

## Stoichiometry

- ◆ Balanced Equations
- ◆ Mole-Mole Conversions
- ◆ Mass-Mass Stoichiometry
- ◆ Limiting Reactant
- ◆ Percent Yield

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## Definitions

Greek from *stoicheion* meaning element and *metron* meaning measure.

Stoichiometry is the study of quantitative (measurable) relationships that exist in chemical formulas and chemical reactions.

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## Balanced Equations

We already know how to balance an equation, and can induce from that what the equation's coefficients mean:

Now, we could multiply every coefficient by the same number, say 20, and still have a balanced equation.

As a result, the coefficients not only tell us the molecule ratio in the reaction, it also tells us the mole ratio.

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## Mole to Mole Stoichiometry

Knowing these facts, it is now possible to predict the amount of chemicals used or produced in a reaction from knowing just one amount of any one of the materials.

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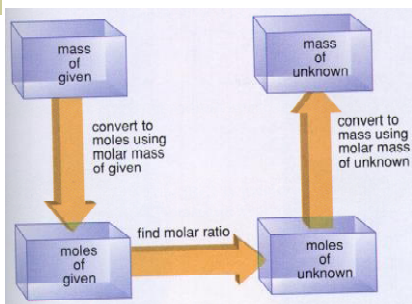
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## Mass to Mass Stoichiometry



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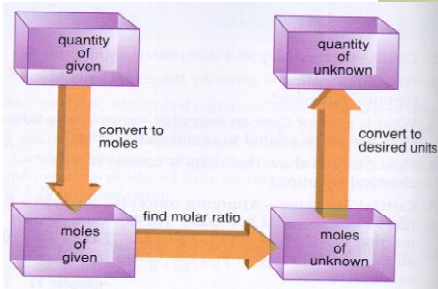
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## Quantity to Quantity Stoichiometry



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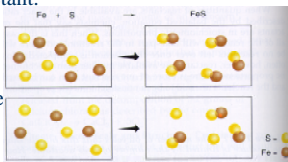
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## Limiting Reactant

Sometimes chemicals are combined in non-stoichiometric proportions. When this happens, one reactant is completely used up, but there is an excess of the other reactant.

The reactant that limits the amount of product that can be formed is called the limiting reactant.



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## Limiting Reactant

To determine which reactant is the limiting reactant and which is in excess, it is necessary to calculate the yield of both reactants assuming stoichiometric proportions.

The reactant that produces the smaller yield will be identified as the limiting reactant, since it will run out first.

Do not assume the reactant in smaller amount will automatically be the limiting reactant.

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## Percent Yield

Many times, in performing an experiment, the actual yield (amount you actually produce) will be different from the expected yield (amount you calculate it should produce).

A percent yield is helpful to determine the percent of the calculated yield obtained:

$$\% \text{ yield} = \frac{\text{actual yield}}{\text{expected yield}} \times 100\%$$

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