Answer on the question #54717 – Chemistry – General chemistry

Question:

Combustion analysis of 150.0 mg of 1,2,3-benzenetriol, a compound composed of carbon, hydrogen, and oxygen, gives 64.3 mg of H_2O and 314.2 mg of CO_2.

What is the empirical formula of 1,2,3-benzenetriol?
Express your answer as a chemical formula.

Answer:

Let's find the number of moles and the mass for each element, starting with carbon:

$$n(C) = n(CO_2) = \frac{m(CO_2)}{M(CO_2)} = \frac{314.2}{44.01} = 7.14\ mmol; m(C) = n(C) * M(C) = 85.67\ mg$$

$$n(H) = 2n(H_2O) = 2 * \frac{m(H_2O)}{M(H_2O)} = 2 * \frac{64.3}{18.05} = 7.14\ mmol; m(H) = 7.14\ mg$$

The mass of oxygen can be found through the mass of the compound:

$$m(O) = m(comp.) - m(C) - m(H) = 150 - 85.67 - 7.14 = 57.19\ mg$$

$$n(O) = \frac{m(O)}{M(O)} = \frac{57.19}{16} = 3.57\ mmol$$

Then, let's find the relation between the number of the moles of different elements:

$$n(C): n(H): n(O) = 7.14: 7.14: 3.57 = 2: 2: 1$$

Thus, empirical formulae of the compound is $C_{2x}H_{2x}O_x$. As the number of the oxygen atoms in the compound is 3, then x=3.

The final formulae of 1,2,3 benzenetriol is $C_6H_6O_3$.