Mass/Mass Problems

With a balanced equation, a *Periodic Table*, and some knowledge of chemistry, you can figure out how much of any product will form from a given amount of reactant. Consider the following problem:

How much oxygen is needed to produce 27.0 g of water by burning hydrogen?

Step 1: Write a balanced equation

$2H_2 + O_2 \rightarrow 2H_2O$

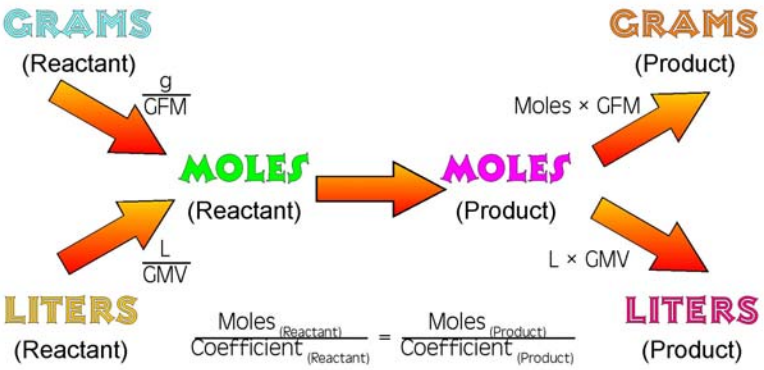
Step 2: Calculate the GFM of the known and unknown.

O_2: $O = 16 \times 2 = 32$

H_2O: $H = 1 \times 2 = 2$, $O = 16 \times 1 = 16$, total 18

Step 3: Apply the factor label method

$$27\,g_{H_2O} \times \frac{1\,mol_{H_2O}}{18\,g_{H_2O}} \times \frac{1\,mol_{O_2}}{2\,mol_{H_2O}} \times \frac{32\,g_{O_2}}{1\,mol_{O_2}} = 24\,g_{O_2}$$



You will notice that, in applying the factor label method, you are first converting grams of the known to moles, then moles of the known to moles of the unknown using a proportion from the coefficients of the balanced equation, and, finally, moles of the unknown to grams as shown above. You can use the equations above instead of using the factor label method.

Calculate the amount of material asked for in each of the following. A balanced equation is provided:

1. How many grams of oxygen will be produced from the decomposition of 244 grams of $KClO_3$?

$$2KClO_3 \rightarrow 2KCl + 3O_2$$

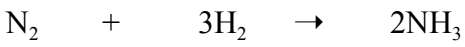
2. How many grams of Zn will be needed to completely react with 72 g of HCl?

$$Zn + 2\,HCl \rightarrow ZnCl_2 + H_2$$

3. How many moles of oxygen will be needed to completely oxidize 64 g CH_4?

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

4. How many grams of hydrogen will be needed to react with 56 g of nitrogen according to the following?



$$N_2 + 3H_2 \rightarrow 2NH_3$$

5. Using the above reaction how many grams of NH_3 will be formed if 36 grams of H_2 is used?

6. How many grams of sulfur will be needed to oxidize 195 grams of zinc to zinc sulfide?

$$Zn + S \rightarrow ZnS$$

7. How many grams of silver chloride will be produced if 216 grams of silver is allowed to react with an unlimited amount of chlorine?

$$Ag^+ + Cl^- \rightarrow AgCl(s)$$

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