Ch. 3 Stoichiometry

. What is stoichiometry?

- Stoichiometry calculations are used to convert grams, moles, and volume using molarity by relating amounts of reactants and products in a balanced chemical equation.
- Molarity (mol/L) is a relation between moles of a solute and volume of the solution and is a useful conversion factor in stoichiometry.
- Mole ratios (mol/mol) between reactants and products are also useful conversion factors.

. General steps of how to set up conversions

- *Always* balance your equation first (make sure that there is an equal amount of reactants and products in your equation)
- For a balanced equation,
  a A + b B → c C + d D

  To go from a given grams of A to grams of B use moles of A and then moles of B,

Grams of A	Moles of A	Moles of B	Grams of B
Starting point. Use molar mass (g/mol) of A to convert to moles of A	Use coefficients (lowercase letters) from the balanced chemical equation to convert moles of A to moles of B	Use molar mass (g/mol) of B to convert to grams of B	Goal

$$grams\ A \times \frac{mol\ A}{grams\ A} \times \frac{mol\ b\ (coefficient)}{mol\ a\ (coefficient)} \times \frac{grams\ B}{mol\ B} = grams\ B$$

. Practice

Convert 0.355 moles of NaCl to grams.

$$0.355\ mol\ NaCl \times \frac{58.44\ g\ NaCl}{1\ mol\ NaCl} = ?$$

. Practice

Aqueous solutions of sodium hypochlorite (NaOCl), bleach, are prepared by reacting sodium hydroxide with chlorine. How many grams of NaOH are needed to react with 30.0 g of Cl_2? How many moles of NaOH are needed to react with 30.0 g of Cl_2?

2 NaOH (aq) + Cl_2 (g) → NaOCl (aq) + NaCl (aq) + H_2O (l)

$$30.0\ g\ Cl_2 \times \frac{1\ mol\ Cl_2}{70.9\ g\ Cl_2} \times \frac{?\ mol\ NaOH}{?\ mol\ Cl_2} \frac{40.0\ g\ NaOH}{1\ mol\ NaOH} = ?$$

Solutions

. Practice

Convert 0.355 moles of NaCl to grams:

$$0.355\ mol\ NaCl\ \times \frac{58.44\ g\ NaCl}{1\ mol\ \ NaCl} = 20.7\ g\ NaCl$$

. Practice

Aqueous solutions of sodium hypochlorite (NaOCl), bleach, are prepared by reacting sodium hydroxide with chlorine. How many grams of NaOH are needed to react with 30.0 g of Cl_2?

$2\ NaOH\ (aq) + Cl_2\ (g) \rightarrow NaOCl\ (aq) + NaCl\ (aq) + H_2O\ (l)$

$30.0\ g\ Cl_2 \times \frac{1\ mol\ Cl_2}{70.9\ g\ Cl_2} \times \frac{2\ mol\ NaOH}{1\ mol\ Cl_2} \frac{40.0\ g\ NaOH}{1\ mol\ NaOH} = 33.9\ g\ NaOH$ needed to react with 30.0 g of Cl_2.

$33.9\ g\ NaOH \times \frac{1\ mol\ NaOH}{40.0\ g\ NaOH} = 0.848\ mol\ NaOH$ are needed to react with 30.0 g of Cl_2.