To hear and view this Pencast PDF on your computer,
click here to get the latest version of Adobe® Reader®.

3.8: The Mole Concept for Compounds

The molar mass of a compound is the sum of the atomic masses of all of the elements in the formula.

For molecular compounds, this is the mass of one mole of molecules, and for ionic compounds it is the mass of one mole of formula units.

Example: How many moles and total number of molecules are in 22.7 g C_2H_6O?

First calculate the molar mass of C_2H_6O:

2 × MM of C + 6 × MM of H + 1 × MM of O

$2 \times 12.01\ g/mol + 6 \times 1.008\ g/mol + 16.00\ g/mol$

$= 46.07\ g/mol$

$$\frac{22.7\ g}{46.07\ g/mol} = 0.493\ mol$$

$$0.493\ mol \times 6.022 \times 10^{23}\ \frac{molecules}{mol}$$

$= 2.97 \times 10^{23}$ molecules

To hear and view this Pencast PDF on your computer,
click here to get the latest version of Adobe® Reader®

3.9: Composition of Compounds

The **percent composition** of a compound is the percentage of the total mass of the compound that is due to the mass of each element.

The percent by mass of each element in a compound can be calculated by this formula:

$$\%\text{ of element} = \frac{n \times \text{molar mass of the element}}{\text{molar mass of the compound}} \times 100$$

Where n is the number of moles of the element in 1 mol of the compound (*i.e.* its subscript in the formula of the compound)

Example: What is the percent composition of C_2H_6O?

$$\%\ C = \frac{2 \times 12.01\ g/mol}{46.07\ g/mol} \times 100 = 52.14\%$$

$$\%\ H = \frac{6 \times 1.008\ g/mol}{46.07\ g/mol} \times 100 = 13.13\%$$

$$\%\ O = \frac{1 \times 16.00\ g/mol}{46.07\ g/mol} \times 100 = 34.73\%$$

Types of Chemical formulas:

Acetylene C_2H_2 - Molecular formula

Simplest ratio: CH - Empirical formula

The **empirical formula** of a compound is the simplest whole number ratio of its elements.

The formula of an ionic compound (*e.g.* NaCl) gives the composition of its **formula unit**, the simplest whole number ratio of ions (so it is really an empirical formula).

To hear and view this Pencast PDF on your computer,
click here to get the latest version of Adobe® Reader®.

3-11 Writing and Balancing Chemical Equations

reactants ⟶ products

$CH_4(g) + 2\,O_2(g) \rightarrow CO_2(g) + 2\,H_2O(l)$

(methane)

coefficient

Symbols for states:

- **(*s*) solid**
- **(*l*) liquid**
- **(*g*) gas**
- **(*aq*) aqueous solution (dissolved in water)**

Examples:

$4\,HCl(g) + O_2(g) \rightarrow 2\,H_2O(l) + 2\,Cl_2(g)$

H	4	H	4
Cl	4	Cl	4
O	2	O	2

$C_3H_8(g) + 5\,O_2(g) \rightarrow 3\,CO_2(g) + 4\,H_2O(l)$

(propane)

C	3	C	3
H	8	H	8
O	10	O	10