

**The COMPLETE
Chemistry Guide to**

MATTER
ATOMIC STRUCTURE
EMPIRICAL AND
MOLECULAR
FORMULAS

Melissa Maribel

TABLE OF CONTENTS

This Table of Contents is clickable!

- 1 Introduction to Chemistry
- 2 Classification of Matter
- 6 Physical and Chemical Properties
- 7 Physical and Chemical Changes
- 8 Intensive and Extensive Properties
- 9 Scientific Notation
- 11 Units of Measurement
- 13 Converting Temperatures
- 16 The Scientific Method and Scientific Laws
- 17 3 Scientific Laws
- 20 Dalton's Atomic Theory

TABLE OF CONTENTS

- 21 The Discovery of the Atomic Structure
- 23 The Atomic Structure
- 25 Isotopes
- 26 Atomic Weight
- 27 Finding Percent Abundance
- 31 The Periodic Table
- 33 Molar Mass
- 34 Percent Composition
- 35 Empirical and Molecular Formulas
- 41 Combustion Analysis

FINDING THE MOLECULAR FORMULA

EXAMPLE 1

What is the molecular formula of a compound that is 34.95% C, 6.844% H, 13.59% N and 46.56% O? The molecular weight of this compound is 210 g/mol.

Recall that to find the molecular formula we first need to find the empirical formula.

STEP 1 Change percentages to grams.

$$34.95\% \text{ C} = 34.95 \text{ g C} \quad 6.844\% \text{ H} = 6.844 \text{ g H} \quad 13.59\% \text{ N} = 13.59 \text{ g N} \quad 46.56\% \text{ O} = 46.56 \text{ g O}$$

STEP 2 Convert values in grams to moles using the molar mass of each element which is found on the periodic table.

$$\frac{34.95 \text{ g C}}{12.01 \text{ g C}} \times \frac{1 \text{ mol C}}{1} = 2.910074938 \text{ mol C}$$

$$\frac{6.844 \text{ g H}}{1.008 \text{ mol H}} \times \frac{1 \text{ mol H}}{1} = 6.78968254 \text{ mol H}$$

$$\frac{13.59 \text{ g N}}{14.01 \text{ g N}} \times \frac{1 \text{ mol N}}{1} = 0.9700214133 \text{ mol N}$$

$$\frac{46.56 \text{ g O}}{16.00 \text{ g O}} \times \frac{1 \text{ mol O}}{1} = 2.91 \text{ mol O}$$

STEP 3 Divide each by the smallest moles. In this case the smallest is N.

$$\frac{2.910074938 \text{ mol C}}{0.9700214133} = 3$$

$$\frac{6.78968254 \text{ mol H}}{0.9700214133} = 6.9995$$

↑
Round up to a whole number
= 7

$$\frac{0.9700214133 \text{ mol N}}{0.9700214133} = 1$$

$$\frac{2.91 \text{ mol O}}{0.9700214133} = 2.9999$$

↑
Round up to a whole number
= 3

These are the potential subscripts for the empirical formula: $\text{C}_3\text{H}_7\text{N}_1\text{O}_3$

STEP 4 Write empirical formula with only whole numbers. Since all subscripts are whole numbers, we found the empirical formula.

