Challenge Problem

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A hydrocarbon mixture consists of 60.0% by mass C_3H_8 and 40.0% C_xH_y. When 10.0g of this mixture is burned, it yields 29.0g CO_2 and 18.8g H_20 as the only products. Write out a balanced reaction in both symbols and words and identify what the formula of the unknown hydrocarbon is.

Problem Solving Template

Analyze

Question: (what are you trying to find out?)

what is the formula of C_xH_y
& Balanced Eq.

1A

Known: (what information does the problem give you?)

60% C_3H_8, 40% C_xH_y - 10g

Product: 29.0g CO_2 & 18.8g H_2O

1B

What do you need to do to solve the problem? (break it down into parts)

amount of C & H

60%=6g 40%=4g 29.0g 18.8g

$C_3H_8 + C_xH_y + O_2 \longrightarrow CO_2 + H_2O$

Calculate

Set up: (Do the work from 1-B)

2A

$\frac{12.01g\,C}{44.01g\,CO_2} = 27.29\%C$ $(0.2729)(29.0g) = 7.91g\,C$

$\frac{2.02g\,H}{18.02g\,H_2O} = 11.21\%H$ $(0.1121)(18.8g) = 2.11g\,H$

total mass

$\frac{36.03g\,C}{44.11g\,C_3H_8} = 81.68\%C$ $(0.8168)(6g) = 4.9g\,C$ in C_3H_8

$\frac{8.08g\,H}{44.11g\,C_3H_8} = 18.32\%H$ $(0.1832)(6g) = 1.1g\,H$ in C_3H_8

mass C & H in C_3H_8

$7.91g$ total C $- 4.9g$ C in $C_3H_8 = 3.01g\,C$ in C_xH_y

$2.1g$ total H $- 1.1g$ H in C_3H_8 $= 1.01g\,H$ in C_xH_y

mass C & H in C_xH_y

2B

Answer the question: (Use the info from above to solve the problem)

Empirical formula

$3.01g\,C\left(\frac{1mol\,C}{12.01g}\right) = 0.251mol \div 0.251 = 1mol\,C$

$1.01g\,H\left(\frac{1mol\,H}{1.01g}\right) = 1mol \div 0.251 = 3.98mol\,H$

C_1H_4

Evaluate

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Does your answer make sense?

$7O_2 + C_3H_8 + CH_4 \longrightarrow 4CO_2 + 6H_2O$