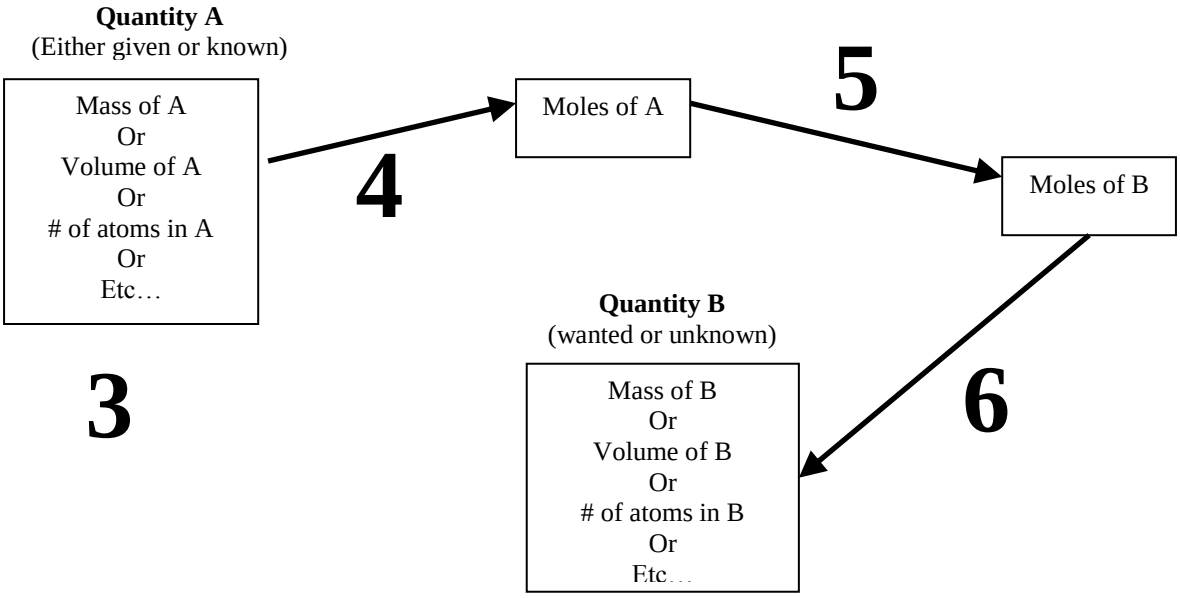
STOICHIOMETRY: Practice with Mass-Mass Problems

The basic idea behind these problems is to find how much of one substance is produced from a given amount of another substance. There are six general steps for doing this;

1. Identify the correct chemical formulas for all reactants and all products.
2. Balance the full chemical equation.
3. Identify the **given quantity** (labeled A here -- it may be # of representative particles, a mass, or a volume of a gas).
4. Convert the **given quantity of A** to the **moles of A**.
5. Convert the **moles of A** into **moles of desired quantity** (labeled B here) using the mole ratio determined from the balanced chemical equation.
6. Convert the **moles of B** into the **desired quantity of B** (it may be # or representative particles, the mass, or the volume of B)

The process can also be represented graphically. The large numbers in this diagram correspond to the steps listed above.



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1. **Balance** the following equations and determine the molar ratios shown. For example, in (a), determine the ratio of C_4H_{10} molecules combusting with O_2 molecules.

   $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

   a) C_4H_{10} / O_2
   b) O_2 / CO_2
   c) O_2 / H_2O
   d) C_4H_{10} / CO_2
   e) C_4H_{10} / H_2O

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FOR EACH PROBLEM GIVEN BELOW, ASSUME ALL PROVIDED CHEMICAL FORMULAS ARE CORRECT. ALSO, ALL EQUATIONS REQUIRE BALANCING FIRST.

2. How many moles of O_2 can be produced by letting 12.00 moles of $KClO_3$ react as shown by the following equation? $KClO_3 \rightarrow KCl + O_2$

3. Given the following equation, $K + Cl_2 \rightarrow KCl$
   a) how many grams of KCl would you expect to be produced from 2.50 g of K?
   b) how many grams of KCl would you expect to be produced from 1.00 g Cl_2?

4. Sodium oxide and water react to form sodium hydroxide.
   a) how many grams of sodium hydroxide are produced from 1.20×10^2 grams of sodium oxide?
   b) how many grams of sodium oxide are required to produce 1.60×10^2 grams of sodium hydroxide?

5. What mass of iron is needed to react completely with 16.0 grams of sulfur in the following reaction? $Fe + S_8 \rightarrow FeS$

6. For the following reaction, $NaClO_3 \rightarrow NaCl + O_2$
   a) 12.00 moles of $NaClO_3$ will produce how many moles of O_2?
   b) How many grams of NaCl are produced when 80.0 grams of O_2 are produced in the reaction?

7. Copper metal and silver nitrate react in a single replacement reaction. Copper forms the copper (II) ion.
   a) How many moles of Cu are needed to react completely with 3.50 moles of $AgNO_3$?
   b) If 89.5 grams of Ag are produced, how many grams of Cu reacted with the $AgNO_3$?

8. Pure molten iron and carbon monoxide are produced in a blast furnace when iron (III) oxide and coke (a form of pure carbon with a chemical formula of just C) react. If 25.0 kg of pure iron (III) oxide is used, how many kg of iron can be produced?

9. The photosynthesis reaction in plants produces glucose from CO_2 in the atmosphere by the following reaction: $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$ The average human (ever met one of these mythical creatures?), requires 120.0 grams of glucose ($C_6H_{12}O_6$) per day. How many grams of CO_2 are required for this amount of glucose to be produced in this reaction?

ANSWERS

1a:	2/13	4a:	1.55×10^2 g NaOH	9:	175.8 g CO_2
1b:	13/8	4b:	1.24×10^2 g Na_2O		
1c:	13/10	5:	27.9 g Fe		
1d:	2/8 = 1/4	6a:	18.00 mol O_2		
1e:	2/10 = 1/5	6b:	97.4 g NaCl		
2:	18.00 mol O_2	7a:	1.75 mol Cu		
3a:	4.77 g KCl	7b:	26.4 g Cu		
3b:	2.10 g KCl	8:	17.5 kg Fe		