The mass percent of H in the compound is

$$\frac{0.489\ \text{mg}}{10.68\ \text{mg}} \times 100\% = 4.58\%\text{H}$$

The unknown compound contains only carbon, hydrogen and oxygen. The remainder must be oxygen.

100.00 % – (40.91% C + 4.58% H) = 54.51% O

EMPIRICAL FORMULA

(*Chemistry* 6th ed. pages 98–101 / 7th ed. pages 93–95)

What is the empirical formula of a compound that contains 40.91% carbon, 4.58% hydrogen and 54.51 % oxygen?

$$40.91\ \text{g C} \times \frac{1\ \text{mol C}}{12.01\ \text{g}} = 3.406\ \text{mol C}$$

$$4.58\ \text{g H} \times \frac{1\ \text{mol H}}{1.008\ \text{g}} = 4.54\ \text{mol H}$$

$$54.51\ \text{g O} \times \frac{1\ \text{mol O}}{16.00\ \text{g}} = 3.407\ \text{mol O}$$

Divide by the smallest number

$$\frac{4.54\ \text{mol H}}{3.406} = 1.33\ \text{mol H} \times 3 = 3.99 \sim 4.00$$

$$C_{\frac{3.406}{3.406}} H_{\frac{4.54}{3.406}} O_{\frac{3.407}{3.406}} = (C_{1.00}H_{1.33}O_{1.00})3 = C_3H_4O_3$$

Empirical Formula

Since a whole number ratio is required, we multiply all subscripts by the lowest factor (3) to obtain the whole number. Rounding can only occur when the subscripts are within 0.1 of the nearest whole number.

CONVERSIONS INVOLVED IN STOICHIOMETRIC CALCULATIONS

Type of Conversion	Example	Reference
g → mol (using molar mass)	$\frac{18\ \text{g}}{1\ \text{mol } H_2O}$	*Chemistry* 6th ed. pages 90–91 / 7th ed. page 86
mol → mol (using mole ratio – coefficients from balanced chemical equation)	$\frac{1\ \text{mol } O_2}{2\ \text{mol } H_2O}$	*Chemistry* 6th ed. pages 108–110 / 7th ed. pages 102–104
mol → L (using molarity which is a solution's concentration equal to the number of mols of solute in 1 liter of solution)	$\frac{6\ \text{mol HCl}}{1\text{L}}$	*Chemistry* 6th ed. pages 140–148 / 7th ed. pages 133–140