FINDING EMPIRICAL FORMULA USING COMBUSTION ANALYSIS

Menthol, the substance we can smell in mentholated cough drops, is composed of C, H, and O. A 0.1005 g sample of menthol is combusted, producing 0.2829 g of CO_2 and 0.1159 g of H_2O. **What is the empirical formula for menthol?** (x is a multiplication operator).

$$0.2829 \text{ g of } CO_2 \times \frac{1 \text{ mol } CO_2}{44.0 \text{g } CO_2} = 0.006430 \text{ mol } CO_2 \times \frac{1 \text{ mol C}}{1 \text{ mol } CO_2} = 0.006430 \text{ mol C}$$

$$0.1159 \text{ g of } H_2O \times \frac{1 \text{ mol } H_2O}{18.0 \text{g } H_2O} = 0.006439 \text{ mol } H_20 \times \frac{2 \text{ mol H}}{1 \text{ mol } H_20} = 0.01288 \text{ mol H}$$

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$$0.006430 \text{ mol c} \times \frac{12.0 \text{g C}}{1 \text{ mol C}} = 0.07716 \text{g C}$$

$$0.001288 \text{ mol H} \times \frac{1.0 \text{g H}}{1 \text{ mol H}} = 0.01288 \text{g H}$$

Find the mass of Oxygen by subtracting the C and H from the total mass of the sample

Total= mass C + mass H + mass O

0.1005g= 0.07716 g C + 0.01288 g H + mass O

mass O = 0.01046g O

Convert to moles of O

$$0.01046 \text{g O} \times \frac{1 \text{ mol O}}{16.0 \text{g O}} = 0.0006538 \text{ mol O}$$

Finally find the mole ratio by dividing by the smallest quantity

0.006430 mol C / 0.0006538 =9.83 $\approx$ 10
0.01288 mol H / 0.0006538 = 19.70 $\approx$ 20
0.0006538 mol O / 0.0006538 = 1

Empirical Formula **$C_{10}H_{20}O$**