

**CHEM 101 LECTURE NOTES: CHAPTER 9: CALCULATIONS FROM
CHEMICAL EQUATIONS pgs. 168-190**

Mole Relationships

1. Recall that 1 mole equals the following:

6.022x10²³ atoms, molecules, ions, or formula units of a substance

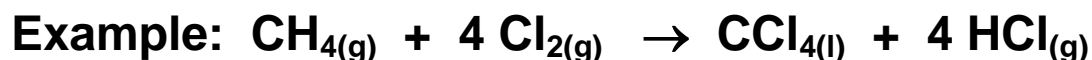
2. Mass of a compound (or element) in grams (molar mass): determined by adding up all the atomic masses of the elements present

3. 22.4 L of a gas at STP

Stoichiometry: “mole measure” (Greek)

A mathematical method of determining relationships among the reactants and products of a chemical reaction

One of the most important steps of stoichiometry is determining the mole ratios between reactants and products in a balanced equation.

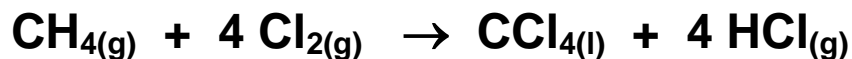


The mole ratios for CH₄ would be:

- a. 1 mole CH₄ : 4 moles Cl₂
- b. 1 mole CH₄ : 1 mole CCl₄
- c. 1 mole CH₄ : 4 moles HCl

For Cl₂

- a. 4 moles Cl₂ : 1 mole CH₄



b. 4 moles Cl_2 : 1 mole CCl_4

c. 4 moles Cl_2 : 4 moles HCl → Reduces to 1:1.

For CCl_4

a. 1 mole CCl_4 : 1 mole CH_4

b. 1 mole CCl_4 : 4 moles Cl_2

c. 1 mole CCl_4 : 4 moles HCl

For HCl

a. 4 moles HCl : 1 mole CH_4

b. 4 moles HCl : 4 moles Cl_2 → Reduces to 1:1.

c. 4 moles HCl : 1 mole CCl_4

Knowing how to determine mole ratios is an important step towards solving these problems.

SUGGESTED STEPS TOWARDS SOLVING STOICHIOMETRY PROBLEMS

- 1. Write the balanced equation: Check to be sure formulas are correct.**
- 2. Write down given quantity. (It may be in units of moles, grams, liters, atoms, ions, molecules, or formula units.)**
- 3. Determine relationship to get units of given to cancel out using a ratio or fraction of desired : given (desired/given) OR unknown : known (unknown/known).**

4. Repeat step 3 as many times as needed to result in an answer with desired units (moles, grams, liters, atoms, etc.). You usually need to use more than one fraction relationship to multiply given value by.

TYPES OF STOICHIOMETRY PROBLEMS

A. mole - mole: given moles of one substance, find moles of another

B. mole - mass: given moles of one substance, find mass of another

C. mass - mole: given mass of one substance, find moles of another

d. mass - mass: given mass of one substance, find mass of another

NOTE: Variants of these can occur if given and/or desired units are atoms, ions, formula units, or liters rather than masses.

e. Limiting Reactant: given quantity of 2 reactants, determine how much product can be produced and/or how much of excess reactant is left over after reaction.

f. % Yield: Determining the theoretical amount of product by doing a stoichiometry calculation that can be produced and given actual amount of product produced, divide actual amount by theoretical amount and multiply by 100 to get % Yield.