Name: **Honors Chemistry**

Section: Real-Life Stoichiometry: Limiting Reagent Problems

When the quantities of two (or more) reactants are given in a problem, you must first determine which reactant is the "limiting reagent," or the one which will run out first, causing the reaction to stop. You can then calculate the amount of product produced using the limiting reagent to do the calculation.

To calculate the limiting reagent:

1. Start with the amount of either of the reactants given (it doesn't matter which one). Use it to calculate the amount NEEDED of the *second* reactant. Then compare the amount needed with the amount you HAVE.
    - If you HAVE more than you NEED of the *second* reagent, the 2nd reagent is in excess, and the reagent with which you started is the limiting reagent.
    - If you NEED more than you HAVE of the *second* reagent, then the 2nd reagent is the limiting reagent.
2. Proceed with the problem, using the LIMITING reagent to calculate the amount of product.

Example:
How many grams of ammonia can be formed when 20.0 g of nitrogen gas react with 10.0 g of hydrogen gas according to the equation:

$N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$

1. When copper metal comes in contact with silver nitrate solution, silver metal comes out of solution and copper (II) nitrate is formed (as in your lab!). If 100.0 grams of copper metal are reacted with 100.0 g of silver nitrate, how many grams of silver metal will be produced? (63.50 g Ag)

2. Nitrogen gas can be prepared by passing gaseous ammonia over solid copper (II) oxide at high temperatures. The other products of the reaction are solid copper and water vapor. How many grams of N_2 are formed when 18.1 g of NH_3 are reacted with 90.4 g of CuO? (10.6 g N_2)

3. An experiment that led to the formation of the field of organic chemistry involved the synthesis of urea, CN_2H_4O, by the controlled reaction of ammonia and carbon dioxide::

   $2\ NH_3\ (g) + CO_2(g) \rightarrow CH_2H_4O(s) + H_2O(l)$

   What is the theoretical yield of urea when 100. g of ammonia is reacted with 100. g of carbon dioxide? (136 g urea)

4. Elemental bromine, $Br_2(l)$, can be produced by treating a concentrated aqueous sodium bromide solution with gaseous elemental chlorine. If 10.0 g of chlorine gas is reacted with a solution containing 25.00 g of sodium bromide, calculate the mass of bromine produced. (Be sure to start with a balanced equation!) (19.4 g Br_2)