Answer question #59504, Chemistry / Physical Chemistry

Question:

A 0.1888g sample of hydrocarbon produces 0.6266g of carbon dioxide and 0.1602 water. in a combustion analysis its molecular mass is 106g/mol. determine its mass percent composition

Solution:

Reaction equation is:

$$2C_xH_{2x+2} + (3x+1)O_2 \rightarrow 2xCO_2 + 2(x+1)H_2O$$

The number of the moles of carbon dioxide is:

$$n(CO_2) = \frac{0.6266(g)}{44\ (g\ mol^{-1})} = 0.0142\ mol$$

Mass of carbon is:

$$m(C) = n(C) * 12(g\ mol^{-1}) = n(CO_2) * 12(g\ mol^{-1}) = 0.171\ g$$

The number of the moles of water and hydrogen are:

$$n(H_2O) = \frac{m(H_2O)}{18\ (g\ mol^{-1})} = \frac{0.1602\ (g)}{18\ (g\ mol^{-1})} = 0.0089\ mol$$

$$n(H) = 2n(H_2O) = 0.0178\ mol$$

$$m(H) = n(H) * 1(g\ mol^{-1}) = 0.0178\ g$$

Finally, mass percentages of hydrogen and carbon are:

$$\omega(C) = \frac{m(C)}{m(hydrocarbon)} * 100\% = 90.5\%$$

$$\omega(H) = \frac{m(H)}{m(hydrocarbon)} * 100\% = 9.4\%$$

Answer: 90.5% of carbon and 9.4% of hydrogen.