

36141, Chemistry, Other | Completed

A compound contains 82.7% C and 17.3% hydrogen. The density of its vapor at STP is 2.59 g/L. Assume the molecular mass of O₂ is 32.0. What is the molecular formula of the compound?

Solution:

If we take 100 g of compound you will obtain 82.7 g of Carbon and 17.3 g of Hydrogen. So, ratio of

C and H in the molecular formula will be: $\frac{m(C)}{Ar(C)} : \frac{m(H)}{Ar(H)} = \frac{82.7}{12.0} : \frac{17.3}{1.0} = 6.9 : 17.3 = 1 : 2.5 = 2 : 5$.

The molar mass of the simplest compound is: $M(C_2H_5) = 12.0 \cdot 2 + 1.0 \cdot 5 = 29.0$ g/mol.

If the mass of 1L of its vapor is 2.59 g, the mass (molar mass) of 22.4 L (molar volume) will be:

$$M(C_xH_y) = \frac{2.59 \cdot 22.4}{1} = 58.016 \text{ g/mol.}$$

So, the real molecular formula of the compound is C₄H₁₀.

Answer: The molecular formula of the compound is C₄H₁₀.