

Answer on Question #63898 - Chemistry - General Chemistry

Task:

A compound contains 68.2 mass percent C, 6.86 mass percent H, 15.9 mass percent N, and 9.08 mass percent O. Its molar mass is 176 g/mol. Determine the molecular formula for the compound.

Solution:

Suppose we are given 100 g of the compound, then:

$$w(X) = m(X).$$

We find the molar ratio between the elements:

$$n(C) : n(H) : n(N) : n(O) = \frac{w(C)}{Ar(C)} : \frac{w(H)}{Ar(H)} : \frac{w(N)}{Ar(N)} : \frac{w(O)}{Ar(O)};$$

$$n(C) : n(H) : n(N) : n(O) = \frac{68.2}{12} : \frac{6.86}{1} : \frac{15.9}{14} : \frac{9.08}{16};$$

$$n(C) : n(H) : n(N) : n(O) = 5.6833 : 6.8600 : 1.1357 : 0.5675 = 10 : 12 : 2 : 1$$

So, the simplest molecular formula of the compound is as follows: $C_{10}H_{12}N_2O$

$$M(\text{compound}) = 176 \frac{\text{g}}{\text{mol}} = M(C_{10}H_{12}N_2O) \times N;$$

$$M(C_{10}H_{12}N_2O) \times N = (12 \times 10 + 1 \times 12 + 14 \times 2 + 1 \times 16) \times N = 176 \times N;$$

$$176 \frac{\text{g}}{\text{mol}} = 176 \times N; \Rightarrow N = 1;$$

Therefore, the molecular formula for compound - $C_{10}H_{12}N_2O$.

Answer:



