdf) to complete them. You may also use your [ions reference sheet](http://kaffee.50webs.com/Science/activities/Chem/Ions.Reference.Handout.html).

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| **Conceptual Questions** |
| 1. How can you identify the limiting reactant when given a chemical equation and amounts for all reactants?
2. When a reaction proceeds with a limited amount of the excess reagent how do you figure out how much of the excess reagctant is left after the reaction?
 | 1. Why does the amount of product made in a reaction depend only on how much of the limiting reactant is available?
2. Why do some chemical reactions produce less than the theoretical yield of products?
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**LIMITING REACTANT & % YIELD PRACTICE**

5. Methanol, CH3OH, can be produced by the following reaction: **2H2 + CO 🡪 CH3OH**

1. Calculate the theoretical yield of CH3OH if 68.5 g of CO is reacted with 8.6 g of H2. (2 givens and 2 calculations)

**Theoretical yield = \_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. What is the limiting reactant in the reaction? The reactant in excess?

 **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is LR, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is in excess**

1. If 35.7 g CH3OH is actually produced, what is the % yield of methanol?

 **% Yield = *Actual Yield* x 100% =**

 ***Theoretical* *Yield***

1. Nitrogen and hydrogen react to form ammonia (NH3). Consider the mixture of N2 (gray spheres) and H2 (white spheres) in the picture below. Draw a picture of the product mixture, assuming that the reaction goes to completion. Which is the limiting reactant?



 **N2 + 3H2 🡪 2NH3** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is LR; \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is in excess

How many molecule of the excess reactant are left over? \_\_\_\_\_\_\_\_\_

7. Part of the SO2 that is introduced into the atmosphere by combustion of sulfur containing compounds ends up being converted to sulfuric acid, H2SO4. How many moles of H2SO4 can be formed from 5.0 mol SO2, 4.0 mol O2 and 10.0 mol H2O? Which is the limiting reactant? **2SO2*(g)* + O2*(g)* + 2H2O*(l)* 🡪 2H2SO4*(aq)***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* H2SO4 is produced, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is LR**

8. Some of the acid in acid rain is produced from the following reaction: **3NO2*(g)* + H2O*(l)* 🡪 NO*(g)* + 2HNO3*(aq)***

A falling raindrop weighing 0.050 g comes into contact with 0.010 g of NO2.

 a) Which reactant is the limiting reactant?

b) What is the theoretical yield of HNO3?

 c) What is the % yield of nitric acid if 0.006 g of HNO3 are actually formed?

1. Identify the limiting and excess reagents when 25 L of nitrogen reacts with 25 L of hydrogen at STP. How many liters of ammonia gas are formed in this reaction? \_\_\_\_ N2 + \_\_\_\_ H2 → \_\_\_\_ NH3

1. 50.0 mL of 2.00*M* H­2SO4 react with 75.0 mL of 2.00*M* NaOH. Identify the limiting and excess reactants. How many grams of Na2SO4 will be formed? \_\_ H2SO4 + \_\_ NaOH → \_\_ Na2SO4 + \_\_ H2O
2. If 6.57 g of iron are reacted with an excess of hydrochloric acid, HCl, then hydrogen gas and 14.63 g of iron(III) chloride are obtained. Calculate the theoretical yield and percent yield of FeCl­3.

\_\_\_\_ Fe + \_\_\_\_ HCl → \_\_\_\_ H2 + \_\_\_\_ FeCl3

1. A chemist burns 160. g of aluminum in oxygen to produce aluminum oxide. She produces 260. g of aluminum oxide. Write a balanced equation and calculate the theoretical yield and percent yield.
2. You need to produce 100.0 g of FeCl3 in the reaction from #11. If the percent yield of the reaction is 85%, how many grams of iron do you need to start with?