11.1 Notes - What is stoichiometry?

- Stoichiometry - Study of how amounts of reactants are used to produce different amounts of products by chem. rxns
  - based on conservation of matter
    (mass of reactants must equal mass of all products)

- Let's show this using the following eqn: $\boxed{2H_2O_{2(aq)} \rightarrow 2H_2O_{(l)} + O_{2(g)}}$

- We can see that the coefficients tell us that, for this rxn, it takes 2 molecules of H_2O_2 to produce 2 molecules H_2O & 1 molecule O_2

* This also means that 2 mol H_2O_2 → 2 mol H_2O & 1 mol O_2

Let's convert to mass to show conservation of mass (use mole units)

$2\ mol\ H_2O_2 \times \frac{34.0\ g}{1\ mol} = 68.0\ g\ H_2O_2$ $\left(\frac{H-2\times1.0,\ O-2\times16.0}{34.0\ g/mol}\right)$

$2\ mol\ H_2O \times \frac{18.0\ g}{1\ mol} = 36.0\ g\ H_2O$ $\left(\frac{H-2\times1.0,\ O-1\times16.0}{18.0\ g/mol}\right)$

$1\ mol\ O_2 \times \frac{32.0\ g}{1\ mol} = 32.0\ g\ O_2$ $(O-2\times16 = 32.0\ g/mol)$

- Let's check $68.0 = 36.0 + 32.0$ ✓ Follows Cons of Mass

Mole Ratios

- Ratio between # of moles of any 2 substances in a balanced equation

ex) $2Na_{(s)} + Cl_{2(g)} \rightarrow 2NaCl_{(s)}$

* What are some mole ratios that we can write?

-

- compare Na to all other substances in eqn:

ex) $\frac{2\ mol\ Na}{1\ mol\ Cl_2}$ & $\frac{2\ mol\ Na}{2\ mol\ NaCl}$

- compare Cl_2 to all other substances in eqn:

ex) $\frac{1\ mol\ Cl_2}{2\ mol\ Na}$ & $\frac{1\ mol\ Cl_2}{2\ mol\ NaCl}$

- compare NaCl to all other substances in eqn:

ex) $\frac{2\ mol\ NaCl}{2\ mol\ Na}$ & $\frac{2\ mol\ NaCl}{1\ mol\ Cl_2}$

* these 6 ratios describe all relationships in equation

This process can be done in all equations to show ratios of all substances in equations - and are important later

* To determine how many mole ratios exist for a chem. equation that has n total substances in it = $\boxed{(n)(n-1)}$

ex) A rxn that has 4 substances (like $NaCl + LiBr \rightarrow NaBr + LiCl$)

$= (4)(4-1) = (4)(3) =$ 12 mole ratios