

Answer on Question #78095, Chemistry / General Chemistry

A compound containing only C, H, and O, was extracted from the bark of the sassafras tree. The combustion of 58.7 mg produced 159 mg of CO₂ and 32.6 mg of H₂O. The molar mass of the compound was 162 g/mol. Determine its empirical and molecular formulas.

Solution

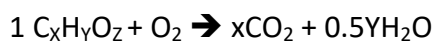
At first find the amounts of the compound, CO₂ and H₂O:

$$v_{\text{comp}} = \frac{0.0587}{162} = 3.62 \times 10^{-4} \text{ (mol)}$$

$$v_{\text{CO}_2} = \frac{0.159}{44} = 3.61 \times 10^{-3} \text{ (mol)}$$

$$v_{\text{H}_2\text{O}} = \frac{0.0326}{18} = 1.81 \times 10^{-3} \text{ (mol)}$$

The equation of the reaction of combustion is



$$\text{If } 3.62 \times 10^{-4} - 1 \text{ mole}$$

$$3.61 \times 10^{-3} - X$$

$$\mathbf{X = 10}$$

$$\text{If } 3.62 \times 10^{-4} - 1 \text{ mole}$$

$$1.81 \times 10^{-3} - 0.5Y$$

$$\mathbf{Y = 10}$$

So the compound has 10 atoms of Carbon and Hydrogen

$$M(\text{C}_{10}\text{H}_{10}) = 12 \times 10 + 1 \times 10 = 130$$

$$M(\text{O}_z) = 162 - 130 = 32$$

$$Z = 32/16 = 2$$

Answer

The molecular formula is C₁₀H₁₀O₂.

The empirical formula is C₅H₅O.