# Chapter 6
# Stoichiometry: Mass Mass Relationships

**10.1 Information in a Chemical Equation:**

- *Coefficients in a balanced chemical equation represent relative number of moles, particles (molecules, atoms, etc.) and volumes of gases* (for gases at same conditions of temperature and pressure).
- What is conserved in a balanced reaction?

Consider the reaction: $N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$
Read as: 1 (mole or molecule) of nitrogen reacts with 3 (moles or molecules) of hydrogen to produce 2 (moles or molecules) of ammonia.
Check for balance of atoms and tally for bookkeeping
Mass: _____ (yes)
Moles: _____ (no)
Molecules: __ (no)
Atoms: _____ (yes)

**10.2 Mole:Mole relationships**

Consider the amounts in a recipe in terms of multiples of some ratio.
Practice Guided questions in class:

For $2\ Na + Cl_2 \rightarrow 2\ NaCl$, how many moles of sodium chloride can be produced from 30 moles of sodium? , from 30 moles of chlorine? (Assume excess of other reactant).
Other: $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$
In Class Practice: **P. 235 #11-14, 17, 18**

**10.3 Mass:Mass Calculations Stoichiometry Problems**

Sample Table for to illustrate relationships and calculations:

$$4\ Al_{(s)} + 3\ O_{2(g)} \rightarrow 2\ Al_2O_{3(s)}$$

| **Reaction** | Al | $O_2$ | $Al_2O_3$ |
|---|---|---|---|
| **Molar Mass** | 27 g/mol | 32 g/mol | 102 g/mol |
| **Moles** | *0.300 mol | 0.225 mol | 0.150 mol |
| **Particles** | $1.81 \times 10^{23}$ | $1.35 \times 10^{23}$ | $9.03 \times 10^{22}$ |
| **Mass** | 8.10 grams | 7.20 g | 15.3g = 8.10g + 7.20g |

*0.30 moles is a given number to begin the question with. It could have been any number for sake of illustrating this type of problem. Choose on a class member to give a number.

**Dimensional Analysis Approach:**

Example Problem: For reaction $2LiOH_{(s)} + + CO_{2(g)} \rightarrow Li_2CO_{3(s)} + H_2O_{(l)}$
LiOH is used to remove carbon dioxide gas on manned space vehicles as the reaction above shows. What mass of lithium hydroxide is used to remove 1.00 kg of carbon dioxide?

a.) Identify the components of the reaction that are under analysis. What is the molar ratio?
_?_ grams of LiOH : 1.00 kg of $CO_2$, molar ratio is 2:1
b.) Convert given to moles
c.) Show the mole ratio
d.) Convert moles into desired unit of grams

$$1.00 \times 10^3\ g\ CO_2 \times \frac{1\ mole\ CO_2}{44\ g\ CO_2} \times \frac{2\ mol\ LiOH}{1\ mol\ CO_2} \times \frac{24\ g\ LiOH}{1\ mol\ LiOH} = 1.09 \times 10^3\ g\ LiOH$$

**Distribute Stoichiometry Practice Worksheet with solutions**

- HW. P. 236 #21, 22, 24, 26
- Percent Yield
- Limiting Reactant