Empirical Formula

Definition: The simplest whole number ratio of atoms of each element present in a compound.

Formula:

1. Use the mass of compound and mass of element to find the percentage mass of each element in the compound
2. Use the percentages and state the mass of each element in 100g of the substance
3. Find the moles of each element within 100g of the element
4. Round the moles of each element to the nearest unit
5. Place in a molar ratio
6. Write as a formula

> ☰ 💡 **Example: Percentage Composition** ⌄
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> Question: A substance with 0,4026g was found containing 0,1610g of carbon, 0,0268g of hydrogen, and 0,2148g of oxygen

Percentage Composition

$$\%C = \frac{m_{\text{carbon}}}{0,4026g} \times 100 = \frac{0,1610g}{0,4026g} \times 100 = 40\%$$

$$\%H = \frac{m_{\text{hydrogen}}}{0,4026g} \times 100 = \frac{0,0268g}{0,4026g} \times 100 = 6.66\%$$

$$\%O = \frac{m_{\text{oxygen}}}{0,4026g} \times 100 = \frac{0,2148g}{0,4026g} \times 100 = 53,35\%$$

Mass of Each element
in 100g of the substance, there is: $40gC; 6,66gH; 53,35gO$

Moles of each element

$$n = \frac{m}{M}$$

$$n_C = \frac{m_C}{M_C} = \frac{40g}{12} = 3,33mol$$

$$n_H = \frac{m_H}{M_H} = \frac{6,66g}{1} = 6,66mol$$

$$n_O = \frac{m_O}{M_O} = \frac{53,3g}{16} = 3,33mol$$

Molar Ratio
$3,33 : 6,66 : 3,33 = 1 : 2 : 1 = C : H : O$

Empirical Formula
$C : H : O = 1 : 2 : 1$
$\therefore$ substance $= CH_2O$

Explanation

Empirical Formula relies of the concept of Law of Constant Composition > Percentage Composition.