Chemical Equations & Balancing

Recall

- The Law of Conservation of Mass
  - In a chemical reaction, the mass of the REACTANTS is equal to the mass of the PRODUCTS

Example

- How oxygen reacts with 40 g of calcium to produce 100 g of calcium oxide?
- Calcium + Oxygen → Calcium Oxide
- 40 g ? 100g

- Answer: 60g (both sides equal 100g)

Law of Conservation of Mass

- We can also apply the law of conservation of mass in terms of atoms (rather than mass). We do this by balancing chemical equations. Equations must have the same number of atoms of the same kind on both sides.
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- Recall that in order to balance a chemical equation, we use *coefficients*. These numbers are placed in FRONT of chemical formulas.

Balancing Equations

1. Write unbalanced equation (skeleton)
2. Proceed element by element to determine what coefficients are necessary to balance atoms
   i. Metals first
   ii. Non-metals or polyatomic ions next (note: if the same polyatomic shows up on both sides of the equation, treat the polyatomic as one thing).
   iii. Leave hydrogen or oxygen until last
3. All coefficients must be in lowest terms and whole numbers

Balancing Equations

- Diatomic molecules –like O_2, N_2, H_2, Cl_2
  - These elements can not exist on their own in an equation. They must be bonded to something or as a pair in a molecule

e.g. $2Al + 3Cl_2 \rightarrow 2AlCl_3$

e.g. $3NaOH + H_3PO_4 \rightarrow Na_3PO_4 + 3H_2O$

e.g. $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$