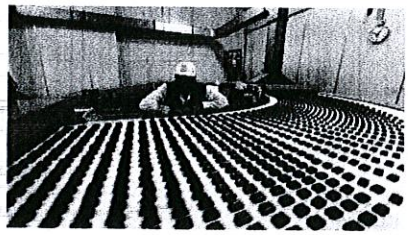
Stoichiometry

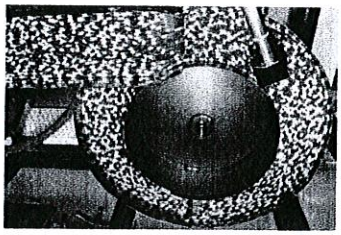
What is it?

Determining how much product can be made from specific amounts of reactants.

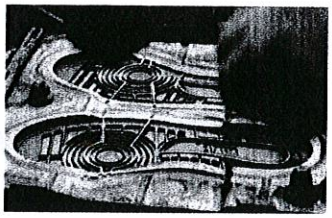
Where is used in real life?



Mars Chocolate Factory



Tylenol Factory



Nike Shoe Factory

It's used everywhere there is a product being manufactured!

How do you solve problems?

- **Use a MOLE RATIO!**
  - The mole ratio is used to convert from the moles of your given substance (what you have) into moles of what your unknown is (what you are trying to make!
  - **Moles unknown** / **Moles given** comes from a balanced equation

Examples

2 Al (s) + 3 Cl_2 (g) → 2 $AlCl_3$ (s)

2 moles 3 moles 2 moles

2 LiOH (s) + H_2SO_4 (aq) → Li_2SO_4 (aq) + 2 H_2O (l)

2 moles 1 mole 1 mole 2 moles

$2\,Al\,(s) + 3\,Cl_2\,(g) \rightarrow 2\,AlCl_3\,(s)$

A) How many moles of aluminum chloride can be produced from 4.00 moles of aluminum reacting with excess chlorine gas?

$$4.00 \text{ mol Al} \left| \frac{2 \text{ mol } AlCl_3}{2 \text{ mol Al}} \right. = 4.00 \text{ mol } AlCl_3$$

B) How many moles of aluminum chloride can be produced from 1.50 moles of chlorine gas reacting with excess aluminum?

$$1.50 \text{ mol } Cl_2 \left| \frac{2 \text{ mol } AlCl_3}{3 \text{ mol } Cl_2} \right. = 1.00 \text{ mol } AlCl_3$$

C) How many moles of chlorine gas are needed to completely react with 33.3 moles of aluminum?

GIVEN

$$33.3 \text{ mol Al} \left| \frac{3 \text{ mol } Cl_2}{2 \text{ mol Al}} \right. = 50.0 \text{ mol } Cl_2$$

$$2\,LiOH\,(s) + H_2SO_4\,(aq) \rightarrow Li_2SO_4\,(aq) + 2\,H_2O\,(l)$$

D) How many moles of lithium sulfate are formed from the reaction of 47.9 g if lithium hydroxide with excess sulfuric acid? (? ; GIVEN)

$$47.9\,g\,LiOH \left| \frac{1\,mol\,LiOH}{23.95\,g\,LiOH} \right| \frac{1\,mol\,Li_2SO_4}{2\,mol\,LiOH} = 1.00\,mol\,Li_2SO_4$$

Li 6.94g
O 16.00g
H + 1.01g
23.95 g

E) How many moles of water are produced when 32.70 g of sulfuric acid react with excess lithium hydroxide? (? ; GIVEN)

$$32.70\,g\,H_2SO_4 \left| \frac{1\,mol\,H_2SO_4}{98.09\,g\,H_2SO_4} \right| = .333367315\,mol\,H_2SO_4 \left| \frac{2\,mol\,H_2O}{1\,mol\,H_2SO_4} \right| = .6667\,mol\,H_2O$$

2H = 2.02g
1S = 32.07g
4O = 64.00g
98.09g

F) How many moles of lithium hydroxide are needed to produce 90.1 g of water? (? ; GIVEN)

$$2LiOH + H_2SO_4 \rightarrow Li_2SO_4 + 2H_2O$$

$$90.1\,g\,H_2O \left| \frac{1\,mol\,H_2O}{18.02\,g\,H_2O} \right| \frac{2\,mol\,LiOH}{2\,mol\,H_2O} = 5.00\,mol\,H_2O$$

2H 2.02g
1O 16.00g
18.02g