Chemical Equations/Reactions:

A representation of chemical reactions in terms of the symbols and formulas of the elements and compounds involved.

reactants $\rightarrow$ products

- **$\rightarrow$ symbol for yield**
- **(g): gas (s):solid (l): liquid (aq):aqueous**

Ex: $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

2 H_2 molecules react with 1 O_2 molecule to yield 2 H_2O molecules.

Balancing Chemical Reaction Equations:

The same number of elements must appear on both sides of the yield sign in the equation.

Can not change subscripts. Can only alter the coefficients in front of each substance.

Balance the following:

Ex:

$$Fe(s) + H_2O(g) \rightarrow Fe_3O_4(s) + H_2(g)$$

Ex2:

$$C_2H_6(g) \quad + \quad O_2(g) \quad \rightarrow \quad CO_2(g) \; + \; H_2O(l)$$

Stoichiometry:

Given the amounts of reactants, can use the stoichiometry of the balanced chemical equation to determine the amounts of reactants needed and/or products produced.

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2 H_2 molecules react with 1 O_2 molecule to yield 2 H_2O molecules.

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Likewise,

2 dozen H_2 molecules react with 1 dozen O_2 molecule to yield 2 dozen H_2O molecules.

Thus,

Represents a reaction where

2 mol H_2 reacts with 1 mol O_2 to yield 2 mol H_2O.

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2 mol H_2 reacts with 1 mol O_2 to yield 2 mol H_2O.

Ex:

$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$

Determine the number of moles of O_2 required to react with 5.00 mol of C_2H_6?

Ex:

$$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$$

How many grams of HCl are required to react with 25.0 g MnO_2? How many grams of Cl_2 are produced?

Limiting Reagent:

Consider the reaction

$$X + Y \rightarrow Z$$

If 1.00 mol of X and 2.00 mol of Y are available.

	X +	Y →	Z
Initial:	1.00 mol	2.00 mol	0 mol
Change:	-1.00 mol	-1.00 mol	+1.00 mol
Final:	0.00 mol	1.00 mol	1.00 mol

X: used up completly   Y: Limiting Reagent

Ex:

$$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$$

How many moles of H_2 can be prepared from 4.00 mol Fe and 5.00 mol H_2O?

Yield:

Actual Yield: Actual mass or amount of products obtained in a reaction.

Theoretical Yield: Mass or amount of products that should be obtained based on the limiting reagent.

$$\textbf{Percent Yield} = \frac{\textbf{actual yield}}{\textbf{theoretical yield}} \times \mathbf{100\%}$$

Ex:

$$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$$

If 25.0 g MnO_2 used in excess HCl and 18.0 g Cl_2 is actually produced, calculate the percent yield?

Ex2:

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

If you have 5.00 g of N_2 and 3.00 g of H_2.

a) **Calculate the limiting reagent.**

b) **If 4.00 g of NH_3 is actually produced, calculate the % Yield.**