HOW TO DO IT

BALANCING AND STOICHIOMETRY

A. BALANCING EQUATIONS:

1. **Make sure you have all the correct formulas!**
   YOU MAY NOT CHANGE THE FORMULAS!
2. Remember the 7 elements that are written as diatomic molecules (when not in a compound):
   H_2 N_2 O_2 F_2 Cl_2 Br_2 I_2
3. If an element occurs by itself (uncombined), save it for balancing after everything else.
4. Keep polyatomic ions together as much as possible, and balance each as a unit.
5. If OH^- ions occur, then rewrite water as HOH. (This is a special case of rule #4.)
6. Balance one thing at a time, by trial and error.
7. Once several things are in balance, keep them in balance; if you multiply one of them, you need to multiply them all by the same number.
8. If you need ½ or 1½ or 2½ or 3½ or 4½ of something, then multiply everything by 2. This occurs mostly with O_2.
9. When you are finished, **check everything**.

The best way to learn this is to give yourself as much practice as you can!

B. STOICHIOMETRY (one basic method works for all problems):

1. **Make sure you are starting with a correctly balanced equation!** (If not, it's hopeless!) Write out the equation, neatly, with lots of room between compounds.
2. Under each formula, copy the coefficient and write "mole" or "moles" after it. (If no coefficient appears, the coefficient is really 1, so write "1 mole".)
3. Calculate all molecular weights, then multiply each by its coefficient and write it beneath the corresponding number of moles. By doing so, you have just written, under every quantity in moles, the same quantity in grams. EXAMPLE: If your equation has H_2SO_4 (MW = 98.09), then, under H_2SO_4, write 1 mole and, under that, 98.09 g. If your equation has 2 H_2SO_4, write 2 moles and 196.18 g.
4. Add up the masses (in grams) of all reactants on the left side of the equation. Also add up the masses of all the products on the right side. **They should balance** by adding up to the same total. (If they don't balance, you have made a mistake. Go back and find it.)
5. Now, set up a proportion between the substance whose quantity you know and the substance whose quantity you want to find. Put an "equals" sign between the two fractions.
   a. Write each fraction directly beneath the substance to which it applies.
   b. Words that mean "how much" should be translated as a variable *x* or *y* in the numerator.
   c. Other quantities given in the problem should also appear in the numerator.
   d. The denominator of each fraction should be taken from the theoretical equation, steps 2-3.
   e. Choose the same units on top and bottom of each fraction. If a quantity is given in grams, then the denominator should be in grams. If you are asked to find an answer in moles or in grams, then the denominator under *x* or *y* should be in the units you want for your answer. EXAMPLE: If the equation specifies 2 H_2SO_4, then "how much" would be x / 2 moles or x / 196.18 g, and "20 g" would become 20 g / 196.18 g.
6. Solve the resulting equation by multiplying both sides by the denominator under *x* or *y*.
7. For a limiting reactant problem, do everything twice and choose the smaller yield of product.