Chemical Equations and Balancing

Write and Balance

1. If the equation is not written out, first write the chemical equation using names for each substance involved (reactants ⟶ products).
2. Rewrite the equation by translating each word into the correct symbol or formula, indicating the state or condition after each (s), (l), (g), or (aq).
3. Balance the equation:
    a. Count the total number of each atom in all formulas on each side of the equation.
    b. Balance any unbalanced atom by placing the necessary whole-number coefficient in front of the appropriate symbol or formula. The coefficient applies to the entire formula. **Never change the subscript of a formula!**
    c. Often, step b will unbalance another atom. Repeat steps a & b until all atoms are balanced.
    d. The equation is balanced when there is the same number of atoms of a given type on each side of the equation.

Equation Formulation Tips

1. The "formula" of any **uncombined** element is its symbol (e.g. Copper is Cu), except for the diatomic elements (H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2).
2. The state of *any element* is **solid**, except:
    a. Hg, Br_2 are **liquids**
    b. H_2, N_2, O_2, F_2, Cl_2 are **gases** (as well as with the noble gases)
3. Ionic compounds are in the solid state, except that they are usually dissolved in water, thus are **aqueous** (aq).

Balancing Tips

1. A rule of thumb for the order of balancing atoms is: Balance metals first, then non-metals, then hydrogen, then oxygen.
2. Use the principle of Least Common Multiple to balance atoms.
3. An uncombined element in the equation is good to balance last.
4. Polyatomic ions that are present on both sides of the equation can be counted as a whole unit for ease. This is especially useful for double replacement reactions.
5. Remember to multiply coefficients & subscripts, when counting atoms, for example:

    The formula, **$3(NH_4)_2Cr_2O_7$** has a total of

    ___ nitrogen atoms
    ___ hydrogen atoms
    ___ chromium atoms
    ___ oxygen atoms