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CHEMISTRY NOTES – Chapter 9

Stoichiometry

Goals : To gain an understanding of :

1. Stoichiometry
2. Limiting reagents and percent yield

NOTES:

Stoichiometry is the calculation of chemical quantities from balanced equations.

The four quantities involved in stoichiometric calculations are:

- particles - the relative amounts of atoms, ions, and formulas or molecules in various reactants or products
- moles - the relative number of moles of reactants or products
- mass - the relative masses of reactants or products
- volume - the relative amounts of gaseous reactants or products

Atoms and mass are always conserved in chemical reactions.

Before getting into stoichiometric calculations let me make an analogy to an everyday experience - the making of a peanut butter and jelly sandwich. Here is the equation :

2 slices bread + 1 serving peanut butter (pb) + 1 serving jelly → 1 sandwich

In this "balanced equation" we see a number of ratios : 2 slices bread/1 serving pb, 2 slices bread/1 serving jelly or 1 serving pb/1 serving jelly etc..

Stoichiometry uses these ratios to determine relative amounts of reactants or products. For example, if I had 12 slices of bread, how many servings of peanut butter would I need and how many sandwiches could I make? Here are the stoichiometric calculations :

Here is an example of a balanced chemical equation with some chemical quantities listed below them.

$$4\,Na_{(s)} + O_{2(g)} \rightarrow 2\,Na_2O_{(s)}$$

4 atoms	+	1 molecule	→	2 unit formula
4 moles	+	1 mole	→	2 moles
91.96 g	+	32.00 g	→	123.96 g

Here are some calculations that can then be performed :

a. If 3.50 moles of Na_2O are needed, how many moles of sodium will be required (assuming sufficient oxygen)?

$$3.50\ \text{moles}\ Na_2O \left(\frac{4\ \text{moles}\ Na}{2\ \text{moles}\ Na_2O}\right) = 7.00\ \text{moles}\ Na$$

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