

Answer on Question#48418 – Chemistry, Physical Chemistry

Ibuprofen is made up of C, H, and O atoms. When a sample of ibuprofen, weighing 5g burns in oxygen, 13.86 g of CO₂ and 3.926 g of H₂O are obtained. What is the simplest formula of ibuprofen?

Solution:

$$v = \frac{m}{M}; \quad v - \text{mole (mol)}; \quad m - \text{the mass (g)}; \quad M - \text{the molar mass (g}^{\wedge}\text{mol}^{-1}\text{)}$$

$$v(\text{C}) = v(\text{CO}_2)$$

$$v(\text{CO}_2) = \frac{m(\text{CO}_2)}{M(\text{CO}_2)};$$

$$M(\text{CO}_2) = \text{Ar}(\text{C}) + 2\text{Ar}(\text{O}) \quad M(\text{CO}_2) = 44 \text{ g}^{\wedge}\text{mol}^{-1}$$

$$v(\text{CO}_2) = 0.315 \text{ mol};$$

$$v(\text{H}) = 2v(\text{H}_2\text{O}); \quad M(\text{H}_2\text{O}) = 18 \text{ g}^{\wedge}\text{mol}^{-1}; \quad v(\text{H}) = 0.436 \text{ mol};$$

$$m(\text{C}) = 3.78 \text{ g}; \quad m(\text{H}) = 0.436 \text{ g};$$

$$m(\text{O}) = m(\text{C}_x\text{H}_y\text{O}_z) - m(\text{C}) - m(\text{H}); \quad m(\text{O}) = 0.784 \text{ g}$$

$$v(\text{O}) = 0.049 \text{ mol}$$

$$v(\text{C}) : v(\text{H}) : v(\text{O}) = 0.315 : 0.436 : 0.049 = 6.4 : 8.9 : 1$$

$$v(\text{C}) : v(\text{H}) : v(\text{O}) = 13 : 18 : 2$$

Answer: C₁₃H₁₈O₂