Percent Composition

We can define the percent composition of a substance to be the mass of the different atoms (or molecules) present within the substance, expressed as a percentage of the total mass. We will assume that the total mass of the substance is exactly equal to the molar mass.

Example 1 What is the percent composition of carbon and hydrogen in CH_4 (methane)?

Now in 1 mole we have

mass of C = 12.0 g

mass of H = 4×1.00 = 4.0 g

so $\%C = \frac{\text{mass of C}}{\text{mass of } CH_4} \times 100\%$

$= \frac{12.0\,g}{16.0\,g} \times 100\% = 75\%\ C$

$\%H = \frac{\text{mass of H}}{\text{mass of } CH_4} \times 100\%$

$= \frac{4.00\,g}{16.0\,g} \times 100\% = 25\%\ H$

Note that methane (CH_4) is mostly carbon (75%) and not hydrogen. Percent composition is based on mass not amount!

Example 2

What is the percent composition of water in the hydrated salt $Na_2SO_4 \cdot 2H_2O$

$Na_2SO_4 \cdot 2H_2O$ has a molar mass of 178 g/mol

The water contributes $2 \times 18 = 36$ g/mol

$$\%\ H_2O = \frac{\text{Mass of water}}{\text{Mass of compound}} \times 100\%$$

$$= \frac{36\text{ g}}{178\text{ g}} \times 100\%$$

$$= 20\%$$

The salt is 20% water